FOR CONTRACT NO.: 04-0A5344

INFORMATION HANDOUT

WATER QUALITY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
401 Water Quality certification dated April 29, 2013 for Project EA 04-0A5341
CIWQS Place No. 728678

PERMITS

UNITED STATES ARMY CORPS OF ENGINEERS
SECTION 404 PERMIT
FILE NUMBER 2007-400401S, dated April 29, 2013

AGREEMENTS

UNITED STATES FISH AND WILDLIFE SERVICE BIOLOGICAL OPINION
REFERENCE No. 81420-2009-F-0857-7 dated April 16, 2012

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / NATIONAL MARINE FISHERIES SERVICE LEVEL OF CONCERN
REFERENCE No.: 2010/06180, dated January 14, 2011

MATERIALS INFORMATION

FOUNDATION REPORTS FOR:
23-0246, 23-0247, 23-0248

GEOTECHNICAL DESIGN AND MATERIALS REPORT

ADL SAMPLING LOCATIONS AND ANALYSIS RESULTS

ASBESTOS AND LEAD PAINT SURVEY REPORT

CAL-OSHA MINING AND TUNNELING CLASSIFICATION.

WATER POLLUTION CONTROL

STORMWATER INFORMATION HANDOUT

NON-STORMWATER INFORMATION HANDOUT

ROUTE: 04-SOL-80 12.0/13.1
04-SOL-12 R2.1/2.8

April 29, 2013
CIWQS Place No. 728678

Sent via electronic mail--no hard copy to follow

California Department of Transportation
Attn: Mr. Nicolas Endrawos
Nicolas_Endrawos@dot.ca.gov
111 Grand Ave.
Oakland, CA 94612-3717

Subject: Water Quality Certification for the Interstate 80/Interstate 680/State Route 12 Interchange Project, Phase 1, City of Fairfield, Solano County

Department Project No.: EA 04-0A5300

Dear Mr. Endrawos:

This certification includes legal requirements to submit information prior to commencement of certain project activities. It is the responsibility of the California Department of Transportation, Solano Transportation Authority, and their contractors and sub-contractors, to ensure that all conditions of this certification are met.

The following conditions may affect the Department's construction schedule: 1, 2, 3, 4, 14, 15, and 28.

The following conditions include enforceable timelines to submit information or reports, or conduct activities that could result in enforcement actions if not provided: 1, 2, 3, 4, 8, 11, 12, 15 and 16.

Certification conditions start on certification page 5.

Then overall project consists of several phases which are planned to be built over several decades. Phase 1 consists of 7 construction packages which are scheduled over the next 7 years. This certification permits the impacts associated with only the first 7 construction packages and directs all mitigation for the entire first phase. Phases 2-7 construction package impacts are intended to be permitted with Waste Discharge Requirements to be issued in the near future.

We have reviewed and hereby issue water quality certification to the California Department of Transportation (Department) for the Interstate 80/Interstate 680/State Route 12 Interchange Project (Project). The Department is seeking an Individual Permit for the Project from the U.S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act (33 U.S.C. § 1344). As such, the Department has applied to the San Francisco Bay Regional Water Quality Control Board (Water Board) for a Clean Water Act Section 401 water quality certification that the Project will not violate State water quality standards.

Project: The Department is proposing to improve traffic facilities through the Interstate 80/Interstate 680/State Route 12 corridor in the City of Fairfield. The purpose of the Project is to relieve congestion, reduce traffic on local roads, encourage HOV lane use and ridesharing, improve safety, accommodate current and future truck volumes, and facilitate truck scale operation throughout and around the Project area. The Project has been divided into seven individual construction packages:

- **Construction Package 1**
  Major project elements in construction package 1 include constructing a new westbound I-80 to westbound State Route 12 connector, widening westbound I-80 between the existing I-80/I-680 separation and westbound State Route 12, and reconstructing the west half of the I-80 Green Valley Road interchange. Work would take approximately two years and start in 2013.
- **Construction Package 2**
  Construction package 2 involves constructing a new I-680/Red Top Road interchange, realigning Lopes and Fermi Roads, and realigning Ramsey Road around the proposed I-680 Red Top Road interchange. Construction would start in 2014 and last approximately 1.5 years.
- **Construction Package 3**
  Major project elements include: Constructing the westbound I-80 to southbound I-680 connector; widening westbound I-80 between the I-80/Suisun Valley Road and the I-80/Green Valley Road interchanges; reconstructing the westbound I-80 bridge over Green Valley Creek; constructing a new westbound on-ramp to I-80 at Suisun Valley Road; constructing a new westbound off-ramp from I-80 to Green Valley Road; constructing a new bridge and westbound I-80 off-ramp to Green Valley Road over Green Valley Creek; removing the existing I-80/I-680 connector bridges over I-80 and Green Valley Road; removing Neitzel Road; and excavation and grading of the Business Center Drive Extension. Construction would start in 2014 and last approximately two years.
- **Construction Package 4**
  Major project elements include: Constructing the northbound I-680 to eastbound I-80 connector; reconstructing the eastbound State Route 12 west connector to eastbound I-80; reconstructing the eastbound I-80 off-ramp to Green Valley Road; reconstructing the Green Valley Road on-ramp to eastbound I-80; realigning Lopes

Road and Green Valley Road to connect with the original I-680 alignment; widening eastbound State Route 12 and existing culvert one lane to the south; and constructing a retaining wall between Ledgewood Creek and Pennsylvania Avenue. Construction would start in 2014 and last approximately two years.

- **Construction Package 5**
  Construction package 5 includes constructing a new Red Top Road/Business Center Drive Extension, constructing a northbound I-680 to westbound State Route 12 west connector, reconstructing the I-80/Red Top Road interchange, and constructing a new State Route 12/Red Top Road Interchange. Construction would start in 2018 and last approximately two years.
- **Construction Package 6**
  Construction package 6 involves constructing new I-80/I-680 connectors. Construction would start in 2018 and last approximately two years.
- **Construction Package 7**
  Construction package 7 involves constructing a new northbound I-680/I-80 loop on-ramp, constructing an eastbound I-80 connector to southbound I-680, and reconstructing the Union Pacific Railroad I-80 overpass. Construction would start in 2018 and last approximately one and-a-half years.

This certification allows construction of construction package 1. The Water Board is certifying construction package 1 in advance of issuance of Waste Discharge Requirements (WDRs) for the entire Project at the request of Caltrans because the timeline for WDRs issuance would jeopardize Caltrans's funding deadline for construction package 1. The Water Board plans to adopt Waste Discharge Requirements (WDRs) for construction of the subsequent six construction packages.

Impacts: Project implementation would permanently impact approximately 4.82 acres of wetlands, approximately 2,444 linear feet of waters, and approximately 3.33 acres of riparian habitat. Permanent impacts to jurisdictional waters and wetlands for each construction package are summarized below in Attachment A, *Summary of Permanent Impacts.*

Project implementation would result in temporary impacts to approximately 0.55 acres of jurisdictional seasonal freshwater wetlands, approximately 1,049 linear feet of jurisdictional waters, and approximately 0.11 acres of riparian woodland as a result of construction access. Temporary impacts to jurisdictional waters and wetlands for each construction package are summarized In Attachment B, *Summary of Temporary Impacts.*

Roadway Pollutant Impacts: implementation of construction package 1 would result in approximately 8.1 acres of new and 3.8 acres of reworked impervious area. Stormwater runoff from impervious areas may contain hydrocarbons, metals, volatile organic

compounds, trash, and sediment at levels that may significantly impact jurisdictional waters if left untreated.

Hydromodification Impacts: Added impervious areas may result in alterations to existing hydrologic regimes, resulting in erosion and/or changes of sediment transport in receiving waters (hydromodification). Hydromodification mitigation is not required for this Project because the Project area is not within the Fairfield-Suisun Hydromodification control areas, as identified in Attachment D of the Water Board's Municipal Regional Permit (Order No. R2-2009-0074).

Avoidance and Minimization: The Department has met regularly since 2007, with staff from the Water Board, U.S. Environmental Protection Agency, California Department of Fish and Wildlife, and U.S. Fish and Wildlife Service (USFWS) to discuss various project alternatives. The interagency group agreed that the current design alternative represents the least environmentally damaging practicable alternative that still achieves the basic project purpose.

After selecting the current project design, the Department found additional opportunities to reduce wetland fill through incorporation of retaining walls and alteration of the proposed Business Center Drive extension profile. This certification requires the Department to investigate additional opportunities to avoid and minimize impacts to waters of the State and the U.S. prior to construction of packages 2 through 7 (see condition 2.a).

Mitigation: To mitigate for permanent impacts to wetlands, waters, and riparian habitat, the Department shall: create no less than 8.25 acres of seasonal freshwater wetlands at Suisun Creek Preserve; create no less than 2,461 linear feet of creek channel at Suisun Creek Preserve; create no less than 3.33 acres of riparian habitat at Suisun Creek Preserve and no less than 3.33 acres at a location yet to be determined; and, construct no less than 7,752 linear feet of unlined, earthen ditches within the Project limits.

To mitigate for temporary impacts to wetlands and waters, the Department shall restore temporarily impacted areas to previous or enhanced condition. A specific plan to restore temporarily impacted areas shall be provided in the Final Mitigation and Monitoring Plan (MMP) (see certification condition no. 7.a).

Roadway Pollutant Mitigation: As mitigation for increased pollutant loads associated with impervious areas for construction package 1, the Department shall construct a biofiltration basin in the northwest quadrant of the Interstate 80/Green Valley Road interchange to treat 17.13 acres of impervious area.

CEQA Compliance: The Department prepared and approved an Environmental Impact Report for this Project pursuant to the provisions of the California Environmental Quality Act. The Department filed a Notice of Determination on October 29, 2012 (SCH No. 2003052021).

California Wetlands Portal: It has been determined through regional, state, and national studies that tracking of mitigation/restoration projects must be improved to better assess the performance of these projects. In addition, to effectively carry out the State's No Net Loss Policy for wetlands, the State needs to closely track wetland losses, gains, and mitigation/restoration project success. Therefore, we require the Department use the California Wetlands Standard Form to provide Project information related to impacts and mitigation/restoration measures (see Condition Nos. 11 and 12 of this certification). An electronic copy of the form and instructions may be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml

Project information concerning impacts and mitigation/restoration will be made available at the web link: http://www.californiawetlands.net

Certification: I hereby issue an order certifying that any discharge from the referenced Project will comply with the applicable provisions of sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards) of the Clean Water Act, and with other applicable requirements of State law. This discharge is also regulated under State Water Resources Control Board Order No. 2003 - 0017 – DWQ, "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification" which requires compliance with all conditions of this Water Quality Certification. The following conditions are associated with this certification:

1. The mitigation requirements of this certification reflect the Department's intent to commence all offsite mitigation concurrent with Construction Package 1 impacts to wetlands and waters. If the Department cannot commence mitigation at Suisun Creek Preserve within six months from initiation of Construction Package 1 impacts to wetlands and waters, then the Department shall submit, subject to approval by the Executive Officer, a mitigation proposal to account for temporal loss to wetlands and waters impacted during the delay period.

   All mitigation required for Construction Package 1 shall be constructed prior to completion of Construction Package 1 construction activities. If the Department cannot complete Suisun Creek Preserve mitigation prior to completion of

Construction Package 1, then the outstanding Suisun Creek Mitigation requirements for Construction Package 1 shall thereafter increase by 20% per annum;

2. The Department shall not commence any element of Project construction for construction packages two through seven until Waste Discharge Requirements for those construction packages have been adopted by the Water Board. Water Board staff will request additional information before drafting Waste Discharge Requirements. Requested information shall include, but not be limited to:
    a. Analyses of additional opportunities to avoid and minimize impacts to wetlands and waters and their beneficial uses. These analyses shall be conducted as the design details for construction packages 2-7 progress;
    b. Confirmation of required onsite mitigation implementation;
    c. Confirmation of Suisun Creek Preserve mitigation implementation. Please note if the Suisun Creek Preserve is not meeting performance standards (if applicable) or if any unforeseeable conditions render any portion of the proposed mitigation infeasible, then Waste Discharge Requirements (WDRs) shall not be issued until the site is brought into compliance or alternative mitigation is identified;
    d. A proposal to create or restore no less than 3.33 acres of riparian habitat within the Suisun Bay watershed (above and beyond the 3.33 acres required at Suisun Creek Preserve). The riparian habitat shall be planted no later than December 15, 2014. The proposal shall include a monitoring and reporting proposal equivalent to the riparian planting proposal in the final, accepted MMP; and
    e. A proposal to treat stormwater from an area of impervious surface equivalent to all added and reworked impervious areas associated with Construction Packages 2-7. The Department may propose stormwater treatment proposal timelines for each individual construction package. Under this scenario, WDRs would prohibit construction package construction until the Water Board's Executive Officer accepts the respective stormwater treatment proposal;

3. Not less than sixty days prior to commencement of Package 1 construction, the Department shall submit a Final Mitigation and Monitoring Plan for restoration and enhancement activities at the Suisun Creek Preserve (Suisun Plan). The Suisun Plan must be submitted in this time frame to accommodate public and staff review. Package 1 staging and construction shall not commence until the Suisun Plan has been found acceptable to Water Board staff. The Suisun Plan shall include, but not be limited to:

a. A proposal to create no less than 8.25 acres of seasonal freshwater wetlands at Suisun Creek Preserve; create no less than 2,461 linear feet of creek channel at Suisun Creek Preserve; and create no less than 3.33 acres of riparian habitat at Suisun Creek Preserve;

b. A detailed riparian and wetland planting plan and palette. Seed mixes shall consist only of species native to the Suisun Bay hydrologic area. The Department shall prioritize use of seeds developed from local seed sources to promote genetic integrity;

c. An invasive species control plan;

d. A plan for controlled herbicide use that includes use criteria (e.g., target invasives, weather condition criteria, herbicide types). All herbicide use shall be inventoried and reported in each mitigation site annual report. The type of herbicide, target species, frequency and duration of use shall be reported);

e. Performance standards for all plantings;

f. A monitoring period no less than ten years for wetland and riparian areas;

g. An adaptive management plan;

h. A grazing plan that prohibits cattle from entering riparian areas. The Department may propose “flash grazing” in riparian areas after defining triggers for such grazing as well as management protocol to ensure damage to channel morphology and riparian plants are prevented. If cattle would be allowed to enter wetland areas, the grazing plan shall explain the benefit to wetland grazing, the circumstances and timing under which wetland grazing would be allowed, and how the wetlands would be protected from grazing activities. The grazing plan shall acknowledge that grazing plan modification, subject to the review of the resource agencies, may be necessary should listed species become established within the grazing area;

i. A plan to wait two full growing seasons after termination of supplemental irrigation before considering success of the associated plantings; and

j. A plan to submit annual reports to the Water Board by December 31st of each year. All monitoring reports shall include photo-documentation utilizing consistent photo vantage points. If the monitoring report includes management recommendations, then the report must express whether the Department shall implement those recommendations.

Any changes to the final, accepted MMP shall be subject to the review and acceptance of Water Board staff prior to implementation.

4. Prior to Year 10 mitigation monitoring at Suisun Creek Preserve and transfer of the Suisun Creek Preserve to the long-term manager, the Department shall demonstrate

the ability to secure all supplemental water necessary to support mitigation site functions. This may occur in the form of a secure water right or the right to purchase and convey supplemental water to the mitigation site;

5. Not less than sixty days prior to commencement of Package 1 construction, the Department shall submit a letter of financial assurance to ensure that the MMP approved by the Executive Officer shall be implemented as accepted and that the mitigation habitat shall be maintained in perpetuity. The letter shall assure the purchase and implementation of alternative compensatory mitigation in the event of mitigation failure;

6. The Department shall ensure that a conservation easement for the Suisun Creek Preserve is completed and recorded with the County Recorder's Office. The conservation easement shall specify preservation of the mitigation area as wetland and riparian wildlife habitat, in perpetuity. Copies of the recorded documents shall be provided to the Water Board within six months of initiation of impact to wetlands and waters in construction package 1;

7. Not less than sixty days prior to commencement of Package 1 construction, the Department shall submit a Final Mitigation and Monitoring Plan for restoration of temporarily impacted areas and creation of unlined, earthen ditches onsite (Onsite Plan). The Onsite Plan must be submitted in the above time frame to allow for public and staff review. Package 1 staging and construction shall not commence until the Onsite Plan has been found acceptable to Water Board staff. The Onsite Plan may be incorporated into the Suisun Plan. The Onsite Plan shall include:

    a. An onsite temporary impact restoration plan detailing specific procedures to restore temporarily impacted wetlands and waters to their pre-construction conditions within the first growing season following cessation of construction activity in those areas. Restoration measures shall be specific to the type of impact (e.g., compaction from heavy machinery and removal of vegetation);

    b. Planting plans and palettes. Seed mixes shall consist only of species native to the Suisun Bay Hydrologic Area;

    c. A proposal to construct 7,752 linear feet of unlined, earthen ditches within the project limits to mitigate for impacts to waters. The proposal shall include an implementation timeline for ditch construction per the timelines included in the certification mitigation summary (Attachment C) as well as the proposed, exact location of the ditches. The ditches shall not be considered successful until they are verified as federal jurisdictional wetlands or waters. To demonstrate the constructed ditches are jurisdictional, the Department shall submit a wetland delineation to the U.S. Army Corps of Engineers for

verification. The Onsite Plan shall also include a monitoring and reporting plan for the constructed ditches;

8. As mitigation for increased pollutant loads associated with impervious areas in construction package 1, the Department shall provide treatment of stormwater runoff from no less than 11.9 acres of impervious area using a bioretention basin. The basin shall be installed consistent with the Project plans included in Attachment D of this certification. The basin shall be constructed as part of construction package 1. Any revisions to the bioretention basin design details shall be subject to the acceptance of Water Board staff before they are implemented.

   Water Board staff recognize that the proposed design would sufficiently treat stormwater from 17.1 acres impervious area. The Department may apply surplus treatment area to future construction packages;

9. All temporarily disturbed areas shall be re-vegetated using only plant species native to the Suisun Bay Hydrologic Area. The Department shall not cause, through operation of heavy machinery, or any other construction activity, compaction of wetlands or waters in areas of temporary impact (see Attachment B for areas of temporary impact). Any compaction of wetlands or waters to areas of temporary impact shall require mitigation;

10. The Resident Engineer (or appropriately authorized agent) shall hold water quality permit compliance meetings (similar to tailgate safety meetings) to discuss permit compliance, including instructions on violation avoidance and violation reporting procedures. The meetings shall be held at least every other week, before forecasted storm events, and when a new contractor or subcontractor arrives to begin work at the site. The contractors, subcontractors and their employees, as well as any inspectors or monitors assigned to the project, shall be present at the meetings. The Department shall maintain dated sign-in sheets for attendees at these meetings, and shall make them available to the Water Board on request;

11. The Department is required to use the California Wetlands Standard Form to provide project information describing impacts and mitigation/restoration measures for construction package 1 within 30 days from the date of this certification. An electronic copy of the form can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml. The completed California Wetlands form shall be submitted electronically to habitatdata@waterboards.ca.gov or shall be submitted as a hard copy to both: 1) The Water Board, 1515 Clay St., Suite 1400, Oakland, CA 94612, to the attention of California Wetlands Portal; and 2) San Francisco Estuary Institute, 4911 Central Ave., Richmond, CA 94804, to the attention of California Wetlands Portal;

12. Suisun Creek Preserve mitigation monitoring reports shall be submitted to the Water Board by January 1 of each year. Modification of this deadline is subject to the acceptance of Water Board staff. The reports may be submitted by upload to the California Wetlands Portal website at http://www.californiawetlands.net/tracker/ba/list. Select the Suisun Creek Preserve restoration project from the Bay Area Project List and then use the "Files & Links" web-link on the mitigation site project page to upload the report. The Department shall immediately notify appropriate Water Board staff once the monitoring report has been uploaded. If the Department cannot, or chooses not to submit the report using the California Wetlands Portal, the report may be submitted directly to Water Board staff electronically, via e-mail;

13. If the Department provides advance mitigation for impacts not incurred, the Department may use that mitigation as credit for other Department project(s), subject to the acceptance of the Water Board Executive Officer. Credit for other Department project(s) may not be granted until all Project impacts have occurred and mitigated unless the Executive Officer determines that the mitigation provided is sufficient to cover all probable Project impacts;

14. Concrete shall be excluded from surface water for a period of 30 days after it is poured/sprayed. During that time the concrete shall be kept moist and runoff from the concrete shall not be allowed to enter State waters. Commercial sealants may be applied to the concrete surface in instances where 30 days of water exclusion is infeasible. If sealant is used, water shall be excluded from the site until the sealant is cured. If groundwater comes into contact with fresh concrete, it shall be prevented from flowing towards surface water;

15. The Project shall be constructed in conformance with the Project Description described in this certification and certification application materials. Any change in the Project that could impact State waters may require compensatory mitigation and shall first be reported to and found acceptable by the Water Board Executive Officer;

16. If, at any time, an unauthorized discharge to surface water (including wetlands, rivers or streams) occurs, or any other water quality problem arises, the associated Project activities shall immediately cease until adequate BMPs are implemented. The Water Board shall be notified promptly and in no case more than 24 hours after the unauthorized discharge or water quality problem arises;

17. The Department shall adhere to the conditions imposed by the Individual Permit issued to the Department by the U.S. Army Corps of Engineers, to the Streambed Alteration Agreement issued to the Department by the California Department of Fish and Wildlife, and to the Biological Opinion issued to the Department by the USFWS;

18. All activities and best management practices (BMPs) shall be implemented according to the submitted application materials and the findings and conditions of this certification. BMPs for erosion, sediment, turbidity and pollutant control shall be implemented and in place at commencement of, during, and after any ground clearing activities, construction activities, or any other Project activities that could result in erosion, sediment, or other pollutant discharges to waters of the State. The BMPs shall be implemented in accordance with the Caltrans Construction Site Best Management Practice Manual (CCSBMPM) and all contractors and subcontractors shall comply with the CCSBMPM. BMPs for erosion and sediment control shall be utilized throughout all phases of construction, regardless of date, wherever sediment-laden runoff threatens to enter waters of the State. The Department shall stage erosion and sediment control materials at the work site. All BMPs shall be installed properly and in accordance with the manufacturer's specifications. If the Project Resident Engineer elects to install alternative BMPs for use on the project, the Department shall submit a proposal to Water Board staff for review and concurrence;

19. The Department shall not use or allow the use of erosion control products that contain synthetic materials within waters of the State at any time. The Department shall request approval from Water Board staff if an exception from this requirement is needed at a specific location. In areas outside waters of the State jurisdiction, the Department shall prioritize the use of wildlife-friendly biodegradable (not photo-degradable) erosion control products. The Department shall not use or allow the use of erosion control products that contain synthetic netting for permanent erosion control (i.e. erosion control materials to be left in place for two years or after the completion date of the Project);

    If the Department finds that erosion control netting or products have entrapped or harmed wildlife, personnel shall remove the netting or product and replace it with wildlife-friendly biodegradable products ;

20. Fueling, lubrication, maintenance, storage and staging of vehicles and equipment shall be prohibited within waters of the State. Fueling of individual equipment types within waters of the State may be authorized if the Department first prepares a fueling plan that:
    a. Identifies the specific piece of machinery that may require fueling within waters of the State;
    b. Provides justification for the need to refuel within State waters. The justification shall describe why fueling outside of jurisdictional waters is infeasible; and
    c. Includes a narrative of specific BMPs that shall be employed to prevent and capture fuel releases.

Fueling of equipment within waters of the State shall be prohibited until the above mentioned plan has been approved by Water Board staff. The fueling plan may be submitted individually, included in the project Storm Water Pollution Prevention Plan (SWPPP), or submitted as a SWPPP amendment;

21. Fueling, lubrication, maintenance, storage and staging of vehicles and equipment shall not result in a discharge or a threatened discharge to any waters of the State. At no time shall the Department use any vehicle or equipment which leaks any substance that may impact water quality;

22. Except as expressly allowed in this certification, the Department is prohibited from discharging waste to waters of the State. No debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or concrete washings, welding slag, oil or petroleum products, or other organic or earthen material from any construction or associated activity of whatever nature, other than that authorized by this certification, shall be allowed to enter into waters of the State. Except for temporary stockpiling of waste generated during demolition operations ("temporary" in this instance means generated and removed during the same working day), waste materials shall not be placed where the materials may be washed by rainfall into waters of the State;

23. The Department shall provide analysis and verification that placement of non-hazardous waste or inert materials (which may include discarded product or recycled materials) will not result in degradation of water quality, human health, or the environment. All Project-generated waste shall be handled, transported, and disposed in strict compliance with all applicable State and Federal laws and regulations. When operations are complete, any excess material or debris shall be removed from the work area and disposed of properly and in accordance with the Special Provisions for the Project and/or the 2006 Standard Specification 7-1.13, Disposal of Material Outside the Highway Right of Way. In accordance with State and Federal laws and regulations, the Department is liable and responsible for the proper disposal of waste generated by their Project;

24. All imported fill material shall be clean and free of pollutants. All fill material shall be imported from a source that has the appropriate environmental clearances and permits. The reuse of low-level contaminated solids as fill on-site shall be performed in accordance with all State and Federal policies and established guidelines; a plan for such re-use must first be submitted to Water Board staff for review and concurrence;

25. Work in flowing or standing surface waters is prohibited unless otherwise proposed in the Project description and approved by the Water Board;

26. Gravel bags used within waters of the State shall:

a. Consist of mechanically-rounded and washed, and/or river run gravel obtained from a river or creek bed;
b. Be clean, hard, sound, durable, uniform in quality, and free of disintegrated material, organic matter, or other deleterious substances;
c. Be composed entirely of particles that have no more than one fractured face;
d. Have a cleanliness value of at least 85, using the Cleanness Value Test Method for California Test No. 227; and
e. Have a diameter no less than 0.75 inches in diameter, and no greater than four inches in diameter.

Gravel bag fabric shall be nonwoven polypropylene geotextile (or comparable polymer) and shall conform to the following requirements:

a. Mass per unit area, grams per square meter, min ASTM Designation: D 5261 – 270;
b. Grab tensile strength (25-mm grip), kilonewtons, min. ASTM Designation: D4632* 0.89;
c. Ultraviolet stability, percent tensile strength retained after 500 hours, ASTM Designation: D4355, xenon arc lamp method 70 or appropriate test method for specific polymer;
d. Gravel bags shall be between 600 mm and 800 mm in length, and between 400 mm and 500 mm in width;
e. Yarn used in construction of the gravel bags shall be as recommended by the manufacturer or bag supplier and shall be of a contrasting color. The opening of gravel-filled bags shall be secured to prevent gravel from escaping. Gravel-filled bags shall be between 13 kg and 22 kg in mass; and
f. Caltrans shall request approval from Water Board staff if an exception from this requirement is needed for a specific location;

27. Herbicides and pesticides shall not be used within the Project. If Caltrans has a compelling case as to why herbicides and pesticides should be used, they may submit a request along with a BMP plan to Water Board staff for review, consideration, and concurrence;

28. Caltrans shall submit, subject to the acceptance of Water Board staff, a dewatering and/or diversion plan that appropriately describes the dewatered or diverted areas and how those areas will be handled during construction. The diversion/dewatering plans shall be submitted no later than 30 days prior to conducting the proposed activity. Diversion/dewatering activities shall be prohibited until Water Board staff has accepted the dewatering/diversion plan for that specific water. Information submitted shall include the area or work to be diverted or dewatered and method of the proposed activity. All diversion or dewatering activities shall be designed to minimize

the impact to waters of the State, avoid fish entrainment, and maintain natural flows upstream and downstream. All dewatering or diversion structures shall be installed in a manner that does not cause sedimentation, siltation or erosion upstream or downstream. All dewatering or diversion structures shall be removed immediately upon completion of Project activities;

29. This certification does not allow for the take, or incidental take, of any special status species. The Department shall use the appropriate protocols, as approved by the California Department of Fish and Wildlife and the USFWS, to ensure that Project activities do not impact the Beneficial Use of the Preservation of Rare and Endangered Species, as described in the San Francisco Bay Regional Water Quality Control Plan;

30. The Department shall maintain a copy of this certification at the Project site to be available at all times to Project personnel. It is the Department's responsibility to ensure that all personnel (employees, contractors, and subcontractors) are adequately informed and trained in the conditions of this certification;

31. The Water Board may add to or modify the conditions of this certification, as appropriate, to implement any new or revised water quality standards and implementation plans adopted or approved pursuant to the Porter-Cologne Water Quality Control Act or section 303 of the Clean Water Act;

32. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Section 13330 of the California Water Code and Title 23 of the California Code of Regulations, Section 3867;

33. This certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license, unless the pertinent certification application was filed pursuant to California Code of Regulations Title 23, Subsection 3855(b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought; and

34. Certification is conditioned upon total payment of the full fee required in State regulations (23 CCR Section 3833). The Water Board has received the full fee for this certification.

We anticipate your cooperation in implementing these conditions. However, please be advised that any violation of water quality certification conditions is a violation of State law and subject to administrative civil liability pursuant to California Water Code, Section

13350. Failure to respond, inadequate response, late response, or failure to meet any condition of this certification may subject you to civil liability imposed by the Water Board to a maximum of $5,000 per day per violation or $10 for each gallon of waste discharged in violation of this certification.

This certification includes requirements for information and reports. Any requirement for a report made as a condition to this action is a formal requirement pursuant to CWC section 13267, and failure or refusal to provide, or falsification of such required report is subject to civil liability as described in California Water Code, Section 13268.

If you have any question, please contact Dale Bowyer at (510) 622-2323, or via e-mail to DBowyer@waterboards.ca.gov.

Sincerely,

Bruce H. Wolfe
Executive Officer

Attachments:
A- Summary of Permanent Impacts
B- Summary of Temporary Impacts
C- Summary of Mitigation Requirements for Permanent Impacts
D- Biofiltration Basin Design Details
E- Consideration of Public Comments

cc (via e-mail):
Mr. Bill Orme SWRCB-DWQ
Ms. Laurie Monarres, USACE
Ms. Jane Hicks, Regulatory Branch, USACE
Ms. Melissa Escaron, Caltrans
Ms. Paula Gill, USACE
Mr. Scott Steinwert, Circle Point
Ms. Janet Adams, Solano Trans.
Mr. Dale Bowyer, Water Board
Mr. Cyrus Vafai, Caltrans
Mr. Hardeep Takhar, Caltrans
Ms.Melissa Scianni, USEPA
Mr. Jason Brush, USEPA
Mr. Wilfung Martono, Caltrans
Mr. Dale Dennis, Solano Trans

Attachment A
Summary of Permanent Impacts

Table 1: Summary of Permanent Impacts—Construction Package 1

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal roadside drainage, impacted at two locations: 1) Where Lopes Road terminates to the north at Green Valley Road; and 2) North of I-80, east of Green Valley Road, south of Green Valley Creek	0.10 acres (862 linear feet)
OW-61	Seasonal roadside drainage adjacent Southbound Green Valley Road, north of westbound I-80	0.04 acres
OW-61a	Seasonal roadside drainage adjacent westbound I-80. The impact area extends between just west of Green Valley Road and the I-80 off-ramp to westbound State Route 12	0.20 acres
OW-61a	Riparian vegetation (oak woodland) adjacent OW-61a	0.26 acres
OW-180	Drainage connecting wetlands W-180a and W-180b, north of westbound State Route 12, just east of Red Top Road	0.01 acres
W-13	Vernal pool seasonal wetland adjacent westbound State Route 12 approximately 250 feet west of Red Top Road	0.02 acres
W-14	Vernal pool seasonal wetland adjacent westbound State Route 12 approximately 1,800 feet west of Red Top Road	0.01 acres
W-15	Vernal pool seasonal wetland adjacent westbound State Route 12 approximately 250 feet northeast of existing Red Top Road terminus at State Route 12	0.03 acres
W-180a	Vernal pool seasonal wetland adjacent westbound State Route 12 approximately 300 feet northeast of existing Red Top Road terminus at State Route 12, just south of W-15	0.09 acres
W-180b	Seasonal wetland adjacent westbound State Route 12 approximately 400 feet south of Mangels Pond, immediately south of W-181	0.05 acres
W-181	Perennial marsh south of Mangels Pond and north of W-180b	0.01 acres
W-45-1	Seasonal wetland immediately north of westbound I-80 and immediately west of and below existing I-680 overpass	0.01 acres
W-45-2	Seasonal wetland east of Green Valley Road, west of Green Valley Creek, and north of I-80	0.03 acres
W-45a-2	Vernal pool seasonal wetland east of Green Valley Road, west of Green Valley Creek, north of I-80, south of W-45-2	0.16 acres
W-60	Seasonal wetland adjacent the north side of the existing I-80 off ramp to westbound State Route 12	0.20 acres
W-61b	Seasonal wetland adjacent north side of southbound Green Valley Road on-ramp to westbound I-80	0.47 acres
W-62	Seasonal wetland adjacent the north side of the existing I-80 off ramp to westbound State Route 12, just north of W-60	0.03 acres
W-63	Vernal pool Seasonal wetlands adjacent north side of westbound I-80 between Green Valley Road and off-ramp to State Route 12 west	0.02 acres

Table 1: Summary of Permanent Impacts—Construction Package 1 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-64	Seasonal wetlands adjacent north side of westbound I-80 between Green Valley Road and off-ramp to State Route 12 west	0.02 acres
W-143		0.05 acres
	totals:	1.55 acres and 5 linear feet of fill to jurisdictional wetlands and waters; 0.26 acres of permanent impact to riparian woodland

Table 2: Summary of Permanent Impacts—Construction Package 2

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-19	Seasonal drainages west of southbound 680 at location of proposed Red Top Road/I-680 interchange	0.04 acres
OW-150		0.02 acres
OW-151		0.02 acres
W-20	Linear seasonal wetland between OW-19 and southbound I-680	0.05 acres
W-21	Seasonal wetland adjacent southbound I-680 at proposed location of Red Top Road on-ramp to southbound I-680	0.01 acres
W-C	Seasonal wetlands east of northbound I-680 at location of proposed Red Top Road/I-680 interchange	0.13 acres
W-D		0.36 acres
W-E		0.15 acres
	totals:	0.78 acres of fill to jurisdictional wetlands and waters

Table 3: Summary of Permanent Impacts—Construction Package 3

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-45	Perennial marsh segment of Green Valley Creek just north of westbound I-80	0.21 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.01 acres
OW-8	Jameson Canyon Creek beneath proposed I-80 to southbound I-680 connector	490 linear feet (0.34 acres)
OW-8	Riparian Woodland along Jameson Canyon Creek	0.72 acres

Table 3: Summary of Permanent Impacts—Construction Package 3 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal drainage adjacent the north side of westbound I-80 just east of Green Valley Road	0.02 acres
OW-161	Seasonal drainage in footprint of the proposed Business Center Drive extension, approximately 900 feet due east from northern end of Mangels Pond	0.01 acres
OW-164	Seasonal drainage upstream of Mangels Pond in footprint of the proposed Business Center Drive extension	0.08 acres
OW-175	Seasonal drainage approximately 600 feet west of existing Business Center Drive terminus in footprint of the proposed Business Center Drive extension	43 linear feet (0.01 acres)
W-45-1	Seasonal wetland adjacent the north side of westbound I-80 east of Green Valley Road in footprint of proposed westbound I-80 to southbound I-680 connector	0.15 acres
W-109	Seasonal wetland between existing westbound I-80 mainline and I-80 westbound off-ramp to Green Valley Road	0.18 acres
W-182	Seasonal wetland between existing westbound I-80 mainline and I-80 westbound off-ramp to Green Valley Road. Just east of W-109	0.48 acres
W-F	Seasonal wetland in footprint of the proposed Business Center Drive extension approximately 1800 feet due east from southern end of Mangels Pond	0.01 acres
	totals:	1.14 acres and 533 linear feet of fill to jurisdictional wetlands and waters; 0.73 acres of permanent impact to riparian woodland

Table 4: Summary of Permanent Impacts—Construction Package 4

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-8	Riparian Woodland along Jameson Canyon Creek	0.07 acres
OW-8b-1	Seasonal drainage immediately east of Red Top Road, south of State Route 12	326 linear feet
OW-8b-1	Riparian woodland along seasonal drainage immediately east of Red Top Road, south of State Route 12	0.89 acres

Table 4: Summary of Permanent Impacts—Construction Package 4 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal drainage alongside eastbound I-80 between West Cordelia Road and Green Valley Road	0.10 acres
OW-90	Ledgewood Creek south of State Route 12 east	18 linear feet
OW-90a	Perennial drainage south of State Route 12 east approximately 800 feet west of Beck Avenue	0.01 acres
OW-119	Seasonal drainage outletting under State Route 12 immediately east of Pennsylvania Avenue	0.01 acres
W-28	Seasonal wetland south of eastbound I-80 approximately 1,000 feet northeast of West Cordelia Road intersection with I-80	0.03 acres
W-29	Seasonal wetland south of eastbound I-80 approximately 1,100 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
W-30	Seasonal wetland south of eastbound I-80 approximately 1,700 feet northeast of West Cordelia Road intersection with I-80	0.10 acres
W-45a-1	Seasonal wetland south of eastbound I-80 approximately 500 feet northwest of the terminus of Auto Plaza Court	0.20 acres
W-90	Ledgewood Creek at State Route 12	0.02 acres
W-90a	Perennial marsh south of State Route 12 east from approximately 800 feet west of Beck Avenue to Beck Avenue	0.02 acres
W-145	Seasonal wetland south of eastbound I-80 approximately 1,200 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
W-146	Seasonal wetland south of eastbound I-80 approximately 800 feet northeast of West Cordelia Road intersection with I-80	0.02 acres
W-194	Alkali seasonal marsh along southern side of SR 12 east, just west of Pennsylvania Avenue	0.01 acres
		0.54 acres and 344 linear feet of fill to jurisdictional wetlands and waters; 0.96 acres of permanent impact to riparian woodland

Table 5: Summary of Permanent Impacts—Construction Package 5

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-1	Seasonal drainages in vicinity of the proposed Business Center Drive extension western terminus at westbound I-80	157 linear feet
OW-1a		213 linear feet
OW-2		22 linear feet
OW-2a		0.01 acres

Table 5: Summary of Permanent Impacts—Construction Package 5 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-3	Seasonal drainage in location of proposed Business Center Drive extension on-ramp to westbound I-80	0.01 acres
OW-8	Riparian Woodland along Jameson Canyon Creek	0.11 acres
OW-8a	Riparian woodland along Jameson Canyon Creek at location of proposed Business Center Drive extension, south of SR 12	0.20 acres
OW-8b-1	Riparian woodland along seasonal drainage immediately east of Red Top Road, south of State Route 12	0.46 acres
OW-8c	Riparian woodland along seasonal Jameson Canyon Creek tributary, south of I-80, just northeast of confluence with Jameson Canyon Creek	0.09 acres
OW-158	Seasonal drainage north and south of SR 12 west approximately 1,700 feet west of Red Top Road	85 linear feet
OW-158a		342 linear feet
OW-158a	Riparian woodland at OW-158a	0.41 acres
OW-160a	Seasonal drainage south of SR 12 west approximately 1,500 feet west of Red Top Road	171 linear feet
OW-162	Seasonal drainage north and south of SR 12 west approximately 1,050 feet west of Red Top Road	395 linear feet
OW-163	Seasonal drainage north and south of SR 12 west approximately 250 feet west of Red Top Road	0.01 acres
OW-175	Seasonal drainage approximately 600 feet west of existing Business Center Drive terminus in footprint of the proposed Business Center Drive extension	37 linear feet (0.01 acres)
OW-175a	Seasonal drainage north of SR 12 west, just north of the Red Top Road, adjacent eastern end of W-15	0.01 acres
W-13	Vernal pool seasonal wetland north of SR 12 approximately 150 feet west of the Red Top Road terminus	0.26 acres
W-14	Vernal pool seasonal wetland north of SR 12 approximately 1600 feet west of the Red Top Road terminus and directly north of OW-160a	0.08 acres
W-15	Vernal pool seasonal wetland north of SR 12 west, just northeast of Red Top Road	0.08 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.01 acres
W-42	Seasonal wetland adjacent southern side of Southern-Pacific railroad and eastbound I-80	0.03 acres
W-158a	Seasonal wetland at southern extent of OW-158a	0.01 acres
W-173	Vernal pool seasonal wetland north of SR 12 west, just north of the Red Top Road	0.01 acres

Table 5: Summary of Permanent Impacts—Construction Package 5 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-177	Seasonal wetlands north of SR 12 west, just north of the Red Top Road	0.01 acres
W-178		0.01 acres
W-179		0.01 acres
W-180a	Vernal pool seasonal wetland north of SR 12 west, just northeast of the Red Top Road	0.08 acres
W-180b	Seasonal wetland north of SR 12 west, just north of the Red Top Road. East of W-180a with a hydrological connection via OW-180	0.06 acres
	totals:	0.68 acres and 1,422 linear feet of fill to jurisdictional wetlands and waters; 1.28 acres of permanent impact to riparian woodland

Table 6: Summary of Permanent Impacts—Construction Package 6

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45	Green Valley Creek in I-80 Median	11 linear feet (0.01 acres)
		11 linear feet of fill to jurisdictional waters

Table 7: Summary of Permanent Impacts—Construction Package 7

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-8	Jameson Canyon Creek at I-80	118 Linear Feet (0.06 acres)
OW-61a	Seasonal drainage adjacent northern side of existing westbound I-80 off-ramp to SR 12 westbound	0.02 acres
OW-61a	Riparian vegetation (oak woodland) adjacent OW-61a	0.02 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.05 acres
W-41	Riparian Woodland along eastbound Cordelia Road, just south of I-80	0.03 acres

Table 7: Summary of Permanent Impacts—Construction Package 7 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-60	Seasonal wetland adjacent northern side of existing westbound I-80 off-ramp to SR 12 westbound	0.11 acres
	totals:	0.13 acres and 129 linear feet of fill to jurisdictional wetlands and waters; 0.10 acres of permanent impact to riparian woodland

Attachment B
Summary of Temporary Impacts

Table 8: Summary of Temporary Impacts—Construction Package 1

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal roadside drainage, impacted at two locations: 1) Where Lopes Road terminates to the north at Green Valley Road; and 2) North of I-80, east of Green Valley Road, south of Green Valley Creek	0.02 acres
OW-61a	Seasonal roadside drainage adjacent westbound I-80. The impact area extends between just west of Green Valley Road and the I-80 off-ramp to westbound State Route 12	0.05 acres
W-A1	Seasonal wetland between Grobric Court, Central Way, and Ritchie Road	0.18 acres
W-45-2	Seasonal wetland east of Green Valley Road, west of Green Valley Creek, and north of I-80	0.03 acres
W-65	Seasonal wetland adjacent north side of westbound I-80 between Green Valley Road and off-ramp to State Route 12 west. Approximately 200 feet north of W-64	0.01 acres
W-181	Perennial marsh south of Mangels Pond and north of W-180b	0.01 acres
	totals:	0.30 acres of temporary impact to jurisdictional wetlands and waters

Table 9: Summary of Temporary Impacts—Construction Package 2

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-150	Seasonal drainage west of southbound 680 at location of proposed Red Top Road/I-680 interchange	0.05 acres
	totals:	0.05 acres of temporary impact to jurisdictional waters

Table 10: Summary of Temporary Impacts—Construction Package 3

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.02 acres
OW-8	Jameson Canyon Creek beneath proposed I-80 to southbound I-680 connector	80 linear feet (0.06 acres)

Table 10: Summary of Temporary Impacts—Construction Package 3 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45	Green Valley Creek at I-80	111 linear feet (0.18 acres)
OW-45a	Seasonal drainage adjacent the north side of westbound I-80 just east of Green Valley Road	0.01 acres
OW-150	Seasonal drainage west of southbound 680 at location of proposed Red Top Road/I-680 interchange	0.04 acres
	totals:	0.05 acres and 191 linear feet of temporary impacts to jurisdictional waters; 0.02 acres of temporary impacts to riparian woodland

Table 11: Summary of Temporary Impacts—Construction Package 4

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-8	Jameson Canyon Creek at I-80	30 linear feet (0.02 acres)
OW-45a	Seasonal drainage alongside eastbound I-80 between West Cordelia Road and Green Valley Road	0.01 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.18 acres
W-28	Seasonal wetland south of eastbound I-80 approximately 1,000 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
W-30	Seasonal wetland south of eastbound I-80 approximately 1,700 feet north ast of West Cordelia Road intersection with I-80	0.05 acres
W-144	Seasonal wetland south of eastbound I-80 approximately 1,100 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
W-145	Seasonal wetland south of eastbound I-80 approximately 1,200 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
		0.08 acres and 30 linear feet of temporary impact to jurisdictional wetlands and waters

Table 12: Summary of Temporary Impacts—Construction Package 5

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-1	Seasonal drainages in vicinity of the proposed Business Center Drive extension western terminus at westbound I-80	215 linear feet
OW-2a		0.01 acres
OW-8	Jameson Canyon Creek beneath proposed I-80 to southbound I-680 connector	162 linear feet (0.14 acres)
OW-8a	Jameson Canyon Creek at location of proposed Business Center Drive extension, south of SR 12	67 linear feet (0.03 acres)
OW-8b-1	Seasonal drainage immediately east of Red Top Road, south of State Route 12. Temporary impacts at three separate locations	265 linear feet (0.06 acres)
OW-8c	Seasonal Jameson Canyon Creek tributary, south of I-80, just northeast of confluence with Jameson Canyon Creek	14 linear feet (0.01 acres)
OW-160a	Seasonal drainage south of SR 12 west approximately 1,500 feet west of Red Top Road	11 linear feet (0.01 acres)
OW-162	Seasonal drainage north and south of SR 12 west approximately 1,050 feet west of Red Top Road	46 linear feet (0.01 acres)
OW-175a	Seasonal drainage north of SR 12 west, just north of the Red Top Road, adjacent eastern end of W-15	0.01 acres
OW-176	Seasonal drainage approximately 500 feet west of existing Business Center Drive terminus in footprint of the proposed Business Center Drive extension	19 linear feet (0.01 acres)
W-15	Vernal pool easonal wetland north of SR 12 west, just northeast of Red Top Road	0.08 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.03 acres
W-41	Riparian Woodland along eastbound Cordelia Road, just south of I-80	0.03 acres
W-158	Seasonal wetland at southeastern extent of OW-158a, immediately adjacent northern edge of Southern Pacific Railroad	0.01 acres
W-158a	Seasonal wetland at southern extent of OW-158a	0.01 acres
W-160	Seasonal wetland with hydrologic connection and downstream of OW-160a	0.01 acres
W-180b	Seasonal wetland north of SR 12 west, just north of the Red Top Road. East of W-180a with a hydrological connection via OW-180	0.08 acres
W-181	Perennial marsh south of Mangels Pond and north of W-180b	0.08 acres

Table 12: Summary of Temporary Impacts—Construction Package 5

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
	totals:	0.06 acres and 799 linear feet of temporary impact to jurisdictional wetlands and waters; 0.06 acres of temporary impacts to riparian woodland

Table 13: Summary of Temporary Impacts—Construction Package 6

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal roadside drainage, impacted at two locations: 1) Where Lopes Road terminates to the north at Green Valley Road; and 2) North of I-80, east of Green Valley Road, south of Green Valley Creek	0.01 acres
		0.01 acres of temporary impact to jurisdictional waters

Table 14: Summary of Temporary Impacts—Construction Package 7

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-8	Jameson Canyon Creek at I-80	15 linear feet (0.01 acres)
OW-8c	Seasonal Jameson Canyon Creek tributary, south of I-80, just northeast of confluence with Jameson Canyon Creek	14 linear feet (0.01 acres)
	totals:	29 linear feet of temporary impact to jurisdictional waters;

Attachment C
Summary of Mitigation Requirements for Permanent Impacts

Table 1: Summary of Mitigation for Permanent Impacts—Construction Package 1

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-45a	0.10 acres (862 linear feet)	Construction of 1,060 linear feet of unlined, earthen ditch within the project limits during Package 1 construction
OW-61	0.04 acres	Creation of 0.08 acres of seasonal wetlands at the Suisun Creek Preserve
OW-61a	0.20 acres (2,871 linear feet)	Construction of 3,531 linear feet of unlined, earthen ditch within the project limits during Package 1 construction
OW-61a (riparian)	0.26 acres	Creation of 0.52 acres of riparian habitat at the Suisun Creek Preserve
OW-180	0.01 acres (169 linear feet)	Construction of 208 linear feet of unlined, earthen ditch within the project limits during Package 1 construction
W-13	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-14	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-15	0.03 acres	Creation of 0.06 acres of seasonal wetlands at the Suisun Creek Preserve
W-180a	0.09 acres	Creation of 0.18 acres of seasonal wetlands at the Suisun Creek Preserve
W-180b	0.05 acres	Creation of 0.10 acres of seasonal wetlands at the Suisun Creek Preserve
W-181	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-45-1	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-45-2	0.03 acres	Creation of 0.06 acres of seasonal wetlands at the Suisun Creek Preserve
W-45a-2	0.16 acres	Creation of 0.32 acres of seasonal wetlands at the Suisun Creek Preserve
W-60	0.20 acres	Creation of 0.40 acres of seasonal wetlands at the Suisun Creek Preserve
W-61b	0.47 acres	Creation of 0.94 acres of seasonal wetlands at the Suisun Creek Preserve

Table 1: Summary of Mitigation for Permanent Impacts—Construction Package 1

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
W-62	0.03 acres	Creation of 0.06 acres of seasonal wetlands at the Suisun Creek Preserve
W-63	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-64	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-143		
	totals:	Construction of 4,799 linear feet of unlined, earthen ditch within the project limits during Package 1 construction; Creation of 2.38 acres of seasonal wetlands at Suisun Creek Preserve; Creation of 0.52 acres of riparian habitat at the Suisun Creek Preserve

Table 2: Summary of Mitigation for Permanent Impacts—Construction Package 2

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-19	0.04 acres	Creation of 0.08 acres of seasonal wetlands at the Suisun Creek Preserve
OW-150	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
OW-151	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-20	0.05 acres	Creation of 0.10 acres of seasonal wetlands at the Suisun Creek Preserve
W-21	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-C	0.13 acres	Creation of 0.26 acres of seasonal wetlands at the Suisun Creek Preserve
W-D	0.36 acres	Creation of 0.72 acres of seasonal wetlands at the Suisun Creek Preserve
W-E	0.15 acres	Creation of 0.30 acres of seasonal wetlands at the Suisun Creek Preserve
	totals:	Creation of 1.56 acres of seasonal wetlands at the Suisun Creek Preserve

Table 3: Summary of Mitigation for Permanent Impacts—Construction Package 3

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
W-45	0.21 acres	Creation of 0.42 acres of seasonal wetlands at the Suisun Creek Preserve
W-26 (riparian)	0.01 acres	Creation of 0.02 acres of riparian habitat at the Suisun Creek Preserve
OW-8	490 linear feet (0.34 acres)	Creation of 490 linear feet of creek channel at Suisun Creek Preserve
OW-8 (riparian)	0.72 acres	Creation of 1.44 acres of riparian habitat at the Suisun Creek Preserve
OW-45a	0.02 acres (94 linear feet)	Construction of 116 linear feet of unlined, earthen ditch within the project limits no later than during Package 3 construction
OW-161	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
OW-164	0.08 acres	Creation of 0.16 acres of seasonal wetlands at the Suisun Creek Preserve
OW-175	43 linear feet (0.01 acres)	Creation of 43 linear feet of creek channel at Suisun Creek Preserve
W-45-1	0.15 acres	Creation of 0.30 acres of seasonal wetlands at the Suisun Creek Preserve
W-109	0.18 acres	Creation of 0.36 acres of seasonal wetlands at the Suisun Creek Preserve
W-182	0.48 acres	Creation of 0.96 acres of seasonal wetlands at the Suisun Creek Preserve
W-F	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
	totals:	Creation of 2.24 acres of seasonal wetlands at the Suisun Creek Preserve; Creation of 533 linear feet of creek channel at Suisun Creek Preserve; Creation of 1.46 acres of riparian habitat at the Suisun Creek Preserve; Construction of 116 linear feet of unlined, earthen ditch within the project limits no later than during Package 3 construction

Table 4: Summary of Mitigation for Permanent Impacts—Construction Package 4

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-8 (riparian)	0.07 acres	Creation of 0.14 acres of riparian habitat at the Suisun Creek Preserve
OW-8b-1	326 linear feet	Creation of 326 linear feet of creek channel at Suisun Creek Preserve
OW-8b-1 (riparian)	0.89 acres	Creation of 1.21 acres of riparian habitat at the Suisun Creek Preserve
		Creation and/or restoration of 0.57 acres of riparian habitat at a location TBD
OW-45a	0.10 acres (2,071 linear feet)	Construction of 2,547 linear feet of unlined, earthen ditch within the project limits no later than during Package 4 construction
OW-90	18 linear feet	Creation of 18 linear feet of creek channel at Suisun Creek Preserve
OW-90a	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
OW-119	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-28	0.03 acres	Creation of 0.06 acres of seasonal wetlands at the Suisun Creek Preserve
W-29	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-30	0.10 acres	Creation of 0.20 acres of seasonal wetlands at the Suisun Creek Preserve
W-45a-1	0.20 acres	Creation of 0.40 acres of seasonal wetlands at the Suisun Creek Preserve
W-90	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-90a	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-145	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-146	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-194	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve

Table 4: Summary of Mitigation for Permanent Impacts—Construction Package 4 (continued)

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
	totals:	Creation of 344 linear feet of creek channel at Suisun Creek Preserve; Construction of 2,547 linear feet of unlined, earthen ditch within the project limits no later than during Package 4 construction; Creation of 1.35 acres of riparian habitat at the Suisun Creek Preserve; Creation and/or restoration of 0.57 acres of riparian habitat at a location TBD; Creation of 0.88 acres of seasonal wetlands at the Suisun Creek Preserve

Table 5: Summary of Mitigation for Permanent Impacts—Construction Package 5

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-1	157 linear feet	Creation of 157 linear feet of creek channel at Suisun Creek Preserve
OW-1a	213 linear feet	Creation of 213 linear feet of creek channel at Suisun Creek Preserve
OW-2	22 linear feet	Creation of 44 linear feet of creek channel at Suisun Creek Preserve
OW-2a	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
OW-3	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
OW-8 (riparian)	0.11 acres	Creation and/or restoration of 0.22 acres of riparian habitat at a location TBD
OW-8a (riparian)	0.20 acres	Creation and/or restoration of 0.40 acres of riparian habitat at a location TBD
OW-8b-1 (riparian)	0.46 acres	Creation and/or restoration of 0.92 acres of riparian habitat at a location TBD
OW-8c (riparian)	0.09 acres	Creation and/or restoration of 0.18 acres of riparian habitat at a location TBD
OW-158	85 linear feet	Creation of 85 linear feet of creek channel at Suisun Creek Preserve
OW-158a	342 linear feet	Creation of 342 linear feet of creek channel at Suisun Creek Preserve
OW-158a (riparian)	0.41 acres	Creation and/or restoration of 0.82 acres of riparian habitat at a location TBD
OW-160a	171 linear feet	Creation of 171 linear feet of creek channel at Suisun Creek Preserve
OW-162	395 linear feet	Creation of 395 linear feet of creek channel at Suisun Creek Preserve
OW-163	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve

Table 5: Summary of Mitigation for Permanent Impacts—Construction Package 5 (continued)

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-175	37 linear feet	Creation of 37 linear feet of creek channel at Suisun Creek Preserve
OW-175a	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-13	0.26 acres	Creation of 0.39 acres of seasonal wetlands at the Suisun Creek Preserve
W-14	0.08 acres	Creation of 0.12 acres of seasonal wetlands at the Suisun Creek Preserve
W-15	0.08 acres	Creation of 0.12 acres of seasonal wetlands at the Suisun Creek Preserve
W-26 (riparian)	0.01 acres	Creation and/or restoration of 0.02 acres of riparian habitat at a location TBD
W-42	0.03 acres	Creation of 0.045 acres of seasonal wetlands at the Suisun Creek Preserve
W-158a	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-173	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-177	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-178	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-179	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-180a	0.08 acres	Creation of 0.12 acres of seasonal wetlands at the Suisun Creek Preserve
W-180b	0.06 acres	Creation of 0.09 acres of seasonal wetlands at the Suisun Creek Preserve
	totals:	Creation of 1,444 linear feet of creek channel at Suisun Creek Preserve; Creation of 1.02 acres of seasonal wetlands at the Suisun Creek Preserve; Creation and/or restoration of 2.56 acres of riparian habitat at a location TBD

Table 6: Summary of Mitigation for Permanent Impacts—Construction Package 6

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-45	11 linear feet (0.01 acres)	Creation of 22 linear feet of creek channel at Suisun Creek Preserve
	totals:	Creation of 22 linear feet of creek channel at Suisun Creek Preserve

Table 7: Summary of Mitigation for Permanent Impacts—Construction Package 7

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-8	118 Linear Feet (0.06 acres)	Creation of 118 linear feet of creek channel at Suisun Creek Preserve
OW-61a	0.02 acres (236 linear feet)	Construction of 290 linear feet of unlined, earthen ditch within the project limits no later than during Package 7 construction
OW-61a (riparian)	0.02 acres	Creation and/or restoration of 0.04 acres of riparian habitat at a location TBD
W-26 (riparian)	0.05 acres	Creation and/or restoration of 0.10 acres of riparian habitat at a location TBD
W-41 (riparian)	0.03 acres	Creation and/or restoration of 0.06 acres of riparian habitat at a location TBD
W-60	0.11 acres	Creation of 0.17 acres of seasonal wetlands at the Suisun Creek Preserve
	totals:	Creation of 118 linear feet of creek channel at Suisun Creek Preserve; Construction of 290 linear feet of unlined, earthen ditch within the project limits no later than during Package 7 construction; Creation of 0.17 acres of seasonal wetlands at the Suisun Creek Preserve; Creation and/or restoration of 0.20 acres of riparian habitat at a location TBD

Attachment D
Biofiltration Basin Design Details

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	12.2/12.9	148	

REGISTERED CIVIL ENGINEER DATE

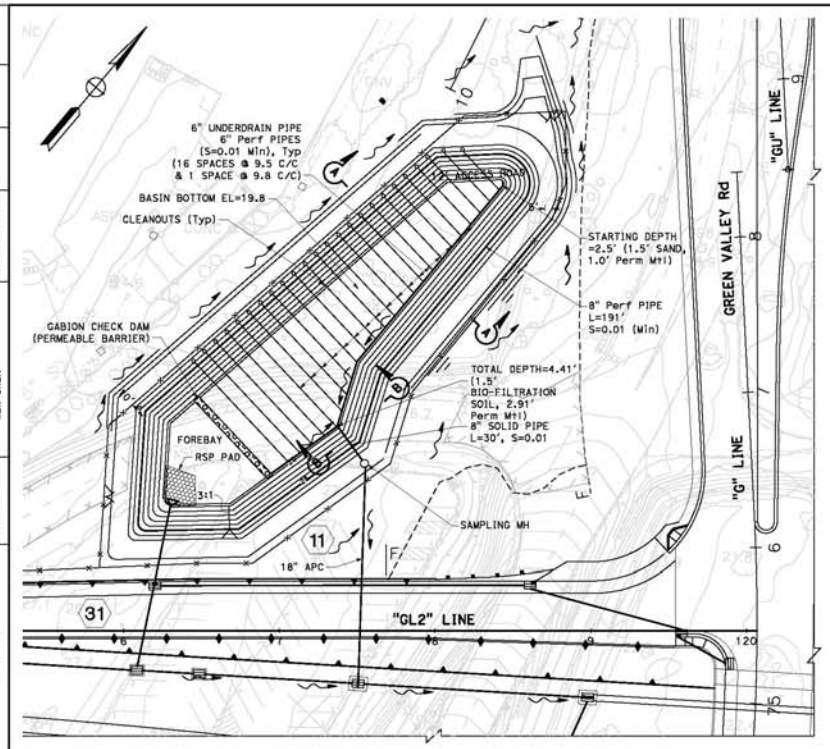
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WEN CHEN No. 71767 Exp. 12-31-13 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

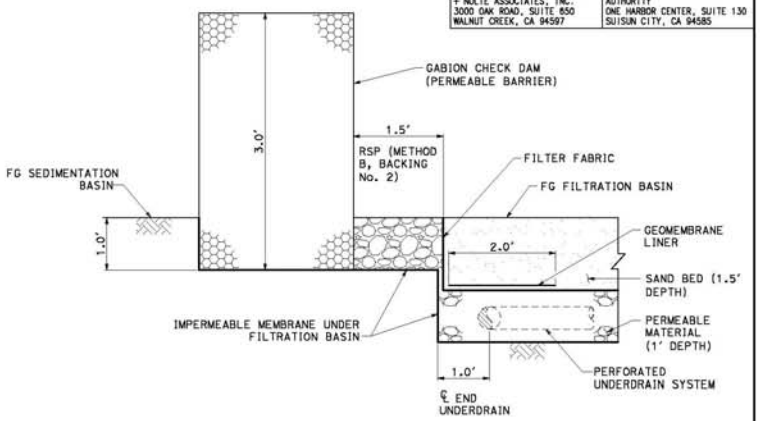
MARK THOMAS & COMPANY, INC.
+ NOLTE ASSOCIATES, INC.
3000 OAK ROAD, SUITE 550
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585



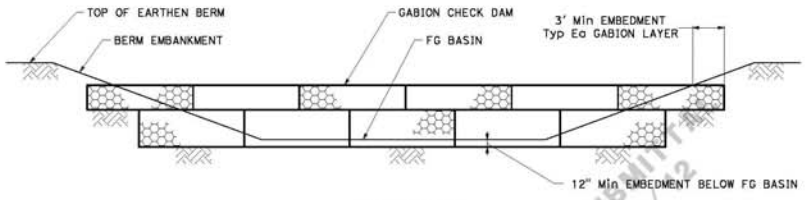
STORM DRAIN TREATMENT BASIN

SCALE: 1" = 30'



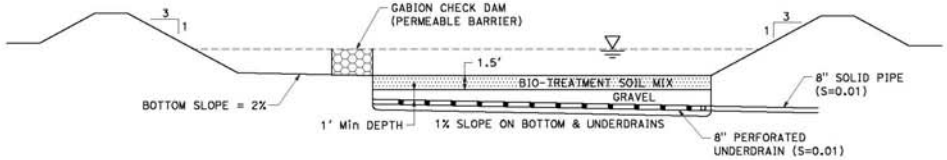
SECTION B-B

NO SCALE



SECTION A-A

NO SCALE



TYPICAL SECTION

NO SCALE

65% SUBMITTAL 05/04/12

DRAINAGE DETAILS

SCALE: AS SHOWN

DD-6

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: WEN CHEN

CALCULATED-DESIGNED BY: WEN CHEN

CHECKED BY

REVISED BY: ABHIJEET BENDRE

DATE REVISED

PATH: N:\WCD50005 - ICP\Cadd\JV Master\Project CADD Files\MAN\Est(Ph-08-Bilas\13_DD\ PLOT DATE: Jul 20, 2012-01:53:29pm CAD USER: bendre

BORDER LAST REVISED 7/2/2010

USERNAME => $USER
DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0741

PROJECT NUMBER & PHASE 04000211311

USE REVISION DATE PLOTTED => $DATE
00-00-00 TIME PLOTTED => $TIME

Attachment E
Public Comment Considerations

Consideration of Comments Received from Citizens Committee to Complete the Refuge	
Comment	**Consideration of Comment**
We are concerned that the estimated direct impacts to waters of the state (and U.S.) increase with each new document we review (PN - Draft MMP1 - Draft MMP2). We believe this is indicative of the fact the application was submitted prematurely, before Caltrans has access to all available and necessary information (property access, etc.). We believe it is necessary, therefore, for Caltrans to provide some assurance that additional impacts will not be unveiled during construction or as Construction Packages 2-7 are implemented.	We cannot restrict Caltrans from changing their project design after the certification has been issued. Should Caltrans change the project design and incur additional impacts to State waters, then a certification modification and/or additional mitigation may be required. Refer to certification condition # 15, which addresses this concern.
Our question remains regarding whether changes on adjacent properties could impact the long-term sustainability of the proposed mitigation site, particularly those lands to the north and east of the proposed mitigation area.	It is unlikely that changes in adjacent land use would significantly affect the long-term sustainability of the mitigation site. The mitigation site would receive water from the northern connector drainage ditch which collects excess water from irrigation and storm events. Properties in the area are currently zoned for agricultural uses and are not anticipated to change per the County General Plan. The property to the east is owned by the same property owner as the mitigation site. This area is being proposed for a mitigation bank. The property to the north is owned by a cattle rancher. A drainage easement would be placed over the portion of his property supplying water from the northern ditch.
We would like confirmation of the source of hydrology for the large area of wetlands located along the western portion of the mitigation site. The information provided seems to indicate direct precipitation is the source of the seasonal wetlands, but we request confirmation of the	Caltrans ensures that this wetland area is not affected by off-site hydrology and receives water from direct precipitation. A small earthen berm separates this area from the property located to the north. An area of approximately 125 acres would continue to provide runoff to this wetland following mitigation construction.

source of hydrology for existing wetlands (within the proposed mitigation site).	
If direct precipitation is the source of hydrology, the project proponent must ensure that construction, erosion/sediment control measures, stockpiling of material, etc. will not result in alteration of the hydrological regime, or result in degradation or diminished areal extent of the existing wetlands. The RWQCB should require the areal extent of existing wetlands and waters (those that are being "preserved") be mapped and included in annual monitoring reports.	We don't have a compelling reason to suspect that the proposed activities would indirectly impact existing wetlands. If we were to require monitoring of existing wetlands and noticed a decline in jurisdictional area, we would likely not be able to identify a causal relationship in the absence of an overwhelming probable cause. Direct unreported impacts to jurisdictional wetlands and waters are prohibited by this certification.
The proposed success criteria are inadequate: Under performance criteria for created wetlands - the criteria should be more stringent than 60% cover - 60% cover by which species? Success criteria for riparian habitat should be more than just survivorship - survivorship alone doesn't provide any indication of the degree to which the created habitat is flourishing - shouldn't there be an inclusion of a requirement for increased % cover? Monitoring should extend well beyond two years of cessation of irrigation.	Performance criteria shall be revised and proposed in a revised MMP. The MMP shall be subject to public review and comment. See certification conditions 3 and 7. The certification requires that the final MMP include ”A plan to wait two full growing seasons after termination of supplemental irrigation before considering success of the associated plantings”
Grazing - While we agree grassland habitat can benefit from grazing, we are concerned about the introduction of nuisance/invasive species. We are	Comment noted. See certification condition no. 3.h; The certification requires that the final MMP include “A grazing plan that prohibits cattle from entering riparian areas. The Department may propose “flash grazing” in riparian areas after defining

also concerned about the impacts of cattle in particular on the preserved, enhanced, restored, or created waters of the state. The project proponent must ensure grazing will not adversely impact waters of the state, and if adverse impacts result (e.g. diminished areal extent, continued introduction of nuisance/invasive species, etc.) grazing must be prohibited in waters of the state.	triggers for such grazing as well as management protocol to ensure damage to channel morphology and riparian plants are prevented. If cattle would be allowed to enter wetland areas, the grazing plan shall explain the benefit to wetland grazing, the circumstances and timing under which wetland grazing would be allowed, and how the wetlands would be protected.”
The grazing plan should be subject to restrictions should listed species become established - the grazing plan would need to be consistent with the protection of listed species.	Comment noted. See language added to certification condition no. 3.h.
Salt marsh harvest mouse - although a habitat assessment has been conducted for this species, prior to construction activities within the proposed mitigation site, USFWS and CDFW should be contacted to determine whether surveys for the species are required.	Comment noted. It is our understanding that authorization from USFWS and CDFG will be necessary before mitigation may commence. Authorization would entail evaluation of potential impacts to special status species.
Newly created/established wetlands will be seeded with a native wetlands species seed mix" - is the seed mix from local seed sources to ensure genetic integrity?	Comment noted. See certification condition no. 3.b

Funding - "If Grizzly Bay LLC cannot qualify for one of these types of financial assurances, an alternative mechanism such as formal documented commitment from Caltrans or other public authority shall be issued." What other "public authority"? Why wouldn't it be Caltrans?	Grizzly Bay LLC insists it is fully capable of funding the required assurances. These assurances would be provided in advance of construction so funding would be in place prior to any impacts on the mitigation site. STA/Caltrans will also be required to provide a funding assurance letter (see condition no. 4).
Irrigation plan - "It is currently assumed that irrigation of planted trees and shrubs will be performed with a drip irrigation system." What is the source of irrigated water?	Temporary irrigation water would be provided to all riparian planting through a drip irrigation system. A new PVC line would extend from the existing Club House on Chadbourne Road to the Mitigation Site. This will be a pressurized, metered source with shutoff and timers.
Removal of exotic invasives should not be limited to the list provided.	Agreed. We have asked Caltrans to revise the MMP to revise the mitigation plan to identify specific non-native species that are naturalized to the area and that also do not represent a threat to development of healthy wetland and riparian systems. We also have asked them to change invasive plant performance standards to address potential threats from plants outside the list of those identified in the draft MMP. Please look for a revised condition once the revised MMP is issued.
Herbicides should not be used on the site without the approval of the USFWS, CDFW, RWQCB.	Noted. Please refer to certification condition 3.d.
What means of "rodent control" is used to protect the integrity of the levees? Are rodenticides used and could this adversely impact sensitive species such as the Swainson's hawk?	We do not know at this time. Although this is out of our jurisdiction, we have asked Caltrans about this and are awaiting a reply.

"In the event that additional freshwater is needed to maintain wetland habitat on the Mitigation Area, Grizzly Bay, LLC is able to obtain water from the Solano Irrigation District. The Solano Irrigation District currently provides irrigation water to the surrounding properties directly north of the Mitigation Area through a series of irrigation ditches. Minor modifications could be implemented in the ditch system in order to provide Solano Irrigation District water into the drainage channel providing water to the Mitigation Area. If there is a necessity to augment freshwater to the Mitigation Area, Grizzly Bay, LLC may need to construct additional connecting channel features to obtain Solano Irrigation District water. It would be the responsibility of Grizzly Bay, LLC or property owner to obtain all required permits/authorizations prior to undertaking these actions." This statement raises concerns regarding the long-term sustainability of the proposed compensatory mitigation.	Comment noted. The designers of the mitigation insist that created seasonal wetlands would be sustained by direct precipitation as well as overflow from the channel during the winter. No additional water is expected during the summer to support wetlands, allowing the wetland features to dry. Augmentation of flows during dry months are proposed at < 2 cubic feet per second to support plant communities along the newly created channel. Upstream water sources are available in dry months from irrigation tail water and other unspecified upstream sources. Use of Solano Irrigation District water is not a requirement of this certification—it is only mentioned as a possible adaptive management measure should the identified sources of water appear inadequate to meet mitigation goals.
The major concern is the necessity for a variety of potentially tenuous agreements to ensure likelihood of success. Levees must be maintained, pumping and associated costs must be continued, a drainage easement is necessary and potential modifications to that agreement are necessary to provide a source of hydrology, and grazing must be managed. We are therefore concerned about the long-term viability of the proposed mitigation site.	Comment noted. We believe the site is viable long-term because the levee integrity and pumping regime are significant regional priorities involving stakeholders other than the mitigation site sponsor.

Figures 12 and 13 provide a conceptual design for created wetlands, vernal pools, riparian woodland, and channel recreation. I don't believe the most recent MMP still states the intent to create vernal pool habitat	Caltrans is not proposing vernal pool habitat at Suisun Creek Preserve because the site is not appropriate for vernal pool creation.
Would bringing in water from off-site impact existing wetlands?	Water being received from the northern connector drainage ditch is excess water from irrigation and storm events and is not water that would otherwise sustain wetlands. Caltrans will be “tapping-in” to a water source that would otherwise be pumped directly to tidal waters at the far southern end of the Grizzly Bay mitigation parcel.
Alternatively, the Mitigation Plan mentions the possibility of accepting treated water from the nearby waste water treatment plant. If tertiary (?) waste water is proposed as a water source, the project proponent should be required to demonstrate that endocrine disrupting chemicals (EDCs) are not present in the treated water, as there are adverse ramifications for amphibians and fish exposed to EDCs. Is this no longer being proposed?	This is no longer being proposed.
Consistent with the Corps Mitigation and Monitoring Guidelines, December 2004, longitudinal profiles of the created channels, as well as reference locations upstream and downstream of the channel creation should be provided. Before and after bank-full flows above and downstream of the created channels should be monitored. Cross-sections of the created channel, and reference locations above stream and downstream of the created channel should be provided. If necessary, water rights	Due to the relatively low-gradient and low-velocity nature of the channel, as well as the fact that the channel will be very low in the watershed, we are not particularly concerned with changes in channel morphology. Water that is received from the drainage ditch to the north is irrigation and stormwater runoff. According to Caltrans, there are no water rights associated with this water as it is drainage water. Certification condition number 4 requires Caltrans to secure any water source used to support mitigation site functions.

availability should also be provided. It appears the MMP incorporates these requirements. It also appears information regarding water rights will be provided.	
Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp - Caltrans has proposed the preservation of 1.71 acres of vernal pool and swale habitat and the creation of 1.45 acres of restoration of vernal pool and swale habitat no later than 60 calendar days prior to the date of initial ground disturbance of the specific construction packages. Once again, for purposes of clarity, to preserve institutional knowledge, and to ensure compliance, the timing of these impacts should be indicated on Table 1 as recommended above. The Conservation Measure (#21) also states the location of the compensation will be submitted for approval by the Service. Does Caltrans propose to create/restore/preserve habitat for vernal pool species at the Suisun Creek Preserve? If so, the Mitigation Plan would have to provide substantive information regarding the existing and proposed hydrological regime as discussed above. The Mitigation Plan would also need to describe the target suite of vernal pool species, proposed pond depths (all to be 18"?) and duration of ponding, etc. Where is this now being proposed? Is it at the Elsie Gridley mitigation bank? If so, have issues regarding not meeting success criteria been resolved?	Caltrans is not proposing to create/restore/preserve habitat for vernal pool species at the Suisun Creek Preserve. We do not know where mitigation for vernal pool shrimp will occur. We defer to the United States Fish and Wildlife Service to ensure that these special status species are protected.

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

REPLY TO
ATTENTION OF:

Regulatory Division

APR 30 2013

SUBJECT: File Number 2007- 400401S

Ms. Melanie Brent
California Department of Transportation, District 4
111 Grand Avenue
Oakland, California 94623-0660

Dear Ms. Brent:

Enclosed are two copies of a Department of the Army (DA) permit to improve the I-80/I-680/SR-12 Interchange. You are advised that the Corps has established an Administrative Appeal Process, as described in our regulations at 33 C.F.R. Part 331 (65 Fed. Reg. 16486; March 28, 2000) and outlined in the enclosed flowchart and Notification of Administrative Appeal Options, Process, and Request for Appeal (NAO-RFA) form. The following two options are available to you in your evaluation of the enclosed permit:

1) You may sign and date both copies of the permit on the line designated for "Permittee". Your signature on the permit indicates that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions. Both copies of the permit must be returned to this office for final authorization. We will then forward one copy of the fully executed permit for your records, at which time you will be authorized to commence work.

2) You may decline to sign the permit because you object to certain terms and conditions, and you may request that the permit be modified. If you decline the permit, you must return the permit to the District Engineer and may not proceed with your project until notified by the District Engineer. You must outline your objections to the terms and conditions of the permit by completing Section II of the NAO-RFA form. Your objections must be received by the District Engineer within 60 days of the date of this letter, or you will forfeit your right to request changes to the terms and conditions of the permit.

Upon receipt of the completed NAO-RFA form, the District Engineer will evaluate your objections, and may: (a) modify the permit to address all of your objections, (b) modify the permit to address some of your objections, or (c) not modify the permit, having determined that the permit should be issued as previously written. In any of these three cases, the District Engineer will send you a final permit for your reconsideration, as well

as a second NAO-RFA form. Should you decline the final proffered permit, you can appeal the declined permit by submitting the completed NAO-RFA form to the Division Engineer. The NAO-RFA form must be received by the Division Engineer within 60 days of the date of the second transmittal letter, or you will forfeit your right to pursue an appeal.

If you fail to sign and return both copies of this permit or fail to request a modification of the permit within 60 days from the date of this letter, your permit application may be withdrawn pursuant to our regulations at 33 C.F.R. Section 325.2(d)(5).

Should you have any questions regarding this matter, please call Paula Gill of our Regulatory Division at (415) 503-6776 or by email at Paula.C.Gill@usace.army.mil. Please address all correspondence to the Regulatory Division and refer to the File Number at the head of this letter.

Sincerely,

John K. Baker

John K. Baker, P. E.
Lieutenant Colonel, U.S. Army
Commander and District Engineer

Enclosures

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Ms. Melanie Brent, Caltrans, District 4		File No. 2007-400401S	Date: 4/29/13
Attached is:			See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
✓	PROFFERED PERMIT (Standard Permit or Letter of permission)		B
	PERMIT DENIAL		C
	APPROVED JURISDICTIONAL DETERMINATION		D
	PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the DISTRICT ENGINEER for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this Notice and return the Notice to the DISTRICT ENGINEER. Your objections must be received by the DISTRICT ENGINEER within 60 days of the date of this Notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your NOTICE, the DISTRICT ENGINEER will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the DISTRICT ENGINEER will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the DISTRICT ENGINEER for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this NOTICE and sending the NOTICE to the DIVISION ENGINEER. This Notice must be received by the DIVISION ENGINEER within 60 days of the date of this Notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this Notice sending the Notice to the DIVISION ENGINEER. This Notice must be received by the DVISION ENGINEER within 60 days of the date of this Notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this Notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.

- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this Notice and sending the Notice to the DIVISION ENGINEER. This Notice must be received by the DIVISION ENGINEER within 60 days of the date of this Notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION

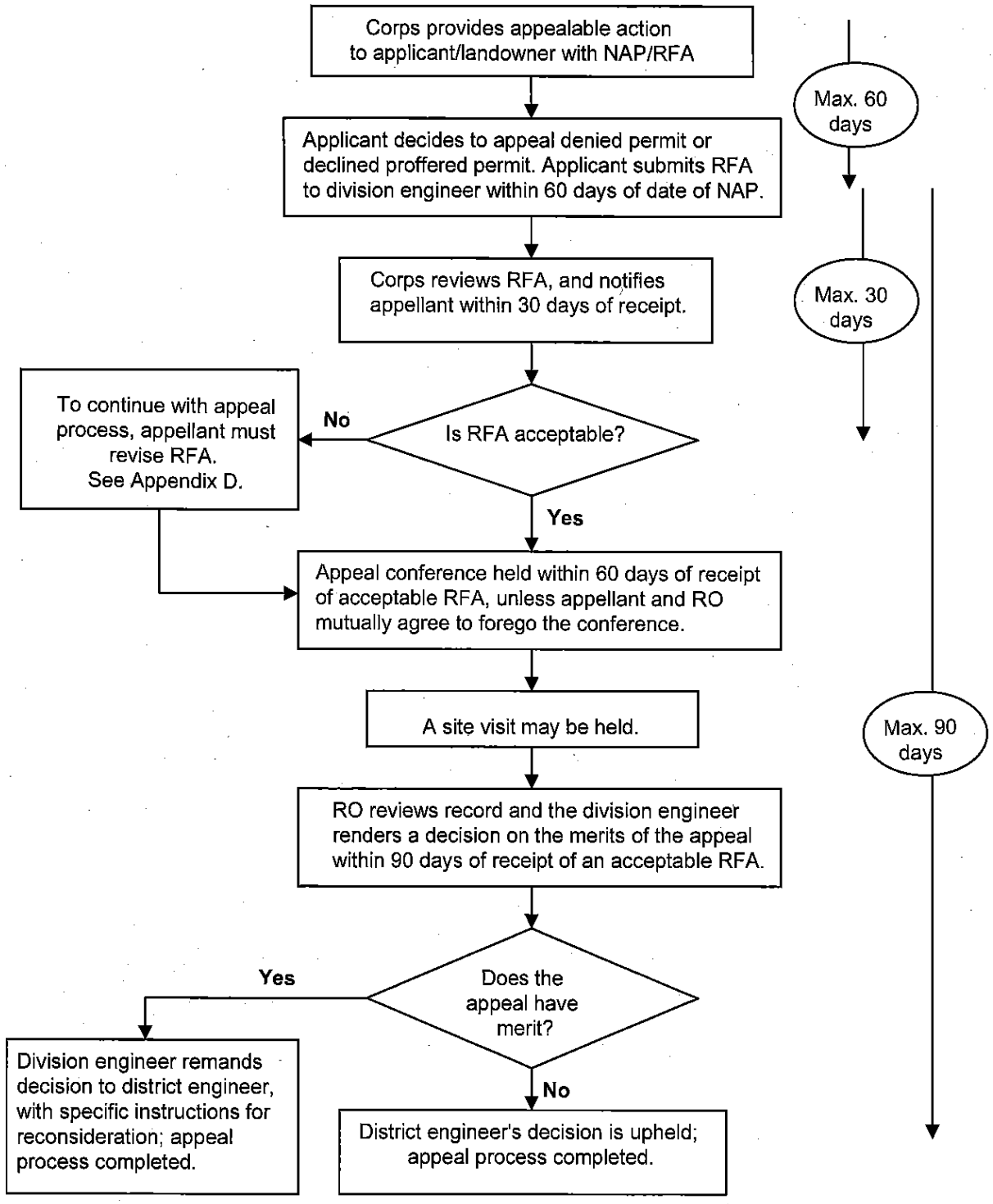
If you have questions regarding this decision and/or the appeal process you may contact:
Cameron L. Johnson, Chief, South Branch, Regulatory Division
U.S. Army Corps of Engineers, San Francisco District
1455 Market Street, 16th Floor, Attn: CESPN-R-S
San Francisco, CA 94103-1398
Tel. (415) 503-6773 FAX (415) 503-6690

If you only have questions regarding the appeal process you may also contact:
Thomas J. Cavanaugh, Appeal Review Officer
U.S. Army Corps of Engineers, South Pacific Division
1455 Market Street, 20th Floor, Attn: CESPD-PDS-O
San Francisco, CA 94103-1399
Tel. (415) 503-6574 FAX (415) 503-6646

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Signature of appellant or agent.	Date:	Telephone number:

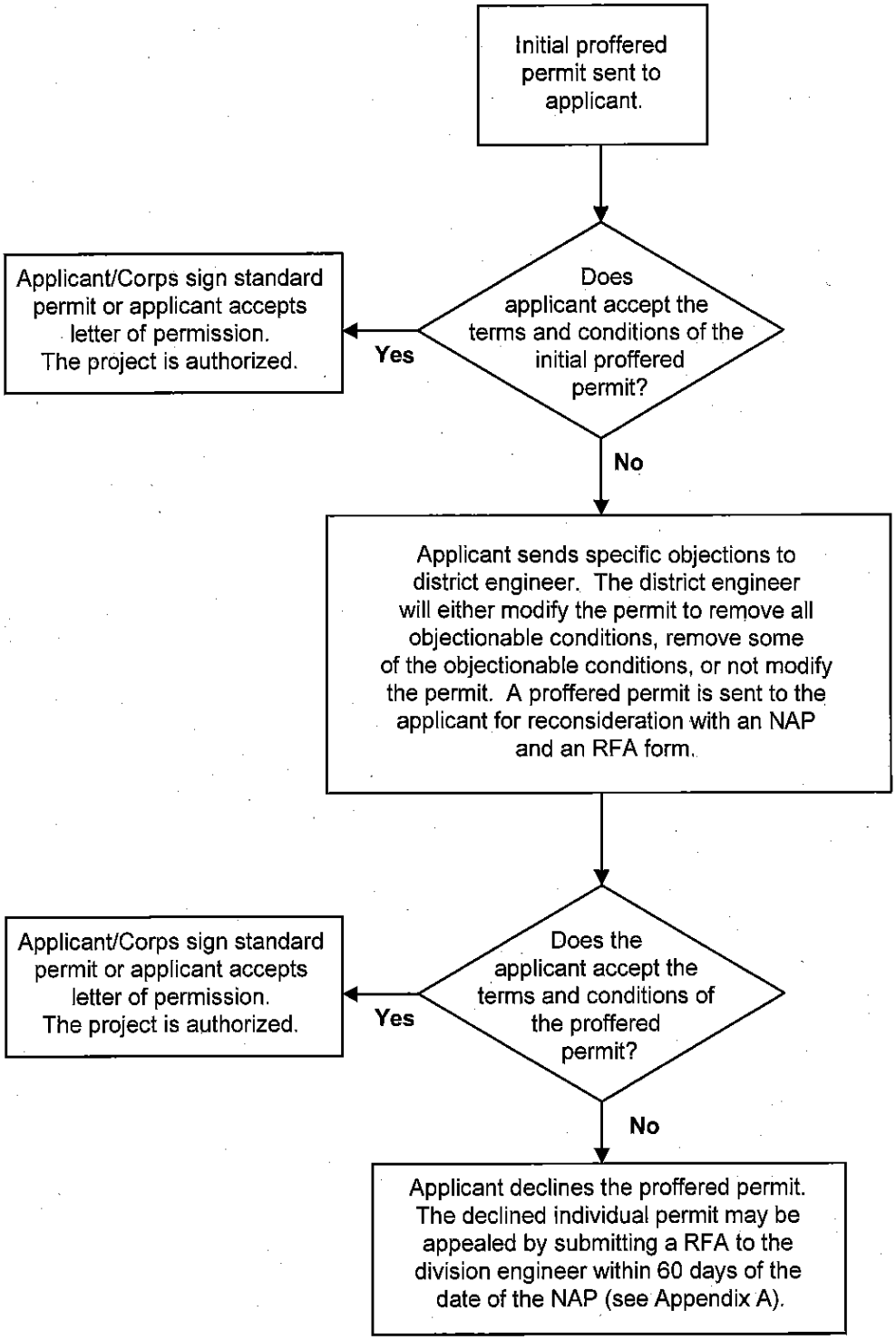
Administrative Appeal Process for Permit Denials and Proffered Permits



NOTE: If new information is provided to the Corps, the applicant will be asked if the applicant wishes to revise the project or record. If so, the appeal will be withdrawn and the case returned to the District for appropriate action. If not, then the Division Engineer will rule on the merits of the appeal based on the administrative record without consideration of the new information. However, the new information may cause the District Engineer to take action under 33 CFR 325.7, independent of the appeal process.

Appendix A

Applicant Options with Initial Proffered Permit



Appendix B

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

REPLY TO
ATTENTION OF:

MAY 01 2013

Regulatory Division

SUBJECT: File Number 2007-400401S

Ms. Melanie Brent
California Department of Transportation
111 Grand Avenue
Oakland, California 94623-0660

Dear Ms. Brent:

Enclosed is your signed copy of a Department of the Army permit (Enclosure 1) to improve the I-80/I-680/SR-12 Interchange.

Please complete the appropriate parts of "Project Status" form (Enclosure 2), and return it to this office as your work progresses. You are responsible for ensuring that the contractor or workers executing the activity authorized herein are knowledgeable of the terms and conditions of this authorization.

Should you have any questions regarding this matter, please call Paula Gill of our Regulatory Division at (415) 503-6776 or by email at Paula.C.Gill@usace.army.mil. Please address all correspondence to the Regulatory Division and refer to the File Number at the head of this letter. If you would like to provide comments on our permit review process, please complete the Customer Survey Form available online at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

John K. Baker

John K. Baker, P. E.
Lieutenant Colonel, U.S. Army
Commander and District Engineer

Enclosures

Copy Furnished (w/encl 1 only):

US EPA, San Francisco, CA
US FWS, Sacrament, CA
US NMFS, Santa Rosa, CA
CA DFW, Yountville, CA
CA RWQCB, Oakland, CA
SF BCDC, San Francisco, CA

DEPARTMENT OF THE ARMY PERMIT

PERMITTEE: Ms. Melanie Brent, California Department of Transportation (Caltrans)

PERMIT NO.: 2007-400401S

ISSUING OFFICE: San Francisco District

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate District or Division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below:

PROJECT DESCRIPTION:

The Interstate 80 (I-80)/Interstate 680 (I-680)/State Route 12 (SR 12) Interchange Project will (1) improve the connection from westbound I-80 to I-680 and SR 12 West, (2) provide a direct connection between northbound I-680 and SR 12 West, (3) provide a connection from I-80/Red Top Road interchange with Business Center Drive, (4) construct or improve interchanges at SR 12 West/Red Top Road, I-80/Red Top Road, I-80/Green Valley Road, and I-680/Red Top Road, and (5) construct the Suisun Creek Preserve mitigation site. For funding and construction purposes, the project has been divided into seven construction packages summarized in Table 1 below. This Department of the Army permit specifically authorizes the construction of the initial construction package. **Prior to implementation of construction packages 2 through 7 of the overall project, Caltrans is required to obtain, from the Corps, written approval and permit modifications specifically authorizing future construction packages and related impacts to waters of the United States.**

The initial construction package shall be completed in accordance with the plans and drawings titled "*USACE File #2007-400401S, I-80/I-680/SR-12 (80/680/12) Interchange Project, Solano County, April 29, 2013, Figures 1 to 14*" (enclosure 1). Construction packages 2 – 7 shall be completed, upon further permit modification, in accordance with the and the written project description (enclosure 2) and plans and drawings titled "*USACE File #2007-400401S, I-80/I-680/SR-12 (80/680/12) Interchange Project, Solano County, April 29, 2013, Figures 15 to 20*" provided as enclosure 3, including the re-designed Red Top Road Interchange "*USACE File #2007-400401S, I-80/I-680/SR-12 (80/680/12) Interchange Project, Solano County, April 29, 2013, Figures 21 to 23*", provided as enclosure 4.

Compensatory mitigation for unavoidable loss of Waters of the United States shall occur through implementation of the "*Suisun Creek Preserve Mitigation and Monitoring Plan*" dated April 2013. Implementation of the plan shall result in the creation of 8.96 acres of seasonal wetland habitat and establishment of 2,682 linear feet (0.06 acres) of seasonal drainage.

Implementation of the project (construction packages 1-7) and construction of the mitigation site is expected to require permanent fill of no more than 4.45 acres of wetlands and 1.47 acres (10,331 linear feet) of Other Waters of the U.S. Of the 10,307 linear feet of Other Waters of the U.S. that will be filled for project implementation 7,752 linear feet will be relocated adjacent to the newly constructed roadway. Temporary impacts would occur to 1.56 acre of wetlands and 0.76 acre (3,394) linear feet of Other Waters of the U.S.

Implementation of the first construction package would result in the permanent fill of 1.20 acres of wetland and 0.37 acres (4,358 linear feet) of Other Waters of the U.S. Temporary impacts would occur to 0.23 acre of wetland. Discharge of fill material for all construction packages is depicted in drawings titled, "*USACE File # 2007-400401N, I-80/I-680/SR-12 (80/680/12) Interchange Project, Solano County, April 29, 2013, Figures 24 to 27*", provided as enclosure 5.

Table 1: Summary of Main Construction Elements for seven Construction Packages

Package #	Main Construction Elements	Permanent impact to waters of the U.S. (acre)	Temporary impacts to waters of the U.S. (acre)
Suisun Creek Mitigation	• Construct the required compensatory mitigation including seasonal wetlands, creek, and riparian mitigation.	Total: 0.23 Wetland: 0.22 OUWS: 0.01	Total: 0.72 Wetland: 0.72 OUWS: 0
1	• Construct the I-80 WB, SR12 WB connector; • widen WB I-80 between the existing I-80/I-680 separation and SR 12 west; and • reconstruct the west half of the Green Valley road interchange.	Total: 1.57 Wetland: 1.20 OUWS: 0.37	Total: 0.30 Wetland: 0.23 OUWS: 0.07
2	• Construct the I-680/red Top Road interchange; • realign Lopes Road and Fermi Road; and • realign Ramsey Road around proposed I-680/Red Top Road Interchange.	Total: 0.77 Wetland: 0.70 OWUS: 0.07	Total: 0.04 Wetland: 0.0 OWUS: 0.04
3	• Construct the WB I-80 to SB I-680 connector; • widen the WB I-80 between the I-80/Suisun Valley Road and the I-80/Green valley road interchanges; • reconstruct the WB I-80 bridge over Green Valley Creek; • construct a new WB on-ramp from I-80 at Suisun Valley Road; • construct a new WB off-ramp from I-80 to Green Valley Road; • construct a new bridge over Green valley Creek carrying WB off-ramp to Green Valley Road; • remove the existing I-80/I-680 connector bridges over i-80 and green valley road; • remove Neitzel road; and • excavation and grading of the Business Center Drive extension.	Total: 1.52 Wetland: 1.07 OWUS: 0.45	Total: 0.30 Wetland: 0.02 OWUS: 0.28
4	• Construct the NB I-680 to EB I-80 connector; • reconstruct the EB SR 12 west connector to EB I-80; • reconstruct the EB I-80 off ramp to Green Valley Road; • reconstruct Green Valley Road on-ramp to EB I-80. • realign both Lopes Road and Green valley Road to connect to the original I-680 alignment; • widen SR 12 east one lane to the south, including widening the culvert; and • add retaining wall between Ledgewood Creek and Pennsylvania.	Total: 0.65 Wetland: 0.42 OUWS: 0.23	Total: 0.29 Wetland: 0.26 OUWS: 0.03
5	• Construct the NB I-680 to WB SR 12 W connector; • reconstruct the I-80 Red Top Road interchange; • construct the new SR 12 W/Red Top Road interchange; and • construct the Red Top Road/Business Center drive extension.	Total: 0.80 Wetland: 0.65 OWUS: 0.15	Total: 0.64 Wetland: 0.33 OWUS: 0.31
6	• Construct the I-80/I-680 HOV connectors	Total: 0.01 Wetland: 0.0 OUWS: 0.01	Total: 0.01 Wetland: 0.0 OUWS: 0.01
7	• Construct the NB I-680/I-80 loop on-ramp; • construct the EB I-80 connector to SB I-680; and • reconstruct the Union Pacific Railroad overpass.	Total: 0.33 Wetland: 0.20 OWUS: 0.13	Total: 0.02 Wetland: 0.0 OWUS: 0.02
	Total	Total: 5.92 Wetland: 4.45 OWUS: 1.47	Total: 1.6 Wetland: 1.56 OWUS: 0.76

PROJECT LOCATION: The project is located in the vicinity of the city of Fairfield, Solano County, California. The project area covers approximately 9 miles encompassing I-80, I-680, and SR 12. The project involves improvements on I-80 between Red Top Road and Suisun Valley Road, on I-680 between Gold Hill Road and I-80, on SR 12 West (SR 12W) between 0.5

mile west of Red Top Road and I-80, and on SR 12 East (SR 12E) between Chadbourne Road and just east of Pennsylvania Avenue (enclosure 6).

PERMIT CONDITIONS:

GENERAL CONDITIONS:

1. The time limit for completing the work authorized ends on May 1, 2018. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. A conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is provided as enclosure 7.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

7. You understand and agree that, if future operations by the United States require the removal, relocation or other alteration of the structure or work authorized herein, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, you will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

SPECIAL CONDITIONS:

1. Prior to implementation of construction packages two through seven you are required to obtain, from the Corps, <u>written permit modifications</u> authorizing proposed construction packages and associated unavoidable impacts to waters of the United States. The following information should be provided, allowing the Corps at least 60 days for review and approval:

    a. Demonstration that the proposed construction package is consistent with the project described in the NEPA document (*Interstate 80/Interstate 680/State Route 12 Interchange Project, Solano County California, Final Environmental Impact Statement/Report, October 2012*) and 404(b)1 analysis (*I-80/I-680/State Route 12 Interchange Project Solano County, California, District 4-SOL-80 (PM 10.8/17.0); SOL-680 (PM 10.0/13/1); SOL-SR 12 (PM 1.7/L2.8); and SOL-SR 12 (PM L1.8/4.8) 0A5300 SECTION 404(b)(1) Evaluation dated February 2012*).

b. Demonstration of compliance with all documents for the project (construction packages one through seven) prepared in accordance with Section 7 of the Endangered Species Act of 1973 as amended, 16 U.S.C. §§ 1531-1544, and Section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1855(b)(4)(B), including statements that:

    1. The amount or extent of incidental take indicated in the Biological Opinions has not been exceeded.
    2. Effects to listed species or critical habitat beyond those considered in the concluded section 7 consultation are not expected.
    3. The construction packages have not been modified in a manner that will cause an effect to the listed species or critical habitat that was not considered in the completed opinion; and
    4. A statement that new species or critical habitat have not been designated within the action area.
    5. Compliance with any provisional conditions included in the Biological Opinion (e.g., conducting Service protocol-level plant surveys on the Mangels' property north of SR 12 West (SR 12W) for showy Indian clover prior to the initial ground breaking for Construction Package 3).

c. Waste Discharge Requirements (WDRs) adopted by the Water Board for the proposed construction package.

d. Analyses of additional opportunities to avoid and minimize impacts to jurisdictional waters consistent with "*Attachment G: Waters of the U.S. Avoidance Minimization Assessment*" of the 404(b)1 analysis.

e. Any required documentation from the appropriate Coastal Zone Management Agency that proposed work within the Suisun Marsh Protection Plan Area (i.e. construction package 2 (Red Top Road Interchange) and Suisun Creek Preserve) is compliant with all appropriate approvals pursuant to the Suisun Marsh Preservation Act, the Suisun Marsh Protection Plan, and the federal Coastal Zone Management Act.

f. In order for modification of this permit to occur for future construction packages you must demonstrate full compliance with the *Suisun Creek Mitigation and Monitoring Plan* dated April 2013 and achieve performance standards as outlined in Table A- Suisun Creek Preserve Performance Standards, provided as enclosure 8. Mitigation ratios for future construction packages shall be determined based on the successful progress of the mitigation site toward the objectives outlined in the plan. If the site fails to meet performance standards, the Adaptive Management Plan shall be implemented or alternative mitigation shall be identified.

g. An update regarding the status of the Suisun Creek Preserve. If the Suisun Creek Preserve is not meeting the performance standards outlined in Table A- Suisun Creek Preserve Performance Standards provided as enclosure 8, permit modification and construction of future construction packages shall be suspended until the site is brought into compliance or the alternative mitigation is identified.

2. The "*Suisun Creek Preserve Mitigation and Monitoring Plan*" dated April 2013 has been approved to provide compensatory mitigation for the permanent fill of 4.23 acres of wetlands and 1.41 acres (10,307 linear feet) of Other Waters of the U.S. for the project through creation of 8.96 acres of seasonal wetland and establishment of 2,682 linear feet (0.06 acres) of seasonal drainage. Performance standards are outlined in Table A- Suisun Creek Preserve Performance Standards provided as enclosure 8. The 10-year monitoring program will be implemented as outlined in the attached table and Chapter 5 of the Plan. In the event that inconsistencies between the performance standards table and the plan are discovered, the attached table shall supersede information in the plan. Annual monitoring reports shall be submitted to the Corps by December 31st, of each year.

3. Within six months of placement of fill into a jurisdictional feature required for the implementation of the initial construction package, the final mitigation plan shall be implemented. If construction of Suisun Creek Preserve does not commence within six months from impact to a jurisdictional feature required for construction of the initial construction package (not to include utility work), and conclude prior to the completion of the initial construction package, then you shall submit, subject to approval by the Corps, a mitigation proposal to account for temporal loss of jurisdictional waters impacted during the delay period.

4. The Permittee retains ultimate legal responsibility for meeting the requirements of the final mitigation plan and the performance standards outlined in Table A- Suisun Creek Preserve Performance Standards provided as enclosure 8.

5. As stipulated in the "*Suisun Creek Preserve Mitigation and Monitoring Plan*" dated April 2013, a performance bond, other Corps-approved financial assurance mechanism, or alternate mechanism, such as a formal, documented commitment from Caltrans or a public authority, must be in place within ninety (90) days following permit issuance or prior to commencing the permit activity, whichever is sooner. It must ensure a high level of confidence that the compensatory mitigation will be performed and maintained, in accordance with 33 C.F.R. § 332.3(n) and the Institute for Water Resources White Paper, *Implementing Financial Assurance for Mitigation Project Success*, June 2011. The performance bond shall be for 20% of the estimate for planning, plan implementation, performance standard monitoring, and contingency implementation. The cost estimate of the listed items shall be provided to the Corps thirty (30) days following permit issuance.

6. You shall ensure that a conservation easement for the Suisun Creek Preserve is completed and recorded with the County Recorder's Office, specifying the preservation of the mitigation area as wetland and riparian wildlife habitat in perpetuity. Copies of the recorded documents shall be provided to the Corps within six (6) months of initiation of impact to a jurisdictional feature.

7. Any changes to the final mitigation plan, as a result of requests made by the Regional Water Quality Control Board, including changes to the performance standards and any proposed adaptive management actions, shall be submitted in writing to the Corps at least 60 days prior to proposed implementation. Caltrans shall not implement the proposed changes prior to receiving written approval from the Corps.

8. The reference sites proposed in the "*Suisun Creek Preserve Mitigation and Monitoring Plan*", the wetland seed mix, and the final placement of transects for monitoring have not been approved. Prior to placement of fill into a jurisdictional feature, required for the implementation of the initial construction package, reference wetlands, and transect placement must be approved. Transect number and placement shall be statistically justified. The wetland seed mix shall consist of only species with a facultative, facultative/wet, and/or obligate indicator status and shall consist of species native to the Suisun Bay hydrologic area.

9. Your responsibility to complete the required compensatory mitigation as set forth in Special Condition 2 above will not be considered fulfilled until you have demonstrated mitigation success and have received written verification from the Corps.

10. Within 1-year of initiation of temporary impact to a jurisdictional feature, you shall re-contour the temporarily impacted area and replant it with appropriate soil-stabilizing native species. Temporary impacts include relocation of 7,752 linear feet of jurisdictional Other Waters of the U.S. within the project area. You shall monitor each re-vegetated area for 5 years. At the end of the fifth year, re-vegetated areas shall provide 75% absolute vegetative cover. In re-vegetated wetlands, the number of dominant species must be greater than 51% absolute cover (having a facultative (FAC) or wetter indicator status). You shall submit a monitoring report for the re-vegetated areas at the end of years 1, 3, and 5. The reports shall include representative photos of the re-vegetated areas. If the cover requirements for the re-vegetated areas are not met, the Corps may require further monitoring, re-vegetation, and/or off-site mitigation.

11. Prior to year 10 and transfer of the Suisun Creek Preserve to the long-term manager the ability to secure contingency supplemental water shall be ensured. This may occur in the form of a secure water right or the right to purchase and convey supplemental water to the project site.

12. In accordance with Performance Standard 17, required wetland delineations at year 5 and 10 shall be completed by an independent third party and shall be submitted to USACE for verification.

13. In accordance with Performance Standard 14, if flooding occurs on the site that does not drain within an appropriate amount of time (i.e., prior to adverse effects to species composition, vegetation health, excessive anaerobic conditions, or flooding in the upland portions of the site) then the Permittee shall fund and implement measures to relieve flood waters and remediate the source of the flood waters.

14. This Corps permit does not authorize you to 'take' a federally listed species. In order to legally 'take' a listed species, you must have a separate authorization under the Endangered Species Act (ESA) (e.g., an ESA Section 10 permit or a Biological Opinion (BO) under ESA Section 7 with "incidental take" provisions with which you must comply). The

enclosed U.S. Fish and Wildlife Service (USFWS) BOs titled "*Biological Opinion on the Effects of the Proposed Interstate 80 /Interstate 680/State Route 12 Interchange Phase 1 Project, Solano County, California (EA OA5300)*" dated April 16, 2012, "*Amendment to the Biological Opinion on the Effects of the Proposed Interstate 80 /Interstate 680/State Route 12 Interchange Phase 1 Project, Solano County, California (EA OA5300)*" dated May 2, 2012, and "*Re-initiation of Formal Consultation for the Proposed Interstate 80/Interstate 680/State Route 12 Interchange Phase 1 Project's Peltier Creek Restoration Project, Solano County, California (Caltrans EA OA5300)*" dated April 29, 2013 (enclosures 9 and 10, respectively) contain mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" that are also specified in the BOs. Your authorization under this Corps permit is conditional upon your compliance with all of the mandatory terms and conditions associated with incidental take authorized by the attached BOs, whose terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the BOs, where a 'take' of the listed species occurs, would constitute an unauthorized take and it would also constitute non-compliance with this Corps permit. The USFWS is the appropriate authorities to determine compliance with the terms and conditions of their BOs and with the ESA.

15. The NMFS concurred with the determination that the project was not likely to adversely affect Central California coast steelhead and designated critical habitat for this species. This concurrence was premised, in part, on project work restrictions outlined in the January 14, 2011, letter from NMFS provided as enclosure 11. These work restrictions are incorporated to ensure unauthorized incidental take of species and loss of critical habitat does not occur.

16. Work in drainages and wetlands are restricted to the dry season (April 15 to October 15). Work in drainages that support habitat for anadromous fish, such as Green Valley Creek and Ledgewood Creek, will be restricted to the time when fish are not as likely to be present. To the extent possible, vegetation removal will be limited to between September 1 and January 31 to minimize adverse effects to migratory birds.

17. As required in the enclosed U.S. Fish and Wildlife Service (USFWS) BO dated April 16, 2012 (enclosure 9), protocol-level surveys for showy Indian clover shall be completed in designated parcels. If the species is detected Caltrans shall re-initiate section 7 consultation with the possibility that additional conservation measures could be required. Surveys and consultation with the USFWS should be completed prior to request for a permit modification for construction package 3.

18. Caltrans, acting as the Federal lead agency, initiated consultation with the State Historic Preservation Officer to address project related impacts to properties listed in the National Register of Historic Places. A Memorandum of Agreement (MOA) signed on November 7, 2011, cited in enclosure 12, titled "*Programmatic Agreement between the California Department of Transporation and the California State Historic Preservation Officer Regarding the I-80/I-680/SR-12 Interchange Project, Solano County, California*", was finalized. Project authorization is conditional upon compliance with the mandatory stipulations of the MOA.

19. You shall employ sediment and erosion control best management practices as needed throughout the project area. No objects or fill shall be placed where they can be eroded or washed into drainage systems in the project area. All debris generated as a result of the project, shall be removed from the site and disposed of at an approved location outside of Corps jurisdiction. All project staging and equipment storage areas shall be located away from areas subject to the jurisdiction of the Corps. After construction, any materials used to dewater areas within the creeks shall be removed in their entirety.

20. While temporary creek diversions are in place, appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable.

21. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows.

22. Temporary fills must be removed at the end of each construction season in their entirety. The affected area must be returned to pre-construction elevations post-construction.

FURTHER INFORMATION:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

(x) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. Section 403).
(x) Section 404 of the Clean Water Act (33 U.S.C. Section 1344).
( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. Section 1413).

2. Limits of this authorization:

a. This permit does not obviate the need to obtain other Federal, State, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability: In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision: This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate. (See Item 4 above.)

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 C.F.R. Section 325.7 or enforcement procedures such as those contained in 33 C.F.R. Sections 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 C.F.R. Section 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions: General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the

public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

Melanie Burt — May 1, 2013

(PERMITTEE) (DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

John K. Baker — 01 MAY 2013

John K. Baker (DATE)
Lieutenant Colonel, U.S. Army
District Commander

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE) (DATE)

Enclosure 2:

Western Segment

Mainline Improvements

I-80W would be realigned between west of Suisun Valley Road to just west of the SR 12W/I-680 interchange by constructing a new six-lane highway alignment north of the existing highway alignment. The realignment would create space in the median for direct high occupancy vehicle (HOV) connector ramps to be built between I-80 and I-680, as well as future widening of the eastbound lanes. The realigned westbound I-80 would have six lanes, including an HOV lane and an auxiliary lane matching the existing cross section at the existing Suisun Valley Road overcrossing. Immediately west of the Suisun Valley Road overcrossing, a seventh lane would be added, as well as an eighth lane with the on-ramp from Suisun Valley Road. A ninth lane would be added immediately west of the Green Valley Road off-ramp. The four right lanes would exit from I-80 to connect to SR 12W and I-680. There would be a left exit from the HOV lane to an HOV connector to I-680. A wider, single-span bridge would replace the existing bridge over Green Valley Creek. The existing loop on-ramp from northbound I-680 to westbound I-80 would be removed. The connector from northbound I-680 to SR 12W would be constructed to replace this movement. The segment of I-680 north of Red Top Road would be realigned.

Freeway-to-Freeway Interchange Improvements

New connector ramps from westbound I-80 to westbound SR 12W and southbound I-680 would be constructed. The proposed westbound I-80 to southbound I-680 connector would cross over I-80, the eastbound SR 12W connector to eastbound I-80, the UPRR tracks, Fulton Drive, and the realigned Lopes Road. A new bridge will be constructed over Jameson Canyon Creek as part of Construction Package 3. Access from westbound I-80 to westbound SR 12W would be braided with (cross over) the Green Valley Road on-ramp to westbound I-80. A separate direct connector structure would be built to carry the HOV lanes in both directions between I-680 and I-80 east of the I-80/I-680/SR 12 interchange. Direct connectors between northbound I-680 and westbound I-80 and eastbound I-80 and southbound I-680 would be constructed. Motorist access from northbound I-680 to westbound I-80 would be served by a loop ramp off the I-680 to SR 12W connector. Traffic from eastbound I-80 to southbound I-680 would use a new ramp which will require widening of the existing bridge over Jameson Canyon Creek as part of Construction Package 7. Motorists traveling eastbound on SR 12W who wish to go to southbound I-680 would exit SR 12W at the proposed SR 12W/Red Top Road interchange to access EB I-80 at Red Top Road and then take the first exist (about ¼ mile away) which will be the EB I-80 connector to SB I-680.

Interchange Improvements

The I-80/Green Valley Road interchange would have a tight diamond configuration westbound and a partial cloverleaf (loop on-ramp) configuration eastbound. The same interchange and overcrossing would provide access to the existing alignment of I-680, which would be relinquished as a local arterial.

The connection from eastbound I-80 to southbound I-680 would be removed, with eastbound I-80 directed to exit at Green Valley interchange and then follow Lopes Road south to the new I-680/Red Top Road interchange. A new on-ramp at Green Valley Road would provide access to the new westbound I-80 alignment. The I-80/Red Top Road interchange would be partially reconstructed to have westbound hook ramps. Red Top Road would be realigned to connect this interchange on I-80 with a new SR 12W/ Red Top Road interchange. Improvements to I-680 would include the construction of an interchange at Red Top Road.

Local Road Improvements

A bicycle path would be relocated along the western boundary of the business park at the west end of the existing Business Center Drive parking lot, and along the north side of the new connector from westbound I-80 to westbound SR 12W to maintain access between the existing bicycle path along Jameson Canyon Road (SR 12W) and Business Center Drive. This path would be removed when Business Center Drive is extended to the SR 12W/Red Top Road interchange because bicyclists would be able to utilize the extension of Business Center Drive to reach Red Top Road and points west. The existing Green Valley Road overcrossing at I-80 would be removed, and a new one would be constructed on a different alignment. The overcrossing would consist of western four lanes of the seven-lane structure.

Eastern Segment

A third lane would be added to eastbound SR 12E requiring widening of the existing box culvert that conveys Ledgewood Creek. This lane would connect (start) at the eastbound SR 12E/Chadbourne Road interchange and would extend east, connecting and ending at the eastbound SR 12E/Webster Street exit. A retaining wall will be built along the south side of SR 12E from east of Ledgewood Creek to Pennsylvania Avenue.

Utilities

As part of the proposed project, utilities within the project area will be relocated, realigned, or extended as necessary to accommodate project construction and operation. Utilities that will be affected include water, electrical, gas, cable/fiber, and telephone lines. Water lines include those owned by the cities of Fairfield, Vallejo, and Benicia. Irrigation and non-potable water and agricultural drains owned by the Solano Irrigation District are located within the project area. These water facilities and sewer facilities owned by the cities of Fairfield and Suisun City and by the Fairfield-Suisun Sewer District, will be realigned or extended, as necessary.

Pacific Gas and Electric (PG&E)-owned electrical and gas lines within the project area will be affected by construction and operation. One 115-kilovolt (kV) electrical transmission line that crosses I-680 between Fermi and Fulton drives will be realigned, and towers will be relocated. The Vaca-Suisun-Jameson tower line crosses I-680 and Green Valley Road near the eastbound I-80 ramps intersection. The line will be raised by 45 feet (ft) to accommodate the project. Additionally, to accommodate the proposed connectors, one tower will be relocated and the line height raised by 90 ft between Dittmer Road and the Jameson substation on Watt Court. Several other overhead distribution or transmission lines will be realigned, as will a 12-kV underground line that crosses I-80 just east of the existing Green Valley Road overcrossing. Additionally, PG&E gas lines, primarily in the vicinity of the I-80/Green Valley Road will be modified or realigned and it may be necessary to acquire new easements.

A PG&E valve lot, a gas transmission facility, will be relocated to a vacant parcel owned by the Fairfield-Suisun Unified School District (FSUSD) at the former Green Valley Middle School location at 3630 Ritchie Road in Fairfield. The relocated valve lot will occupy a 1.3-acre (ac) portion of the larger 7.69-ac FSUSD parcel. This relocation will require the acquisition of 1.3 ac from FSUSD, as well as securing permanent and temporary easements needed for operation, maintenance, and construction staging purposes.

Cable lines belonging to Comcast and located within local roads will be relocated where necessary. Qwest Communications has a fiber conduit mounted on the UPRR bridge, which will be relocated along the new bridge.

Telephone facilities within the project area include local, long-distance, and local services (i.e., TelNet) lines owned by AT&T. These include both overhead and underground lines and conduit. These facilities will be relocated where they conflict with the proposed project. All relocations of the long distance and TelNet lines will be handled through AT&T California.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

IN SOLANO COUNTY
IN AND NEAR FAIRFIELD
FROM 0.5 MILE WEST OF ROUTE 12/80 SEPARATION
TO ROUTE 80/680 SEPARATION
FROM ROUTE 80/12 SEPARATION TO ROUTE 80/680 SEPARATION

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2010

INDEX OF PLANS

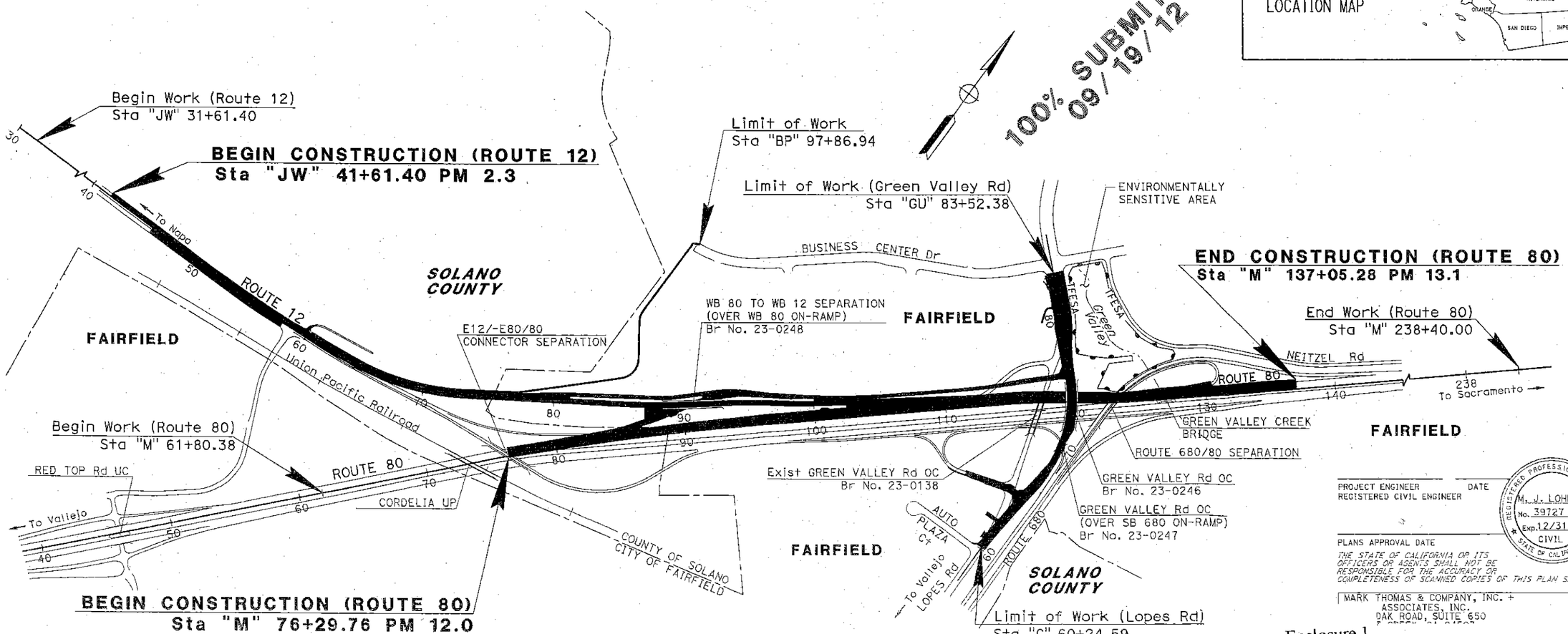
SHEET No.	DESCRIPTION
1	TITLE
2-30	TYPICAL CROSS SECTIONS
31	KEY MAP AND LINE INDEX
32	PROJECT CONTROL AND MONUMENTATION
33-44	LAYOUTS
45-63	PROFILES/SUPERELEVATION DIAGRAM
64-91	CONSTRUCTION DETAILS
92	WATER POLLUTION CONTROL QUANTITIES
93-105	EROSION CONTROL PLANS AND QUANTITIES
106-116	CONTOUR GRADING
117-177	DRAINAGE PLANS, PROFILES, DETAILS AND QUANTITIES
178-185	SUBSURFACE DRAINAGE PLANS
186-223	UTILITY PLANS
224-235	CONSTRUCTION AREA SIGNS
236-312	STAGE CONSTRUCTION AND TRAFFIC HANDLING PLANS
313-318	DETOUR PLANS
319-335	PAVEMENT DELINEATION PLANS AND QUANTITIES
336-355	SIGN PLANS, DETAILS AND QUANTITIES
356-358	SUMMARY OF QUANTITIES
359-407	LIGHTING AND SIGN ILLUMINATION, TOS, ELECTRICAL

STRUCTURES PLANS

408-459	RETAINING WALL PLANS
460-535	STRUCTURE PLANS

LOCATION MAP

100% SUBMITTAL 09/19/12



PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp. 12/31/13 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

MARK THOMAS & COMPANY, INC. + ASSOCIATES, INC.
OAK ROAD, SUITE 650

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
MICHAEL J. LOHMAN	RONI BOUKHALIL	50744	9/30/13	

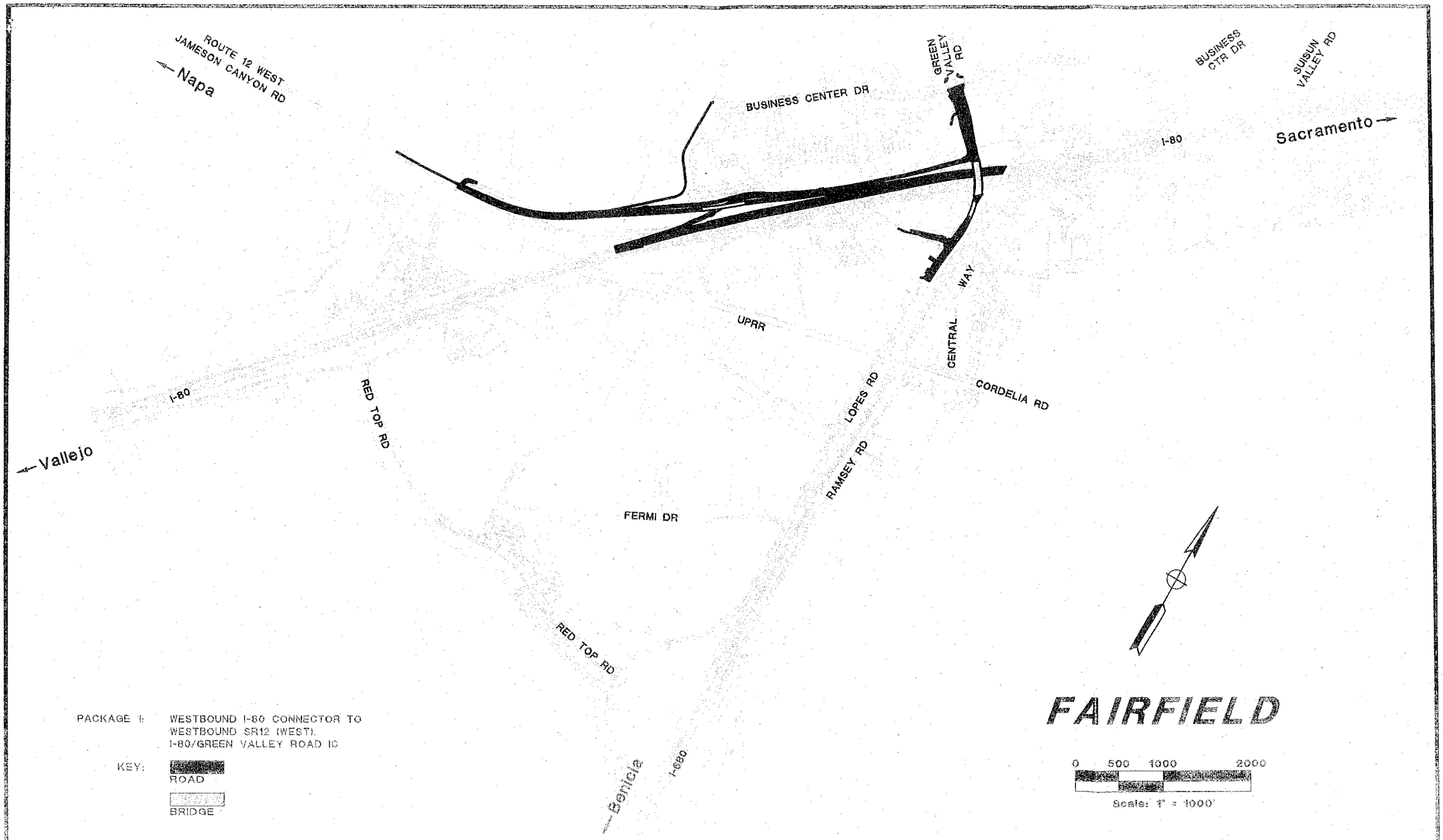
THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

Enclosure 1

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 1 of 14

PLOTTED => 20-SEP-2012
LAST PLOTTED => 13:10



PACKAGE 1: WESTBOUND I-80 CONNECTOR TO WESTBOUND SR12 (WEST). I-80/GREEN VALLEY ROAD IC

KEY:
ROAD
BRIDGE

SCALE: 1" = 1000' (11"x17")
DATE: AUGUST 2012
JOB: 61 52002-130
SHEET NO.: 1 OF 7

I-80/I-680/SR-12 INTERCHANGE IMPROVEMENT PROJECT, PHASE 1
Construction Package 1

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 2 of 14

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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MARK THOMAS & COMPANY, INC.
+ NOLTE ASSOCIATES, INC.
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

NOTES:

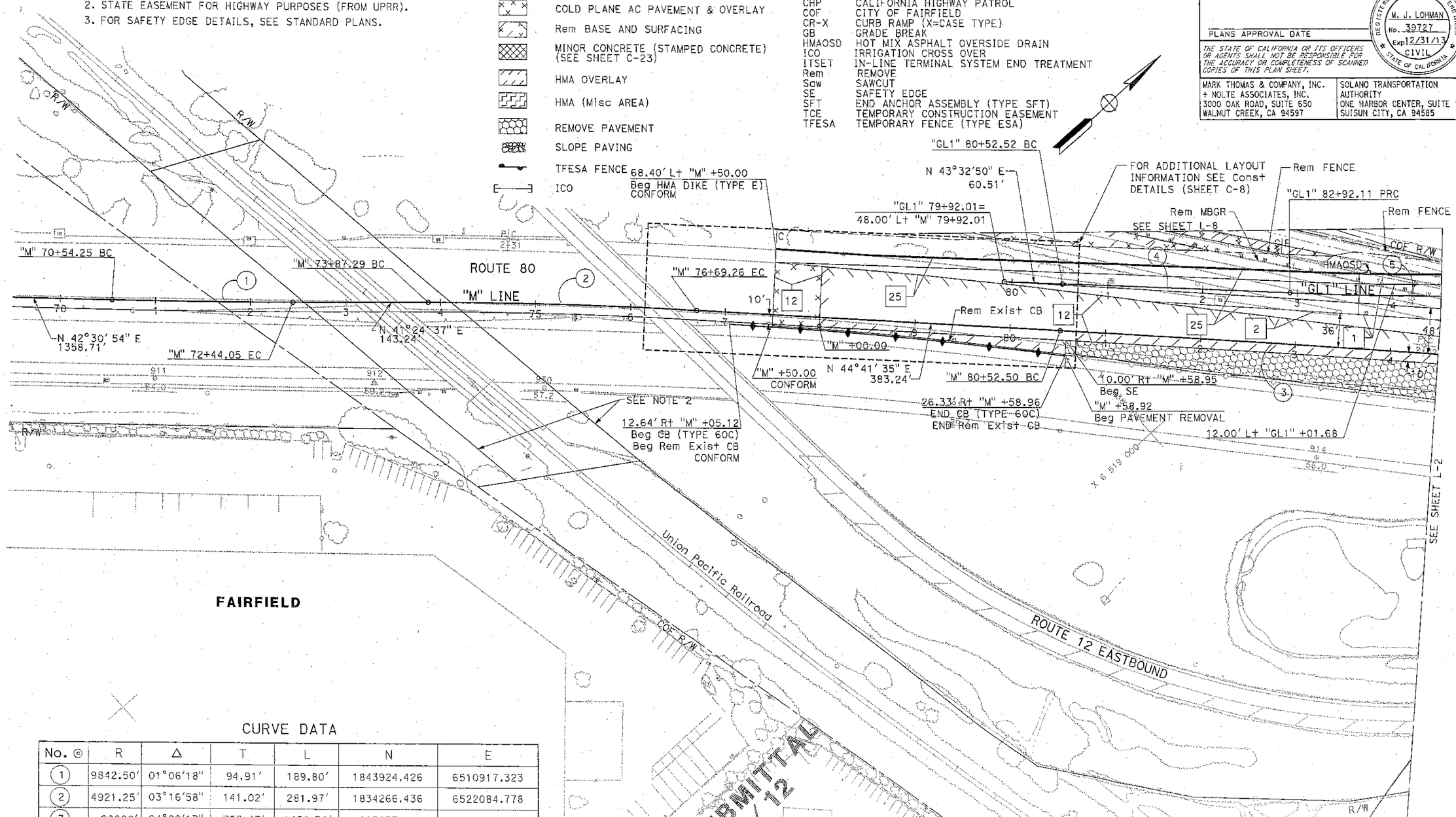
1. FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT DISTRICT OFFICE.
2. STATE EASEMENT FOR HIGHWAY PURPOSES (FROM UPRR).
3. FOR SAFETY EDGE DETAILS, SEE STANDARD PLANS.

LEGEND:

- (No.) CURVE ALIGNMENT DATA
- [No.] PAVEMENT STRUCTURAL SECTION
- COLD PLANE AC PAVEMENT & OVERLAY
- Rem BASE AND SURFACING
- MINOR CONCRETE (STAMPED CONCRETE) (SEE SHEET C-23)
- HMA OVERLAY
- HMA (Misc AREA)
- REMOVE PAVEMENT
- SLOPE PAVING
- TFESA FENCE
- E ICO

ABBREVIATIONS:

AFTS	ALTERNATIVE FLARED TERMINAL SYSTEM END TREATMENT
AP+	ANGLE POINT
BOW	BACK OF SIDEWALK
C&G	CURB AND GUTTER
CHP	CALIFORNIA HIGHWAY PATROL
COF	CITY OF FAIRFIELD
CR-X	CURB RAMP (X=CASE TYPE)
GB	GRADE BREAK
HMAOSD	HOT MIX ASPHALT OVERSIDE DRAIN
ICO	IRRIGATION CROSS OVER
ITSET	IN-LINE TERMINAL SYSTEM END TREATMENT
Rem	REMOVE
Saw	SAWCUT
SE	SAFETY EDGE
SFT	END ANCHOR ASSEMBLY (TYPE SFT)
TCE	TEMPORARY CONSTRUCTION EASEMENT
TFESA	TEMPORARY FENCE (TYPE ESA)



CURVE DATA

No.	R	Δ	T	L	N	E
1	9842.50'	01°06'18"	94.91'	189.80'	1843924.426	6510917.323
2	4921.25'	03°16'58"	141.02'	281.97'	1834266.436	6522084.778
3	20000'	04°09'17"	725.47'	1450.30'	1823933.869	6533073.574
4	20048'	00°41'05"	119.80'	239.60'	1824222.532	6533351.820
5	3532'	04°00'30"	123.59'	247.09'	1840671.115	6516456.243

100% SUBMITTAL 09/19/12

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 3 of 14

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN
CALCULATED-DESIGNED BY: J. M. PANGBURN
CHECKED BY: R. M. BROGAN
REVISED BY / DATE REVISED

BORDER LAST REVISED 7/2/2010 | USERNAME => jacky | DGN FILE => 04000211311e001.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0741 | PROJECT NUMBER & PHASE 04000211311

LAST REVISION 09-12-12 | DATE PLOTTED => 20-SEP-2012 | TIME PLOTTED => 13:20

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE. SEE SHEET L-9

CURVE DATA

No.	R	Δ	T	L	N	E
3	20000'	04°09'17"	725.47'	1450.30'	1823933.869	6533073.574
5	3532'	04°00'30"	123.59'	247.09'	1840671.115	6516456.243
6	1350'	09°04'45"	107.19'	213.93'	1839351.922	6518198.285
7	1000'	25°25'00"	225.51'	443.60'	1838326.355	6520324.294
8	5950'	05°39'45"	294.26'	588.04'	1843483.253	6515746.865
9	3900'	03°24'47"	116.19'	232.31'	1835940.621	6522085.149
10	3900'	02°51'45"	97.44'	194.84'	1842473.018	6517811.912
11	1000'	09°41'19"	84.75'	169.10'	1839559.333	6518659.271
12	1024'	15°13'24"	136.84'	272.08'	1838281.341	6520249.855
13	155'	83°23'05"	138.06'	225.58'	1838778.361	6518815.179
44	1150'	110°59'40"	1673.08'	2227.80'	1838182.265	6520565.520
45	11070.19'	02°20'14"	225.83'	451.59'	1830654.375	6527111.359
46	2355'	08°44'55"	180.15'	359.59'	1839884.734	6517315.795
70	155'	04°32'39"	6.15'	12.29'	1838884.070	6518740.649

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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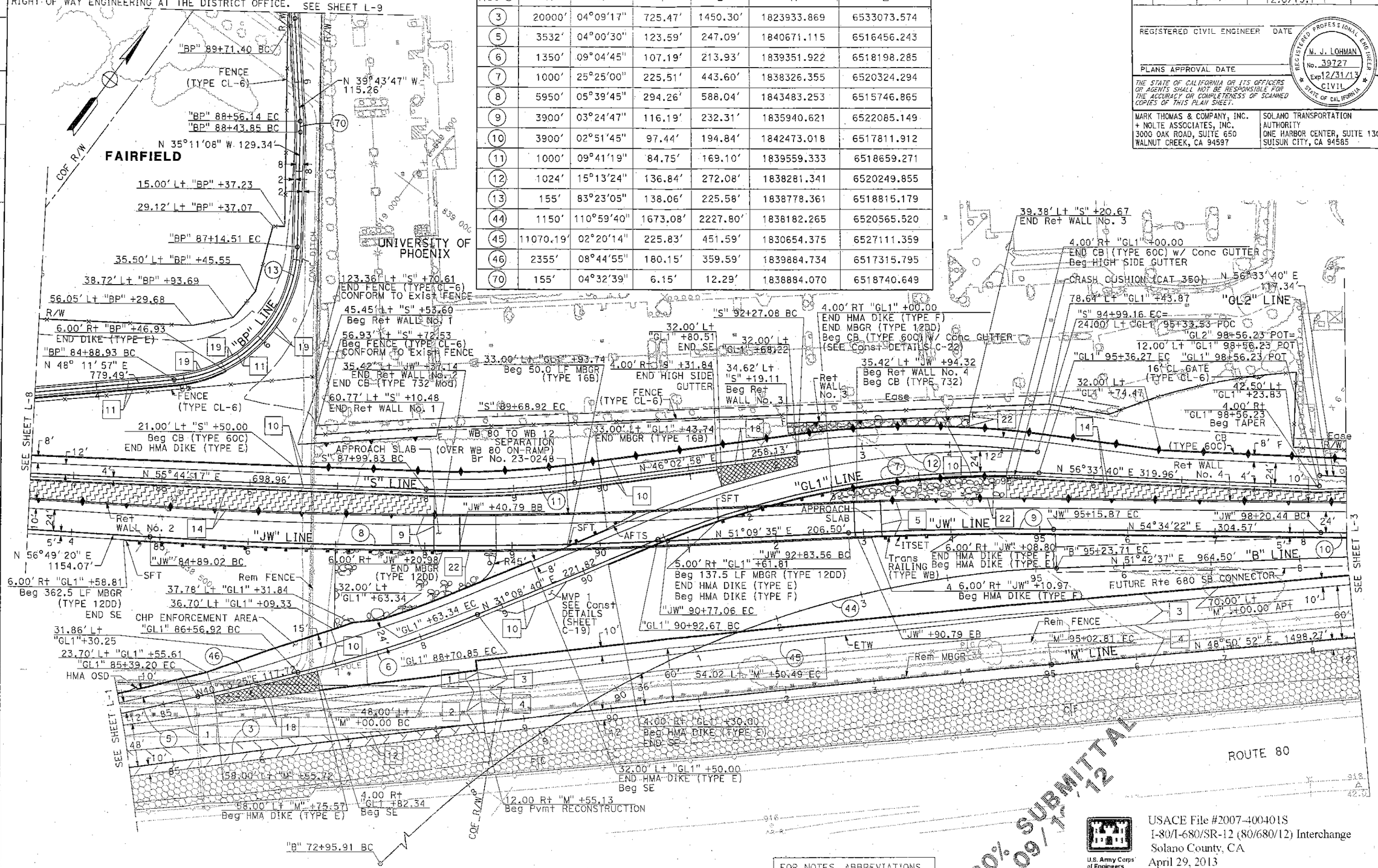
MARK THOMAS & COMPANY, INC.
+ NOLTE ASSOCIATES, INC.
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585



FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET L-1

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 4 of 14

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN
CALCULATED-DESIGNED BY: J. M. PANGBURN
CHECKED BY: R. M. BROGAN
REVISED BY
DATE REVISED

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:20
09-12-12

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

CURVE DATA

No. ⊕	R	Δ	T	L	N	E
10	3900'	02°51'45"	97.44'	194.84'	1842473.018	6517811.912
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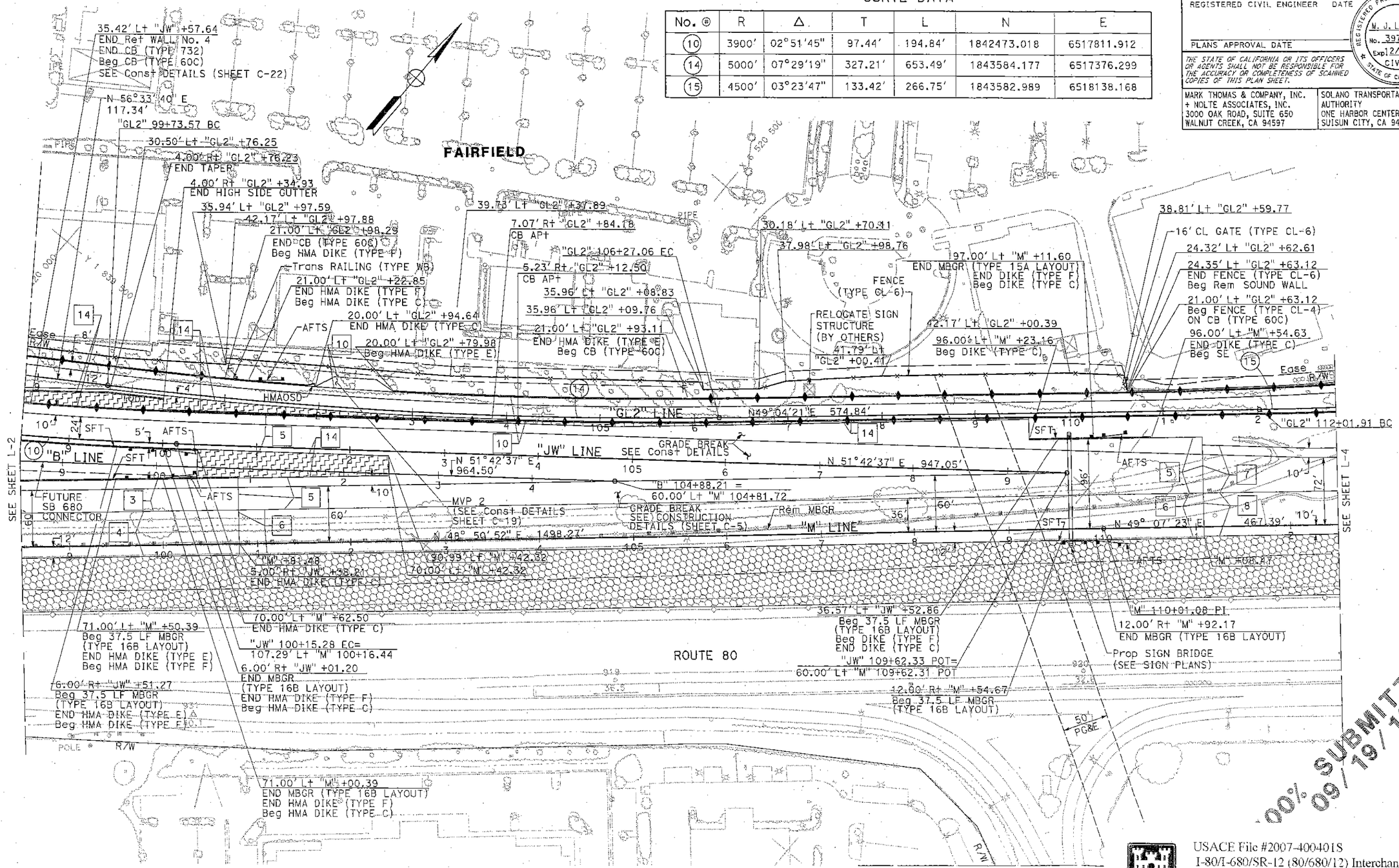

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET L-1

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 5 of 14

100% SUBMITTAL 09/19/12

REVISED BY	DATE REVISED
J. M. PANGBURN	R. M. BROGAN
CALCULATED-DESIGNED BY	CHECKED BY
MICHAEL J. LOHMAN	

CONSULTANT FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:20

09-12-12

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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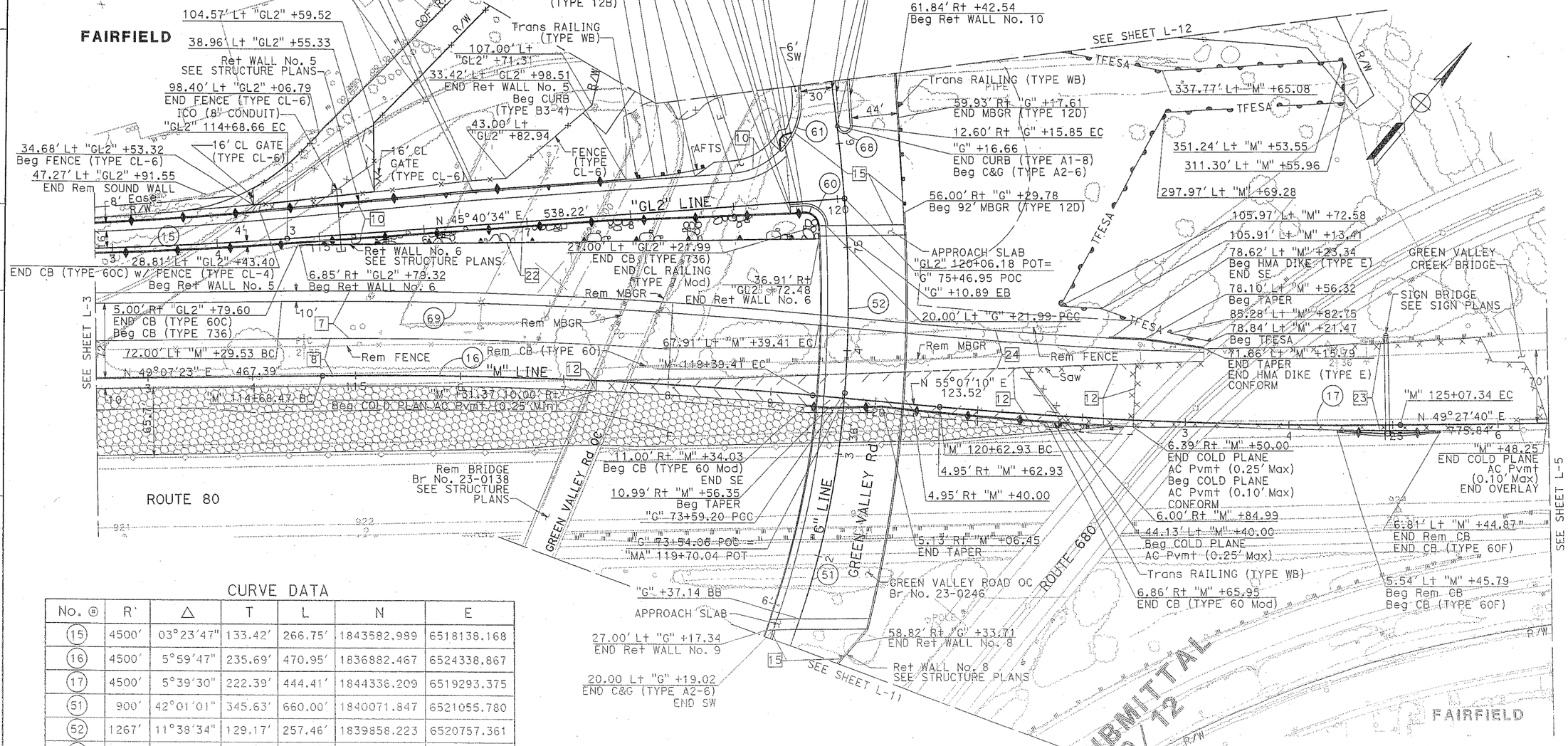
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



CURVE DATA

No. ⊕	R'	△	T	L	N	E
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16	4500'	5°59'47"	235.69'	470.95'	1836882.467	6524338.867
17	4500'	5°39'30"	222.39'	444.41'	1844336.209	6519293.375
51	900'	42°01'01"	345.63'	660.00'	1840071.847	6521055.780
52	1267'	11°38'34"	129.17'	257.46'	1839858.223	6520757.361
60	20'	91°21'54"	20.48'	31.89'	1840694.390	6521655.333
61	70'	92°54'54"	73.66'	113.52'	1840739.065	6521520.744
68	7.32'	180°00'00"	-1.00'	22.98'	1840793.496	6521622.810
69	4628'	6°24'33"	259.10'	517.65'	1836813.633	6524344.447

FOR NOTES, A AND LEGEND.

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 6 of 14

REVISED BY | DATE REVISED
J. M. PANGBURN | R. M. BROGAN
CALCULATED-DESIGNED BY | CHECKED BY
CONSULTANT FUNCTIONAL SUPERVISOR | MICHAEL J. LOHMAN
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:20

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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+ NOLTE ASSOCIATES, INC.
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WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

CURVE DATA

No. ⊕	R	Δ	T	L	N	E
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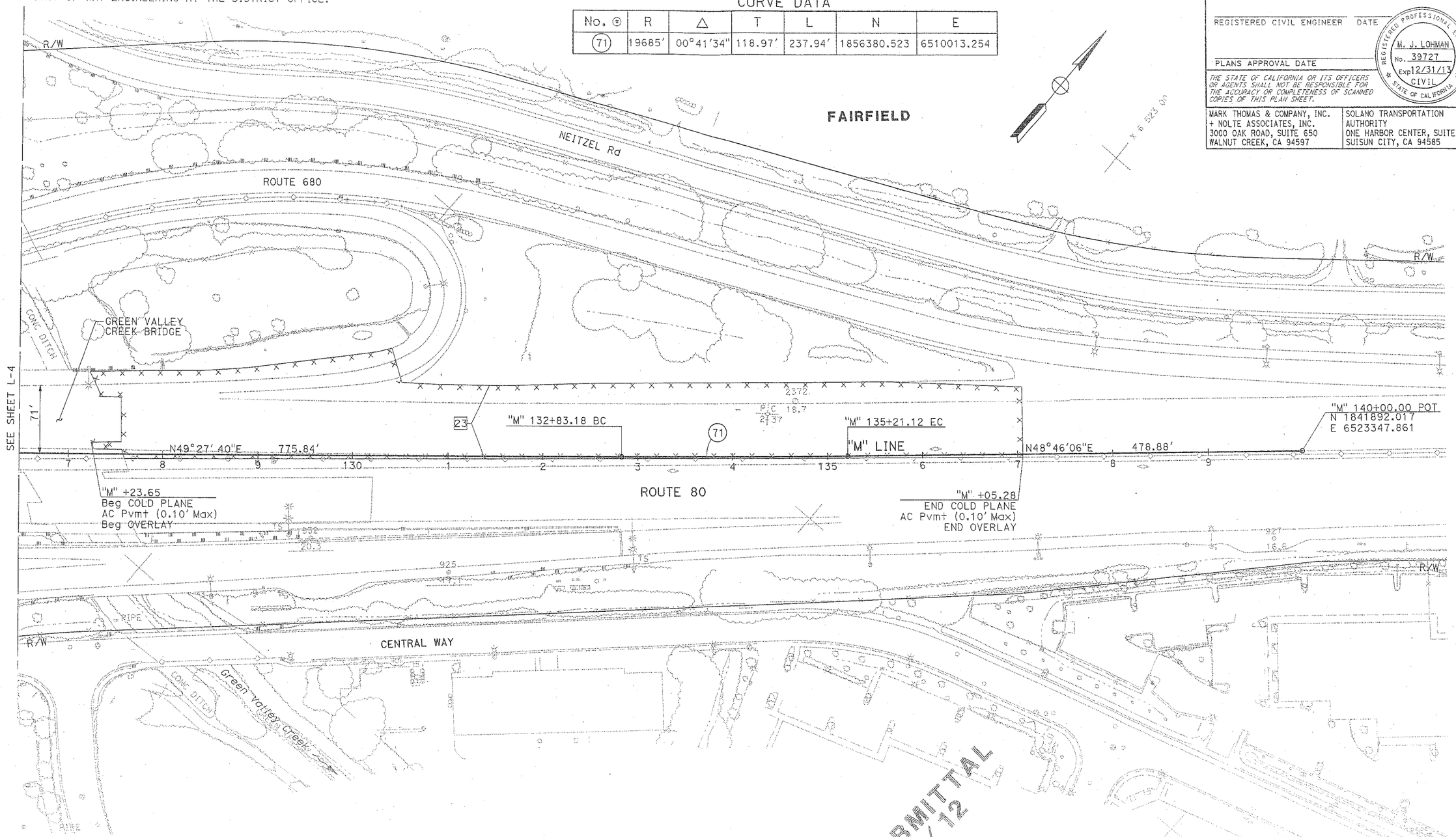

100% SUBMITTAL 09/19/12

FOR NOTES, AB AND LEGEND, S

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 7 of 14

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN

CALCULATED-DESIGNED BY: J. M. PANGBURN
CHECKED BY: R. M. BROGAN

REVISED BY | DATE REVISED

BORDER LAST REVISED 7/2/2010 | USERNAME => jpatr | DGN FILE => 0400021131ig005.dgn | RELATIVE BORDER SCALE IS 1M INCHES | UNIT 0741 | PROJECT NUMBER & PHASE 0400021131

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:21

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

CURVE DATA

No. ⊕	R	Δ	T	L	N	E
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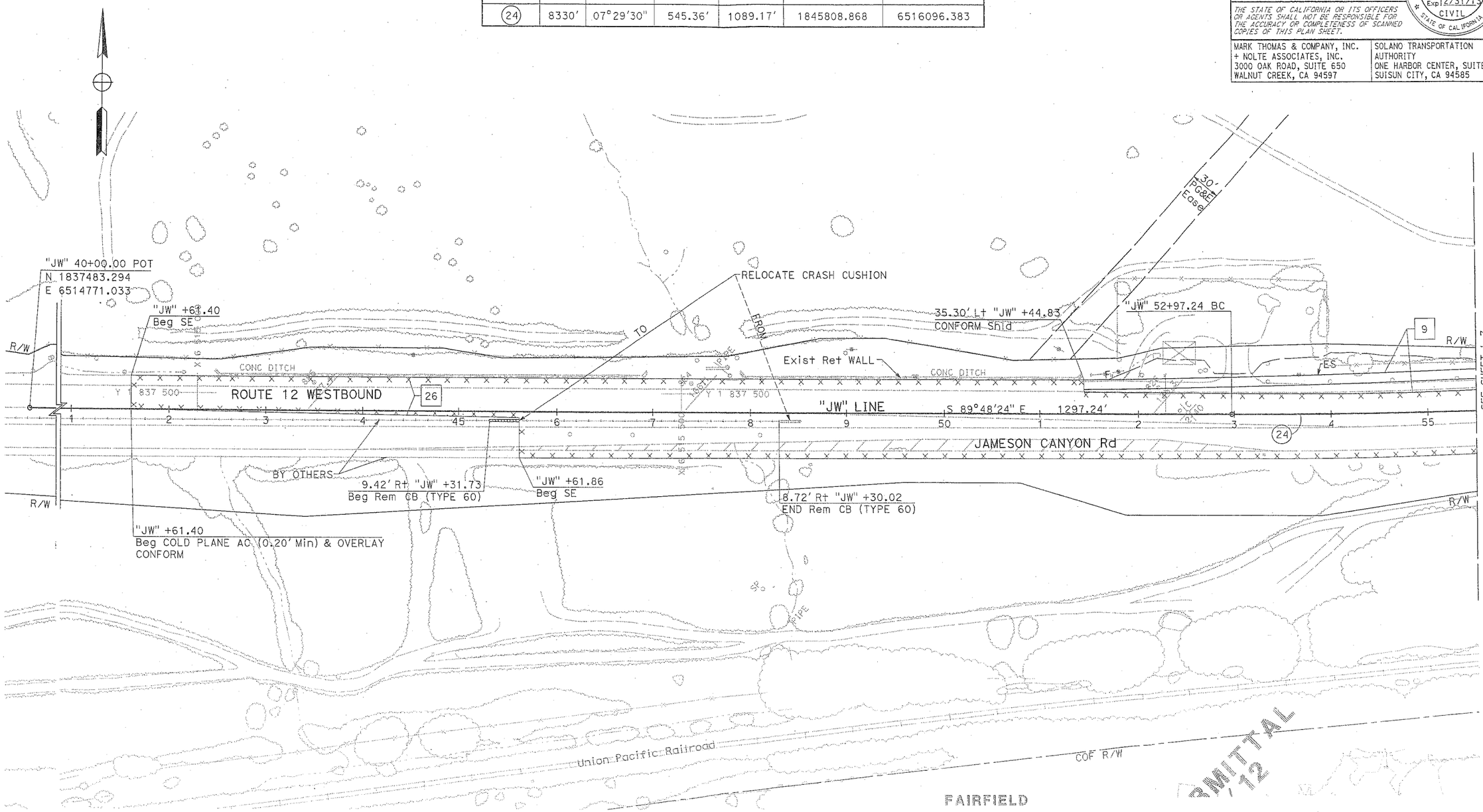

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET L-1

100%

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 8 of 14

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION | CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN | CALCULATED-DESIGNED BY: J. M. PANGBURN | CHECKED BY: R. M. BROGAN | REVISED BY | DATE REVISED

Caltrans

DATE PLOTTED => 29-SEP-2012
TIME PLOTTED => 13:21

BORDER LAST REVISED 7/2/2010 | USERNAME => jcorr | DGN FILE => 04000211311e006.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0741 | PROJECT NUMBER & PHASE 04000211311

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

CURVE DATA

No. ⊕	R	Δ	T	L	N	E
24	8330′	07°29′30″	545.36′	1089.17′	1845808.868	6516096.383
28	2100′	25°52′46″	482.50′	948.53′	1839629.341	6516887.802
29	8275′	02°48′32″	202.88′	405.67′	1845808.868	6516096.383
30	1900′	26°19′14″	444.25′	872.82′	1839489.989	6516940.411
56	1909′	26°19′14″	876.96′	446.36′	1839489.989	6516940.411

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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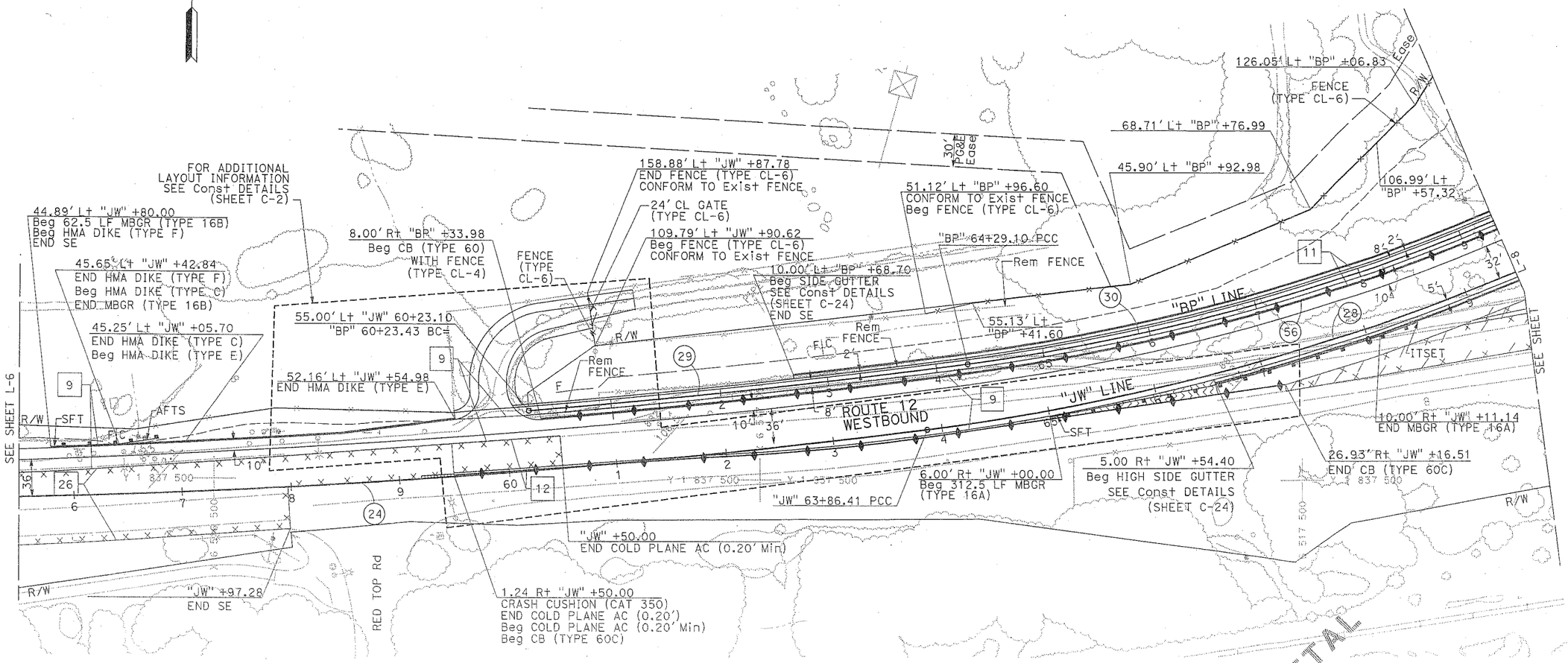
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585



100% SUBMITTAL 09/19/12

FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET L-1

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 9 of 14

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN

CALCULATED-DESIGNED BY: J. M. PANGBURN

CHECKED BY: R. M. BROGAN

REVISED BY / DATE REVISED

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:21

BORDER LAST REVISED 7/2/2010 | USERNAME => jcoty | DGN FILE => 04000211311ea007.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0741 | PROJECT NUMBER & PHASE 04000211311 | 9

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

CURVE DATA

No. ⊕	R	Δ	T	L	N	E
28	2100′	25°52′46″	482.50′	948.53′	1839629.341	6516887.802
30	1900′	26°19′14″	444.25′	872.82′	1839489.989	6516940.411
34	2971′	01°46′40″	46.09′	92.18′	1840545.439	6516590.588
35	155′	06°05′40″	8.25′	16.49′	1838258.795	6518234.094
36	3000′	5°03′49″	132.65′	265.13′	1840545.439	6516590.588
37	2100′	5°07′31″	93.99′	187.85′	1836603.767	6519826.823

Dis+	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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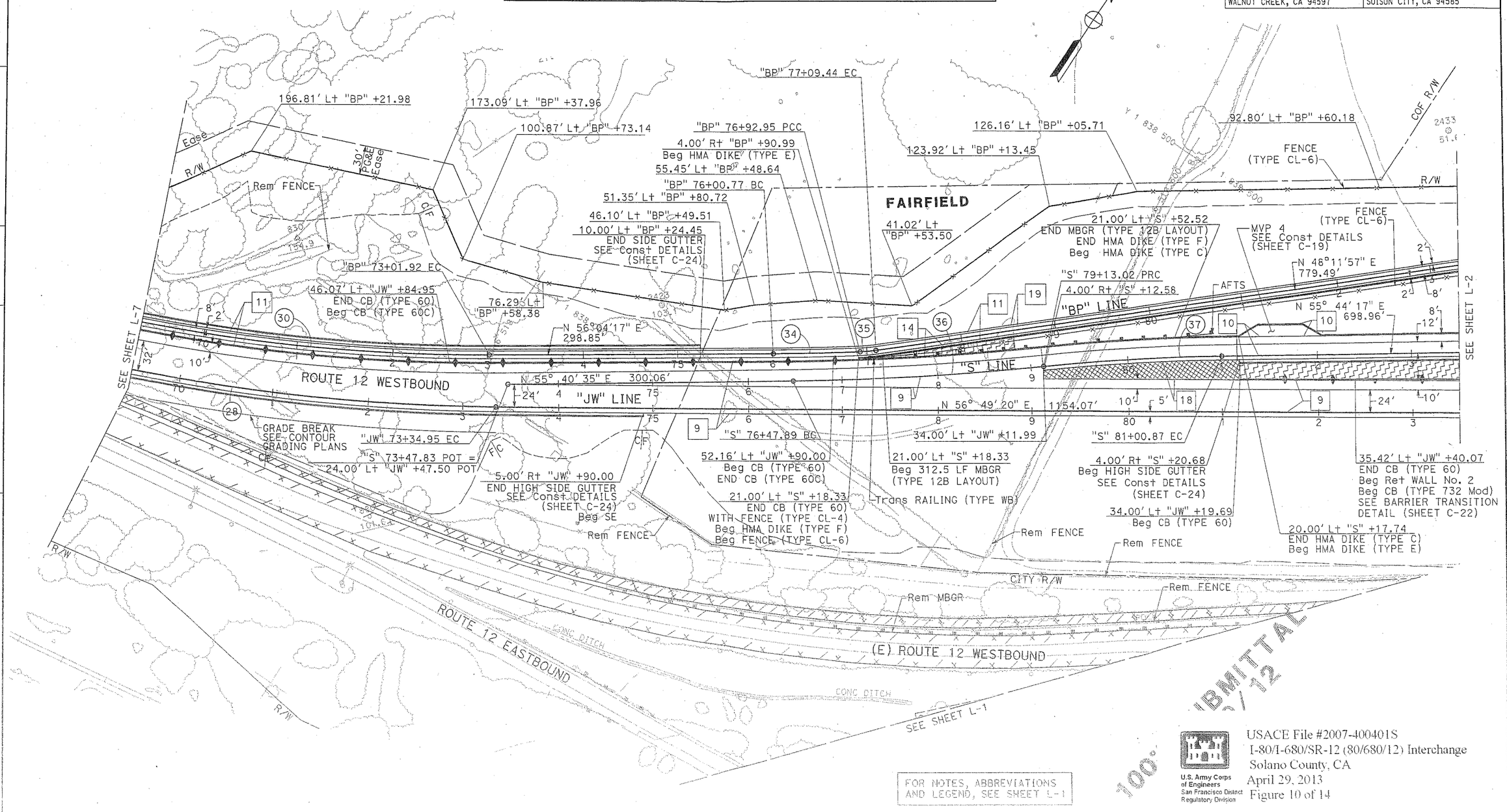
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585



FOR NOTES, ABBREVIATIONS AND LEGEND, SEE SHEET L-1

U.S. Army Corps of Engineers
San Francisco Distinct
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 10 of 14

REVISED BY	DATE REVISED
J. M. PANGBURN	R. M. BROGAN

CALCULATED-DESIGNED BY / CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Gibbons

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:21

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

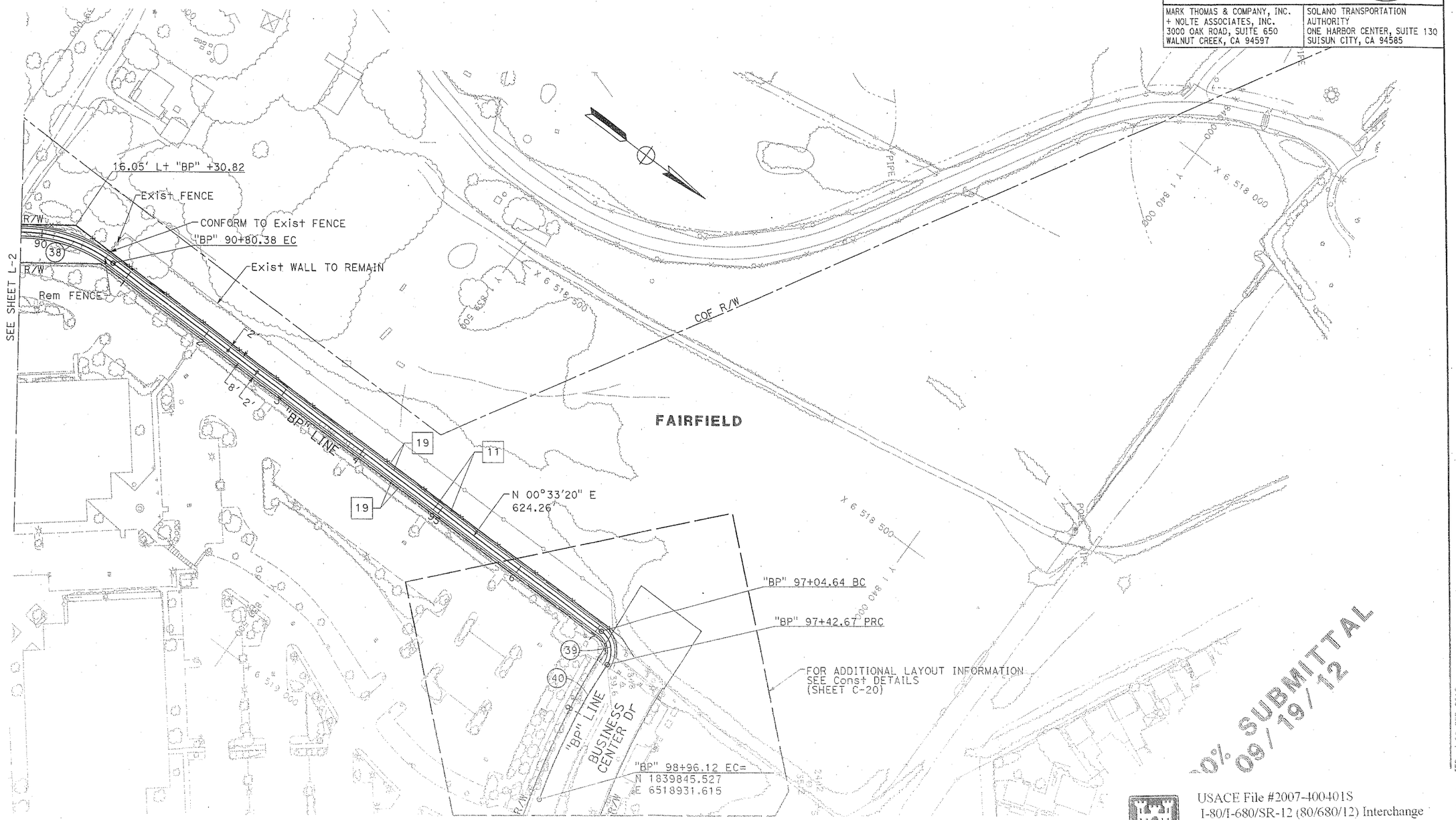
SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

CURVE DATA

No. ⊜	R	Δ	T	L	N	E
38	155′	40°17′07″	56.85′	108.98′	1839170.851	6518905.393
39	25′	87°09′08″	23.79′	38.03′	1839796.342	6518781.450
40	646′	13°36′36″	77.09′	153.45′	1840466.805	6518754.612



FOR NOTES, ABBREVIAT AND LEGEND, SEE SHEE

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 11 of 14

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN
CALCULATED-DESIGNED BY: J. M. PANGBURN
CHECKED BY: R. M. BROGAN
REVISED BY
DATE REVISED

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:21

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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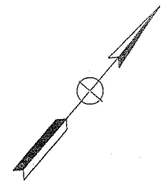
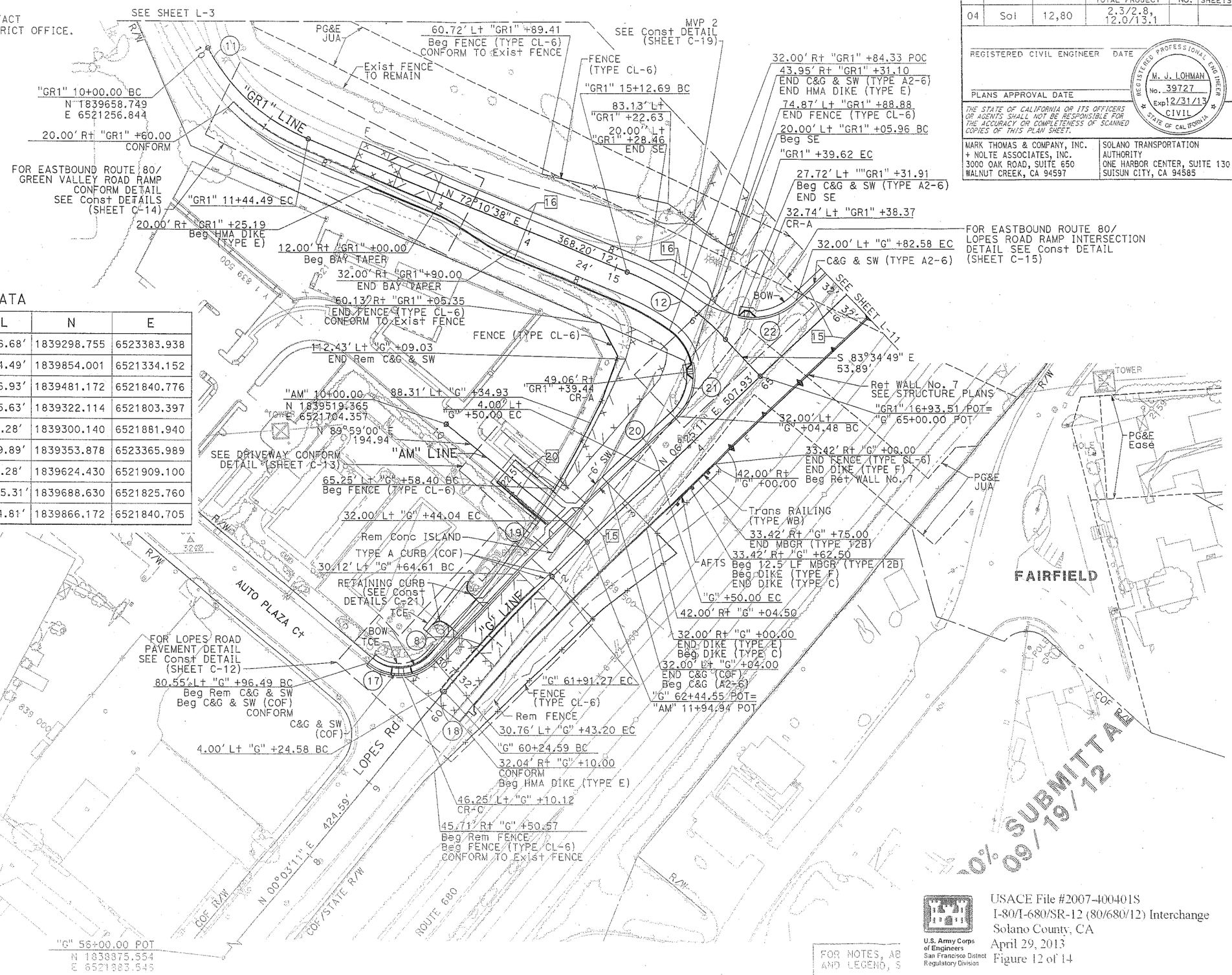
SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.





CURVE DATA

No. ⊛	R	Δ	T	L	N	E
8	1500'	06°22'01"	83.43'	166.68'	1839298.755	6523383.938
11	210'	39°25'24"	75.24'	144.49'	1839854.001	6521334.152
12	300'	24°14'33"	64.43'	126.93'	1839481.172	6521840.776
17	50'	86°39'55"	47.17'	75.63'	1839322.114	6521803.397
18	2'	180°00'13"	1.00'	6.28'	1839300.140	6521881.940
19	1506'	03°02'22"	39.96'	79.89'	1839353.878	6523365.989
20	2'	180°00'00"	1.00'	6.28'	1839624.430	6521909.100
21	60'	100°33'35"	72.22'	105.31'	1839688.630	6521825.760
22	65'	83°34'11"	58.09'	94.81'	1839866.172	6521840.705

FOR NOTES, AB
AND LEGEND, S

U.S. Army Corps of Engineers
San Francisco Distnct
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 12 of 14

90% SUBMITTAL 09/19/12

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN

CALCULATED-DESIGNED BY: J. M. PANGBURN

CHECKED BY: R. M. BROGAN

REVISED BY | DATE REVISED

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:21

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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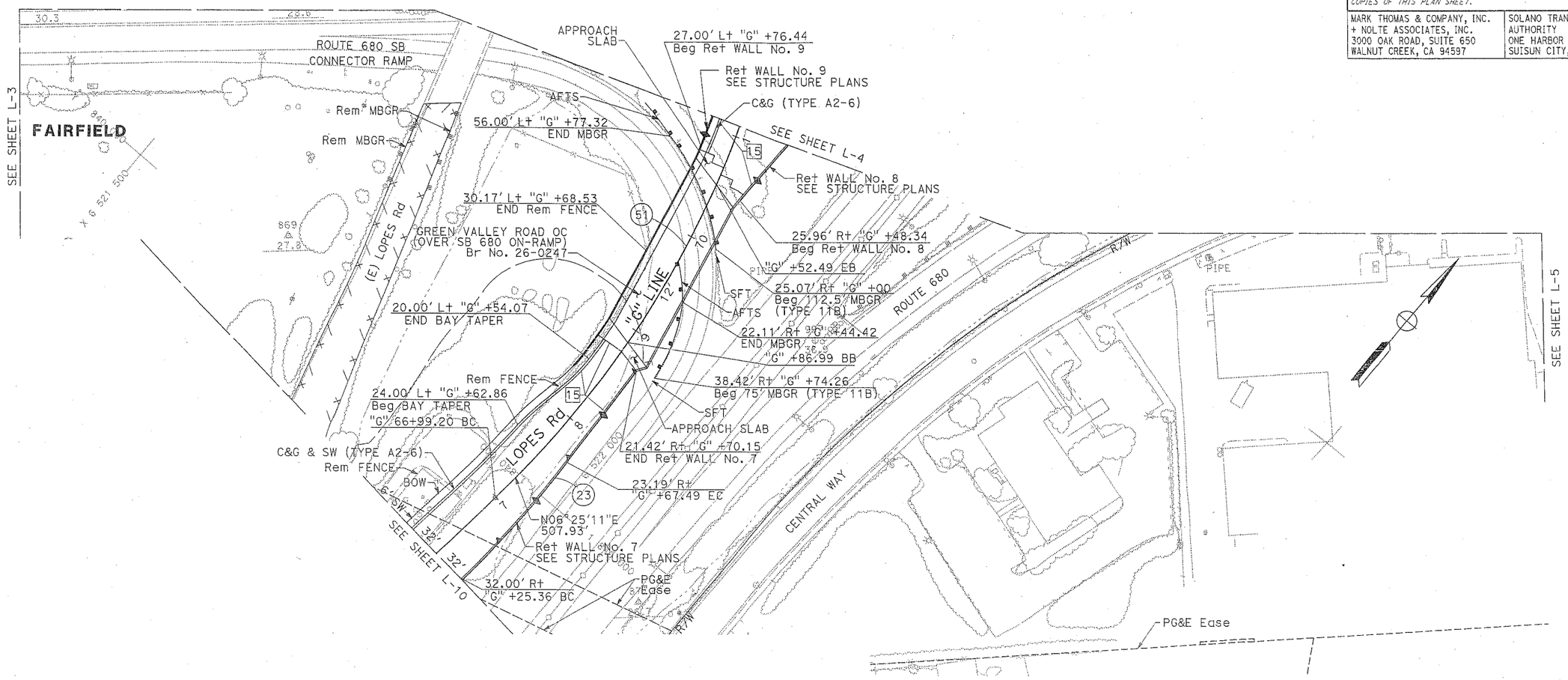
+ NOLTE ASSOCIATES, INC.
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



CURVE DATA

No. ⊕	R	△	T	L	N	E
51	900'	42°01'01"	345.63'	660.00'	1840071.847	6521055.780
23	908'	09°06'51"	72.37'	144.44'	1839995.783	6521071.373

100% SUBMITTAL 09/19/12

FOR NOTES, ABB AND LEGEND, SE

U.S. Army Corps of Engineers
San Francisco Distnct
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 13 of 14

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN
CALCULATED-DESIGNED BY: J. M. PANGBURN
CHECKED BY: R. M. BROGAN
REVISED BY
DATE REVISED

BORDER LAST REVISED 7/2/2010 | USERNAME => jdory | OGN FILE => 0400021131ec011.dgn | RELATIVE BORDER SCALE IS 1M INCHES | UNIT 0741 | PROJECT NUMBER & PHASE 0400021131

DATE PLOTTED => 20-SEP-2012
TIME PLOTTED => 13:21

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

CURVE DATA

No. ⊕	R	Δ	T	L	N	E
13	30′	60°35′56"	17.53′	31.73′	1841048.015	6521251.699
24	902′	07°46′03"	61.23′	122.28′	1841502.535	6522200.709
25	944′	11°27′33"	94.72′	188.80′	1840498.845	6520705.311
27	48′	65°27′14"	30.85′	54.83′	1841398.974	6521193.030
28	48′	76°43′31"	37.99′	64.28′	1841505.592	6521061.808
29	48′	66°32′10"	31.49′	55.74′	1841226.052	6521044.208
30	48′	82°26′08"	42.05′	69.06′	1841359.409	6520922.206
31	3′	169°14′31"	31.86′	8.86′	1841316.310	6521104.799

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.3/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp 12/31/13 CIVIL STATE OF CALIFORNIA

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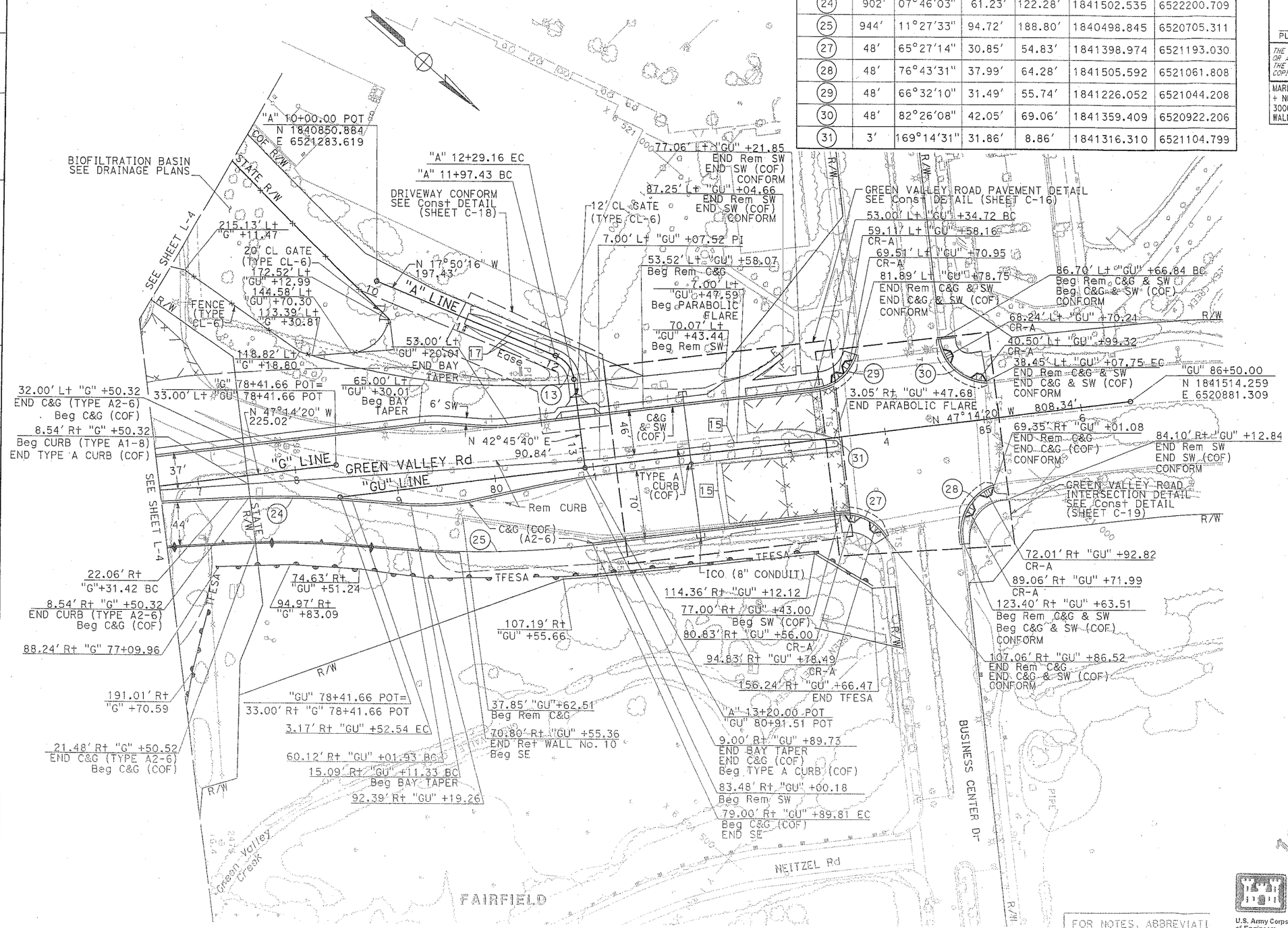
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585



FOR NOTES, ABBREVIATI AND LEGEND, SEE SHEET

100% SUBMITTAL 09/19/12

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 14 of 14

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

CONSULTANT FUNCTIONAL SUPERVISOR: MICHAEL J. LOHMAN

CALCULATED-DESIGNED BY: J. M. PANGBURN | CHECKED BY: R. M. BROGAN | REVISED BY | DATE REVISED

BORDER LAST REVISED 7/3/2010 | USERNAME => jdarr | DGN FILE => 04000211316a012.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0741 | PROJECT NUMBER & PHASE 04000211311

09-12-12 | DATE PLOTTED => 20-SEP-2012 | TIME PLOTTED => 13:21

Enclosure 2:

Western Segment

Mainline Improvements

I-80W would be realigned between west of Suisun Valley Road to just west of the SR 12W/I-680 interchange by constructing a new six-lane highway alignment north of the existing highway alignment. The realignment would create space in the median for direct high occupancy vehicle (HOV) connector ramps to be built between I-80 and I-680, as well as future widening of the eastbound lanes. The realigned westbound I-80 would have six lanes, including an HOV lane and an auxiliary lane matching the existing cross section at the existing Suisun Valley Road overcrossing. Immediately west of the Suisun Valley Road overcrossing, a seventh lane would be added, as well as an eighth lane with the on-ramp from Suisun Valley Road. A ninth lane would be added immediately west of the Green Valley Road off-ramp. The four right lanes would exit from I-80 to connect to SR 12W and I-680. There would be a left exit from the HOV lane to an HOV connector to I-680. A wider, single-span bridge would replace the existing bridge over Green Valley Creek. The existing loop on-ramp from northbound I-680 to westbound I-80 would be removed. The connector from northbound I-680 to SR 12W would be constructed to replace this movement. The segment of I-680 north of Red Top Road would be realigned.

Freeway-to-Freeway Interchange Improvements

New connector ramps from westbound I-80 to westbound SR 12W and southbound I-680 would be constructed. The proposed westbound I-80 to southbound I-680 connector would cross over I-80, the eastbound SR 12W connector to eastbound I-80, the UPRR tracks, Fulton Drive, and the realigned Lopes Road. A new bridge will be constructed over Jameson Canyon Creek as part of Construction Package 3. Access from westbound I-80 to westbound SR 12W would be braided with (cross over) the Green Valley Road on-ramp to westbound I-80. A separate direct connector structure would be built to carry the HOV lanes in both directions between I-680 and I-80 east of the I-80/I-680/SR 12 interchange. Direct connectors between northbound I-680 and westbound I-80 and eastbound I-80 and southbound I-680 would be constructed. Motorist access from northbound I-680 to westbound I-80 would be served by a loop ramp off the I-680 to SR 12W connector. Traffic from eastbound I-80 to southbound I-680 would use a new ramp which will require widening of the existing bridge over Jameson Canyon Creek as part of Construction Package 7. Motorists traveling eastbound on SR 12W who wish to go to southbound I-680 would exit SR 12W at the proposed SR 12W/Red Top Road interchange to access EB I-80 at Red Top Road and then take the first exist (about ¼ mile away) which will be the EB I-80 connector to SB I-680.

Interchange Improvements

The I-80/Green Valley Road interchange would have a tight diamond configuration westbound and a partial cloverleaf (loop on-ramp) configuration eastbound. The same interchange and overcrossing would provide access to the existing alignment of I-680, which would be relinquished as a local arterial.

The connection from eastbound I-80 to southbound I-680 would be removed, with eastbound I-80 directed to exit at Green Valley interchange and then follow Lopes Road south to the new I-680/Red Top Road interchange. A new on-ramp at Green Valley Road would provide access to the new westbound I-80 alignment. The I-80/Red Top Road interchange would be partially reconstructed to have westbound hook ramps. Red Top Road would be realigned to connect this interchange on I-80 with a new SR 12W/ Red Top Road interchange. Improvements to I-680 would include the construction of an interchange at Red Top Road.

Local Road Improvements

A bicycle path would be relocated along the western boundary of the business park at the west end of the existing Business Center Drive parking lot, and along the north side of the new connector from westbound I-80 to westbound SR 12W to maintain access between the existing bicycle path along Jameson Canyon Road (SR 12W) and Business Center Drive. This path would be removed when Business Center Drive is extended to the SR 12W/Red Top Road interchange because bicyclists would be able to utilize the extension of Business Center Drive to reach Red Top Road and points west. The existing Green Valley Road overcrossing at I-80 would be removed, and a new one would be constructed on a different alignment. The overcrossing would consist of western four lanes of the seven-lane structure.

Eastern Segment

A third lane would be added to eastbound SR 12E requiring widening of the existing box culvert that conveys Ledgewood Creek. This lane would connect (start) at the eastbound SR 12E/Chadbourne Road interchange and would extend east,

connecting and ending at the eastbound SR 12E/Webster Street exit. A retaining wall will be built along the south side of SR 12E from east of Ledgewood Creek to Pennsylvania Avenue.

Utilities

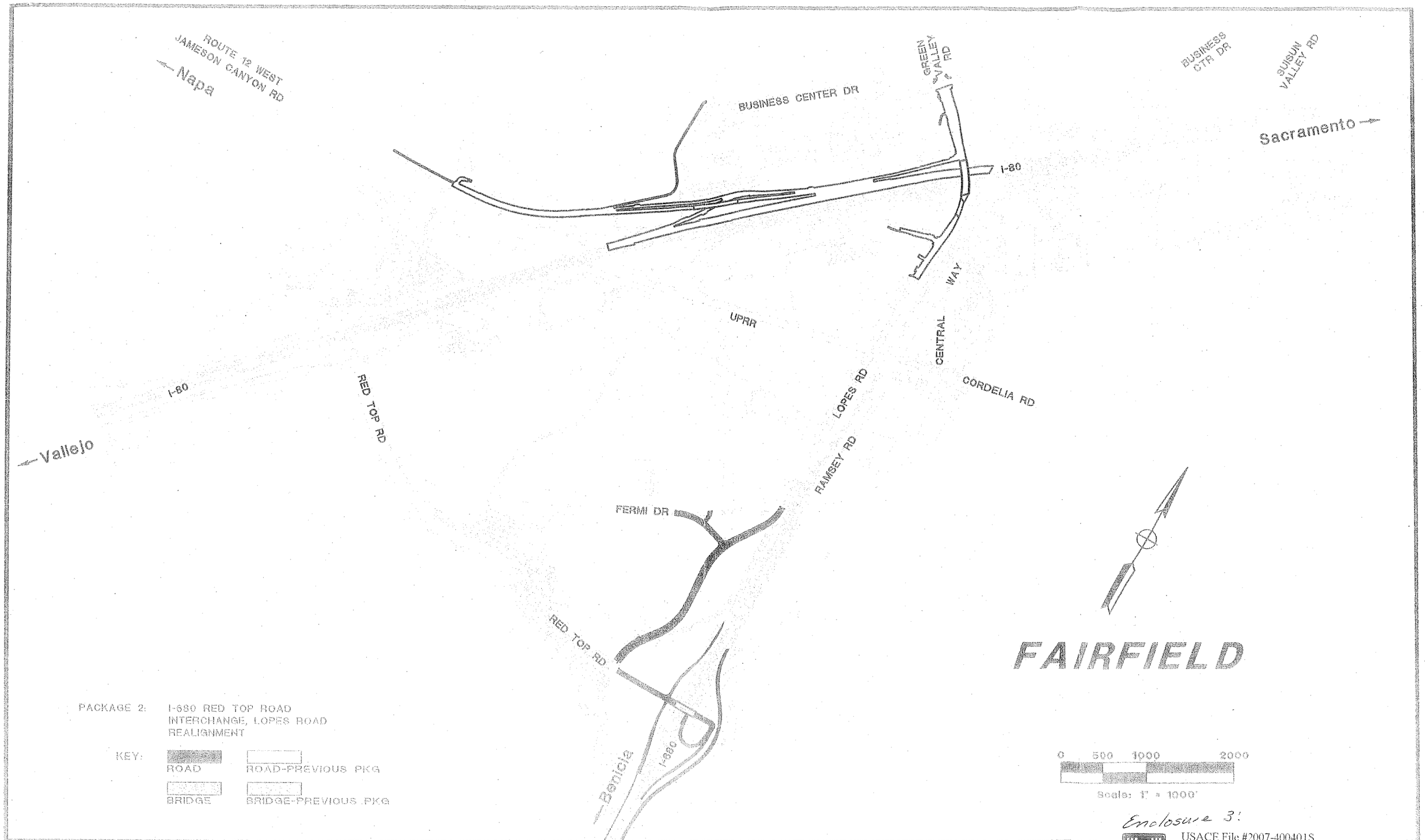
As part of the proposed project, utilities within the project area will be relocated, realigned, or extended as necessary to accommodate project construction and operation. Utilities that will be affected include water, electrical, gas, cable/fiber, and telephone lines. Water lines include those owned by the cities of Fairfield, Vallejo, and Benicia. Irrigation and non-potable water and agricultural drains owned by the Solano Irrigation District are located within the project area. These water facilities and sewer facilities owned by the cities of Fairfield and Suisun City and by the Fairfield-Suisun Sewer District, will be realigned or extended, as necessary.

Pacific Gas and Electric (PG&E)-owned electrical and gas lines within the project area will be affected by construction and operation. One 115-kilovolt (kV) electrical transmission line that crosses I-680 between Fermi and Fulton drives will be realigned, and towers will be relocated. The Vaca-Suisun-Jameson tower line crosses I-680 and Green Valley Road near the eastbound I-80 ramps intersection. The line will be raised by 45 feet (ft) to accommodate the project. Additionally, to accommodate the proposed connectors, one tower will be relocated and the line height raised by 90 ft between Dittmer Road and the Jameson substation on Watt Court. Several other overhead distribution or transmission lines will be realigned, as will a 12-kV underground line that crosses I-80 just east of the existing Green Valley Road overcrossing. Additionally, PG&E gas lines, primarily in the vicinity of the I-80/Green Valley Road will be modified or realigned and it may be necessary to acquire new easements.

A PG&E valve lot, a gas transmission facility, will be relocated to a vacant parcel owned by the Fairfield-Suisun Unified School District (FSUSD) at the former Green Valley Middle School location at 3630 Ritchie Road in Fairfield. The relocated valve lot will occupy a 1.3-acre (ac) portion of the larger 7.69-ac FSUSD parcel. This relocation will require the acquisition of 1.3 ac from FSUSD, as well as securing permanent and temporary easements needed for operation, maintenance, and construction staging purposes.

Cable lines belonging to Comcast and located within local roads will be relocated where necessary. Qwest Communications has a fiber conduit mounted on the UPRR bridge, which will be relocated along the new bridge.

Telephone facilities within the project area include local, long-distance, and local services (i.e., TelNet) lines owned by AT&T. These include both overhead and underground lines and conduit. These facilities will be relocated where they conflict with the proposed project. All relocations of the long distance and TelNet lines will be handled through AT&T California.



PACKAGE 2: I-680 RED TOP ROAD INTERCHANGE, LOPES ROAD REALIGNMENT

KEY:
- ROAD
- ROAD-PREVIOUS PKG
- BRIDGE
- BRIDGE-PREVIOUS PKG

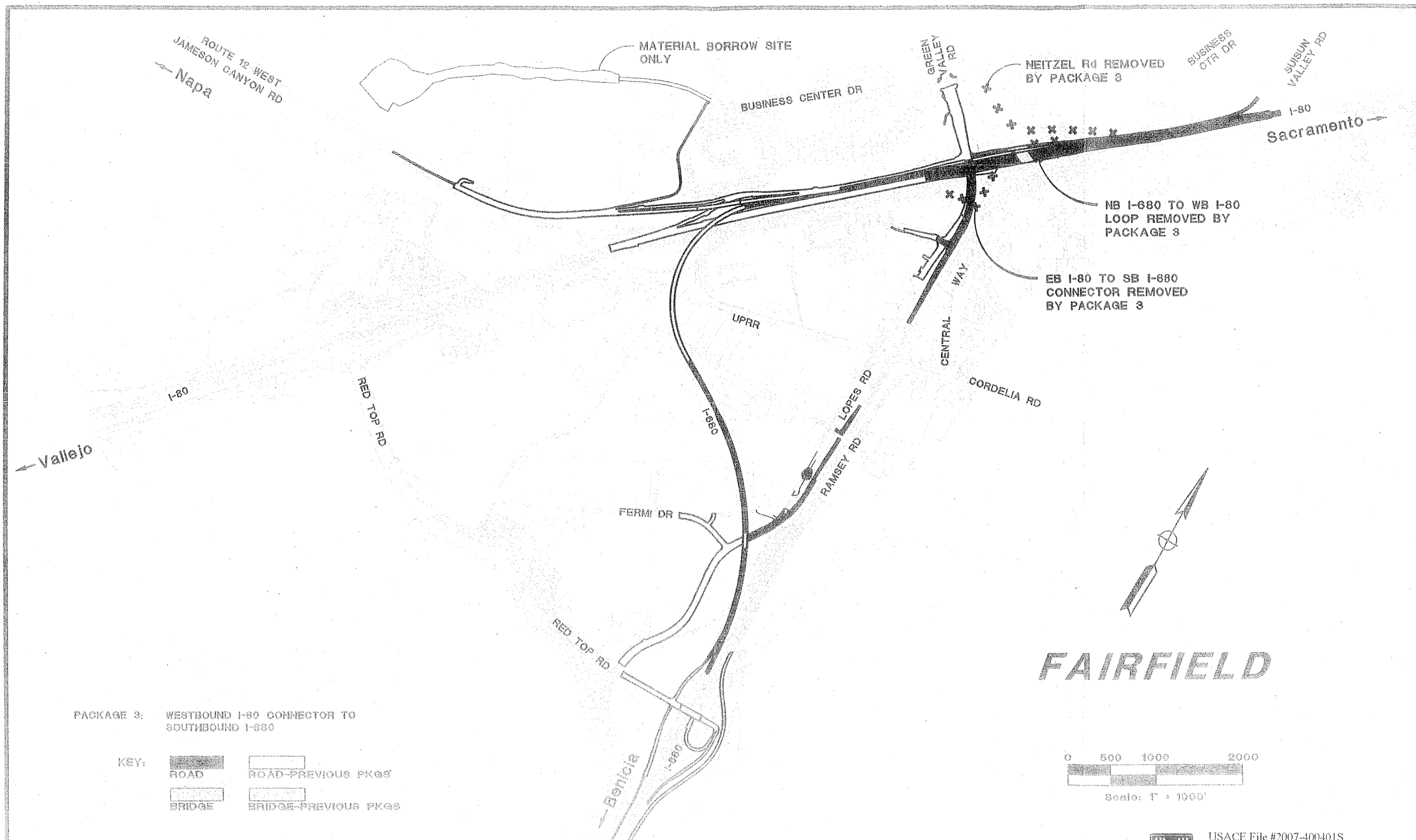
SCALE: 1" = 1000' (11"x17")
DATE: NOVEMBER 2012
JOB: 51-52008-RH
SHEET NO. 2 OF 7

I-80/I-680/SR-12 INTERCHANGE IMPROVEMENT PROJECT, PHASE 1
Construction Package 2

Enclosure 3!

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 15 of 29



PACKAGE 3: WESTBOUND I-80 CONNECTOR TO SOUTHBOUND I-680

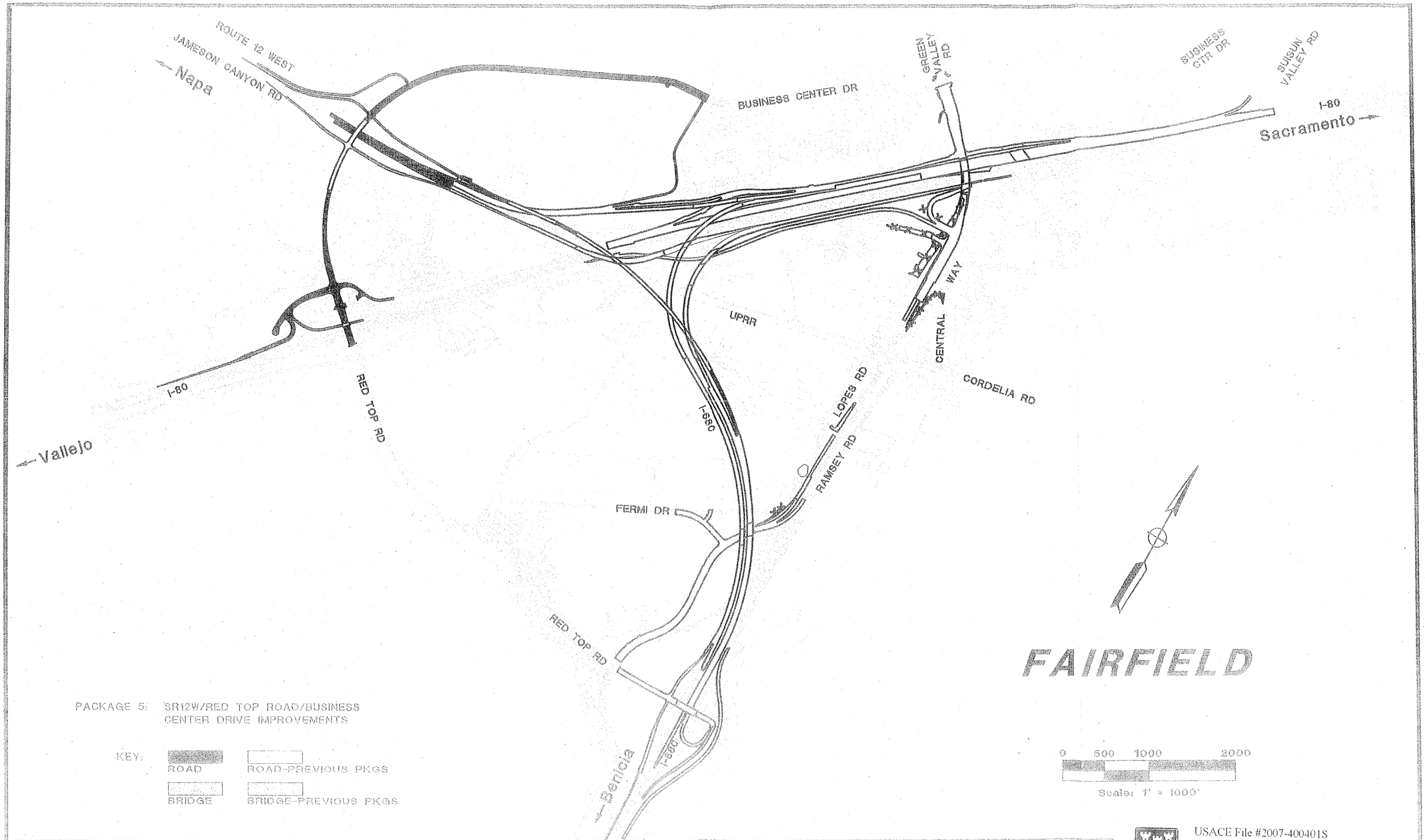
KEY: ROAD; ROAD-PREVIOUS PKGS; BRIDGE; BRIDGE-PREVIOUS PKGS

SCALE: 1" = 1000' (11"x17")
DATE: NOVEMBER 2012
JOB: 61-52006-152
SHEET NO.: 5 OF 7

I-80/I-680/SR-12 INTERCHANGE IMPROVEMENT PROJECT, PHASE 1
Construction Package 3

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 16 of 28



PACKAGE 5: SR12W/RED TOP ROAD/BUSINESS CENTER DRIVE IMPROVEMENTS

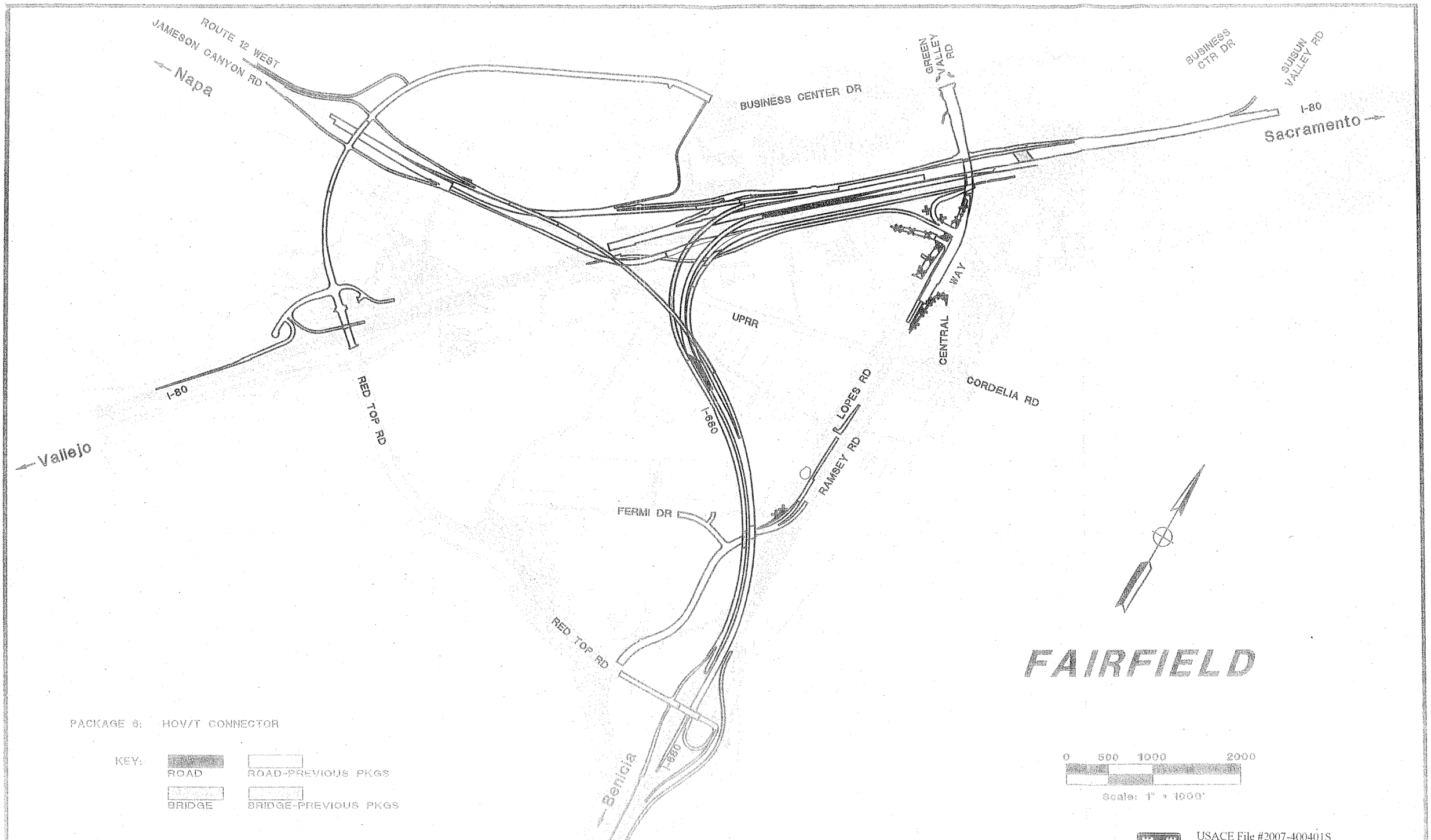
KEY:
- ROAD
- ROAD-PREVIOUS PKGS
- BRIDGE
- BRIDGE-PREVIOUS PKGS

SCALE: 1" = 1000' (11"x17")
DATE: NOVEMBER 2012
JOB: 31-52008-134
SHEET NO.: 5 OF 7

I-80/I-680/SR-12 INTERCHANGE IMPROVEMENT PROJECT, PHASE 1
Construction Package 5

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 18 of 20



PACKAGE 6: HOV/T CONNECTOR

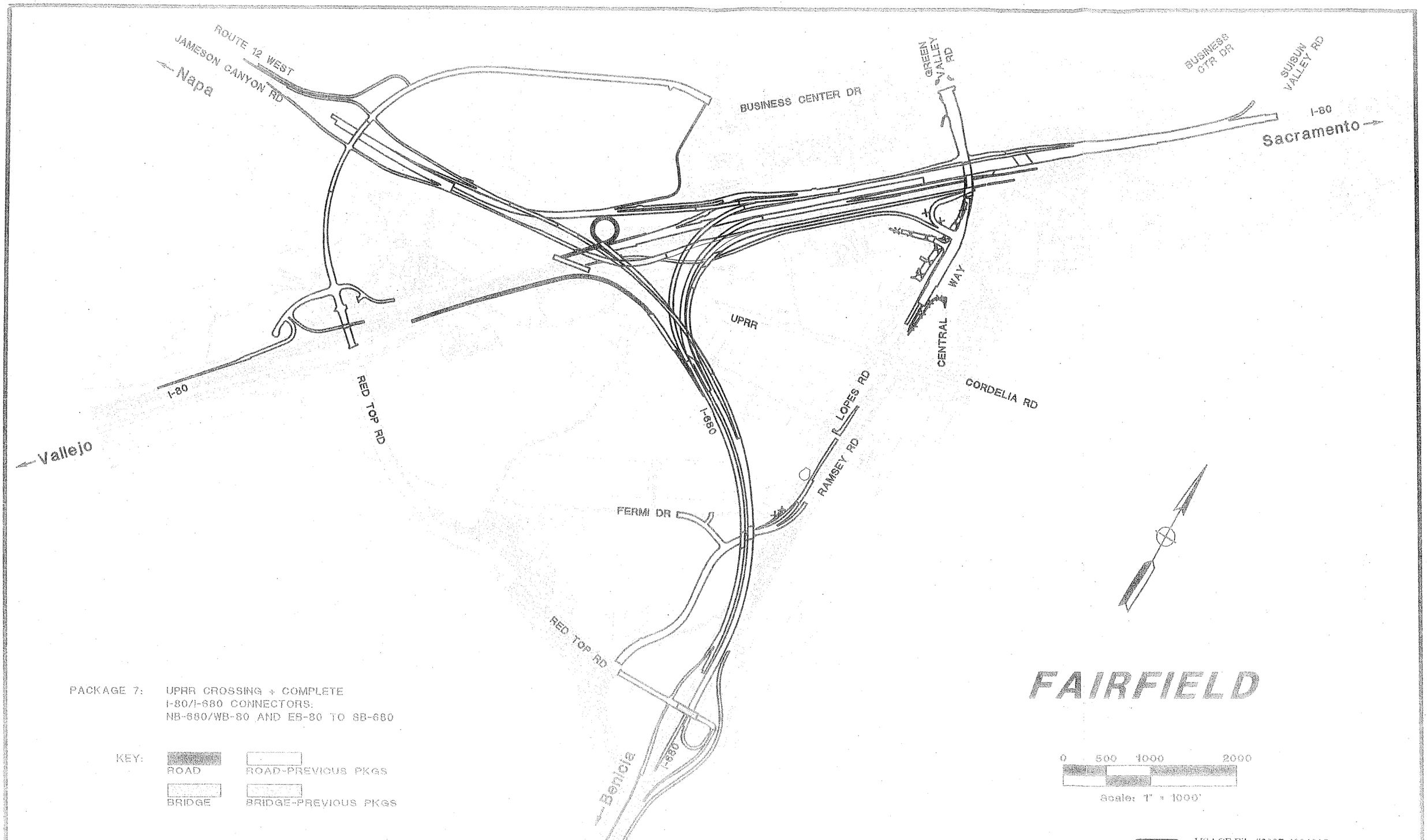
KEY:
- ROAD
- ROAD-PREVIOUS PKGS
- BRIDGE
- BRIDGE-PREVIOUS PKGS

SCALE: 1" = 1000' (11"x17")
DATE: NOVEMBER 2012
JOB: 01-62008-135
SHEET NO.: 3 OF 7

I-80/I-680/SR-12 INTERCHANGE IMPROVEMENT PROJECT, PHASE 1
Construction Package 6

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 19 of 20



PACKAGE 7: UPRR CROSSING + COMPLETE I-80/I-680 CONNECTORS: NB-680/WB-80 AND EB-80 TO SB-680

KEY:
- ROAD
- ROAD-PREVIOUS PKGS
- BRIDGE
- BRIDGE-PREVIOUS PKGS

SCALE: 1" = 1000' (11"x17")
DATE: NOVEMBER 2012
JOB: 31-52008-198
SHEET NO.: 7 OF 7

I-80/I-680/SR-12 INTERCHANGE IMPROVEMENT PROJECT, PHASE 1
Construction Package 7

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USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange
Solano County, CA
April 29, 2013
Figure 20 of 20

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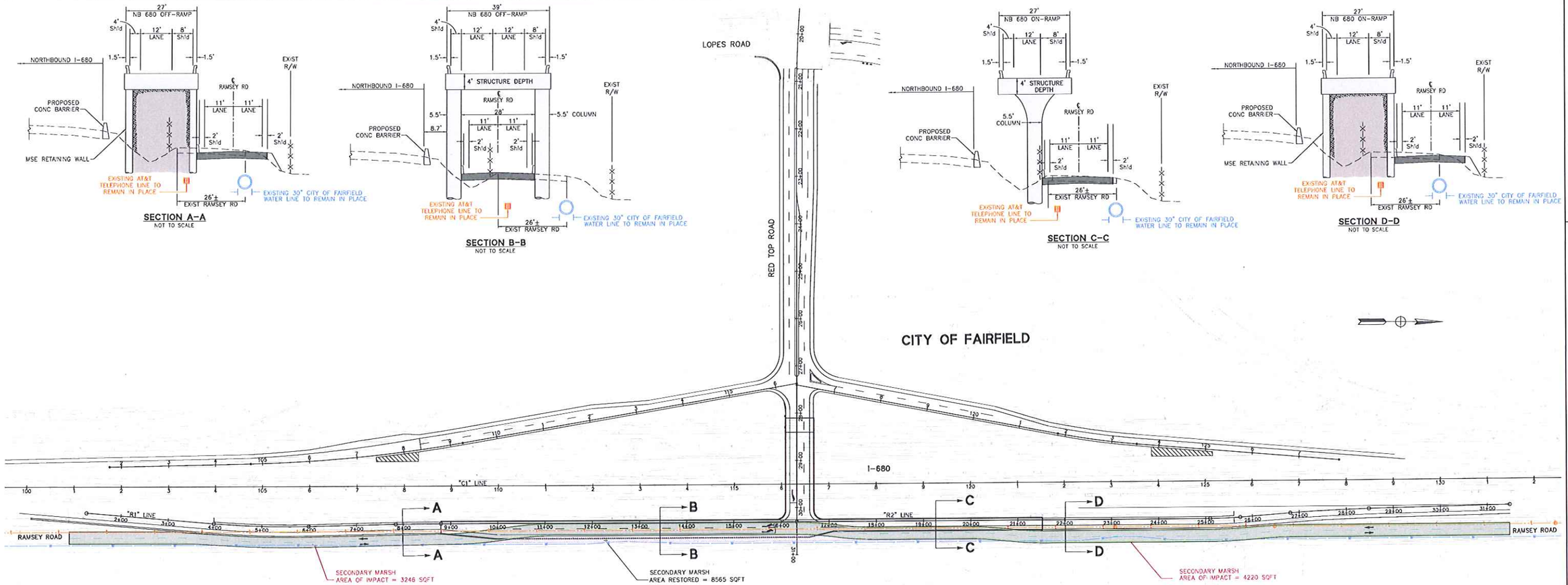
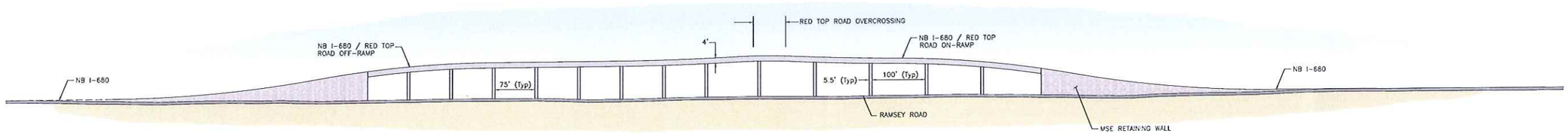
SECTION A-A
NOT TO SCALE

SECTION B-B
NOT TO SCALE

SECTION C-C
NOT TO SCALE

SECTION D-D
NOT TO SCALE





NOTES:
1. 15' MIN VERTICAL CLEARANCE PROVIDED OVER RAMSEY ROAD
2. IF EXISTING TELEPHONE & WATER UTILITIES ARE IMPACTED AFTER FURTHER EVALUATION, BOTH UTILITIES WILL BE RELOCATED TO THE PROPOSED LOCATION OF RAMSEY ROAD.

LEGEND:

- SEGMENT 2B IMPROVEMENTS ALTERNATIVE
- REALIGNED RAMSEY ROAD
- EXISTING AT&T TELEPHONE LINE
- EXISTING 30" CITY OF FAIRFIELD WATER LINE

SECONDARY MARSH SUMMARY	
AREA OF IMPACT	7,466 SQ. FT.
AREA RESTORED TO SECONDARY MARSH	8,565 SQ. FT.
NET AREA RESTORED	1,099 SQ. FT.

Enclosure 4.

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CALIFORNIA

RED TOP ROAD
INTERCHANGE PROJECT
ALTERNATIVE
SOLANO COUNTY

CITY OF FAIRFIELD

No.	Revisions

Date: 02-04-13
Scale: 1"=40'
Drawn:
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Job No: 2007700-10

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of

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I-80/I-680/SR-12 (80/680/12) Interchange Project
Solano County, CA
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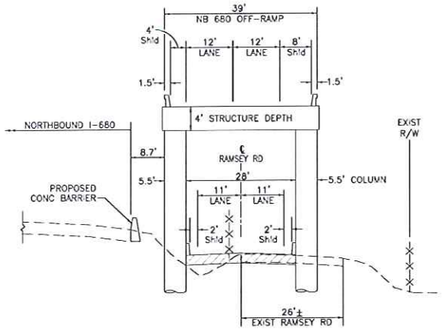
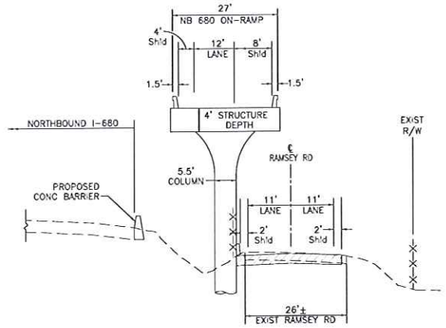


SECTION A-A
NOT TO SCALE

NOTE: 15' MIN VERTICAL CLEARANCE PROVIDED OVER RAMSEY ROAD



SECTION B-B
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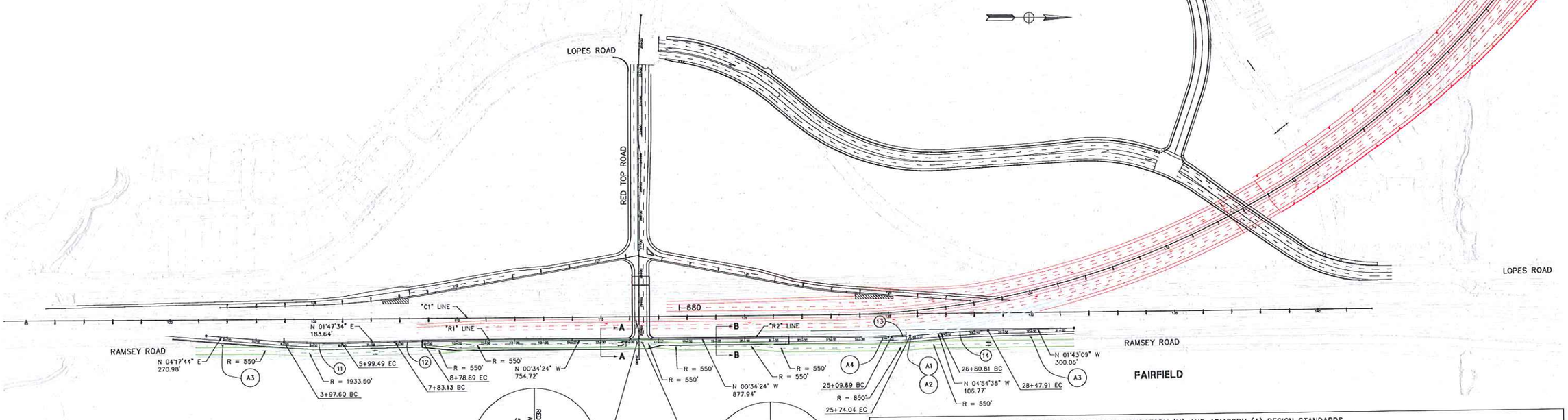
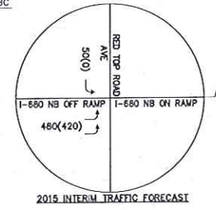
NOTE: 15' MIN VERTICAL CLEARANCE PROVIDED OVER RAMSEY ROAD





2015 INTERIM TRAFFIC FORECAST

2035 TRAFFIC FORECAST

LENGEND:

- FUTURE SEGMENT 3 IMPROVEMENTS
- SEGMENT 2B IMPROVEMENTS ALTERNATIVE
- PROPOSED REALIGN RAMSEY ROAD
- SEGMENT 2B IMPROVEMENTS ALTERNATIVE CONNECTION TO FUTURE SEGMENT 3 IMPROVEMENTS

CURVE DATA

No.	R	Δ	T	L	N - COORDINATE	E - COORDINATE
11	1900.00'	06°05'18"	101.04'	201.89'	1,832,551.774	6,520,218.693
12	4500.00'	01°13'09"	47.88'	95.76'	1,832,935.536	6,526,609.816
13	850.00'	04°20'14"	32.19'	64.34'	1,834,514.577	6,521,243.743
14	3000.00'	03°11'29"	83.57'	167.10'	1,834,950.521	6,525,070.472

DESIGN EXCEPTION MATRIX TO MANDATORY (M) AND ADVISORY (A) DESIGN STANDARDS

ITEM	PROPOSED	STANDARD	STATION
A1	PROPOSED NONSTANDARD SUPERELEVATION TRANSITION ON I-680 / RED TOP NB ONRAMP.	HDM INDEX 202.5(1) – GENERAL. A SUPERELEVATION TRANSITION SHOULD BE DESIGNED IN ACCORDANCE WITH THE DIAGRAM AND TABULAR DATA SHOWN IN FIGURE 202.5A TO SATISFY THE REQUIREMENTS OF SAFETY, COMFORT AND PLEASING APPEARANCE.	"R2" 23+51.08 TO 28+01.08
A2	PROPOSED NONSTANDARD SUPERELEVATION RUNOFF LOCATIONS ON I-680 / RED TOP NB ONRAMP.	HDM INDEX 202.5(2) – RUNOFF. TWO-THIRDS OF THE SUPERELEVATION RUNOFF SHOULD BE ON THE TANGENT AND ONE-THIRD WITHIN THE CURVE.	"R2" 23+51.08 TO 28+01.08
A3	THE WIDTH OF OUTER SEPARATION IS 0 FEET FROM EDGE OF TRAVELED WAY TO EDGE OF TRAVELED WAY.	HDM INDEX 310.2 – OUTER SEPARATION – IN URBAN AREAS AND IN MOUNTAINOUS TERRAIN, THE WIDTH OF THE OUTER SEPARATION SHOULD BE A MINIMUM OF 26 FEET FROM FROM EDGE OF TRAVELED WAY TO EDGE OF TRAVELED WAY	"C1" 101+66.09 TO 129+94.13
A4	HIGH OCCUPANCY VEHICLE (HOV) PREFERENTIAL LANE NOT PROVIDED AT NB ONRAMP.	CALTRANS RAMP METERING DESIGN GUIDELINES (JANUARY 2000) – AN HOV PREFERENTIAL LANE SHALL BE PROVIDED AT ALL RAMP METER LOCATIONS.	"R2" 17+00.00 TO 25+60.44

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RED TOP ROAD INTERCHANGE PROJECT
ALTERNATIVE
SOLANO COUNTY

CITY OF FAIRFIELD

Revisions

No.	Date	Description

Date: 03-07-13
Scale: 1"=100'
Drawn:
Checked:
Approved:
Job No.20170003-10
Drawing Number:
of

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange Project
Solano County, CA
April 29, 2013
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San Francisco District
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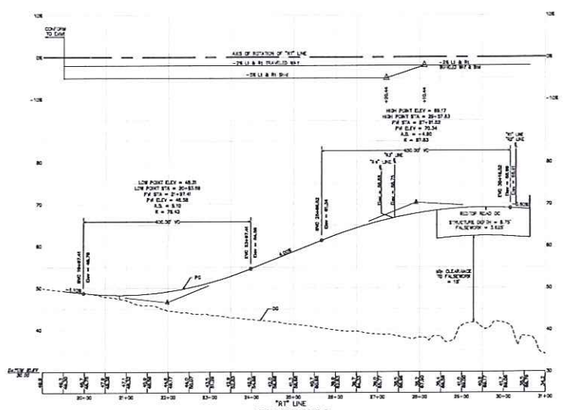

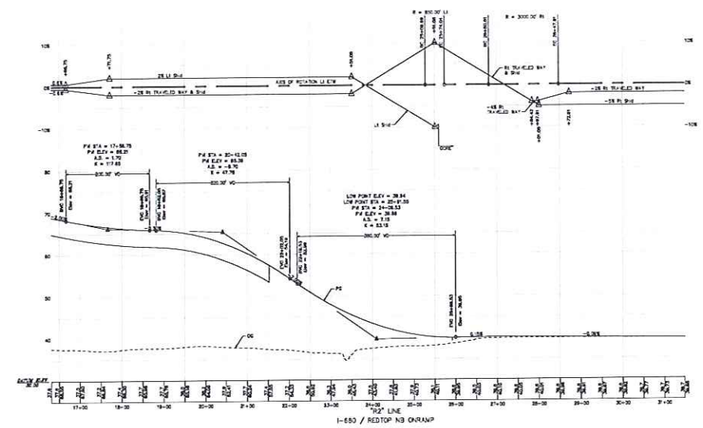

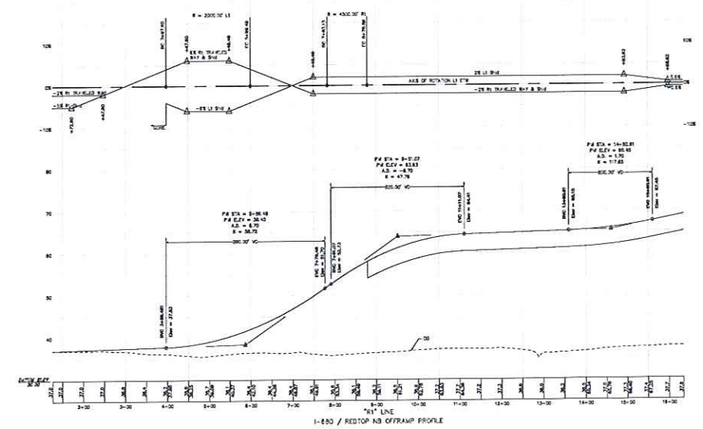

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RED TOP ROAD
INTERCHANGE PROJECT
ALTERNATIVE
SOLANO COUNTY

CITY OF FAIRFIELD

Date	By	Revisions
03-20-13		

Date 03-20-13
Scale 1"=40'
Drawn
Design
Checked
Job No. 0617100-10

Drawing Number

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange Project
Solano County, CA
April 29, 2013
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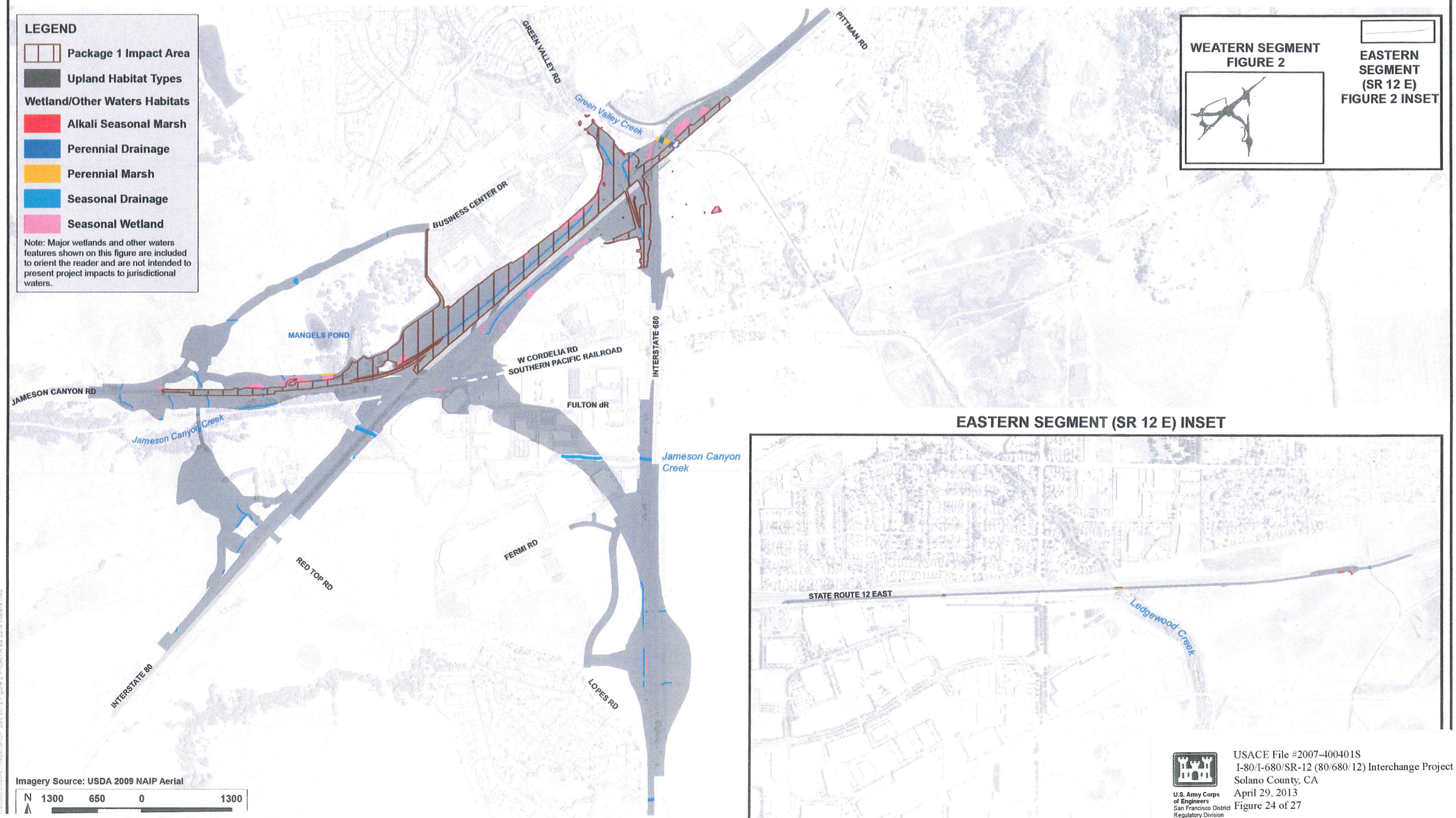
U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

WESTERN SEGMENT



Enclosure 5

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

Figure 2: Interchange Project Area

I-80/I-680/SR 12 Interchange Project - Package 1 (3328-01)

December 2012

Jurisdictional Waters	ID	Feature Total Acreage	Permanent Impacts	Temporary Impacts	Linear Ft Permanent Impacts	Linear Ft Temporary Impacts
Perennial Marsh	1. W-181	1.18 ac	0.01 ac	0.01 ac	0 ft	0 ft
	Total	**1.18 ac**	**0.01 ac***	**0.01 ac**	**0 ft**	**0 ft**
Seasonal Drainage	1. OW-45a	0.34 ac	0.10 ac	0.02 ac	862 ft	425 ft
	2. OW-61	0.07 ac	0.04 ac	0.00 ac	437 ft	0 ft
	3. OW-61a	0.24 ac	0.20 ac	0.05 ac	2871 ft	665 ft
	4. OW-162	0.03 ac	0.01 ac	0.00 ac	5 ft	0 ft
	5. OW-163	0.01 ac	0.01 ac	0.00 ac	14 ft	0 ft
	6. OW-180	0.01 ac	0.01 ac	0.00 ac	169 ft	0 ft
	Total	**0.70 ac**	**0.37 ac***	**0.07 ac**	**4358 ft**	**1090 ft**
Seasonal Wetland	1. W-13	0.28 ac	0.02 ac	0.00 ac	0 ft	0 ft
	2. W-14	0.08 ac	0.01 ac	0.00 ac	0 ft	0 ft
	3. W-15	0.19 ac	0.03 ac	0.00 ac	0 ft	0 ft
	4. W-45-1	0.16 ac	0.01 ac	0.00 ac	0 ft	0 ft
	5. W-45-2	1.13 ac	0.03 ac	0.03 ac	0 ft	0 ft
	6. W-45a-2	0.16 ac	0.16 ac	0.00 ac	0 ft	0 ft
	7. W-60	0.20 ac	0.20 ac	0.00 ac	0 ft	0 ft
	8. W-61b	0.47 ac	0.47 ac	0.00 ac	0 ft	0 ft
	9. W-62	0.03 ac	0.03 ac	0.00 ac	0 ft	0 ft
	10. W-63	0.02 ac	0.02 ac	0.00 ac	0 ft	0 ft
	11. W-64	0.18 ac	0.02 ac	0.00 ac	0 ft	0 ft
	12. W-65	0.11 ac	0.00 ac	0.01 ac	0 ft	0 ft
	12. W-143	0.05 ac	0.05 ac	0.00 ac	0 ft	0 ft
	13. W-180a	0.16 ac	0.09 ac	0.00 ac	0 ft	0 ft
	14. W-180b	0.18 ac	0.05 ac	0.00 ac	0 ft	0 ft
	15. W-A1	1.28 ac	0.00 ac	0.18 ac	0 ft	0 ft
	Total	**4.68 ac**	**1.19 ac ***	**0.22 ac**	**0 ft**	**0 ft**

* Please note: These numbers are based upon the 100% design. Impacts summarized here for the entire package 1.

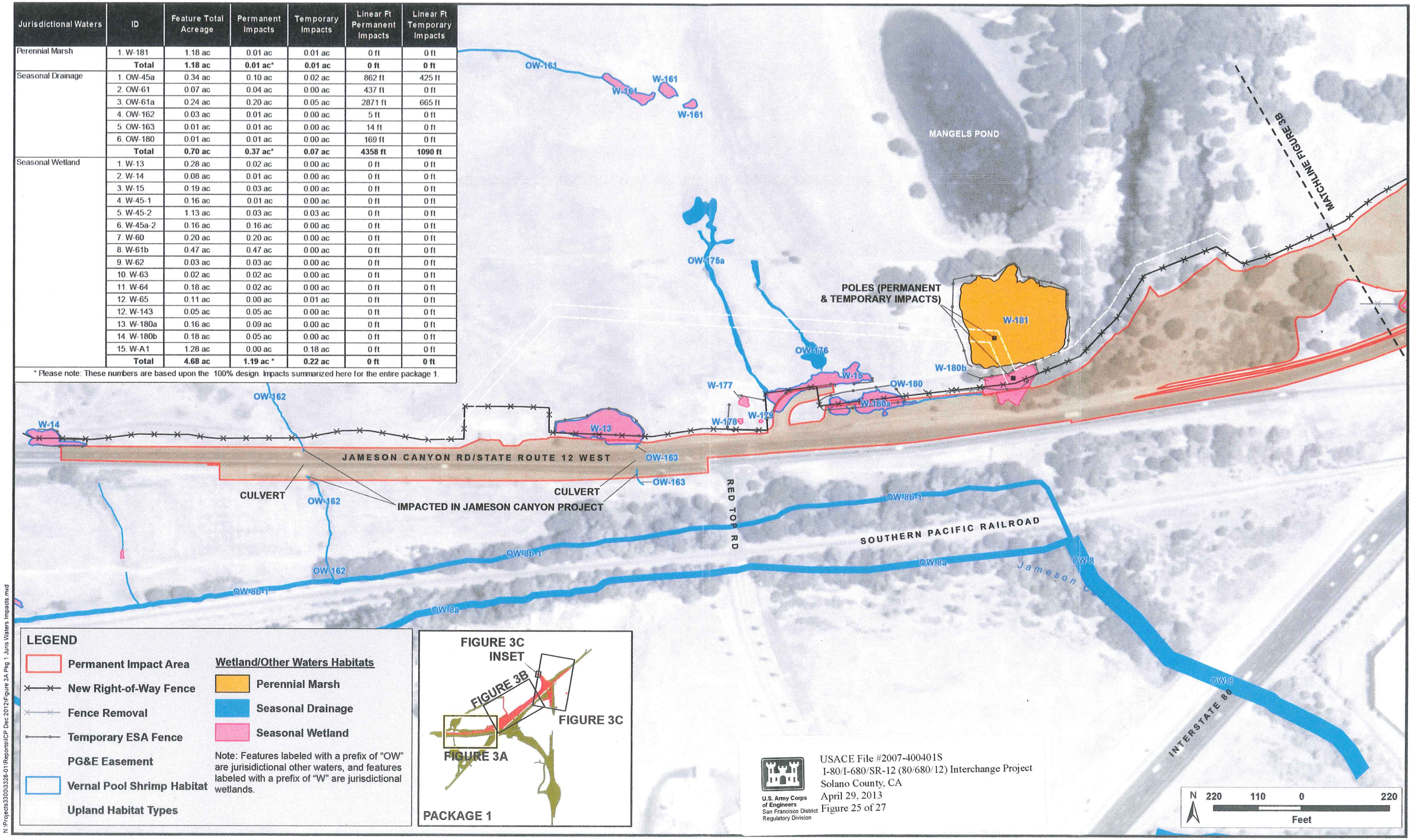


Figure 3A: Package 1 Jurisdictional Waters Impacts

I-80/I-680/SR 12 Interchange Project - Package 1 (3328-01)
December 2012

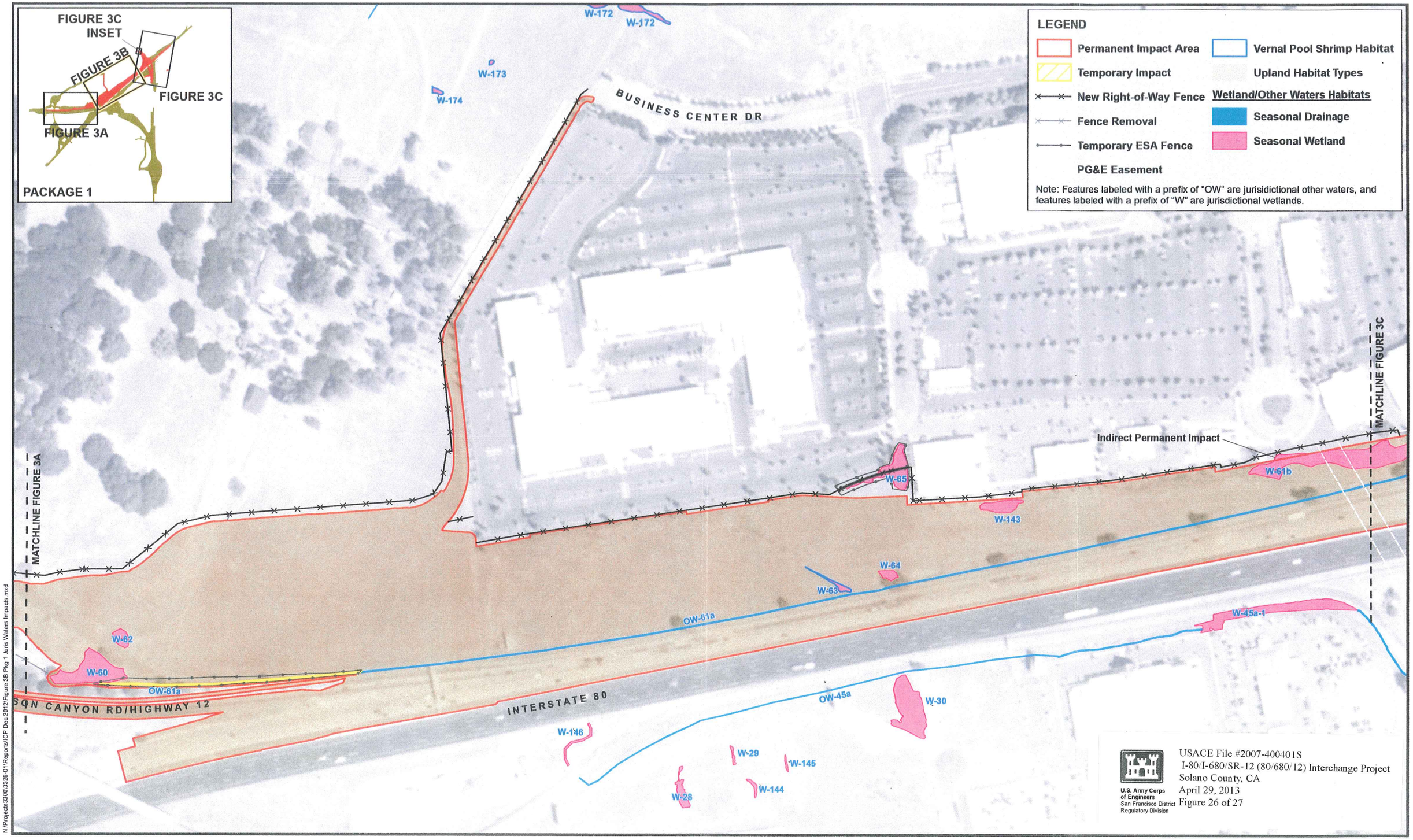
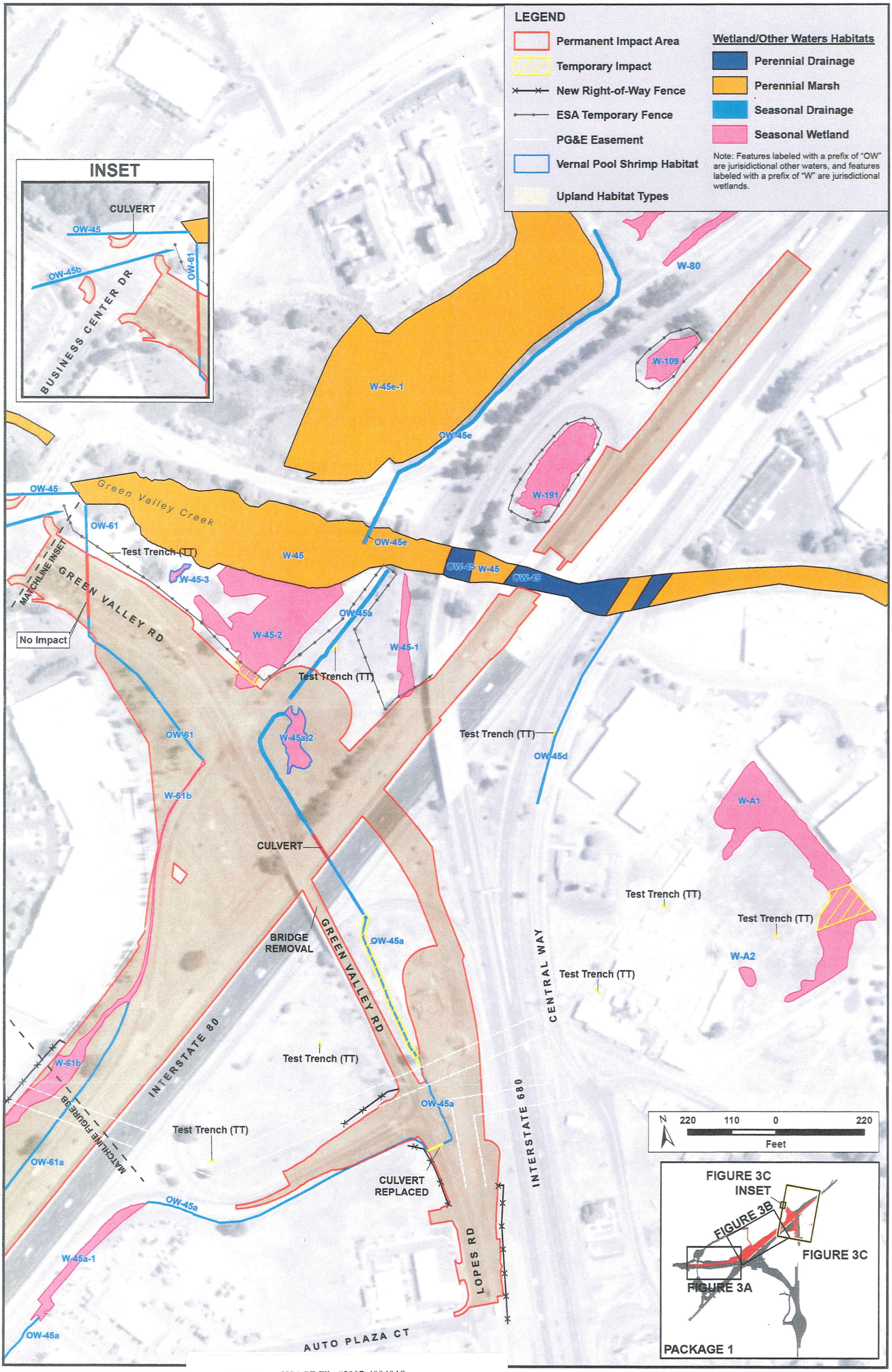


Figure 3B: Package 1 Jurisdictional Waters Impacts

I-80/I-680/SR 12 Interchange Project - Package 1 (3328-01)

December 2012



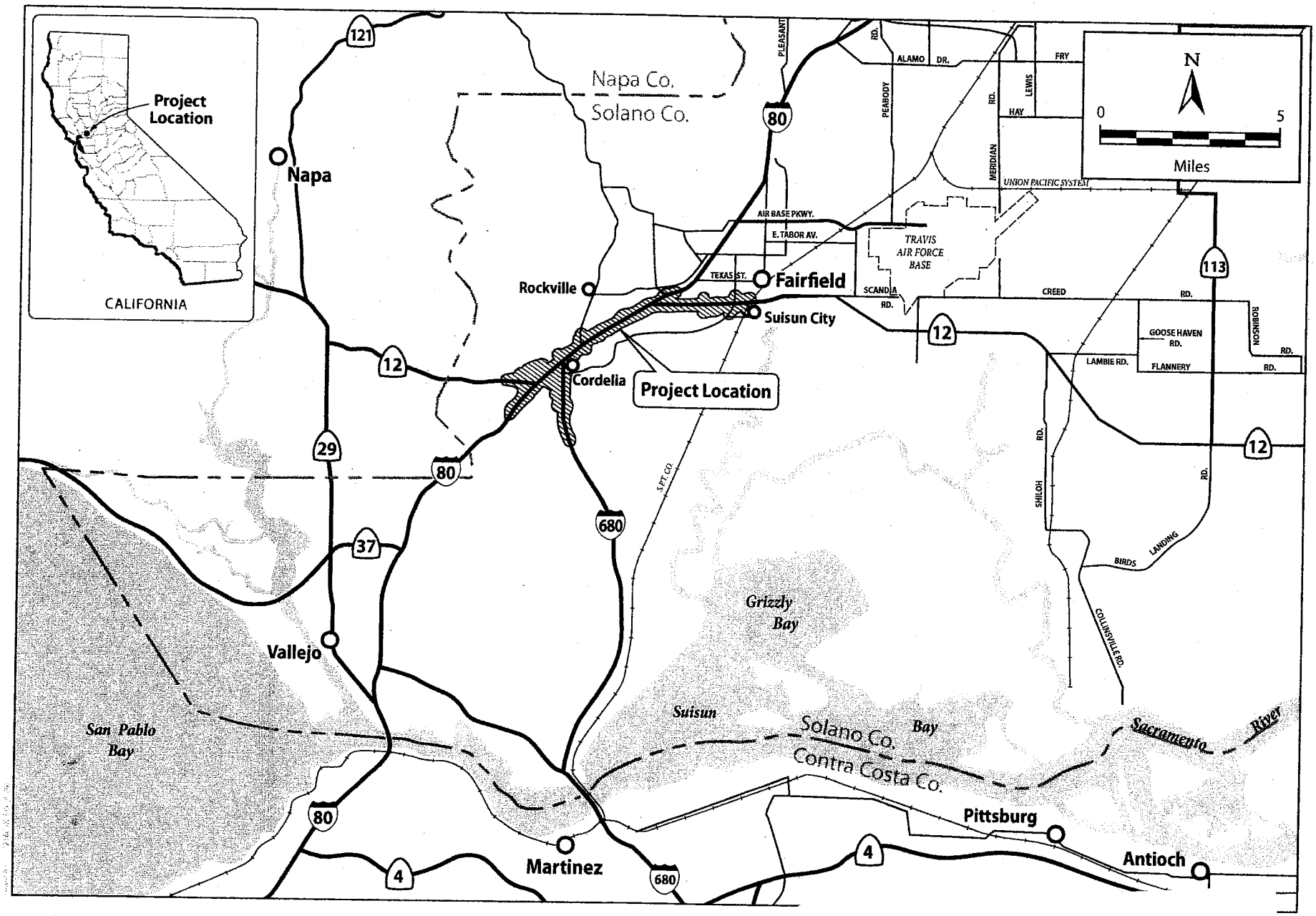
U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

USACE File #2007-400401S
I-80/I-680/SR-12 (80/680/12) Interchange Project
Solano County, CA
April 29, 2013
Figure 27 of 27

Figure 3C: Package 1 Jurisdictional Waters Impacts

I-80/I-680/SR 12 Interchange Project - Package 1 (3328-01)

December 2012



Enclosure 6

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

Enclosure 7

CALIFORNIA
Water Boards

U.S. Army Corps
of Engineers
San Francisco District
Regulatory Division

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

San Francisco Bay Regional Water Quality Control Board

April 29, 2013
CIWQS Place No. 728678

Sent via electronic mail--no hard copy to follow

California Department of Transportation
Attn: Mr. Nicolas Endrawos
Nicolas_Endrawos@dot.ca.gov
111 Grand Ave.
Oakland, CA 94612-3717

Subject: Water Quality Certification for the Interstate 80/Interstate 680/State Route 12 Interchange Project, Phase 1, City of Fairfield, Solano County

Department Project No.: EA 04-0A5300

Dear Mr. Endrawos:

This certification includes legal requirements to submit information prior to commencement of certain project activities. It is the responsibility of the California Department of Transportation, Solano Transportation Authority, and their contractors and sub-contractors, to ensure that all conditions of this certification are met.

The following conditions may affect the Department's construction schedule: 1, 2, 3, 4, 14, 15, and 28.

The following conditions include enforceable timelines to submit information or reports, or conduct activities that could result in enforcement actions if not provided: 1, 2, 3, 4, 8, 11, 12, 15 and 16.

Certification conditions start on certification page 5.

Then overall project consists of several phases which are planned to be built over several decades. Phase 1 consists of 7 construction packages which are scheduled over the next 7 years. This certification permits the impacts associated with only the first 7 construction packages and directs all mitigation for the entire first phase. Phases 2-7 construction package impacts are intended to be permitted with Waste Discharge Requirements to be issued in the near future.

We have reviewed and hereby issue water quality certification to the California Department of Transportation (Department) for the Interstate 80/Interstate 680/State Route 12 Interchange Project (Project). The Department is seeking an Individual Permit for the Project from the U.S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act (33 U.S.C. § 1344). As such, the Department has applied to the San Francisco Bay Regional Water Quality Control Board (Water Board) for a Clean Water Act Section 401 water quality certification that the Project will not violate State water quality standards.

Project: The Department is proposing to improve traffic facilities through the Interstate 80/Interstate 680/State Route 12 corridor in the City of Fairfield. The purpose of the Project is to relieve congestion, reduce traffic on local roads, encourage HOV lane use and ridesharing, improve safety, accommodate current and future truck volumes, and facilitate truck scale operation throughout and around the Project area. The Project has been divided into seven individual construction packages:

- **Construction Package 1**
  Major project elements in construction package 1 include constructing a new westbound I-80 to westbound State Route 12 connector, widening westbound I-80 between the existing I-80/I-680 separation and westbound State Route 12, and reconstructing the west half of the I-80 Green Valley Road interchange. Work would take approximately two years and start in 2013.
- **Construction Package 2**
  Construction package 2 involves constructing a new I-680/Red Top Road interchange, realigning Lopes and Fermi Roads, and realigning Ramsey Road around the proposed I-680 Red Top Road interchange. Construction would start in 2014 and last approximately 1.5 years.
- **Construction Package 3**
  Major project elements include: Constructing the westbound I-80 to southbound I-680 connector; widening westbound I-80 between the I-80/Suisun Valley Road and the I-80/Green Valley Road interchanges; reconstructing the westbound I-80 bridge over Green Valley Creek; constructing a new westbound on-ramp to I-80 at Suisun Valley Road; constructing a new westbound off-ramp from I-80 to Green Valley Road; constructing a new bridge and westbound I-80 off-ramp to Green Valley Road over Green Valley Creek; removing the existing I-80/I-680 connector bridges over I-80 and Green Valley Road; removing Neitzel Road; and excavation and grading of the Business Center Drive Extension. Construction would start in 2014 and last approximately two years.
- **Construction Package 4**
  Major project elements include: Constructing the northbound I-680 to eastbound I-80 connector; reconstructing the eastbound State Route 12 west connector to eastbound I-80; reconstructing the eastbound I-80 off-ramp to Green Valley Road; reconstructing the Green Valley Road on-ramp to eastbound I-80; realigning Lopes

Road and Green Valley Road to connect with the original I-680 alignment; widening eastbound State Route 12 and existing culvert one lane to the south; and constructing a retaining wall between Ledgewood Creek and Pennsylvania Avenue. Construction would start in 2014 and last approximately two years.

- **Construction Package 5**
  Construction package 5 includes constructing a new Red Top Road/Business Center Drive Extension, constructing a northbound I-680 to westbound State Route 12 west connector, reconstructing the I-80/Red Top Road interchange, and constructing a new State Route 12/Red Top Road Interchange. Construction would start in 2018 and last approximately two years.
- **Construction Package 6**
  Construction package 6 involves constructing new I-80/I-680 connectors. Construction would start in 2018 and last approximately two years.
- **Construction Package 7**
  Construction package 7 involves constructing a new northbound I-680/I-80 loop on-ramp, constructing an eastbound I-80 connector to southbound I-680, and reconstructing the Union Pacific Railroad I-80 overpass. Construction would start in 2018 and last approximately one and-a-half years.

This certification allows construction of construction package 1. The Water Board is certifying construction package 1 in advance of issuance of Waste Discharge Requirements (WDRs) for the entire Project at the request of Caltrans because the timeline for WDRs issuance would jeopardize Caltrans's funding deadline for construction package 1. The Water Board plans to adopt Waste Discharge Requirements (WDRs) for construction of the subsequent six construction packages.

Impacts: Project implementation would permanently impact approximately 4.82 acres of wetlands, approximately 2,444 linear feet of waters, and approximately 3.33 acres of riparian habitat. Permanent impacts to jurisdictional waters and wetlands for each construction package are summarized below in Attachment A, *Summary of Permanent Impacts.*

Project implementation would result in temporary impacts to approximately 0.55 acres of jurisdictional seasonal freshwater wetlands, approximately 1,049 linear feet of jurisdictional waters, and approximately 0.11 acres of riparian woodland as a result of construction access. Temporary impacts to jurisdictional waters and wetlands for each construction package are summarized In Attachment B, *Summary of Temporary Impacts.*

Roadway Pollutant Impacts: implementation of construction package 1 would result in approximately 8.1 acres of new and 3.8 acres of reworked impervious area. Stormwater runoff from impervious areas may contain hydrocarbons, metals, volatile organic

compounds, trash, and sediment at levels that may significantly impact jurisdictional waters if left untreated.

Hydromodification Impacts: Added impervious areas may result in alterations to existing hydrologic regimes, resulting in erosion and/or changes of sediment transport in receiving waters (hydromodification). Hydromodification mitigation is not required for this Project because the Project area is not within the Fairfield-Suisun Hydromodification control areas, as identified in Attachment D of the Water Board's Municipal Regional Permit (Order No. R2-2009-0074).

Avoidance and Minimization: The Department has met regularly since 2007, with staff from the Water Board, U.S. Environmental Protection Agency, California Department of Fish and Wildlife, and U.S. Fish and Wildlife Service (USFWS) to discuss various project alternatives. The interagency group agreed that the current design alternative represents the least environmentally damaging practicable alternative that still achieves the basic project purpose.

After selecting the current project design, the Department found additional opportunities to reduce wetland fill through incorporation of retaining walls and alteration of the proposed Business Center Drive extension profile. This certification requires the Department to investigate additional opportunities to avoid and minimize impacts to waters of the State and the U.S. prior to construction of packages 2 through 7 (see condition 2.a).

Mitigation: To mitigate for permanent impacts to wetlands, waters, and riparian habitat, the Department shall: create no less than 8.25 acres of seasonal freshwater wetlands at Suisun Creek Preserve; create no less than 2,461 linear feet of creek channel at Suisun Creek Preserve; create no less than 3.33 acres of riparian habitat at Suisun Creek Preserve and no less than 3.33 acres at a location yet to be determined; and, construct no less than 7,752 linear feet of unlined, earthen ditches within the Project limits.

To mitigate for temporary impacts to wetlands and waters, the Department shall restore temporarily impacted areas to previous or enhanced condition. A specific plan to restore temporarily impacted areas shall be provided in the Final Mitigation and Monitoring Plan (MMP) (see certification condition no. 7.a).

Roadway Pollutant Mitigation: As mitigation for increased pollutant loads associated with impervious areas for construction package 1, the Department shall construct a biofiltration basin in the northwest quadrant of the Interstate 80/Green Valley Road interchange to treat 17.13 acres of impervious area.

CEQA Compliance: The Department prepared and approved an Environmental Impact Report for this Project pursuant to the provisions of the California Environmental Quality Act. The Department filed a Notice of Determination on October 29, 2012 (SCH No. 2003052021).

California Wetlands Portal: It has been determined through regional, state, and national studies that tracking of mitigation/restoration projects must be improved to better assess the performance of these projects. In addition, to effectively carry out the State's No Net Loss Policy for wetlands, the State needs to closely track wetland losses, gains, and mitigation/restoration project success. Therefore, we require the Department use the California Wetlands Standard Form to provide Project information related to impacts and mitigation/restoration measures (see Condition Nos. 11 and 12 of this certification). An electronic copy of the form and instructions may be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml

Project information concerning impacts and mitigation/restoration will be made available at the web link: http://www.californiawetlands.net

Certification: I hereby issue an order certifying that any discharge from the referenced Project will comply with the applicable provisions of sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards) of the Clean Water Act, and with other applicable requirements of State law. This discharge is also regulated under State Water Resources Control Board Order No. 2003 - 0017 – DWQ, "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received State Water Quality Certification" which requires compliance with all conditions of this Water Quality Certification. The following conditions are associated with this certification:

1. The mitigation requirements of this certification reflect the Department's intent to commence all offsite mitigation concurrent with Construction Package 1 impacts to wetlands and waters. If the Department cannot commence mitigation at Suisun Creek Preserve within six months from initiation of Construction Package 1 impacts to wetlands and waters, then the Department shall submit, subject to approval by the Executive Officer, a mitigation proposal to account for temporal loss to wetlands and waters impacted during the delay period.

   All mitigation required for Construction Package 1 shall be constructed prior to completion of Construction Package 1 construction activities. If the Department cannot complete Suisun Creek Preserve mitigation prior to completion of

Construction Package 1, then the outstanding Suisun Creek Mitigation requirements for Construction Package 1 shall thereafter increase by 20% per annum;

2. The Department shall not commence any element of Project construction for construction packages two through seven until Waste Discharge Requirements for those construction packages have been adopted by the Water Board. Water Board staff will request additional information before drafting Waste Discharge Requirements. Requested information shall include, but not be limited to:

    a. Analyses of additional opportunities to avoid and minimize impacts to wetlands and waters and their beneficial uses. These analyses shall be conducted as the design details for construction packages 2-7 progress;

    b. Confirmation of required onsite mitigation implementation;

    c. Confirmation of Suisun Creek Preserve mitigation implementation. Please note if the Suisun Creek Preserve is not meeting performance standards (if applicable) or if any unforeseeable conditions render any portion of the proposed mitigation infeasible, then Waste Discharge Requirements (WDRs) shall not be issued until the site is brought into compliance or alternative mitigation is identified;

    d. A proposal to create or restore no less than 3.33 acres of riparian habitat within the Suisun Bay watershed (above and beyond the 3.33 acres required at Suisun Creek Preserve). The riparian habitat shall be planted no later than December 15, 2014. The proposal shall include a monitoring and reporting proposal equivalent to the riparian planting proposal in the final, accepted MMP; and

    e. A proposal to treat stormwater from an area of impervious surface equivalent to all added and reworked impervious areas associated with Construction Packages 2-7. The Department may propose stormwater treatment proposal timelines for each individual construction package. Under this scenario, WDRs would prohibit construction package construction until the Water Board's Executive Officer accepts the respective stormwater treatment proposal;

3. Not less than sixty days prior to commencement of Package 1 construction, the Department shall submit a Final Mitigation and Monitoring Plan for restoration and enhancement activities at the Suisun Creek Preserve (Suisun Plan). The Suisun Plan must be submitted in this time frame to accommodate public and staff review. Package 1 staging and construction shall not commence until the Suisun Plan has been found acceptable to Water Board staff. The Suisun Plan shall include, but not be limited to:

a. A proposal to create no less than 8.25 acres of seasonal freshwater wetlands at Suisun Creek Preserve; create no less than 2,461 linear feet of creek channel at Suisun Creek Preserve; and create no less than 3.33 acres of riparian habitat at Suisun Creek Preserve;

b. A detailed riparian and wetland planting plan and palette. Seed mixes shall consist only of species native to the Suisun Bay hydrologic area. The Department shall prioritize use of seeds developed from local seed sources to promote genetic integrity;

c. An invasive species control plan;

d. A plan for controlled herbicide use that includes use criteria (e.g., target invasives, weather condition criteria, herbicide types). All herbicide use shall be inventoried and reported in each mitigation site annual report. The type of herbicide, target species, frequency and duration of use shall be reported);

e. Performance standards for all plantings;

f. A monitoring period no less than ten years for wetland and riparian areas;

g. An adaptive management plan;

h. A grazing plan that prohibits cattle from entering riparian areas. The Department may propose "flash grazing" in riparian areas after defining triggers for such grazing as well as management protocol to ensure damage to channel morphology and riparian plants are prevented. If cattle would be allowed to enter wetland areas, the grazing plan shall explain the benefit to wetland grazing, the circumstances and timing under which wetland grazing would be allowed, and how the wetlands would be protected from grazing activities. The grazing plan shall acknowledge that grazing plan modification, subject to the review of the resource agencies, may be necessary should listed species become established within the grazing area;

i. A plan to wait two full growing seasons after termination of supplemental irrigation before considering success of the associated plantings; and

j. A plan to submit annual reports to the Water Board by December 31st of each year. All monitoring reports shall include photo-documentation utilizing consistent photo vantage points. If the monitoring report includes management recommendations, then the report must express whether the Department shall implement those recommendations.

Any changes to the final, accepted MMP shall be subject to the review and acceptance of Water Board staff prior to implementation.

4. Prior to Year 10 mitigation monitoring at Suisun Creek Preserve and transfer of the Suisun Creek Preserve to the long-term manager, the Department shall demonstrate

the ability to secure all supplemental water necessary to support mitigation site functions. This may occur in the form of a secure water right or the right to purchase and convey supplemental water to the mitigation site;

5. Not less than sixty days prior to commencement of Package 1 construction, the Department shall submit a letter of financial assurance to ensure that the MMP approved by the Executive Officer shall be implemented as accepted and that the mitigation habitat shall be maintained in perpetuity. The letter shall assure the purchase and implementation of alternative compensatory mitigation in the event of mitigation failure;

6. The Department shall ensure that a conservation easement for the Suisun Creek Preserve is completed and recorded with the County Recorder's Office. The conservation easement shall specify preservation of the mitigation area as wetland and riparian wildlife habitat, in perpetuity. Copies of the recorded documents shall be provided to the Water Board within six months of initiation of impact to wetlands and waters in construction package 1;

7. Not less than sixty days prior to commencement of Package 1 construction, the Department shall submit a Final Mitigation and Monitoring Plan for restoration of temporarily impacted areas and creation of unlined, earthen ditches onsite (Onsite Plan). The Onsite Plan must be submitted in the above time frame to allow for public and staff review. Package 1 staging and construction shall not commence until the Onsite Plan has been found acceptable to Water Board staff. The Onsite Plan may be incorporated into the Suisun Plan. The Onsite Plan shall include:

    a. An onsite temporary impact restoration plan detailing specific procedures to restore temporarily impacted wetlands and waters to their pre-construction conditions within the first growing season following cessation of construction activity in those areas. Restoration measures shall be specific to the type of impact (e.g., compaction from heavy machinery and removal of vegetation);

    b. Planting plans and palettes. Seed mixes shall consist only of species native to the Suisun Bay Hydrologic Area;

    c. A proposal to construct 7,752 linear feet of unlined, earthen ditches within the project limits to mitigate for impacts to waters. The proposal shall include an implementation timeline for ditch construction per the timelines included in the certification mitigation summary (Attachment C) as well as the proposed, exact location of the ditches. The ditches shall not be considered successful until they are verified as federal jurisdictional wetlands or waters. To demonstrate the constructed ditches are jurisdictional, the Department shall submit a wetland delineation to the U.S. Army Corps of Engineers for

verification. The Onsite Plan shall also include a monitoring and reporting plan for the constructed ditches;

8. As mitigation for increased pollutant loads associated with impervious areas in construction package 1, the Department shall provide treatment of stormwater runoff from no less than 11.9 acres of impervious area using a bioretention basin. The basin shall be installed consistent with the Project plans included in Attachment D of this certification. The basin shall be constructed as part of construction package 1. Any revisions to the bioretention basin design details shall be subject to the acceptance of Water Board staff before they are implemented.

   Water Board staff recognize that the proposed design would sufficiently treat stormwater from 17.1 acres impervious area. The Department may apply surplus treatment area to future construction packages;

9. All temporarily disturbed areas shall be re-vegetated using only plant species native to the Suisun Bay Hydrologic Area. The Department shall not cause, through operation of heavy machinery, or any other construction activity, compaction of wetlands or waters in areas of temporary impact (see Attachment B for areas of temporary impact). Any compaction of wetlands or waters to areas of temporary impact shall require mitigation;

10. The Resident Engineer (or appropriately authorized agent) shall hold water quality permit compliance meetings (similar to tailgate safety meetings) to discuss permit compliance, including instructions on violation avoidance and violation reporting procedures. The meetings shall be held at least every other week, before forecasted storm events, and when a new contractor or subcontractor arrives to begin work at the site. The contractors, subcontractors and their employees, as well as any inspectors or monitors assigned to the project, shall be present at the meetings. The Department shall maintain dated sign-in sheets for attendees at these meetings, and shall make them available to the Water Board on request;

11. The Department is required to use the California Wetlands Standard Form to provide project information describing impacts and mitigation/restoration measures for construction package 1 within 30 days from the date of this certification. An electronic copy of the form can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml. The completed California Wetlands form shall be submitted electronically to habitatdata@waterboards.ca.gov or shall be submitted as a hard copy to both: 1) The Water Board, 1515 Clay St., Suite 1400, Oakland, CA 94612, to the attention of California Wetlands Portal; and 2) San Francisco Estuary Institute, 4911 Central Ave., Richmond, CA 94804, to the attention of California Wetlands Portal;

12. Suisun Creek Preserve mitigation monitoring reports shall be submitted to the Water Board by January 1 of each year. Modification of this deadline is subject to the acceptance of Water Board staff. The reports may be submitted by upload to the California Wetlands Portal website at http://www.californiawetlands.net/tracker/ba/list. Select the Suisun Creek Preserve restoration project from the Bay Area Project List and then use the "Files & Links" web-link on the mitigation site project page to upload the report. The Department shall immediately notify appropriate Water Board staff once the monitoring report has been uploaded. If the Department cannot, or chooses not to submit the report using the California Wetlands Portal, the report may be submitted directly to Water Board staff electronically, via e-mail;

13. If the Department provides advance mitigation for impacts not incurred, the Department may use that mitigation as credit for other Department project(s), subject to the acceptance of the Water Board Executive Officer. Credit for other Department project(s) may not be granted until all Project impacts have occurred and mitigated unless the Executive Officer determines that the mitigation provided is sufficient to cover all probable Project impacts;

14. Concrete shall be excluded from surface water for a period of 30 days after it is poured/sprayed. During that time the concrete shall be kept moist and runoff from the concrete shall not be allowed to enter State waters. Commercial sealants may be applied to the concrete surface in instances where 30 days of water exclusion is infeasible. If sealant is used, water shall be excluded from the site until the sealant is cured. If groundwater comes into contact with fresh concrete, it shall be prevented from flowing towards surface water;

15. The Project shall be constructed in conformance with the Project Description described in this certification and certification application materials. Any change in the Project that could impact State waters may require compensatory mitigation and shall first be reported to and found acceptable by the Water Board Executive Officer;

16. If, at any time, an unauthorized discharge to surface water (including wetlands, rivers or streams) occurs, or any other water quality problem arises, the associated Project activities shall immediately cease until adequate BMPs are implemented. The Water Board shall be notified promptly and in no case more than 24 hours after the unauthorized discharge or water quality problem arises;

17. The Department shall adhere to the conditions imposed by the Individual Permit issued to the Department by the U.S. Army Corps of Engineers, to the Streambed Alteration Agreement issued to the Department by the California Department of Fish and Wildlife, and to the Biological Opinion issued to the Department by the USFWS;

18. All activities and best management practices (BMPs) shall be implemented according to the submitted application materials and the findings and conditions of this certification. BMPs for erosion, sediment, turbidity and pollutant control shall be implemented and in place at commencement of, during, and after any ground clearing activities, construction activities, or any other Project activities that could result in erosion, sediment, or other pollutant discharges to waters of the State. The BMPs shall be implemented in accordance with the Caltrans Construction Site Best Management Practice Manual (CCSBMPM) and all contractors and subcontractors shall comply with the CCSBMPM. BMPs for erosion and sediment control shall be utilized throughout all phases of construction, regardless of date, wherever sediment-laden runoff threatens to enter waters of the State. The Department shall stage erosion and sediment control materials at the work site. All BMPs shall be installed properly and in accordance with the manufacturer's specifications. If the Project Resident Engineer elects to install alternative BMPs for use on the project, the Department shall submit a proposal to Water Board staff for review and concurrence;

19. The Department shall not use or allow the use of erosion control products that contain synthetic materials within waters of the State at any time. The Department shall request approval from Water Board staff if an exception from this requirement is needed at a specific location. In areas outside waters of the State jurisdiction, the Department shall prioritize the use of wildlife-friendly biodegradable (not photo-degradable) erosion control products. The Department shall not use or allow the use of erosion control products that contain synthetic netting for permanent erosion control (i.e. erosion control materials to be left in place for two years or after the completion date of the Project);

    If the Department finds that erosion control netting or products have entrapped or harmed wildlife, personnel shall remove the netting or product and replace it with wildlife-friendly biodegradable products ;

20. Fueling, lubrication, maintenance, storage and staging of vehicles and equipment shall be prohibited within waters of the State. Fueling of individual equipment types within waters of the State may be authorized if the Department first prepares a fueling plan that:
    a. Identifies the specific piece of machinery that may require fueling within waters of the State;
    b. Provides justification for the need to refuel within State waters. The justification shall describe why fueling outside of jurisdictional waters is infeasible; and
    c. Includes a narrative of specific BMPs that shall be employed to prevent and capture fuel releases.

Fueling of equipment within waters of the State shall be prohibited until the above mentioned plan has been approved by Water Board staff. The fueling plan may be submitted individually, included in the project Storm Water Pollution Prevention Plan (SWPPP), or submitted as a SWPPP amendment;

21. Fueling, lubrication, maintenance, storage and staging of vehicles and equipment shall not result in a discharge or a threatened discharge to any waters of the State. At no time shall the Department use any vehicle or equipment which leaks any substance that may impact water quality;

22. Except as expressly allowed in this certification, the Department is prohibited from discharging waste to waters of the State. No debris, soil, silt, sand, bark, slash, sawdust, rubbish, cement or concrete or concrete washings, welding slag, oil or petroleum products, or other organic or earthen material from any construction or associated activity of whatever nature, other than that authorized by this certification, shall be allowed to enter into waters of the State. Except for temporary stockpiling of waste generated during demolition operations ("temporary" in this instance means generated and removed during the same working day), waste materials shall not be placed where the materials may be washed by rainfall into waters of the State;

23. The Department shall provide analysis and verification that placement of non-hazardous waste or inert materials (which may include discarded product or recycled materials) will not result in degradation of water quality, human health, or the environment. All Project-generated waste shall be handled, transported, and disposed in strict compliance with all applicable State and Federal laws and regulations. When operations are complete, any excess material or debris shall be removed from the work area and disposed of properly and in accordance with the Special Provisions for the Project and/or the 2006 Standard Specification 7-1.13, Disposal of Material Outside the Highway Right of Way. In accordance with State and Federal laws and regulations, the Department is liable and responsible for the proper disposal of waste generated by their Project;

24. All imported fill material shall be clean and free of pollutants. All fill material shall be imported from a source that has the appropriate environmental clearances and permits. The reuse of low-level contaminated solids as fill on-site shall be performed in accordance with all State and Federal policies and established guidelines; a plan for such re-use must first be submitted to Water Board staff for review and concurrence;

25. Work in flowing or standing surface waters is prohibited unless otherwise proposed in the Project description and approved by the Water Board;

26. Gravel bags used within waters of the State shall:

a. Consist of mechanically-rounded and washed, and/or river run gravel obtained from a river or creek bed;
b. Be clean, hard, sound, durable, uniform in quality, and free of disintegrated material, organic matter, or other deleterious substances;
c. Be composed entirely of particles that have no more than one fractured face;
d. Have a cleanliness value of at least 85, using the Cleanness Value Test Method for California Test No. 227; and
e. Have a diameter no less than 0.75 inches in diameter, and no greater than four inches in diameter.

Gravel bag fabric shall be nonwoven polypropylene geotextile (or comparable polymer) and shall conform to the following requirements:

a. Mass per unit area, grams per square meter, min ASTM Designation: D 5261 – 270;
b. Grab tensile strength (25-mm grip), kilonewtons, min. ASTM Designation: D4632* 0.89;
c. Ultraviolet stability, percent tensile strength retained after 500 hours, ASTM Designation: D4355, xenon arc lamp method 70 or appropriate test method for specific polymer;
d. Gravel bags shall be between 600 mm and 800 mm in length, and between 400 mm and 500 mm in width;
e. Yarn used in construction of the gravel bags shall be as recommended by the manufacturer or bag supplier and shall be of a contrasting color. The opening of gravel-filled bags shall be secured to prevent gravel from escaping. Gravel-filled bags shall be between 13 kg and 22 kg in mass; and
f. Caltrans shall request approval from Water Board staff if an exception from this requirement is needed for a specific location;

27. Herbicides and pesticides shall not be used within the Project. If Caltrans has a compelling case as to why herbicides and pesticides should be used, they may submit a request along with a BMP plan to Water Board staff for review, consideration, and concurrence;

28. Caltrans shall submit, subject to the acceptance of Water Board staff, a dewatering and/or diversion plan that appropriately describes the dewatered or diverted areas and how those areas will be handled during construction. The diversion/dewatering plans shall be submitted no later than 30 days prior to conducting the proposed activity. Diversion/dewatering activities shall be prohibited until Water Board staff has accepted the dewatering/diversion plan for that specific water. Information submitted shall include the area or work to be diverted or dewatered and method of the proposed activity. All diversion or dewatering activities shall be designed to minimize

the impact to waters of the State, avoid fish entrainment, and maintain natural flows upstream and downstream. All dewatering or diversion structures shall be installed in a manner that does not cause sedimentation, siltation or erosion upstream or downstream. All dewatering or diversion structures shall be removed immediately upon completion of Project activities;

29. This certification does not allow for the take, or incidental take, of any special status species. The Department shall use the appropriate protocols, as approved by the California Department of Fish and Wildlife and the USFWS, to ensure that Project activities do not impact the Beneficial Use of the Preservation of Rare and Endangered Species, as described in the San Francisco Bay Regional Water Quality Control Plan;

30. The Department shall maintain a copy of this certification at the Project site to be available at all times to Project personnel. It is the Department's responsibility to ensure that all personnel (employees, contractors, and subcontractors) are adequately informed and trained in the conditions of this certification;

31. The Water Board may add to or modify the conditions of this certification, as appropriate, to implement any new or revised water quality standards and implementation plans adopted or approved pursuant to the Porter-Cologne Water Quality Control Act or section 303 of the Clean Water Act;

32. This certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Section 13330 of the California Water Code and Title 23 of the California Code of Regulations, Section 3867;

33. This certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license, unless the pertinent certification application was filed pursuant to California Code of Regulations Title 23, Subsection 3855(b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought; and

34. Certification is conditioned upon total payment of the full fee required in State regulations (23 CCR Section 3833). The Water Board has received the full fee for this certification.

We anticipate your cooperation in implementing these conditions. However, please be advised that any violation of water quality certification conditions is a violation of State law and subject to administrative civil liability pursuant to California Water Code, Section

13350. Failure to respond, inadequate response, late response, or failure to meet any condition of this certification may subject you to civil liability imposed by the Water Board to a maximum of $5,000 per day per violation or $10 for each gallon of waste discharged in violation of this certification.

This certification includes requirements for information and reports. Any requirement for a report made as a condition to this action is a formal requirement pursuant to CWC section 13267, and failure or refusal to provide, or falsification of such required report is subject to civil liability as described in California Water Code, Section 13268.

If you have any question, please contact Dale Bowyer at (510) 622-2323, or via e-mail to DBowyer@waterboards.ca.gov.

Sincerely,

Shin-Roei Lee acting for

Shin-Roei Lee
2013.04.29
17:50:47 -07'00'

Bruce H. Wolfe
Executive Officer

Attachments:
A- Summary of Permanent Impacts
B- Summary of Temporary Impacts
C- Summary of Mitigation Requirements for Permanent Impacts
D- Biofiltration Basin Design Details
E- Consideration of Public Comments

cc (via e-mail):
Mr. Bill Orme SWRCB-DWQ
Ms. Laurie Monarres, USACE
Ms. Jane Hicks, Regulatory Branch, USACE
Ms. Melissa Escaron, Caltrans
Ms. Paula Gill, USACE
Mr. Scott Steinwert, Circle Point
Ms. Janet Adams, Solano Trans.
Mr. Dale Bowyer, Water Board
Mr. Cyrus Vafai, Caltrans
Mr. Hardeep Takhar, Caltrans
Ms.Melissa Scianni, USEPA
Mr. Jason Brush, USEPA
Mr. Wilfung Martono, Caltrans
Mr. Dale Dennis, Solano Trans

Attachment A
Summary of Permanent Impacts

Table 1: Summary of Permanent Impacts—Construction Package 1

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal roadside drainage, impacted at two locations: 1) Where Lopes Road terminates to the north at Green Valley Road; and 2) North of I-80, east of Green Valley Road, south of Green Valley Creek	0.10 acres (862 linear feet)
OW-61	Seasonal roadside drainage adjacent Southbound Green Valley Road, north of westbound I-80	0.04 acres
OW-61a	Seasonal roadside drainage adjacent westbound I-80. The impact area extends between just west of Green Valley Road and the I-80 off-ramp to westbound State Route 12	0.20 acres
OW-61a	Riparian vegetation (oak woodland) adjacent OW-61a	0.26 acres
OW-180	Drainage connecting wetlands W-180a and W-180b, north of westbound State Route 12, just east of Red Top Road	0.01 acres
W-13	Vernal pool seasonal wetland adjacent westbound State Route 12 approximately 250 feet west of Red Top Road	0.02 acres
W-14	Vernal pool seasonal wetland adjacent westbound State Route 12 approximately 1,800 feet west of Red Top Road	0.01 acres
W-15	Vernal pool seasonal wetland adjacent westbound State Route 12 approximately 250 feet northeast of existing Red Top Road terminus at State Route 12	0.03 acres
W-180a	Vernal pool seasonal wetland adjacent westbound State Route 12 approximately 300 feet northeast of existing Red Top Road terminus at State Route 12, just south of W-15	0.09 acres
W-180b	Seasonal wetland adjacent westbound State Route 12 approximately 400 feet south of Mangels Pond, immediately south of W-181	0.05 acres
W-181	Perennial marsh south of Mangels Pond and north of W-180b	0.01 acres
W-45-1	Seasonal wetland immediately north of westbound I-80 and immediately west of and below existing I-680 overpass	0.01 acres
W-45-2	Seasonal wetland east of Green Valley Road, west of Green Valley Creek, and north of I-80	0.03 acres
W-45a-2	Vernal pool seasonal wetland east of Green Valley Road, west of Green Valley Creek, north of I-80, south of W-45-2	0.16 acres
W-60	Seasonal wetland adjacent the north side of the existing I-80 off ramp to westbound State Route 12	0.20 acres
W-61b	Seasonal wetland adjacent north side of southbound Green Valley Road on-ramp to westbound I-80	0.47 acres
W-62	Seasonal wetland adjacent the north side of the existing I-80 off ramp to westbound State Route 12, just north of W-60	0.03 acres
W-63	Vernal pool Seasonal wetlands adjacent north side of westbound I-80 between Green Valley Road and off-ramp to State Route 12 west	0.02 acres

Table 1: Summary of Permanent Impacts—Construction Package 1 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-64	Seasonal wetlands adjacent north side of westbound I-80 between Green Valley Road and off-ramp to State Route 12 west	0.02 acres
W-143		0.05 acres
	totals:	1.55 acres and 5 linear feet of fill to jurisdictional wetlands and waters; 0.26 acres of permanent impact to riparian woodland

Table 2: Summary of Permanent Impacts—Construction Package 2

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-19	Seasonal drainages west of southbound 680 at location of proposed Red Top Road/I-680 interchange	0.04 acres
OW-150		0.02 acres
OW-151		0.02 acres
W-20	Linear seasonal wetland between OW-19 and southbound I-680	0.05 acres
W-21	Seasonal wetland adjacent southbound I-680 at proposed location of Red Top Road on-ramp to southbound I-680	0.01 acres
W-C	Seasonal wetlands east of northbound I-680 at location of proposed Red Top Road/I-680 interchange	0.13 acres
W-D		0.36 acres
W-E		0.15 acres
	totals:	0.78 acres of fill to jurisdictional wetlands and waters

Table 3: Summary of Permanent Impacts—Construction Package 3

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-45	Perennial marsh segment of Green Valley Creek just north of westbound I-80	0.21 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.01 acres
OW-8	Jameson Canyon Creek beneath proposed I-80 to southbound I-680 connector	490 linear feet (0.34 acres)
OW-8	Riparian Woodland along Jameson Canyon Creek	0.72 acres

Table 3: Summary of Permanent Impacts—Construction Package 3 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal drainage adjacent the north side of westbound I-80 just east of Green Valley Road	0.02 acres
OW-161	Seasonal drainage in footprint of the proposed Business Center Drive extension, approximately 900 feet due east from northern end of Mangels Pond	0.01 acres
OW-164	Seasonal drainage upstream of Mangels Pond in footprint of the proposed Business Center Drive extension	0.08 acres
OW-175	Seasonal drainage approximately 600 feet west of existing Business Center Drive terminus in footprint of the proposed Business Center Drive extension	43 linear feet (0.01 acres)
W-45-1	Seasonal wetland adjacent the north side of westbound I-80 east of Green Valley Road in footprint of proposed westbound I-80 to southbound I-680 connector	0.15 acres
W-109	Seasonal wetland between existing westbound I-80 mainline and I-80 westbound off-ramp to Green Valley Road	0.18 acres
W-182	Seasonal wetland between existing westbound I-80 mainline and I-80 westbound off-ramp to Green Valley Road. Just east of W-109	0.48 acres
W-F	Seasonal wetland in footprint of the proposed Business Center Drive extension approximately 1800 feet due east from southern end of Mangels Pond	0.01 acres
	totals:	1.14 acres and 533 linear feet of fill to jurisdictional wetlands and waters; 0.73 acres of permanent impact to riparian woodland

Table 4: Summary of Permanent Impacts—Construction Package 4

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-8	Riparian Woodland along Jameson Canyon Creek	0.07 acres
OW-8b-1	Seasonal drainage immediately east of Red Top Road, south of State Route 12	326 linear feet
OW-8b-1	Riparian woodland along seasonal drainage immediately east of Red Top Road, south of State Route 12	0.89 acres

Table 4: Summary of Permanent Impacts—Construction Package 4 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal drainage alongside eastbound I-80 between West Cordelia Road and Green Valley Road	0.10 acres
OW-90	Ledgewood Creek south of State Route 12 east	18 linear feet
OW-90a	Perennial drainage south of State Route 12 east approximately 800 feet west of Beck Avenue	0.01 acres
OW-119	Seasonal drainage outletting under State Route 12 immediately east of Pennsylvania Avenue	0.01 acres
W-28	Seasonal wetland south of eastbound I-80 approximately 1,000 feet northeast of West Cordelia Road intersection with I-80	0.03 acres
W-29	Seasonal wetland south of eastbound I-80 approximately 1,100 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
W-30	Seasonal wetland south of eastbound I-80 approximately 1,700 feet northeast of West Cordelia Road intersection with I-80	0.10 acres
W-45a-1	Seasonal wetland south of eastbound I-80 approximately 500 feet northwest of the terminus of Auto Plaza Court	0.20 acres
W-90	Ledgewood Creek at State Route 12	0.02 acres
W-90a	Perennial marsh south of State Route 12 east from approximately 800 feet west of Beck Avenue to Beck Avenue	0.02 acres
W-145	Seasonal wetland south of eastbound I-80 approximately 1,200 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
W-146	Seasonal wetland south of eastbound I-80 approximately 800 feet northeast of West Cordelia Road intersection with I-80	0.02 acres
W-194	Alkali seasonal marsh along southern side of SR 12 east, just west of Pennsylvania Avenue	0.01 acres
		0.54 acres and 344 linear feet of fill to jurisdictional wetlands and waters; 0.96 acres of permanent impact to riparian woodland

Table 5: Summary of Permanent Impacts—Construction Package 5

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-1	Seasonal drainages in vicinity of the proposed Business Center Drive extension western terminus at westbound I-80	157 linear feet
OW-1a		213 linear feet
OW-2		22 linear feet
OW-2a		0.01 acres

Table 5: Summary of Permanent Impacts—Construction Package 5 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-3	Seasonal drainage in location of proposed Business Center Drive extension on-ramp to westbound I-80	0.01 acres
OW-8	Riparian Woodland along Jameson Canyon Creek	0.11 acres
OW-8a	Riparian woodland along Jameson Canyon Creek at location of proposed Business Center Drive extension, south of SR 12	0.20 acres
OW-8b-1	Riparian woodland along seasonal drainage immediately east of Red Top Road, south of State Route 12	0.46 acres
OW-8c	Riparian woodland along seasonal Jameson Canyon Creek tributary, south of I-80, just northeast of confluence with Jameson Canyon Creek	0.09 acres
OW-158	Seasonal drainage north and south of SR 12 west approximately 1,700 feet west of Red Top Road	85 linear feet
OW-158a		342 linear feet
OW-158a	Riparian woodland at OW-158a	0.41 acres
OW-160a	Seasonal drainage south of SR 12 west approximately 1,500 feet west of Red Top Road	171 linear feet
OW-162	Seasonal drainage north and south of SR 12 west approximately 1,050 feet west of Red Top Road	395 linear feet
OW-163	Seasonal drainage north and south of SR 12 west approximately 250 feet west of Red Top Road	0.01 acres
OW-175	Seasonal drainage approximately 600 feet west of existing Business Center Drive terminus in footprint of the proposed Business Center Drive extension	37 linear feet (0.01 acres)
OW-175a	Seasonal drainage north of SR 12 west, just north of the Red Top Road, adjacent eastern end of W-15	0.01 acres
W-13	Vernal pool seasonal wetland north of SR 12 approximately 150 feet west of the Red Top Road terminus	0.26 acres
W-14	Vernal pool seasonal wetland north of SR 12 approximately 1600 feet west of the Red Top Road terminus and directly north of OW-160a	0.08 acres
W-15	Vernal pool seasonal wetland north of SR 12 west, just northeast of Red Top Road	0.08 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.01 acres
W-42	Seasonal wetland adjacent southern side of Southern-Pacific railroad and eastbound I-80	0.03 acres
W-158a	Seasonal wetland at southern extent of OW-158a	0.01 acres
W-173	Vernal pool seasonal wetland north of SR 12 west, just north of the Red Top Road	0.01 acres

Table 5: Summary of Permanent Impacts—Construction Package 5 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-177	Seasonal wetlands north of SR 12 west, just north of the Red Top Road	0.01 acres
W-178		0.01 acres
W-179		0.01 acres
W-180a	Vernal pool seasonal wetland north of SR 12 west, just northeast of the Red Top Road	0.08 acres
W-180b	Seasonal wetland north of SR 12 west, just north of the Red Top Road. East of W-180a with a hydrological connection via OW-180	0.06 acres
	totals:	0.68 acres and 1,422 linear feet of fill to jurisdictional wetlands and waters; 1.28 acres of permanent impact to riparian woodland

Table 6: Summary of Permanent Impacts—Construction Package 6

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45	Green Valley Creek in I-80 Median	11 linear feet (0.01 acres)
		11 linear feet of fill to jurisdictional waters

Table 7: Summary of Permanent Impacts—Construction Package 7

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-8	Jameson Canyon Creek at I-80	118 Linear Feet (0.06 acres)
OW-61a	Seasonal drainage adjacent northern side of existing westbound I-80 off-ramp to SR 12 westbound	0.02 acres
OW-61a	Riparian vegetation (oak woodland) adjacent OW-61a	0.02 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.05 acres
W-41	Riparian Woodland along eastbound Cordelia Road, just south of I-80	0.03 acres

Table 7: Summary of Permanent Impacts—Construction Package 7 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-60	Seasonal wetland adjacent northern side of existing westbound I-80 off-ramp to SR 12 westbound	0.11 acres
	totals:	0.13 acres and 129 linear feet of fill to jurisdictional wetlands and waters; 0.10 acres of permanent impact to riparian woodland

Attachment B
Summary of Temporary Impacts

Table 8: Summary of Temporary Impacts—Construction Package 1

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal roadside drainage, impacted at two locations: 1) Where Lopes Road terminates to the north at Green Valley Road; and 2) North of I-80, east of Green Valley Road, south of Green Valley Creek	0.02 acres
OW-61a	Seasonal roadside drainage adjacent westbound I-80. The impact area extends between just west of Green Valley Road and the I-80 off-ramp to westbound State Route 12	0.05 acres
W-A1	Seasonal wetland between Grobric Court, Central Way, and Ritchie Road	0.18 acres
W-45-2	Seasonal wetland east of Green Valley Road, west of Green Valley Creek, and north of I-80	0.03 acres
W-65	Seasonal wetland adjacent north side of westbound I-80 between Green Valley Road and off-ramp to State Route 12 west. Approximately 200 feet north of W-64	0.01 acres
W-181	Perennial marsh south of Mangels Pond and north of W-180b	0.01 acres
	totals:	0.30 acres of temporary impact to jurisdictional wetlands and waters

Table 9: Summary of Temporary Impacts—Construction Package 2

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-150	Seasonal drainage west of southbound 680 at location of proposed Red Top Road/I-680 interchange	0.05 acres
	totals:	0.05 acres of temporary impact to jurisdictional waters

Table 10: Summary of Temporary Impacts—Construction Package 3

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.02 acres
OW-8	Jameson Canyon Creek beneath proposed I-80 to southbound I-680 connector	80 linear feet (0.06 acres)

Table 10: Summary of Temporary Impacts—Construction Package 3 (continued)

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45	Green Valley Creek at I-80	111 linear feet (0.18 acres)
OW-45a	Seasonal drainage adjacent the north side of westbound I-80 just east of Green Valley Road	0.01 acres
OW-150	Seasonal drainage west of southbound 680 at location of proposed Red Top Road/I-680 interchange	0.04 acres
	totals:	0.05 acres and 191 linear feet of temporary impacts to jurisdictional waters; 0.02 acres of temporary impacts to riparian woodland

Table 11: Summary of Temporary Impacts—Construction Package 4

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-8	Jameson Canyon Creek at I-80	30 linear feet (0.02 acres)
OW-45a	Seasonal drainage alongside eastbound I-80 between West Cordelia Road and Green Valley Road	0.01 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.18 acres
W-28	Seasonal wetland south of eastbound I-80 approximately 1,000 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
W-30	Seasonal wetland south of eastbound I-80 approximately 1,700 feet north ast of West Cordelia Road intersection with I-80	0.05 acres
W-144	Seasonal wetland south of eastbound I-80 approximately 1,100 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
W-145	Seasonal wetland south of eastbound I-80 approximately 1,200 feet northeast of West Cordelia Road intersection with I-80	0.01 acres
		0.08 acres and 30 linear feet of temporary impact to jurisdictional wetlands and waters

Table 12: Summary of Temporary Impacts—Construction Package 5

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-1	Seasonal drainages in vicinity of the proposed Business Center Drive extension western terminus at westbound I-80	215 linear feet
OW-2a		0.01 acres
OW-8	Jameson Canyon Creek beneath proposed I-80 to southbound I-680 connector	162 linear feet (0.14 acres)
OW-8a	Jameson Canyon Creek at location of proposed Business Center Drive extension, south of SR 12	67 linear feet (0.03 acres)
OW-8b-1	Seasonal drainage immediately east of Red Top Road, south of State Route 12. Temporary impacts at three separate locations	265 linear feet (0.06 acres)
OW-8c	Seasonal Jameson Canyon Creek tributary, south of I-80, just northeast of confluence with Jameson Canyon Creek	14 linear feet (0.01 acres)
OW-160a	Seasonal drainage south of SR 12 west approximately 1,500 feet west of Red Top Road	11 linear feet (0.01 acres)
OW-162	Seasonal drainage north and south of SR 12 west approximately 1,050 feet west of Red Top Road	46 linear feet (0.01 acres)
OW-175a	Seasonal drainage north of SR 12 west, just north of the Red Top Road, adjacent eastern end of W-15	0.01 acres
OW-176	Seasonal drainage approximately 500 feet west of existing Business Center Drive terminus in footprint of the proposed Business Center Drive extension	19 linear feet (0.01 acres)
W-15	Vernal pool easonal wetland north of SR 12 west, just northeast of Red Top Road	0.08 acres
W-26	Riparian woodland north of West Cordelia Road at location of future westbound I-80 to southbound I-680 connector	0.03 acres
W-41	Riparian Woodland along eastbound Cordelia Road, just south of I-80	0.03 acres
W-158	Seasonal wetland at southeastern extent of OW-158a, immediately adjacent northern edge of Southern Pacific Railroad	0.01 acres
W-158a	Seasonal wetland at southern extent of OW-158a	0.01 acres
W-160	Seasonal wetland with hydrologic connection and downstream of OW-160a	0.01 acres
W-180b	Seasonal wetland north of SR 12 west, just north of the Red Top Road. East of W-180a with a hydrological connection via OW-180	0.08 acres
W-181	Perennial marsh south of Mangels Pond and north of W-180b	0.08 acres

Table 12: Summary of Temporary Impacts—Construction Package 5

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
	totals:	0.06 acres and 799 linear feet of temporary impact to jurisdictional wetlands and waters; 0.06 acres of temporary impacts to riparian woodland

Table 13: Summary of Temporary Impacts—Construction Package 6

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-45a	Seasonal roadside drainage, impacted at two locations: 1) Where Lopes Road terminates to the north at Green Valley Road; and 2) North of I-80, east of Green Valley Road, south of Green Valley Creek	0.01 acres
		0.01 acres of temporary impact to jurisdictional waters

Table 14: Summary of Temporary Impacts—Construction Package 7

Feature ID (as provided in application materials)	Jurisdictional Feature Impacted and Location	Acreage and/or Linear Footage of Permanent Impact
OW-8	Jameson Canyon Creek at I-80	15 linear feet (0.01 acres)
OW-8c	Seasonal Jameson Canyon Creek tributary, south of I-80, just northeast of confluence with Jameson Canyon Creek	14 linear feet (0.01 acres)
	totals:	29 linear feet of temporary impact to jurisdictional waters;

Attachment C
Summary of Mitigation Requirements for Permanent Impacts

Table 1: Summary of Mitigation for Permanent Impacts—Construction Package 1

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-45a	0.10 acres (862 linear feet)	Construction of 1,060 linear feet of unlined, earthen ditch within the project limits during Package 1 construction
OW-61	0.04 acres	Creation of 0.08 acres of seasonal wetlands at the Suisun Creek Preserve
OW-61a	0.20 acres (2,871 linear feet)	Construction of 3,531 linear feet of unlined, earthen ditch within the project limits during Package 1 construction
OW-61a (riparian)	0.26 acres	Creation of 0.52 acres of riparian habitat at the Suisun Creek Preserve
OW-180	0.01 acres (169 linear feet)	Construction of 208 linear feet of unlined, earthen ditch within the project limits during Package 1 construction
W-13	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-14	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-15	0.03 acres	Creation of 0.06 acres of seasonal wetlands at the Suisun Creek Preserve
W-180a	0.09 acres	Creation of 0.18 acres of seasonal wetlands at the Suisun Creek Preserve
W-180b	0.05 acres	Creation of 0.10 acres of seasonal wetlands at the Suisun Creek Preserve
W-181	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-45-1	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-45-2	0.03 acres	Creation of 0.06 acres of seasonal wetlands at the Suisun Creek Preserve
W-45a-2	0.16 acres	Creation of 0.32 acres of seasonal wetlands at the Suisun Creek Preserve
W-60	0.20 acres	Creation of 0.40 acres of seasonal wetlands at the Suisun Creek Preserve
W-61b	0.47 acres	Creation of 0.94 acres of seasonal wetlands at the Suisun Creek Preserve

Table 1: Summary of Mitigation for Permanent Impacts—Construction Package 1

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
W-62	0.03 acres	Creation of 0.06 acres of seasonal wetlands at the Suisun Creek Preserve
W-63	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-64	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-143		
	totals:	Construction of 4,799 linear feet of unlined, earthen ditch within the project limits during Package 1 construction; Creation of 2.38 acres of seasonal wetlands at Suisun Creek Preserve; Creation of 0.52 acres of riparian habitat at the Suisun Creek Preserve

Table 2: Summary of Mitigation for Permanent Impacts—Construction Package 2

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-19	0.04 acres	Creation of 0.08 acres of seasonal wetlands at the Suisun Creek Preserve
OW-150	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
OW-151	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-20	0.05 acres	Creation of 0.10 acres of seasonal wetlands at the Suisun Creek Preserve
W-21	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-C	0.13 acres	Creation of 0.26 acres of seasonal wetlands at the Suisun Creek Preserve
W-D	0.36 acres	Creation of 0.72 acres of seasonal wetlands at the Suisun Creek Preserve
W-E	0.15 acres	Creation of 0.30 acres of seasonal wetlands at the Suisun Creek Preserve
	totals:	Creation of 1.56 acres of seasonal wetlands at the Suisun Creek Preserve

Table 3: Summary of Mitigation for Permanent Impacts—Construction Package 3

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
W-45	0.21 acres	Creation of 0.42 acres of seasonal wetlands at the Suisun Creek Preserve
W-26 (riparian)	0.01 acres	Creation of 0.02 acres of riparian habitat at the Suisun Creek Preserve
OW-8	490 linear feet (0.34 acres)	Creation of 490 linear feet of creek channel at Suisun Creek Preserve
OW-8 (riparian)	0.72 acres	Creation of 1.44 acres of riparian habitat at the Suisun Creek Preserve
OW-45a	0.02 acres (94 linear feet)	Construction of 116 linear feet of unlined, earthen ditch within the project limits no later than during Package 3 construction
OW-161	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
OW-164	0.08 acres	Creation of 0.16 acres of seasonal wetlands at the Suisun Creek Preserve
OW-175	43 linear feet (0.01 acres)	Creation of 43 linear feet of creek channel at Suisun Creek Preserve
W-45-1	0.15 acres	Creation of 0.30 acres of seasonal wetlands at the Suisun Creek Preserve
W-109	0.18 acres	Creation of 0.36 acres of seasonal wetlands at the Suisun Creek Preserve
W-182	0.48 acres	Creation of 0.96 acres of seasonal wetlands at the Suisun Creek Preserve
W-F	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
	totals:	Creation of 2.24 acres of seasonal wetlands at the Suisun Creek Preserve; Creation of 533 linear feet of creek channel at Suisun Creek Preserve; Creation of 1.46 acres of riparian habitat at the Suisun Creek Preserve; Construction of 116 linear feet of unlined, earthen ditch within the project limits no later than during Package 3 construction

Table 4: Summary of Mitigation for Permanent Impacts—Construction Package 4

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-8 (riparian)	0.07 acres	Creation of 0.14 acres of riparian habitat at the Suisun Creek Preserve
OW-8b-1	326 linear feet	Creation of 326 linear feet of creek channel at Suisun Creek Preserve
OW-8b-1 (riparian)	0.89 acres	Creation of 1.21 acres of riparian habitat at the Suisun Creek Preserve
		Creation and/or restoration of 0.57 acres of riparian habitat at a location TBD
OW-45a	0.10 acres (2,071 linear feet)	Construction of 2,547 linear feet of unlined, earthen ditch within the project limits no later than during Package 4 construction
OW-90	18 linear feet	Creation of 18 linear feet of creek channel at Suisun Creek Preserve
OW-90a	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
OW-119	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-28	0.03 acres	Creation of 0.06 acres of seasonal wetlands at the Suisun Creek Preserve
W-29	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-30	0.10 acres	Creation of 0.20 acres of seasonal wetlands at the Suisun Creek Preserve
W-45a-1	0.20 acres	Creation of 0.40 acres of seasonal wetlands at the Suisun Creek Preserve
W-90	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-90a	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-145	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve
W-146	0.02 acres	Creation of 0.04 acres of seasonal wetlands at the Suisun Creek Preserve
W-194	0.01 acres	Creation of 0.02 acres of seasonal wetlands at the Suisun Creek Preserve

Table 4: Summary of Mitigation for Permanent Impacts—Construction Package 4 (continued)

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
	totals:	Creation of 344 linear feet of creek channel at Suisun Creek Preserve; Construction of 2,547 linear feet of unlined, earthen ditch within the project limits no later than during Package 4 construction; Creation of 1.35 acres of riparian habitat at the Suisun Creek Preserve; Creation and/or restoration of 0.57 acres of riparian habitat at a location TBD; Creation of 0.88 acres of seasonal wetlands at the Suisun Creek Preserve

Table 5: Summary of Mitigation for Permanent Impacts—Construction Package 5

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-1	157 linear feet	Creation of 157 linear feet of creek channel at Suisun Creek Preserve
OW-1a	213 linear feet	Creation of 213 linear feet of creek channel at Suisun Creek Preserve
OW-2	22 linear feet	Creation of 44 linear feet of creek channel at Suisun Creek Preserve
OW-2a	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
OW-3	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
OW-8 (riparian)	0.11 acres	Creation and/or restoration of 0.22 acres of riparian habitat at a location TBD
OW-8a (riparian)	0.20 acres	Creation and/or restoration of 0.40 acres of riparian habitat at a location TBD
OW-8b-1 (riparian)	0.46 acres	Creation and/or restoration of 0.92 acres of riparian habitat at a location TBD
OW-8c (riparian)	0.09 acres	Creation and/or restoration of 0.18 acres of riparian habitat at a location TBD
OW-158	85 linear feet	Creation of 85 linear feet of creek channel at Suisun Creek Preserve
OW-158a	342 linear feet	Creation of 342 linear feet of creek channel at Suisun Creek Preserve
OW-158a (riparian)	0.41 acres	Creation and/or restoration of 0.82 acres of riparian habitat at a location TBD
OW-160a	171 linear feet	Creation of 171 linear feet of creek channel at Suisun Creek Preserve
OW-162	395 linear feet	Creation of 395 linear feet of creek channel at Suisun Creek Preserve
OW-163	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve

Table 5: Summary of Mitigation for Permanent Impacts—Construction Package 5 (continued)

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-175	37 linear feet	Creation of 37 linear feet of creek channel at Suisun Creek Preserve
OW-175a	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-13	0.26 acres	Creation of 0.39 acres of seasonal wetlands at the Suisun Creek Preserve
W-14	0.08 acres	Creation of 0.12 acres of seasonal wetlands at the Suisun Creek Preserve
W-15	0.08 acres	Creation of 0.12 acres of seasonal wetlands at the Suisun Creek Preserve
W-26 (riparian)	0.01 acres	Creation and/or restoration of 0.02 acres of riparian habitat at a location TBD
W-42	0.03 acres	Creation of 0.045 acres of seasonal wetlands at the Suisun Creek Preserve
W-158a	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-173	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-177	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-178	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-179	0.01 acres	Creation of 0.015 acres of seasonal wetlands at the Suisun Creek Preserve
W-180a	0.08 acres	Creation of 0.12 acres of seasonal wetlands at the Suisun Creek Preserve
W-180b	0.06 acres	Creation of 0.09 acres of seasonal wetlands at the Suisun Creek Preserve
	totals:	Creation of 1,444 linear feet of creek channel at Suisun Creek Preserve; Creation of 1.02 acres of seasonal wetlands at the Suisun Creek Preserve; Creation and/or restoration of 2.56 acres of riparian habitat at a location TBD

Table 6: Summary of Mitigation for Permanent Impacts—Construction Package 6

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-45	11 linear feet (0.01 acres)	Creation of 22 linear feet of creek channel at Suisun Creek Preserve
	totals:	Creation of 22 linear feet of creek channel at Suisun Creek Preserve

Table 7: Summary of Mitigation for Permanent Impacts—Construction Package 7

Feature ID (as provided in application materials)	Acreage and/or Linear Footage of Permanent Impact	Mitigation
OW-8	118 Linear Feet (0.06 acres)	Creation of 118 linear feet of creek channel at Suisun Creek Preserve
OW-61a	0.02 acres (236 linear feet)	Construction of 290 linear feet of unlined, earthen ditch within the project limits no later than during Package 7 construction
OW-61a (riparian)	0.02 acres	Creation and/or restoration of 0.04 acres of riparian habitat at a location TBD
W-26 (riparian)	0.05 acres	Creation and/or restoration of 0.10 acres of riparian habitat at a location TBD
W-41 (riparian)	0.03 acres	Creation and/or restoration of 0.06 acres of riparian habitat at a location TBD
W-60	0.11 acres	Creation of 0.17 acres of seasonal wetlands at the Suisun Creek Preserve
	totals:	Creation of 118 linear feet of creek channel at Suisun Creek Preserve; Construction of 290 linear feet of unlined, earthen ditch within the project limits no later than during Package 7 construction; Creation of 0.17 acres of seasonal wetlands at the Suisun Creek Preserve; Creation and/or restoration of 0.20 acres of riparian habitat at a location TBD

Attachment D
Biofiltration Basin Design Details

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	12.2/12.9	148	

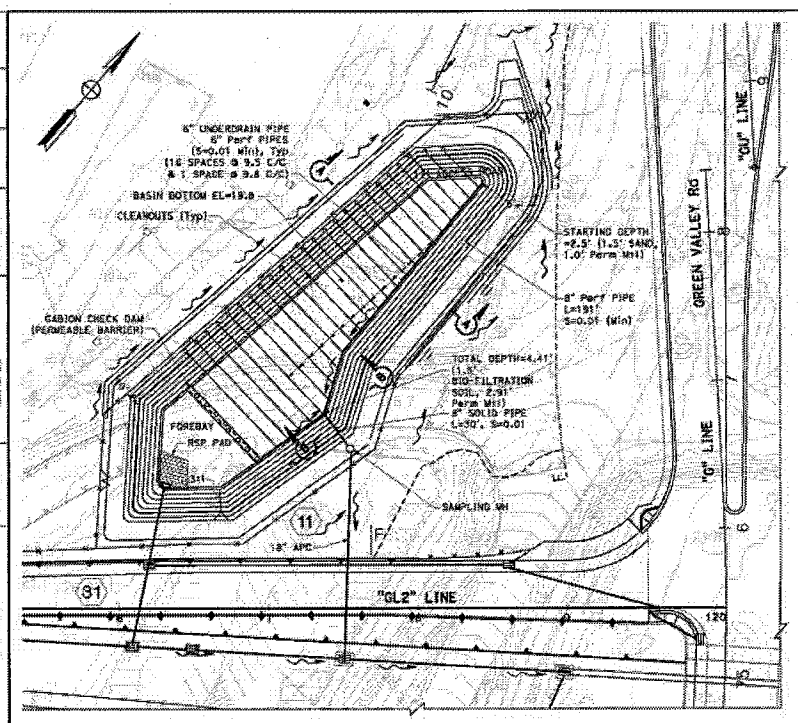
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

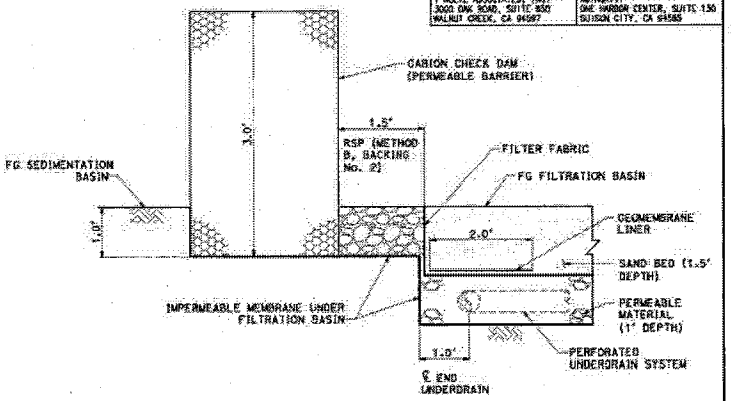
MEN CHEN No. 71787 10-31-10 CIVIL STATE OF CALIFORNIA

MARK THOMAS & COMPANY, INC. + MOLNE ASSOCIATES, INC. 3000 OAK ROAD, SUITE 850 WALNUT CREEK, CA 94597

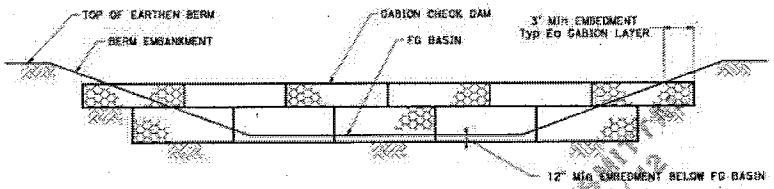
SOLANO TRANSPORTATION AUTHORITY ONE HARBOR CENTER, SUITE 130 SUISUN CITY, CA 94585



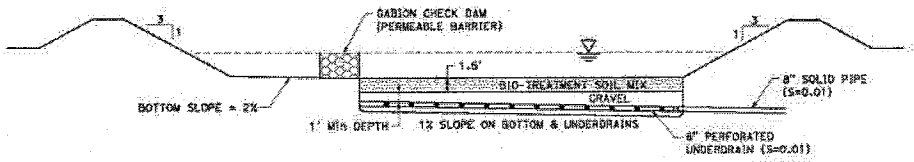
STORM DRAIN TREATMENT BASIN
SCALE: 1" = 30'



SECTION B-B
NO SCALE



SECTION A-A
NO SCALE



TYPICAL SECTION
NO SCALE

65% SUBMITTAL 05/04/2

DRAINAGE DETAILS

SCALE: AS SHOWN

DD-6

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

REVISED BY | DATE REVISED | ANNUALLY RENEWAL | MEN CHEN | CALCULATED-DESIGNED BY | CHECKED BY | MEN CHEN

BORDER LAST REVISED 7/2/2010 | USERNAME => SUSEY | DGN FILE => BRIDGE1 | RELATIVE BORDER SCALE IN 48 INCHES 0 1 2 3 | UNIT 0741 | PROJECT NUMBER & PHASE 04000211311

LOCAL VERSION DATE PLOTTED 10-01-10 TIME PLOTTED 07:36

Attachment E
Public Comment Considerations

Consideration of Comments Received from Citizens Committee to Complete the Refuge	
Comment	**Consideration of Comment**
We are concerned that the estimated direct impacts to waters of the state (and U.S.) increase with each new document we review (PN - Draft MMP1 - Draft MMP2). We believe this is indicative of the fact the application was submitted prematurely, before Caltrans has access to all available and necessary information (property access, etc.). We believe it is necessary, therefore, for Caltrans to provide some assurance that additional impacts will not be unveiled during construction or as Construction Packages 2-7 are implemented.	We cannot restrict Caltrans from changing their project design after the certification has been issued. Should Caltrans change the project design and incur additional impacts to State waters, then a certification modification and/or additional mitigation may be required. Refer to certification condition # 15, which addresses this concern.
Our question remains regarding whether changes on adjacent properties could impact the long-term sustainability of the proposed mitigation site, particularly those lands to the north and east of the proposed mitigation area.	It is unlikely that changes in adjacent land use would significantly affect the long-term sustainability of the mitigation site. The mitigation site would receive water from the northern connector drainage ditch which collects excess water from irrigation and storm events. Properties in the area are currently zoned for agricultural uses and are not anticipated to change per the County General Plan. The property to the east is owned by the same property owner as the mitigation site. This area is being proposed for a mitigation bank. The property to the north is owned by a cattle rancher. A drainage easement would be placed over the portion of his property supplying water from the northern ditch.
We would like confirmation of the source of hydrology for the large area of wetlands located along the western portion of the mitigation site. The information provided seems to indicate direct precipitation is the source of the seasonal wetlands, but we request confirmation of the	Caltrans ensures that this wetland area is not affected by off-site hydrology and receives water from direct precipitation. A small earthen berm separates this area from the property located to the north. An area of approximately 125 acres would continue to provide runoff to this wetland following mitigation construction.

source of hydrology for existing wetlands (within the proposed mitigation site).	
If direct precipitation is the source of hydrology, the project proponent must ensure that construction, erosion/sediment control measures, stockpiling of material, etc. will not result in alteration of the hydrological regime, or result in degradation or diminished areal extent of the existing wetlands. The RWQCB should require the areal extent of existing wetlands and waters (those that are being "preserved") be mapped and included in annual monitoring reports.	We don't have a compelling reason to suspect that the proposed activities would indirectly impact existing wetlands. If we were to require monitoring of existing wetlands and noticed a decline in jurisdictional area, we would likely not be able to identify a causal relationship in the absence of an overwhelming probable cause. Direct unreported impacts to jurisdictional wetlands and waters are prohibited by this certification.
The proposed success criteria are inadequate: Under performance criteria for created wetlands - the criteria should be more stringent than 60% cover - 60% cover by which species? Success criteria for riparian habitat should be more than just survivorship - survivorship alone doesn't provide any indication of the degree to which the created habitat is flourishing - shouldn't there be an inclusion of a requirement for increased % cover? Monitoring should extend well beyond two years of cessation of irrigation.	Performance criteria shall be revised and proposed in a revised MMP. The MMP shall be subject to public review and comment. See certification conditions 3 and 7. The certification requires that the final MMP include "A plan to wait two full growing seasons after termination of supplemental irrigation before considering success of the associated plantings"
Grazing - While we agree grassland habitat can benefit from grazing, we are concerned about the introduction of nuisance/invasive species. We are	Comment noted. See certification condition no. 3.h; The certification requires that the final MMP include "A grazing plan that prohibits cattle from entering riparian areas. The Department may propose "flash grazing" in riparian areas after defining

also concerned about the impacts of cattle in particular on the preserved, enhanced, restored, or created waters of the state. The project proponent must ensure grazing will not adversely impact waters of the state, and if adverse impacts result (e.g. diminished areal extent, continued introduction of nuisance/invasive species, etc.) grazing must be prohibited in waters of the state.	triggers for such grazing as well as management protocol to ensure damage to channel morphology and riparian plants are prevented. If cattle would be allowed to enter wetland areas, the grazing plan shall explain the benefit to wetland grazing, the circumstances and timing under which wetland grazing would be allowed, and how the wetlands would be protected."
The grazing plan should be subject to restrictions should listed species become established - the grazing plan would need to be consistent with the protection of listed species.	Comment noted. See language added to certification condition no. 3.h.
Salt marsh harvest mouse - although a habitat assessment has been conducted for this species, prior to construction activities within the proposed mitigation site, USFWS and CDFW should be contacted to determine whether surveys for the species are required.	Comment noted. It is our understanding that authorization from USFWS and CDFG will be necessary before mitigation may commence. Authorization would entail evaluation of potential impacts to special status species.
Newly created/established wetlands will be seeded with a native wetlands species seed mix" - is the seed mix from local seed sources to ensure genetic integrity?	Comment noted. See certification condition no. 3.b

Funding - "If Grizzly Bay LLC cannot qualify for one of these types of financial assurances, an alternative mechanism such as formal documented commitment from Caltrans or other public authority shall be issued." What other "public authority"? Why wouldn't it be Caltrans?	Grizzly Bay LLC insists it is fully capable of funding the required assurances. These assurances would be provided in advance of construction so funding would be in place prior to any impacts on the mitigation site. STA/Caltrans will also be required to provide a funding assurance letter (see condition no. 4).
Irrigation plan - "It is currently assumed that irrigation of planted trees and shrubs will be performed with a drip irrigation system." What is the source of irrigated water?	Temporary irrigation water would be provided to all riparian planting through a drip irrigation system. A new PVC line would extend from the existing Club House on Chadbourne Road to the Mitigation Site. This will be a pressurized, metered source with shutoff and timers.
Removal of exotic invasives should not be limited to the list provided.	Agreed. We have asked Caltrans to revise the MMP to revise the mitigation plan to identify specific non-native species that are naturalized to the area and that also do not represent a threat to development of healthy wetland and riparian systems. We also have asked them to change invasive plant performance standards to address potential threats from plants outside the list of those identified in the draft MMP. Please look for a revised condition once the revised MMP is issued.
Herbicides should not be used on the site without the approval of the USFWS, CDFW, RWQCB.	Noted. Please refer to certification condition 3.d.
What means of "rodent control" is used to protect the integrity of the levees? Are rodenticides used and could this adversely impact sensitive species such as the Swainson's hawk?	We do not know at this time. Although this is out of our jurisdiction, we have asked Caltrans about this and are awaiting a reply.

"In the event that additional freshwater is needed to maintain wetland habitat on the Mitigation Area, Grizzly Bay, LLC is able to obtain water from the Solano Irrigation District. The Solano Irrigation District currently provides irrigation water to the surrounding properties directly north of the Mitigation Area through a series of irrigation ditches. Minor modifications could be implemented in the ditch system in order to provide Solano Irrigation District water into the drainage channel providing water to the Mitigation Area. If there is a necessity to augment freshwater to the Mitigation Area, Grizzly Bay, LLC may need to construct additional connecting channel features to obtain Solano Irrigation District water. It would be the responsibility of Grizzly Bay, LLC or property owner to obtain all required permits/authorizations prior to undertaking these actions." This statement raises concerns regarding the long-term sustainability of the proposed compensatory mitigation.	Comment noted. The designers of the mitigation insist that created seasonal wetlands would be sustained by direct precipitation as well as overflow from the channel during the winter. No additional water is expected during the summer to support wetlands, allowing the wetland features to dry. Augmentation of flows during dry months are proposed at < 2 cubic feet per second to support plant communities along the newly created channel. Upstream water sources are available in dry months from irrigation tail water and other unspecified upstream sources. Use of Solano Irrigation District water is not a requirement of this certification—it is only mentioned as a possible adaptive management measure should the identified sources of water appear inadequate to meet mitigation goals.
The major concern is the necessity for a variety of potentially tenuous agreements to ensure likelihood of success. Levees must be maintained, pumping and associated costs must be continued, a drainage easement is necessary and potential modifications to that agreement are necessary to provide a source of hydrology, and grazing must be managed. We are therefore concerned about the long-term viability of the proposed mitigation site.	Comment noted. We believe the site is viable long-term because the levee integrity and pumping regime are significant regional priorities involving stakeholders other than the mitigation site sponsor.

Figures 12 and 13 provide a conceptual design for created wetlands, vernal pools, riparian woodland, and channel recreation. I don't believe the most recent MMP still states the intent to create vernal pool habitat	Caltrans is not proposing vernal pool habitat at Suisun Creek Preserve because the site is not appropriate for vernal pool creation.
Would bringing in water from off-site impact existing wetlands?	Water being received from the northern connector drainage ditch is excess water from irrigation and storm events and is not water that would otherwise sustain wetlands. Caltrans will be "tapping-in" to a water source that would otherwise be pumped directly to tidal waters at the far southern end of the Grizzly Bay mitigation parcel.
Alternatively, the Mitigation Plan mentions the possibility of accepting treated water from the nearby waste water treatment plant. If tertiary (?) waste water is proposed as a water source, the project proponent should be required to demonstrate that endocrine disrupting chemicals (EDCs) are not present in the treated water, as there are adverse ramifications for amphibians and fish exposed to EDCs. Is this no longer being proposed?	This is no longer being proposed.
Consistent with the Corps Mitigation and Monitoring Guidelines, December 2004, longitudinal profiles of the created channels, as well as reference locations upstream and downstream of the channel creation should be provided. Before and after bank-full flows above and downstream of the created channels should be monitored. Cross-sections of the created channel, and reference locations above stream and downstream of the created channel should be provided. If necessary, water rights	Due to the relatively low-gradient and low-velocity nature of the channel, as well as the fact that the channel will be very low in the watershed, we are not particularly concerned with changes in channel morphology. Water that is received from the drainage ditch to the north is irrigation and stormwater runoff. According to Caltrans, there are no water rights associated with this water as it is drainage water. Certification condition number 4 requires Caltrans to secure any water source used to support mitigation site functions.

availability should also be provided. It appears the MMP incorporates these requirements. It also appears information regarding water rights will be provided.	
Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp - Caltrans has proposed the preservation of 1.71 acres of vernal pool and swale habitat and the creation of 1.45 acres of restoration of vernal pool and swale habitat no later than 60 calendar days prior to the date of initial ground disturbance of the specific construction packages. Once again, for purposes of clarity, to preserve institutional knowledge, and to ensure compliance, the timing of these impacts should be indicated on Table 1 as recommended above. The Conservation Measure (#21) also states the location of the compensation will be submitted for approval by the Service. Does Caltrans propose to create/restore/preserve habitat for vernal pool species at the Suisun Creek Preserve? If so, the Mitigation Plan would have to provide substantive information regarding the existing and proposed hydrological regime as discussed above. The Mitigation Plan would also need to describe the target suite of vernal pool species, proposed pond depths (all to be 18"?) and duration of ponding, etc. Where is this now being proposed? Is it at the Elsie Gridley mitigation bank? If so, have issues regarding not meeting success criteria been resolved?	Caltrans is not proposing to create/restore/preserve habitat for vernal pool species at the Suisun Creek Preserve. We do not know where mitigation for vernal pool shrimp will occur. We defer to the United States Fish and Wildlife Service to ensure that these special status species are protected.

Category	Performance Standard	Year									
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Buffers: Applicable to "Riparian / VELB Habitat" (orange) indicated on Conceptual Habitat Map											
Species in Buffer: PS 1	The buffer adjacent to aquatic resource shall be dominated by the same plant species composition as a composite of the reference sites and that the area is dominated by native vegetation and soil disturbance (e.g. grading) has not occurred for at least one year.		50% or more native absolute cover along a minimum of 6 randomly placed transects & greater than 50% of the composite of the reference site.			60% or more native absolute cover along a minimum of 6 randomly placed transects & greater than 50% of the composite of the reference site.					60% or more native absolute cover along a minimum of 6 randomly placed transects & greater than 50% of the composite of the reference site.
Creek Establishment (also referred to as Seasonal Drainage Channel Feature): Applicable to "Creek Establishment" (blue line) indicated on Conceptual Habitat Map											
Connection from seasonal drainage to floodplain: PS 3	The permittee shall ensure the seasonal drainage channel is established such that overbank flooding occurs or water can access high-flow channel(s) in the active floodplain (i.e. the riverine wetlands) at least once in a year.	A minimum of one (1) event annually, measured by direct field observation		A minimum of one (1) event annually, measured by direct field observation		A minimum of one (1) event annually, measured by direct field observation					A minimum of one (1) event annually, measured by direct field observation
Drainage Stability: PS 4	The seasonal drainage shall retain or increase stream stability and not cause site, upstream, or downstream excessive erosion or aggradation. Annual cross-section surveys shall be taken at three locations (just inside the upstream entrance to the site, mid-point, and just before the exit). Surveys shall not deviate from design parameters by more than 25% from as built values as measured in terms of channel width to depth ratio (bankfull surface width/bankfull mean depth), entrenchment ratio (floodprone width/bankfull width) and cross-sectional area.	Year 1 Cross-sections compared to 'as built drawings'	Year 2 Cross-sections compared to 'as built drawings'	Year 3 Cross-sections compared to 'as built drawings'	Year 4 Cross-sections compared to 'as built drawings'	Year 5 Cross-sections compared to 'as built drawings'		Year 7 Cross-sections compared to 'as built drawings'		Year 9 Cross-sections compared to 'as built drawings'	Year 10 Cross-sections compared to 'as built drawings'
Riverine Seasonal Wetlands: Applicable to "Riverine wetlands" (yellow) indicated on Conceptual Habitat Map											
Expression of Wetland Hydrology PS 5	Riverine seasonal wetlands will show evidence of ponding through site photography.		Photographs at a minimum of 5 locations shall be established. Photographs shall be three times in winter months.			Same as year 2		Same as year 2			Same as year 2
Target Species PS 6	The wetland shall be dominated by the plant species composition analogous to a composite of the reference sites.		50% or more cover of the composite of the absolute cover of the two reference sites. Observation to be made along a minimum of 5 randomly placed			70% or more cover of the composite of the absolute cover of the two reference sites. Observation to be made along a minimum of 5 randomly placed transects.		70% or more cover of the composite of the absolute cover of the two reference sites. Observation to be made along a minimum of 5 randomly placed			70% or more cover of the composite of the absolute cover of the two reference sites. Observation to be made along a minimum of 5

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

Enclosure 8
Table A:
Suisun Creek Preserve
Performance Standards

Category	Performance Standard	Year									
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
			transects.					transects.			randomly placed transects.
Dominance of Native plant species PS 7	The permittee shall ensure the riverine wetland is dominated by native vegetation typical of that in the reference wetlands.		70% or more of the absolute cover shall be native. Observation shall be made along a minimum of 5 randomly placed transects.			70% or more of the absolute cover shall be native. Observation shall be made along a minimum of 5 randomly placed transects.		70% or more of the absolute cover shall be native. Observation shall be made along a minimum of 5 randomly placed transects.			70% or more of the absolute cover shall be native. Observation shall be made along a minimum of 5 randomly placed transects.
Species Cover PS 8	The total cover of FAC, FACW, and OBL species does not decline during the monitoring period below 51% absolute cover	WD, a minimum of 20 data points shall be taken in areas designated riverine wetland	Same as year 1	Same as year 1	Same as year 1	Same as year 1, with delineation verification performed by Corps		Same as year 1			Same as year 1, with delineation verification performed by Corps
Depressional wetlands: Applicable to "Depressional wetlands" (green) indicated on Conceptual Habitat Map											
Expression of Wetland Hydrology PS 9	The mean number of consecutive days over which the upper 0.5 feet of soil at the wetlands is saturated or inundated exceeds 30 days.	Measurements of period and depth of inundation in the seasonal wetlands. Measurements will be made using at a minimum of 10 staff gages twice a month from Nov-Mar	Same as year 1		Same as year 1	Same as year 1		Same as year 1		Same as year 1	Same as year 1
Expression of Wetland Hydrology PS 10	Riverine seasonal wetlands will show evidence of ponding through site photography.		Photographs at a minimum of 5 locations shall be established. Photographs shall be three times in winter months.			Same as year 2		Same as year 2			Same as year 2
Target Species PS 11	The wetland shall be dominated by the plant species composition analogous to a composite of the reference sites.		50% or more cover of the composite of the absolute cover of the two reference sites. Observation to be made along a minimum of 5 randomly placed transects.			70% or more cover of the composite of the absolute cover of the two reference sites. Observation to be made along a minimum of 5 randomly placed transects.		70% or more cover of the composite of the absolute cover of the two reference sites. Observation to be made along a minimum of 5 randomly placed transects.			70% or more cover of the composite of the absolute cover of the two reference sites. Observation to be made along a minimum of 5 randomly placed transects.
Dominance of Native plant species PS 12	The permittee shall ensure the depressional wetlands in the mitigation site are dominated by native vegetation typical of that in the reference wetlands.		70% or more of the absolute cover shall be native. Observation shall be made along a minimum of 5 randomly placed transects.			70% or more of the absolute cover shall be native. Observation shall be made along a minimum of 5 randomly placed transects.		70% or more of the absolute cover shall be native. Observation shall be made along a minimum of 5 randomly placed			70% or more of the absolute cover shall be native. Observation shall be made along a minimum of 5 randomly placed

Category	Performance Standard	Year									
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
								transects.			transects.
Species Cover PS 13	The total cover of FAC, FACW, and OBL species does not decline during the monitoring period below 51% absolute cover	WD, a minimum of 20 data points shall be taken in areas designated depressional wetland	Same as year 1	Same as year 1	Same as year 1	Same as year 1, with delineation verification performed by Corps		Same as year 1			Same as year 1, with delineation verification performed by Corps
Overall site:											
Assurance against excessive flows PS 14	The constructed wetland complex shall not be flooded with flows in excess of that required to establish functional wetlands. Evidence of excessive flooding would include change in species composition (i.e. cattail establishment) die-back of target hydrophytic vegetation, excessive anaerobic conditions, or flooding of upland portions of the mitigation site.	Observation of extent of standing water after a 2-year rainfall event (2" in a day or up to 3" in a month). Observations will be made 1 day post rainfall event and 10 days post rainfall event. If standing water beyond the lateral extent of created wetlands is still present monitoring will occur at 5-day intervals until water recedes.	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1
Invasive Weed Monitoring and Control PS 15	Weed control: zero establishment of new species rated High on the Cal-IPC list not currently found on the Mitigation Site.	Observation of species composition along a minimum of 10 randomly placed transects specifically documenting invasive species	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1
Invasive Weed Monitoring and Control PS 16	The target percent of weeds on the mitigation site shall not be greater than found at the reference site.	Observation of species composition along a minimum of 10 randomly placed transects specifically documenting invasive species	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1	Same as Year 1

Category	Performance Standard	Year									
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Attaining wetland criteria PS 17	The areas intended to meet the definition of a wetland (riverine and depressional wetlands) will be documented in a wetland delineation. Wetlands shall express hydrology and vegetation criteria consistent with the arid west supplemental manual. The delineations shall be verified by the Corps at years 5 and 10.	WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 25% of data points shall meet all three parameters consistent with wetland condition.	WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 35% of data points shall meet all three parameters consistent with wetland condition	WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 45% of data points shall meet all three parameters consistent with wetland condition	WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 70% of data points shall meet all three parameters consistent with wetland condition	WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 70% of data points shall meet all three parameters consistent with wetland condition	WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 100% of data points shall meet all three parameters consistent with wetland condition	S WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 100% of data points shall meet all three parameters consistent with wetland condition	WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 100% of data points shall meet all three parameters consistent with wetland condition	WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 100% of data points shall meet all three parameters consistent with wetland condition	Sa WD, a minimum of 40 data points shall be taken. 20 data points in riverine and 20 in depressional wetlands. 100% of data points shall meet all three parameters consistent with wetland condition

- Native is defined as a species that is occurring naturally in an area, not as either a direct or indirect consequence of human activity; indigenous; not alien. Status of native species can be found at http://www.calflora.org.

Enclosure 9

U.S. Army Corps of Engineers
San Francisco District
Regulatory Division

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
81420-2009-F-0857- 7

April 16, 2012

Ms. Moujan Mostaghimi
California Department Transportation
Environmental Division, MS 8E
111 Grand Avenue
Oakland, California 94612

Subject: Biological Opinion on the Effects of the Proposed Interstate 80/Interstate 680/State Route 12 Interchange Phase 1 Project, Solano County, California (EA 0A5300)

Dear Ms. Mostaghimi:

This is in response to your April 20, 2011, request for consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Interstate 80 (I-80)/Interstate 680 (I-680) /State Route 12 (SR 12) Interchange Phase 1 Project in Solano County, California. At issue are the effects of the proposed action on the endangered showy Indian clover (*Trifolium amoenum*), endangered Contra Costa goldfields (*Lasthenia conjugans*) and its critical habitat, endangered vernal pool tadpole shrimp (*Lepidurus packardii*), threatened vernal pool fairy shrimp (*Branchinecta lynchi*), endangered callippe silverspot butterfly (*Speyeria callippe callippe*), threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), threatened Central California Distinct Population Segment of the California tiger salamander (*Ambystoma californiense*), the threatened California red-legged frog (*Rana draytonii*) and its critical habitat, and the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*).

The Service concurs with the California Department of Transportation's (Caltrans) determination that the proposed project may affect, but is not likely to adversely affect the showy Indian clover, Contra Costa goldfields, and the Central California Distinct Population Segment of the California tiger salamander.

Caltrans has not completed protocol-level surveys for showy Indian clover in the entire action area due to access problems. Due to its extreme rarity we concur that the proposed project may affect, but is not likely to adversely affect this listed plant. Caltrans has committed to conducting Service protocol-level plant surveys of the previously inaccessible parcels on the Mangels' property north of SR 12 West (SR 12W) for showy Indian clover prior to the initial groundbreaking for Construction Package 3. Caltrans will reinitiate consultation pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C § 1531 *et seq.*)(Act) if

the listed plant is found, with the understanding that the presence of any additional listed species could lead to additional conservation measures that will be determined in conjunction with the Service. In the case of reinitiation, Caltrans' course of action with this species could lead to project delays, project redesign, or other significant effects on the project.

Caltrans has minimized potential effects such that it will not adversely affect the Contra Costa goldfields, Central California Distinct Population Segment of the California tiger salamander, and salt marsh harvest mouse. This determination was based upon: (1) the proposed retaining wall along the south shoulder of SR 12 East (SR 12E) between Ledgewood Creek and approximately 300 feet east of Pennsylvania Avenue and (2) information provided in the April 2011 Biological Assessment (BA) stating that the proposed construction activities and project design would not adversely affect the hydrology of the Gentry Suisun wetlands. The adjacent Gentry Suisun wetlands are occupied by Contra Costa goldfields and this lowland area is designated critical habitat for the species. The area provides potential habitat for the Central California Distinct Population Segment of the California tiger salamander and sufficient surveys have not been conducted to discount species presence. There are records of the salt marsh harvest mouse from within the pickleweed habitat in the Gentry Suisun wetlands (CDFG 2011a, 2011b). Along with *Proposed Conservation Measure 23*, the proposed retaining wall will avoid intrusion of proposed road widening into the low-lying wetland and will be of sufficient height to prevent salamanders that may inhabit the area from entering the SR 12E roadway.

In their April 20, 2011, letter, Caltrans requested formal consultation on the valley elderberry longhorn beetle and the California red-legged frog. Caltrans determined the project may affect, but is unlikely to adversely affect the Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, and callippe silverspot butterfly. Pursuant to 50 CFR 402.13(d), we do not concur with the determination by Caltrans on the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. During the technical assistance phase, the Service informed Caltrans and Solano Transit Authority (STA) that it is our biological opinion that the project may affect and is likely to adversely affect the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. This adverse effects determination was reflected in the DEIR/EIR and was not challenged by Caltrans or STA during the technical assistance phase, prior to issuance of the April 2011 BA. The Service repeated the biological reasoning for our determinations in our June 30, 2011 30-Day Letter and subsequent meetings with Caltrans and STA after Caltrans issued contrary effects determinations in their April 2011 BA. The Service disagreed with the biological rationale provided by Caltrans to support their not likely to adversely affect determinations for the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly in their April 2011 BA, their August 17, 2011 response to the 30-day letter, and in meetings with the Service subsequent to the issuance of the April 2011 BA. Therefore, we are issuing this biological opinion on the adverse effects of your project.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users legislation (23 U.S.C. § 327) allows the Secretary of the U.S. Department of Transportation acting through the Federal Highway Administration (FHWA) to establish a Surface Transportation Project Delivery Pilot Program, whereby a State may assume the FHWA responsibilities under the National Environmental Policy Act (NEPA) for environmental review,

responsibilities under the National Environmental Policy Act (NEPA) for environmental review, agency consultation and other actions pertaining to the review or approval of a specific project. Caltrans assumed these responsibilities for the FHWA on July 1, 2007 through a Memorandum of Understanding within the State of California (http://www.dot.ca.gov/ser/downloads/MOUs/nepa_delegation /sec6005mou.pdf) and are exercising this authority as the Federal nexus for section 7 consultation on this project.

This biological opinion is based on: (1) the April 2011 BA, (2) the September 15, 2011 meeting with Caltrans and STA, (3) site visits and meetings during the technical assistance phase of the consultation; (4) discussions with Sue Wickham of the Solano Land Trust (SLT) regarding listed species in nearby SLT holdings; (5) miscellaneous correspondence and electronic mail (e-mail) messages between the Service and Caltrans; (6) results from the joint resolution process; and (7) other information available to the Service.

Consultation History

March 26, 2007	The Service received meeting notes from a March 15, 2007, NEPA/404 Integration Memorandum of Understanding checkpoint meeting. The Service did not attend the meeting.
March 10, 2009	The Service received a California red-legged frog habitat assessment for the project from STA's consultant.
May 29, 2009	The Service received meeting notes for a February 10, 2009, presentation of the alternatives for inclusion in the Draft Environmental Impact Statement (EIS) for the project and the criteria for the selection of alternatives from Caltrans. The Service did not attend this meeting.
November 19, 2009	The Service met with Caltrans and STA's consultant to discuss future consultation on the project. The expectations for the BA and the need to incorporate wildlife passage into the project design were discussed. The Service was informed that the first project phase was expected to begin in 2012 and later phases may not start for 30 years or more. Caltrans and STA stated that each project phase had independent utility and Caltrans planned to initiate separate consultation on Phase 1 Their current EIS was limited to Phase 1 but the Environmental Impact Report (EIR) included Phase 1 and 2.
June 28, 2010	The Service attended a meeting with Caltrans and STA to discuss the consultation process and a revised project description.
July 15, 2010	The Service provided technical assistance via an e-mail message to STA's consultant in response to the March 2009 California red-legged frog habitat assessment.

July 19, 2010 The Service visited Solano Land Trust land holdings with STA's consultant to discuss needed funding to complete and perform California red-legged frog-associated restoration and habitat management projects. STA was exploring compensation opportunities to minimize the effects of the proposed project on the listed frog. The Service emphasized that preservation and management of red-legged frog breeding and upland habitat adjacent to the proposed Business Center Drive Extension is the preferred option for minimizing the projects' adverse effects on the frog. A conservation easement on this land would preserve the proposed road undercrossing connections between a primary breeding pond and the remainder of the SOL-2 California red-legged frog critical habitat unit.

July 20, 2010 The Service received Wildlife and Fish addendums for the DEIR/EIS from Caltrans for review.

August 13, 2010 The Service received Volumes 1 and 2 of the DEIR/EIS from Caltrans. Although a final alternative has not been selected, Caltrans decided to pursue section 7 consultation on what is identified as Alternative C Phase 1 in the DEIR/EIS. Caltrans included the Solano County Draft Habitat Conservation Plan (HCP) (SCWA 2009) in the *Consistency with State, Regional, and Local Plans and Programs*, Section 3.1.1.2. The DEIR/EIS acknowledged the draft Solano HCP as establishing a framework for complying with State and Federal endangered species regulations. According to the DEIR/EIS, all the proposed project alternatives would result in impacts to callippe silverspot butterfly, vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, California red-legged frog and their habitat. The document stated that Alternative C, Phase 1 had the potential to destroy or disturb callippe silverspot butterfly or its habitat. The DEIR/EIS also stated that Alternative C Phase 1 would result in impacts to 1 71 acres (1.45 acres direct impacts + 0.26 acre indirect impacts) of vernal pool fairy shrimp/vernal pool tadpole shrimp habitat. In the DEIR/EIS, Caltrans committed to compensating for direct effects to vernal pool fairy shrimp and vernal pool tadpole shrimp at 3:1 and at a minimum of 1 1 1 for indirect effects. The DEIR/EIS stated that the actual ratios would be determined through consultation with the Service and that credits would be purchased through a Service-approved conservation bank. Although the analysis was not included in the April 2011 BA, the DEIR/EIS acknowledged that the proposed Business Center Drive Extension would reduce dispersal opportunities within the California red-legged frog SOL-2 critical habitat unit. The DEIR/EIS concluded that this reduction in dispersal could result in substantial frog mortality. The DEIR/EIS stated that the effects to the California red-legged frog would be compensated by habitat enhancement or contribution to a California red-legged frog conservation bank. In the *Growth-Inducing Impacts* section of the DEIR/EIS, Caltrans concluded that the proposed project would accommodate growth and that it would indirectly

lead to development and intensification of land uses by improving access and roadway capacity.

October 18, 2010 The Service issued a DEIR comment letter (Service File #81420-2009-TA-0857-1) to Caltrans.

November 4, 2010 The Service met with STA and their consultant to discuss our DEIR/EIS comments relevant to the consultation. We explained the need for adequate passage to allow listed species and wildlife to safely cross roads, wildlife passage structures and directional fencing designs, construction scheduling, conservation measures, effects determinations on Contra Costa goldfields critical habitat, and the California tiger salamander habitat assessment.

November 10, 2010 The Service sent STA's consultant comments regarding their draft of the November 4, 2010, meeting notes. The Service recommended that the two large crossings on the Business Center Drive Extension be spanned structures rather than culverts and that the western crossing (the third undercrossing on the Business Center Drive Extension) be at least 78 inches wide with a natural bottom. The Service clarified that the use of vegetation would not be an effective alternative to fencing to direct California red-legged frogs to safe undercrossings or exclude them from the road.

November 18, 2010 The Service visited the proposed project site with Caltrans and STA's consultant to discuss the Business Center Drive Extension and the Contra Costa goldfields critical habitat, potential branchiopod habitat, and potential California tiger salamander habitat in the Gentry Suisun wetland area.

November 29, 2010 The Service attended a NEPA/Section 404 Integration Process checkpoint meeting. The Service recommended that the planned relocation of businesses displaced by the project should be covered in the section 7 consultation because the relocations would not occur if not for the proposed project. Caltrans and STA informed the Service that a BA would be provided for the project within a week of the meeting.

April 21, 2011 The Service received a digital and hard copy of an April 2011 BA from Caltrans with a letter requesting formal consultation for the California red-legged frog and valley elderberry longhorn beetle, and informal consultation on Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, and the Central California Distinct Population Segment of the California tiger salamander.

May 24, 2011 The Service received a letter from Caltrans stating that the Service was beyond the 30-day review period for the BA. However, the BA that had been provided to us by Caltrans was incomplete and it did not contain all

	of the information necessary to initiate formal consultation pursuant to 50 CFR 402.14(c).
June 30, 2011	The Service issued a 30-day letter (Service File #81420-2009-0857-2) to Caltrans in response to the April 2011 BA.
August 19, 2011	The Service received Caltrans' August 17, 2011 response to the Service's June 30, 2011 30-day letter. In the letter, Caltrans requested the issuance of a draft biological opinion.
August 26, 2011	Caltrans notified the Service via an e-mail message that they were entering the formal elevation process to resolve consultation conflicts. This is a procedure both agencies have to agree to in order to resolve impasses on projects.
September 15, 2011	The Service met with Caltrans and STA to discuss Caltrans' August 19, 2011, response to the June 30, 2011, 30-day letter. The issues and requests for adequate project and species information were not resolved during the meeting. Caltrans asserts that under section 7 they do not recognize in-perpetuity preservation of habitat as a means to minimize the project's effects on listed species. The Service explained the biological reasons why the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly are likely to be affected by the proposed project. Caltrans and STA stated they were reluctant to seek take coverage for these species because of their concerns of the costs associated with conservation measures for these species. Caltrans and STA requested a list of conservation measures that would be appropriate to minimize the adverse effects on these listed animals. Caltrans requested that the Service issue a biological opinion for the project without authorization for incidental take for these three species with the acknowledgement they would accept the risk of violating the prohibitions of section 9.
October 7, 2011	The Service Caltrans Liaison preparing the draft biological opinion was instructed to stop work on the project while Caltrans considered approval to provide additional funding to complete consultation.
November 3, 2011	In response to a request made during the September 15, 2011 meeting, the Service sent a written list of recommended conservation measures to minimize the proposed project's effects on listed species to Caltrans and STA (Service File #81420-2009-F-0857-3).
November 17, 2011	The Service received Caltrans' November 15, 2011 letter response to the Service's November 3, 2011 letter via e-mail. Caltrans declined to change their determination and request formal consultation for the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. However, they provided no biological explanation for their determination.

	Caltrans also declined adoption of the appropriate conservation measures listed in the Service's November 3, 2011 letter to minimize effects to the vernal pool fairy shrimp, vernal pool tadpole shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog.
November 30, 2011	The Service Caltrans Liaison received approval from Caltrans to resume work on the consultation.
December 1, 2011	The Service attended a NEPA/Section 404 checkpoint meeting. Caltrans and STA discussed the project alternatives and avoidance and minimization measures with a collection of State and Federal regulatory agencies. A final project alternative had not been selected. Caltrans is still in the process of finalizing a Least Environmentally Damaging Practicable Alternative determination and approval of a Conceptual Mitigation Plan.
December 15, 2011-April 11, 2012	Caltrans and the Service entered into and completed the joint dispute resolution elevation process to resolve outstanding issues on the consultation

BIOLOGICAL OPINION

Description of the Proposed Action

The following project description was provided by Caltrans with minor modifications for reasons of clarity and accuracy provided by the Service.

Caltrans' full-build project involves comprehensive transportation improvements to the I- 80/ I-680 /SR 12 interchange complex intended to meet the future traffic demand over a 20-year planning horizon. The full-build includes the widening of I-680 and I-80 and the relocation, upgrade, and expansion of the I-80 westbound truck scales. The full scope of these improvements is not currently funded under the Metropolitan Transportation Commission's Regional Transportation Plan, 2035. Consequently, a fundable first phase of the full-build project has been developed (referred to as Phase 1). Phase 1 is the subject of evaluation under NEPA and the action for which a record of decision will be issued. STA has provided rationale for why Phase 1 has independent utility and therefore is the proposed action for this section 7 consultation.

General Scope of Work

The proposed Phase 1 project is comprised of the following components:

1. Improvements to the I-80/I-680/SR 12W) interchange;

2. Realignment of I-680;

3. A new interchange at I-680 and Red Top Road;

4. A new road connecting the I-80/Red Top Road interchange to Business Center Drive (Business Center Drive Extension);

5. A new interchange at SR 12W and the new Red Top Road alignment;

6. A modified interchange at I-80 and Green Valley Road;

7 New I-80 bridges over Green Valley Creek;

8. Widening I-80;

9. A new lane on eastbound SR 12E; and

10. Widening of the SR 12E bridge over Ledgewood Creek.

Construction Schedule and Funding

The proposed project will be constructed in a series of seven discrete Construction Packages over an eight-year period, as funding becomes available. A summary of the anticipated construction packages, associated activities, and their sequencing is shown in Table 1.

Table 1. Construction Packages and Scheduling

Construction Package Number	Main Construction Elements	Scheduling
1	1. Construct the westbound I-80 to westbound SR 12W (Jameson Canyon) Connector. 2. Widen westbound I-80 between the existing I-80/I-680 separation and SR 12W. 3. Reconstruct the west half of the I-80 Green Valley Road interchange.	Start in 2013 with approximate two-year duration.
2	1. Construct the I-680/Red Top Road interchange. 2. Realign Lopes Road and Fermi Road. 3. Realign Ramsey Road around the proposed I-680/Red Top Road interchange.	Start in 2014 with approximate 1.5-year duration.
3	1. Construct the westbound I-80 to southbound I-680 connector. 2. Widen westbound I-80 between the I-80/Suisun Valley Road and the I-80/ Green Valley Road interchanges. 3. Reconstruct the westbound I-80 bridge over Green Valley Creek. 4. Construct a new westbound on-ramp from I-80 at Suisun Valley Road. 5. Construct a new westbound off-ramp from I-80 to Green Valley Road. 6. Construct new bridge over Green Valley Creek carrying westbound off-ramp to Green Valley Road. 7. Remove the existing I-80/I-680 connector bridges over I-80 and Green Valley Creek. 8. Remove Neitzel Road. 9. Remove eastbound I-80 to SB I-680 connector. 10. Excavation and grading of the Business Center Drive Extension.	Start in 2014 with approximate two-year duration.

4	1. Construct the northbound I-680 to eastbound I-80 connector. 2. Reconstruct the eastbound SR 12W connector to eastbound I-80. 3. Reconstruct the eastbound I-80 off-ramp to Green Valley Road. 4. Reconstruct Green Valley Road on-ramp to eastbound I-80. 5. Realign both Lopes Road and Green Valley Road to connect to the original I-680 alignment. 6. Widen SR 12E one lane to the south, including widening the culvert for Ledgewood Creek.	Start in 2014 with approximate two-year duration. FHWA and Caltrans will adopt the full new alignment of I-680 and transfer the original alignment to local control.
5	1. Construct the northbound I-680 to westbound SR 12W connector. 2. Reconstruct the I-80/Red Top interchange. 3. Construct a new SR 12W/Red Top Road interchange. 4. Construct the Red Top Road/Business Center Drive extension.	Start in 2018 with approximate two-year duration.
6	1. Construct the I-80/I-680 HOV connectors.	Start in 2018 with approximate two-year duration.
7	1. Construct the northbound I-680/WB I-80 loop on-ramp. 2. Construct the eastbound I-80 connector to southbound I-680. 3. Reconstruct the Union Pacific Railroad underpass.	Start in 2018 with approximate 1.5-year duration.

NOTE: This schedule is approximate and subject to change.

Work in drainages and wetlands will be restricted to the dry season (April 15–October 15, or as otherwise specified in regulatory permits). Work in drainages that support habitat for anadromous fish, such as Green Valley Creek and Ledgewood Creek, will be restricted to the time when fish are not as likely to be present. To the extent possible, vegetation removal will be limited to between September 1 and January 31 to minimize adverse effects to migratory birds. Nighttime construction will be minimized.

Construction Activities

Highway and Road Construction

Highway construction for Phase 1 will consist of widening I-80 to the north for approximately 1 mile between a point west of Suisun Valley Road and SR 12W, realignment of I-680 and realignment of the connector between westbound I-80 and SR 12W Caltrans will acquire additional ROWs to accommodate the widening. Some highway construction will take place in all seven Construction Packages.

Highway construction will generally consist of cutting and filling to create a roadbed, grading to a maximum depth of 3.3 feet, paving or repaving, and striping or restriping. Highway sections will be constructed or altered to encourage drainage to the sides of the highway.

Roadway excavation will be conducted using equipment such as scrapers, front-end loaders, and motor graders to excavate the area and haul material to construct the embankments necessary to support the proposed roadways. Surplus excavated material will be hauled offsite to an approved commercial disposal site using dump trucks when necessary. The location(s) of material borrow and location and type of material disposal will be determined by the contractor. Caltrans will require the contractor to obtain any necessary environmental clearances associated with obtaining a material borrow site, or with the disposal or reuse of surplus materials. Once the roadbed has been excavated, the soil will be rolled and vibrated with a sheepsfoot or drum roller to 95 percent relative compaction.

SR 12E Widening
In Construction Package 4, a third eastbound lane and standard shoulder will be constructed along SR 12E from I-80 east to the existing Webster Street off-ramp immediately east of the SR 12E/Pennsylvania Avenue intersection. Construction of the lane and shoulder will include retaining walls to minimize temporary and permanent disturbance south of SR 12E, and the existing ROW fence would remain in its current location. Drainage improvements along SR 12E would maintain existing hydrological conditions and patterns.

Business Center Drive Extension
Construction of the extension of Red Top Road to Business Center Drive will include excavation to a maximum depth of 95 feet in some areas prior to grading and paving. Excavation and grading will occur during Construction Package 3 and roadway construction will occur during Construction Package 5. Three undercrossings will be included in the Business Center Drive Extension between the existing terminus of Business Center Drive and the proposed intersection with Jameson Canyon Road (SR 12W). The undercrossings will include two approximately 15 by 14 feet span style undercrossings corresponding with two existing dirt access roads. The easternmost large undercrossing will allow continued vehicle access to an existing residence and the second undercrossing will enable access for vehicles and cattle to the Mangels' Pond. The third culvert will be located between the pond access and Jameson Canyon Road. This 60-inch diameter round culvert will convey an ephemeral drainage and will be designed to have a natural bottom (dirt or gravel). The extension from the Jameson Canyon Road intersection to I-80 will include a span bridge over Jameson Canyon Creek.

Approximately 2.5 miles of directional fencing will be attached to the ROW fencing paralleling the Business Center Drive Extension. The ROW fencing is intended to define the ROW, deter access to adjacent private land, and keep livestock from entering the ROW The attached directional fencing is intended to exclude California red-legged frogs from the ROW and guide them to the three undercrossings and Jameson Canyon Creek Bridge described in the previous paragraph. The fencing will consist of hard plastic or a combination of permanent hardware cloth and flashing with a lip sufficient to deflect frogs on the top, or similar material and design. Directional fencing will be attached to the newly installed ROW fence on both sides of the new roadway constructed between Business Center Drive and I-80. The fence will be constructed along Business Center Drive, which is a local road off the State highway system, and its long-term maintenance will be the responsibility of STA.

Culverts and Bridge/Box Culvert Construction
The project would require the extension/widening of 12 existing culverts and bridges.

Bridge Replacement Construction Activities. The existing I-80 bridges over Green Valley Creek will be replaced with single-span structures. In Construction Package 3, the existing westbound I-80 bridge will be removed and replaced with a single-span structure approximately 103 feet long and 133 feet wide. A new single-span Green Valley Creek bridge for the I-80 Green Valley Road off-ramp will be approximately 180 feet long and 39 feet wide.

Bridge replacement will occur in two segments to maintain traffic on I-80. The work within Green Valley Creek bed and bank for each segment is expected to take approximately four

months and will be scheduled between June 15 and October 15. Bridge demolition will occur when Central Valley fall-run/late-fall-run Chinook salmon and central California coast steelhead are less likely to be present. Any work occurring before June 15 or after October 15 will be restricted to the road or bridge surface, and all work in or adjacent to a creek will be done with the implementation of water quality best management practices (BMPs).

Construction equipment would access the site from the north side of I-80. A staging area will be located within the curve of the I-680 entrance to westbound I-80. Bridge construction will involve the following activities.

1. Bridge abutment locations will be scarified and then excavated to the bottom of the abutment or pile cap using backhoes or bobcats. In some cases, the area adjacent to the abutment will be over-excavated by several feet to ensure that low-expansion material is adjacent to the abutment and wing walls.

2. Temporary cofferdams will be constructed both upstream and downstream of the bridge, and a piped water diversion system will be installed. The cofferdams will be at least 20 feet from the limit of the existing bridge.

3. Pile driving will be necessary to construct new bridge abutments for both bridges over Green Valley Creek. Piles will be located at the top of the creek bank and are anticipated to be 12-inch-square piles driven to a depth of approximately 70 feet. A vibratory hammer will be used when feasible. The number of strikes will depend on the loading and soil characteristics. Pile driving equipment will be operated from beyond the top bank.

4. Concrete abutments or pile caps will be constructed above the piles.

5. Wooden or steel falsework will be placed within the creek (banks and channel) once the abutments and columns have been constructed as necessary to support the construction of the cast-in-place concrete box girder structures.

6. When the reinforcement is set, the concrete will be placed for the superstructure. Once the concrete for the superstructure has hardened the tendons will be tensioned.

7. The last elements of major construction for the bridges will be bridge railings, approach slabs (placed on the embankment approaches to the bridge), and slope paving.

8. To the extent practicable, disturbed portions of Green Valley Creek (bed and bank) will be restored to pre-project conditions upon completion of construction. This may include grading and contouring the site, and seeding or planting with native plants as appropriate.

Culvert Construction Activities. Culvert construction will take place at Ledgewood Creek in Construction Package 3 and at Jameson Canyon Creek in Construction Packages 3 and 4. Construction associated with the culverts is expected to take approximately four months and will be scheduled during the driest time of the year (June 15–October 15).

Culvert construction will involve the following activities:

1. Temporary cofferdams (made of gravel, fabric, and pipe) will be constructed upstream and downstream from the culvert; a water diversion system using pipes will be installed to facilitate dewatering of the channel within the cofferdam during construction while bypassing creek flow. The cofferdams will be approximately 20 feet from the limit of the existing culvert.

2. Temporary cofferdams will be constructed to facilitate excavation of existing footings. The cofferdams will consist of gravel wrapped in fabric and would be slightly larger than the footing plan dimensions.

3. Vibratory equipment will be used to compact soil if feasible.

4. Falsework will be placed within the creek (banks and channel) as necessary to support construction of the cast-in-place (poured) concrete box culvert.

5. Falsework will be removed after concrete has set.

6. The concrete invert slab (i.e., invert of the culvert) will be extended to the edge of the widened culvert.

7. To the extent practicable, disturbed portions of Ledgwood Creek and Jameson Canyon Creek (bed and bank) will be restored to pre-project conditions when construction is complete. This may include grading and contouring the site, and seeding or planting with native plants as appropriate.

Ledgewood Creek Culvert. The Ledgewood Creek culvert will be extended 15 feet to the south to accommodate an additional lane for SR 12E (Construction Package 4). The existing crossing consists of a series of five culverts, each measuring 16.5 feet wide and supported by wall piers.

Construction associated with the culvert is expected to take approximately four months and will be scheduled during the driest time of the year (June 15–October 15) for ease of operation and to avoid potential effects to anadromous fish.

Jameson Canyon Creek Culvert. The Jameson Canyon Creek culvert will be constructed under the new I-680 alignment. It will be a two-box culvert, with each box approximately 12 feet wide and 8 feet high. Construction associated with the culvert is expected to last approximately four months and will be scheduled during the driest time of the year (June 15–October 15).

Utilities

As part of the proposed project, utilities within the project footprint will be relocated, realigned, or extended as necessary to accommodate project construction and operation. The maximum extent of disturbance from utilities falls within the project footprint. Utilities that will be affected are water, electrical, gas, cable/fiber, and telephone lines. Actions affecting these utilities will be coordinated with the respective operators. Caltrans will submit detailed

descriptions of utility relocations should the area of disturbance exceed the limits of the current proposed project footprint.

Staging Locations

Caltrans has identified potential construction staging areas within the proposed action area. Should construction contractors determine that other staging areas within or outside the state ROW and proposed action area are necessary to complete work, the contractor will be required by Caltrans or STA to obtain all necessary environmental clearances associated with the alternative staging areas prior to their use for staging purposes. Staging locations will be used for temporary placement of heavy construction equipment and vehicles; construction materials such as shotcrete (a mixture of concrete, fine aggregate, and water blown pneumatically through a hose), gravel, road base, and rebar; equipment maintenance shops; field offices; and rest rooms.

Access roads linking staging areas to the various work areas will be cleared and graded using equipment such as excavators, bobcats, and bulldozers. Upon project completion, and to the extent practicable, staging location and access roads will be returned to their pre-project conditions.

Construction Site Restoration

Caltrans plans to restore areas of temporary ground disturbances, including storage and staging areas, and temporary roads. These areas will be re-contoured, if appropriate, and revegetated with seeds and/or cuttings of appropriate native plant species to promote restoration of the area. Caltrans has developed a restoration plan that will be submitted to the Service for approval prior to initial ground breaking. This plan includes immediate application of permanent erosion control measures for all areas disturbed by construction activities. The permanent erosion control measures will include native (here referring to species naturally occurring in Solano County) grass and forb seed, fertilizer, compost and mulch for soil protection. The restoration plan also includes planting at each creek crossing using a combination of wetland, riparian and upland/transitional species appropriate for the conditions at the specific creek crossings and is informed by local reference sites. To the maximum extent practicable (i.e., presence of natural lands), topsoil will be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-off or erosion will be prevented with straw bales, straw wattles, or similar means provided they do not entangle or block California red-legged frog escape or dispersal routes.

Equipment

Construction is expected to require heavy equipment such as cranes, pile drivers, vibratory and hydraulic hammers, excavators, bobcats, bulldozers, roadheaders, hydraulic excavators or backhoes, scrapers, rubber-tired dump trucks, front-end loaders, load-haul-dumps, drill jumbos, front-end loaders and motor graders, sheepsfoot or drum rollers, and asphalt-paving machines.

Temporary construction areas will be cleared, graded, and reestablished using equipment such as excavators, bulldozers, and/or bobcats.

Routine Maintenance

Routine maintenance activities are anticipated within the R-O-Ws. Within R-O-Ws determined to be temporarily impacted, routine maintenance may have restrictions.

Proposed Conservation Measures

Caltrans proposes to avoid and minimize effects to the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, Central California Distinct Population Segment of the California tiger salamander, and California red-legged frog by implementing the following measures:

1 All construction personnel will attend a mandatory Worker Environmental Awareness Training Program delivered by a Service-approved biologist prior to working on the project site. The program will focus on the conservation measures that are relevant to employee's personal responsibility and will include an explanation as how to best avoid take of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog. The program will include an explanation of Federal laws protecting these listed species as well as the importance of compliance with this biological opinion. Documentation of the training, including sign-in sheets, will be kept on file and will be available on request.

2. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

3. A Service-approved biologist(s) will be on-site during any ground-disturbing activities that have the potential to adversely affect the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, California tiger salamander, and California red-legged frog.

4. A Service-approved biologist will be present during all construction-related activities in sensitive habitats. If special-status species are discovered during these activities, the Service-approved biologist, through the Resident Engineer, will halt all work within 50 feet of the species and contact the Service to determine how to proceed.

5. Prior to construction, Environmentally Sensitive Areas will be delineated using high-visibility orange construction fencing installed along the perimeter of the work areas to clearly delineate the extent of the construction area. The project plans will show the locations where fencing will be installed. The plans will also define the fencing installation procedure. The project's special provisions package will provide clear language regarding acceptable fencing material and prohibited construction-related activities, vehicle operation, material and equipment storage, and other surface-disturbing activities within sensitive areas.

6. No more than 20 calendar days prior to any ground disturbance in a given location, pre-construction surveys will be conducted by a Service-approved biologist for the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, elderberry plants, and California red-legged frog where habitat was identified for each respective species. These surveys will consist of walking surveys of the project limits and accessible adjacent areas within at least 50 feet of the project limits. The biologist(s) will investigate all potential California red-legged frog cover sites. This includes thorough investigation of mammal burrows, appropriately sized soil cracks, and debris. Native vertebrates found in the cover sites will be documented and relocated to an adequate cover site in the action area vicinity. The entrances and other refuge features within the project limits will be collapsed or removed following investigation and clearance.

7 Vegetation clearing will be limited throughout the proposed project area to the non-nesting season (September 1–January 31) to the extent possible. Vegetation removal work outside this window will be preceded by preconstruction nest clearance surveys.

8. Vegetation will be cleared only where necessary and will be cut approximately 4 inches above soil level except in areas that will be excavated for roadway construction. This will allow plants that reproduce vegetatively to resprout after construction. All clearing and grubbing of woody vegetation will be done using hand tools, small mechanical tools, or backhoes and excavators. All cleared vegetation will be removed from the project footprint to prevent attracting animals to the project site.

9. All slopes or unpaved areas temporarily disturbed by construction activities will be stabilized to prevent erosion at least three days prior to a forecasted rain event. After construction activities, the temporarily disturbed areas will be restored to pre-project conditions to the maximum extent practicable. Where disturbance includes the removal of trees, native species will be replanted.

10. To reduce the spread of invasive, nonnative plant species and minimize the potential decrease of palatable vegetation for wildlife species, Caltrans will comply with Executive Order 13112. This order is intended to prevent the introduction of invasive species and provide for their control to minimize adverse economic, ecological, and human health effects. In the event that noxious weeds are disturbed or removed during construction-related activities, the contractor will be required to contain the plant material associated with these noxious weeds and dispose of them in a manner that will not promote the spread of the species. The contractor will be responsible for obtaining all permits, licenses, and environmental clearances for properly disposing of materials. Areas subject to noxious weed removal or disturbance will be replanted with fast-growing native grasses or a native erosion control seed mixture. If seeding is not possible, the area of disturbance will be covered to the extent practicable with heavy black plastic solarization material until the end of project construction.

11. Construction access, staging, storage, and parking areas will be located within the project ROW or temporary easements and outside of designated Environmentally Sensitive

Areas. Access routes and the number and size of staging and work areas will be limited to the minimum necessary to construct the proposed project. Routes and boundaries of roadwork will be clearly marked prior to initiating construction or grading.

12. All food and food-related trash items will be enclosed in sealed trash containers and removed completely from the site at the end of each day.

13. No firearms will be allowed in the action area except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

14. Caltrans and STA will install bio-swales and bio-filtration in the area adjacent to roadways to avoid and minimize sediment loading and point source pollutants.

15. Stormwater pollution prevention plans (SWPPPs) and erosion control BMPs will be developed and implemented to minimize any wind- or water-related erosion and will be in compliance with the requirements of the Regional Water Quality Control Board. The design staff will include provisions in construction contracts for measures to protect sensitive areas and prevent and minimize stormwater and nonstormwater discharges. Protective measures will include, at a minimum, those listed below.

    a. No discharge of pollutants from vehicle or equipment cleaning will be allowed into any storm drains or water courses.

    b. Vehicle and equipment fueling and maintenance operations will be at least 50 feet away from water courses, except at established commercial gas stations or established vehicle maintenance facilities.

    c. Concrete waste and water from curing operations will be collected in washouts and will be disposed of and not allowed into water courses.

    d. Spill containment kits will be maintained onsite at all times during construction operations and/or staging or fueling of equipment.

    e. Dust control measures will include use of water trucks and organic tackifiers to control dust in excavation-and-fill areas, covering temporary access road entrances and exits with rock (rocking), and covering of temporary stockpiles when weather conditions require.

    f. Silt fences, coir rolls, or straw wattles will be installed along or at the base of slopes during construction to capture sediment.

16. All equipment will be maintained such that there will be no leaks of automotive fluids such as gasoline, oils, or solvents, and a Spill Response Plan will be prepared.

17 To prevent inadvertent entrapment of animals during construction, all excavated, steep-walled holes or trenches more than 1 foot deep will be covered at the close of each

working day with plywood or other suitable material, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled they must be thoroughly inspected for trapped animals. All replacement pipes, culverts, or similar structures stored in the action area overnight will be inspected before they are subsequently moved, capped, or buried. If at any time a listed species is discovered, the Resident Engineer and Service-approved biologist will be immediately informed. The animal will be allowed to move out of the area on its own volition.

18. If requested through the Resident Engineer or Construction Inspector before, during, or upon completion of groundbreaking and construction activities, Caltrans will ensure that the Service and/or its designated agents can, immediately and without delay, access and inspect the project site for compliance with the proposed project description, conservation measures, and terms and conditions of the biological opinion, and to evaluate project effects on listed species and their habitat.

19. The following measures are intended to avoid and minimize effects to the showy Indian clover.

    a. Prior to groundbreaking for Construction Package 3, protocol-level surveys of the inaccessible parcels on the Mangels' property north of SR 12W will be conducted for showy Indian clover in accordance with the Service protocol.

    b. If protocol-level surveys identify showy Indian clover plants within 250 feet of the project footprint, the project footprint will be fenced and flagged to ensure that construction equipment and construction activities are confined and completely avoid any potential direct or indirect effects on individual showy Indian clover plants during construction. In the event of a positive survey finding, Caltrans will implement the following specific measures.

        i. Orange Environmentally Sensitive Area construction barrier fencing at least 4 feet in height will be installed to protect Environmentally Sensitive Areas. A Service-approved biologist will identify sensitive biological resources adjacent to the construction area; the Environmentally Sensitive Areas to be fenced will be included in the contract plans and specifications.

        ii. A Service-approved biologist will identify potential showy Indian clover habitat, and a protective silt fence, described in the Caltrans Standard BMPs, will be installed to protect down-gradient habitat for showy Indian clover from being affected by sediment loading.

        iii. Construction activities conducted within the area of potential showy Indian clover habitat will be confined to the driest season (June 1–October 15) to protect down-gradient, showy Indian clover habitat and minimize potential indirect dust effects on identified flowering showy Indian clover plants.

iv. A Service-approved biologist will be present during all ground-disturbing activities occurring within 250 feet of occupied showy Indian clover habitat to ensure that showy Indian clover habitat is avoided.

v. Vegetation removal within 250 feet of occupied showy Indian clover habitat will be limited to the maximum extent practicable.

vi. A Service-approved biologist will develop and conduct environmental education training for construction employees working on ground-disturbing activities. The program will include the following: a description of showy Indian clover and its habitat needs, photographs of the plant species, an explanation of its legal status and protection under the Act, and a list of the measures that will be implemented to minimize and avoid potential effects on showy Indian clover.

vii. The Service-approved monitor will coordinate with the Resident Engineer to ensure that the contractor maintains the staked, fenced, and flagged perimeters of the construction area and staging areas adjacent to sensitive biological resources, including occupied or potential showy Indian clover habitat.

20. The following measures are intended to minimize direct and indirect effects to callippe silverspot butterfly.

a. Caltrans will minimize harm to the callippe silverspot butterfly resulting from the adverse effects to 58.14 acres of habitat. Compensation implemented within Service-approved areas that are both California red-legged frog habitat and Callippe silverspot butterfly may be overlaid on common acreage as long as it is appropriate habitat for each species. The area will receive conservation credit from the Service for both species. The compensation will be phased to coincide with project construction packages as presented in Table 1and implemented 60 calendar days prior to the date of initial ground disturbance.

Compensation will be based on the amount of permanent and temporary loss of callippe silverspot butterfly habitat. Temporary habitat loss will be compensated at rates based on the amount of time it takes to restore the habitat to baseline conditions following the date of initial habitat disturbance and whether the restored habitat will be subjected to ongoing roadway maintenance activities that would not be entirely beneficial to the species. Off-site conservation will offset routine maintenance activities that are short in duration, e.g. mowing. Habitat value in these R-O-W areas is diminished but not permanently destroyed. Should the determination of permanent versus temporary habitat loss change after Caltrans has provided this compensation, Caltrans will provide additional compensation, if necessary, or apply excess compensation towards future projects that adversely affect the callippe silverspot butterfly.

The maintained ROW is defined as the ROW between the edge of pavement or denuded road shoulder and the Caltrans ROW fence. Permanent effects will

occur within the bounds of the maintained ROW (road surface and area between edge of pavement and ROW fence).

Callippe Silverspot Butterfly Habitat Compensation

Level of Effect	Duration [1]	Compensation Ratio	Acres of Effects[2]	Acres of Compensation[3]
Permanent	Permanent	3:1	38.82	116.46
Temporary	Within 1 year	1:1on-site 0.5 off-site	19.32	9.66
	Within 2 years	1:1 on-site 1.5:1 off-site	0	0
	Greater than 2 years	3:1 off-site **OR** 2:1 off-site **AND** 1:1 on-site	0	
TOTAL			**58.14**	**126.12**

[1]period of time from the date of initial ground disturbance until the success criteria described in the restoration/revegetation plan are met.
[2] as per GIS map dated March 2012, potential to be adjusted at final project design, with subsequent reinitiation.
[3] Acres of compensation = off-site areas.

Caltrans will compensate for adverse effects to callippe silverspot butterfly habitat by implementing one of the following two options:

i. Caltrans will establish in-perpetuity callippe silverspot butterfly habitat preservation by purchasing habitat or purchasing callippe silverspot butterfly habitat credits from a Service-approved conservation bank.

Compensation will be implemented with in-perpetuity preservation of callippe silverspot butterfly habitat with high conservation values and (1) include ridge line topographical features associated with callippe silverspot butterfly breeding behavior and adult and/or larval nectar plants, and (2) preference given to areas located within the Callippe Silverspot Butterfly Conservation Area defined in the Draft Solano HCP (SCWA 2009). Location of the proposed conservation areas will be submitted to the Service for review and approval.

The habitat will include a Service-approved conservation easement, held by a third party. An approved ecologically-based conservation easement will include managed public access, a management plan, and an in-perpetuity endowment or other permanent non-wasting management fund based on a PAR-like property analysis. The management plan will include a description of the site, management needs (e.g. grazing plan, non-native vegetation and animal control, etc), when the management activities will be implemented, how often and to what level monitoring of the site will occur, and an action/contingency plan to address potential management issues.

ii. Caltrans will implement or fund restoration and enhancement actions within occupied callippe silverspot butterfly habitat that will have beneficial effects on the species. Such measures shall be implemented on lands with in-perpetuity conservation beneficial to the callippe silverspot butterfly.

Implementation includes identification of land to be restored or enhanced, associated agreements to fund restoration or enhancement activities, and a restoration plan and schedule approved by the Service.

b. Caltrans will survey for the presence of adult nectar and larval host plants and adult nectar sources within areas that will be subject to temporary effects within callippe silverspot habitat. The surveys will be conducted during the blooming season (March to May) no more than one year prior to the excavation and grading of the Business Center Drive Extension proposed to occur during Construction Packages within Callippe silverspot butterfly habitat. SLT will be contacted in order to synchronize the surveys with peak *Viola* blooming on the Swett Ranch. Observed adult nectar plants and *Viola* will be mapped and flagged. Caltrans will modify the boundaries of temporary work areas to avoid the nectar and host plants when feasible.

c. To the maximum extent possible, Caltrans will avoid areas of *Viola* delineated prior to construction and during preconstruction surveys within temporary affected areas.

d. The project footprint will be clearly delineated with Environmentally Sensitive Area fencing and signage to limit construction activities to the described footprint and to maintain awareness. All Environmentally Sensitive Areas will be shown on the final construction drawings.

e. Grading activities within callippe silverspot butterfly habitat will be conducted between August 1 and April 1, to the extent practicable as determined during constructability review. When grading activities must take place after April 1 and before August 1, daily biological monitoring will occur for the callippe silverspot butterfly.

f. Insecticides or herbicides in the Business Center Drive Extension ROW will not be applied during road construction or long-term operational maintenance within 300 feet of the host plant occurrences mapped by Monk & Associates in 2004 or otherwise identified or adult nectar plants or from other locations where the chemical treatments can be carried in by wind or surface flow.

g. Standard erosion and dust control measures will be implemented to minimize the deposition of dust, soil, and silt on callippe silverspot butterfly habitat.

h. Caltrans and STA will ensure there is no drift of sprayable dust control formulations used for dust and erosion control towards callippe silverspot butterfly habitat during construction. Appropriate spray devices and application methods, such as spray pressures, nozzle opening size, and additives such as spray retardants, will be used to prevent drift. Applications will be made on calm days or when the wind speed is low and blowing away from callippe silverspot butterfly habitat. Spray applications will not be made within 200 yards by air or 40 yards by ground upwind from callippe silverspot butterfly habitat. Applications will not occur during rain events.

i. No equipment will be driven or parking or laydown areas established within 20 feet of larval host plants located outside the defined construction footprint and, to the extent feasible, within 20 feet of adult nectar plants located outside the defined construction footprint.

j. If any other life history phases of the callippe silverspot butterfly are found such as adults, pupae, larvae, or eggs, the Service shall be immediately contacted for further guidance.

21 The following measures are intended to avoid and minimize direct and indirect effects to vernal pool fairy shrimp and vernal pool tadpole shrimp.

a. The potential vernal pool fair shrimp and vernal pool tadpole shrimp habitat within the action area is within what is described in the draft Solano HCP as having a low conservation value. Caltrans will compensate for the effects to 1 71 acres (1.45 acres direct effects + 0.26 acre indirect effects) of vernal pool habitat based on the conservation strategy in the draft Solano HCP as follows:

Listed Vernal Pool Crustacean Compensation

Type of Effect	Compensation Ratio	Acres of Effects	Acres of Compensation	Type of Compensation
Direct	1:1	1.45	1.45	Preservation of vernal pool and swale habitat
Direct	1:1	1.45	1.45	Restoration of vernal pool and swale habitat
Indirect	1:1	0.26	0.26	Preservation of vernal pool and swale habitat

i. The above compensation of 1.71 acres of preservation and 1.45 acres of restoration will be implemented no later than sixty (60) calendar days prior to the date of initial ground disturbance of the specific construction packages. The compensation will be phased to coincide with the initiation of the individual project construction packages as presented in Table 1.

ii. Preservation and restoration for adverse effects to Low Value Conservation Areas shall occur within Medium to High Value Conservation Areas identified in the draft Solano HCP The location of the compensation will be submitted for Service approval. Preservation and restoration ratios reflected

above are based on the premise that effects to low value conservation areas will be compensated in medium to high value areas.

b. To the extent practicable, Caltrans and its contractors will initiate all work in or within 250 feet of potential habitat for vernal pool crustaceans between May 1 and November 1. When construction activities must take place after November 1 and before May 1, daily biological monitoring will occur for the vernal pool crustaceans.

c. To the extent practicable, Caltrans will incorporate design modifications to avoid direct permanent effects on potential habitat for federally listed branchiopods.

d. Caltrans will avoid potential vernal pool fairy shrimp and vernal pool tadpole shrimp habitat, to the maximum extent practicable, during construction activities in temporary work areas. All potential vernal pool fairy shrimp and vernal pool tadpole shrimp habitat not directly affected will be designated as an Environmentally Sensitive Area and protected with appropriate fencing and signage. All Environmentally Sensitive Areas will be shown on the final construction drawings.

e. Caltrans will perform all work in accordance with a SWPPP BMPs will be implemented and may include the use of silt fences, sandbags, detention basins, and other means as appropriate to prevent erosion into any potential habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp.

22. The following measures are intended to avoid direct and indirect effects to Contra Costa goldfields, and effects to potential listed branchiopods and California tiger salamander habitat immediately south of SR 12E, between Ledgewood Creek and Suisun City.

a. Caltrans will construct a retaining wall along SR 12E, between Ledgewood Creek and Suisun City. This design feature will limit the roadway expansion to the existing raised roadbed and avoid permanent intrusion into the immediately adjacent seasonal wetland habitat (Gentry Suisun wetland).

b. The boundaries of this habitat along SR 12E will be identified as inaccessible by an orange construction barrier fence and depicted on final design plans. The fence will be at least 4 feet high, it will include signage as the boundary of an Environmentally Sensitive Area, and the installation will be guided and monitored by a Service-approved biologist.

c. A Service-approved biologist will identify potential Contra Costa goldfields habitat prior to ground-disturbing activities, and a protective silt fence, described in the Caltrans Standard BMPs, will be installed to protect down-gradient areas from being affected by sediment loading. This fencing will prevent direct impacts on wetlands south of SR 12E between Ledgewood Creek and the eastern end of the construction area.

d. A Service-approved biologist will conduct construction monitoring in and adjacent to all sensitive special-status plant populations. Construction monitoring frequency will range from daily to weekly depending on the biological resource and the construction activities.

e. A Service-approved biologist will coordinate with the Resident Engineer to ensure that the contractor maintains the staked, fenced, and flagged perimeters of the construction area and staging areas adjacent to sensitive biological resources, including potential Contra Costa goldfields habitat.

f. Vegetation removal on the south side of the existing SR 12E will be limited to the minimum necessary.

g. The Service-approved biologist will be present during all ground-disturbing activities occurring within 250 feet of vernal pool habitat.

h. Construction activities conducted within the area between Ledgewood Creek and Suisun City will be confined to the driest season (April 15–October 15, or as otherwise specified in regulatory permits) to protect down-gradient habitat.

i. Caltrans or STA will survey the seasonal wetland / pools south of their Biological Study Area located between SR 12E, Pennsylvania Avenue, Ledgewood Creek, and the SPRR rail line for California tiger salamander prior to construction. Should these surveys find occurrences of California tiger salamander within the action area, Caltrans and STA will reinitiate formal Section 7 consultation with the Service.

23. The following measures are intended to avoid and minimize direct and indirect effects to valley elderberry longhorn beetle.

a. Caltrans will install Environmentally Sensitive Area fencing and flag all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer has been approved by the Service, the fencing will provide a minimum 2-foot setback from the drip line of each elderberry plant.

b. Caltrans will provide contractors with training educating them on the status of the valley elderberry longhorn beetle and its host plant and emphasize the need to avoid damaging elderberry plants.

c. Caltrans will erect signs every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs will be clearly readable from a distance of 20 feet, and will be maintained for the duration of construction.

d. Caltrans will restore, to the maximum extent practicable, any damage or disturbance to the buffer area (areas within 100 feet of elderberry plants) during construction. Caltrans will provide erosion control and revegetate the areas with appropriate native plants.

e. Caltrans will prohibit the use of insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant in the buffer areas or within 100 feet of any elderberry plant with one or more stems measuring 1.0 inch or more in diameter at ground level.

f. Caltrans and STA will work with the Solano County Resource Conservation District or a Service-approved bank to facilitate the plant removal and transplanting effort. Transplantation of ten elderberry shrubs that are within the construction footprint will be done prior to ground-disturbing activities within 100 feet of the shrubs and will be conducted according to the Service's 1999 *Conservation Guidelines for the Valley Elderberry Longhorn Beetle*. A Service-approved biologist will be on-site to monitor the transplanting of the elderberry plants.

g. Caltrans will implement one or a combination of the following:

i. Provide replacement plantings and associated native plantings as described in Table 1 at a Service-approved location.

Table 1. Minimization ratios based on location, stem diameter of affected elderberry plants at ground level, and presence or absence of exit holes.

Location	Stem Diameter (inches)	Exit Holes Present (No/Yes)	Number of Stems	Elderberry Seedling Ratio	Elderberry Seedling Plantings	Associated Native Plant Ratio	Associated Native Plantings
Non-riparian	1-3	N	8	1:1	8	1:1	8
		Y	2	2:1	4	2:1	8
	3-5	N	7	2:1	14	1:1	14
		Y	1	4:1	4	2:1	8
	> 5	N	5	3:1	15	1:1	15
		Y	2	6:1	12	2:1	24
Riparian	1-3	N	20	2:1	40	1:1	40
		Y	0	4:1	0	2:1	0
	3-5	N	8	3:1	24	1:1	24
		Y	0	6:1	0	2:1	0
	> 5	N	9	4:1	36	1:1	36
		Y	0	8:1	0	2:1	0
Total			**62**		**157**		**177**

ii. Purchase valley elderberry longhorn beetle credits from a Service-approved conservation bank.

h. Two elderberry shrubs are located within 100 feet of the limit of disturbance. These shrubs will be protected by:

i. Fencing and flagging all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer has been approved by the Service, Caltrans will provide a minimum setback of at least 20 feet from the dripline of each elderberry plant.

ii. Erecting signs every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs should be clearly readable from a distance of 20 feet, and must be maintained for the duration of construction.

24. The following measures are intended to avoid and minimize direct and indirect effects to California red-legged frog.

a. Caltrans will compensate for harm resulting from adverse effects to the California red-legged frog and 97.80 acres of its habitat, and the adverse effects critical habitat for the California red-legged frog by providing appropriate habitat compensation.

The compensation will be based on the amount of permanent and temporary loss of red-legged frog habitat. Temporary habitat loss will be compensated at rates based on the amount of time it takes to restore the habitat to baseline conditions following the date of initial habitat disturbance and whether the restored habitat will be subjected to ongoing Caltrans routine maintenance activities, e.g. mowing, that may affect the species.

The maintained ROW is defined as the ROW between the edge of pavement or denuded road shoulder and the Caltrans ROW fence. Permanent effects will occur in areas of maintained ROW that include barriers to frog movement. Areas of ROW within and adjacent to retaining walls will be permanently affected by the project. Caltrans commits to installing a Service-approved frog exclusion fence along the proposed Business Center Drive Extension from the existing Business Center Drive to Jameson Canyon Road in order to direct California red-legged frogs to the three proposed undercrossings. Since the exclusion fence will likely prevent individuals of this threatened species from entering the maintained ROW, the entirety of the ROW within this area will be permanently affected by the proposed project. However, less compensation is necessary as the directional fence also results in a beneficial effect to California red-legged frogs by directing them to safe undercrossings. Off-site compensation is proposed to offset temporary impacts within the maintained R-O-W since habitat will continue to be impacted by on-going routine maintenance activities, e.g. mowing. Lastly, additional off-site compensation is necessary for temporal loss of habitat.

Caltrans will compensate for the loss of habitat of the California red-legged frog by implementing the following:

California Red-Legged Frog Habitat Compensation

Level of Effect	Location of disturbance	Duration[1]	Compensation Ratio	Acres of Effects[2]	Acres of Compensation[3]
Permanent	Within or beyond maintained ROW	Permanent	3:1	78.48	235.44
	Within maintained ROW and excluded by directional fence	Permanent	2:1	0	0
Temporary	Within the maintained ROW	Within 1 year	1:1 on-site 1:1 off-site	0	0
	Beyond the maintained ROW	Within 1 year	1:1on-site 0.5:1 off-site	19.32	9.66
	Within the maintained ROW	Within 2 years	1:1 on-site 1.5:1 off-site	0	0
	Beyond the maintained ROW	Within 2 years	1:1 on-site 1:1 off-site	0	0
	Within or beyond maintained ROW	Greater than 2 years	3:1 off-site **OR:** 2:1 off-site **AND** 1:1 on-site	0	0
TOTAL				**97.80**	**245.1**

[1]period of time from the date of initial ground disturbance until the success criteria described in the restoration/revegetation plan are met.
[2] as per GIS map dated March 2012, potential to be adjusted at final project design, with subsequent reinitiation.
[3] Acres of compensation = off-site lands.

Compensation implemented within areas that are both California red-legged frog habitat and Callippe silverspot butterfly habitat may be overlaid on common acreage as long as the area is appropriate habitat for each species. With Service approval, the conservation lands would receive compensation credit from the Service for both species.

Compensation will be implemented with in-perpetuity preservation of California red-legged frog habitat with high conservation values, consistent with the parameters described in the Draft Solano HCP (SCWA 2009) within sixty (60) calendar days prior to the date of initial ground disturbance at the project.

California red-legged frog habitat used for conservation will be: (1) preferably located within the California Red-Legged Frog Conservation Area defined in the Draft Solano HCP (SCWA 2009), (2) within 0.7 mile of unobstructed California red-legged frog breeding habitat and non-breeding aquatic habitats, (3) within a California red-legged frog critical habitat unit or within the vicinity of frog critical habitat, and (4) approval by the Service.

b. The Resident Engineer will stop work at the request of the Service-approved biologist(s) if activities are identified that may result in take of a California red-legged frog. Should the biologist(s) or Resident Engineer exercise this authority, the Service will be notified by telephone and email within one working day. The Service contact will be the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600.

c. The Resident Engineer will halt work immediately and contact the Service-approved project biologist and the Service in the event that a California red-legged frog is found within the construction zone. The Resident Engineer will suspend all construction activities in the immediate construction zone until the animal leaves the site voluntarily or is removed by the biologist to a release site using Service-approved transportation techniques.

d. To the extent practicable, initial ground-disturbing activities will be avoided between November 1 and March 31 to avoid the period when California red-legged frogs are most likely to be moving through upland areas. When ground-disturbing activities must take place between November 1 and March 31, daily monitoring will occur for California red-legged frogs.

e. Exclusionary fencing will be placed at the edge of active construction areas (cleared by biological surveys) in areas identified as California red-legged frog habitat. The fencing is intended to restrict frog access from the adjacent upland and riparian habitat. The fence will consist of taut silt fabric: 24 inches high, stacked at 10-foot intervals, with the bottom buried 6 inches below grade. The bid solicitation package Special Provisions will clearly describe acceptable fencing material and proper fence installation and maintenance. The wildlife exclusion fence will remain in place throughout the duration of construction activities and will be regularly inspected and fully maintained. The fence will be completely removed upon completion of project-related activities within these areas and the areas returned to preconstruction condition or better

f. California red-legged frogs that need to be relocated outside the construction area will be released beyond the exclusion fence within the same riparian area or watershed by the Service-approved biologist. If relocation of the frog outside the fence is not feasible (i.e., there are too many frogs observed per day), the biologist will relocate frogs to a preapproved location determined by Caltrans and the Service. Prior to construction, Caltrans will obtain approval of the relocation protocol from the Service in the event that a California red-legged frog is encountered and needs to be relocated away from the immediate project area.

g. To prevent inadvertent entrapment of a California red-legged frog during construction, all excavated, steep-walled holes or trenches more than 1 foot deep will be covered at the close of each working day with plywood or similar material, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the onsite biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and email within one working day.

h. Within and adjacent to California red-legged frog habitat, all construction equipment or construction debris left overnight within the action area will be inspected for

California red-legged frogs by the Service-approved biologist prior to the beginning of each day's activities and prior to being moved.

i. Injured California red-legged frogs will be cared for by a licensed veterinarian or other qualified person such as the onsite biologist; dead individuals of any listed species will be preserved according to standard museum techniques and held in a secure location. The Service will be notified within one working day of the discovery of death or injury to a listed species that results from project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a U.S. Geological Survey (USGS) 7.5-minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. Dead frogs will be placed in a sealed plastic bag with a piece of paper containing information on where and when the animal was found along with the name of the person who found it, the bag will be placed in a freezer located in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are the Coast-Bay/Forest Foothill Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600 and the Resident Agent-in-Charge of Service's Law Enforcement Division at (916) 414-6660.

j. To the extent practicable, nighttime construction will be minimized, especially for those areas adjacent to California red-legged frog habitat. When nighttime work is to be conducted in areas adjacent to potential habitat, all lighting will face away from potential habitat.

k. Plastic monofilament netting (erosion control matting) or similar material will not be used in the action area because California red-legged frogs can become entangled and trapped in it. Instead, Caltrans will use alternative materials such as coconut coir matting or pacified hydroseeding compounds.

l. Vehicle and equipment speed will be limited to 20 miles per hour in unpaved portions of the action area.

m. No pets will be permitted in the action area.

n. For onsite storage of pipes and conduits and other materials that could provide shelter for California red-legged frogs, an open-top trailer will be used to elevate the materials above ground. This is intended to reduce the potential for animals to climb into the conduits and other materials.

25. Caltrans will provide a Funding Assurance Letter stating that sufficient funds for habitat compensation have been budgeted in the Interstate I-80/I-680/SR 12 Interchange Phase 1 Project Expenditure Authorization. The Funding Assurance Letter will be signed by the District Deputy Director of Project Management and the District Deputy Director of Environmental Planning and Engineering. The Funding Assurance Letter provides

evidence that Caltrans has allocated sufficient funding to implement the proposed compensation.

26. Land used for habitat compensation will include a Service-approved conservation easement. An approved ecologically-based conservation easement will include managed public access, a management plan, and an in-perpetuity endowment or other permanent non-wasting management fund based on a PAR-like property analysis. The management plan will include a description of the site, management needs (e.g. grazing plan, non-native vegetation and animal control, etc), when the management activities will be implemented, how often and to what level monitoring of the site will occur, and a action/contingency plan to address potential management issues.

27 Caltrans will provide a restoration and revegetation plan for each construction package to be reviewed and approved by the Service no later than sixty (60) calendar days prior to date of its initial groundbreaking of each construction package. The plan will include, but will not be limited to: schedule, methodology, a list of the seed mixes and container plants, plant material source, irrigation, maintenance schedule, monitoring program, success criteria, control of invasive, noxious weeds, and remediation and adaptive management. In addition, annual monitoring reports on the success of the plantings shall be provided to the Service following the completion for each construction package. The reports will be submitted on or before December 31 of each year monitoring is conducted.

The revegetation plan will include a photo monitoring plan. The plan will include, but is not limited, to the following:

a. An adequate number of photo monitoring stations will be established to provide representative views of project restoration and construction activities. Stations will be located in areas that allow for unobstructed views and a field of vision of approximately 2000 feet, to the extent allowed by surrounding vegetative cover and topography. Each station will provide a representative panoramic view of the restoration footprint. Caltrans will ensure that photo monitoring stations numbers and locations are sufficient to document restoration success.

b. Baseline photographs will be taken during the spring growing season prior to construction. Following the completion of ground disturbance, photo documentation will be conducted quarterly to document restoration relative to four seasons. Photo documentation will conclude when the Service has agreed that success criteria have been met.

c. Photo monitoring station locations will be provided to the Service in an acceptable geographic format with the coordinate system identified.

d. If the Service or the biological monitor(s) determines that additional monitoring stations are necessary, the locations will be added to the inventory of photo monitoring stations prior to the date of the next photo documentation.

e. During each photo monitoring cycle all stations will be visited within a two day period.

f. At the conclusion of restoration, the acreage of restored areas will be tabulated and provided to the Service. The extent of restoration will be delineated with a handheld GPS device and a trackfile provided to the Service Representative.

28. Routine maintenance activities will be identified in the Restoration/Revegetation Plan. Maintained R-O-Ws may include routine maintenance activities that are short in duration, such as spraying and mowing. Specific restrictions may apply for the valley elderberry longhorn beetle, callippe silverspot butterfly , California red-legged frog, and the showy Indian clover.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the proposed action, the action area includes: (1) all lands associated with the approximately 258.14-acre construction footprint (of which 136.72 acres is existing hardscape) including roads (except for County roads, and State and Federal highways) and other areas accessed by project vehicles, and (2) lands within 1,000 feet of the construction footprint subjected to project-related lighting, noise, vibration, runoff, and fugitive dust.

Analytical Framework for the Jeopardy and Adverse Modification Analysis

Jeopardy Determination

The following analysis relies on four components to support the jeopardy determination for the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog: (1) the *Status of the Species*, which evaluates the species' range wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the role of the action area in the species' survival and recovery; (3) the *Effects of the Action*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the species.

In accordance with the implementing regulations for section 7 and Service policy, the jeopardy determination is made in the following manner: the effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the species' current status and, for non-Federal activities in the action area, those actions likely to affect the species in the future, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

The following analysis places an emphasis on using the range-wide survival and recovery needs of the species and the role of the action area in providing for those needs as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR §402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this Biological Opinion relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range wide condition of designated critical habitat for Contra Costa goldfields and California red-legged frog in terms of PCEs, the factors responsible for that condition, and the intended recovery function of the critical habitat at the provincial and range-wide scale; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and (4) *Cumulative Effects* which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units. For purposes of the adverse modification determination, the effects of the proposed Federal action on Contra Costa goldfields and California red-legged frog critical habitats are evaluated in the context of the range-wide condition of the critical habitat at the provincial and range-wide scales, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for Contra Costa goldfields and the California red-legged frog.

The analysis in this Biological Opinion places an emphasis on using the intended range-wide recovery function of Contra Costa goldfields and California red-legged frog critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

Status of the Species

Vernal Pool Fairy Shrimp

Refer to the *Vernal Pool Fairy Shrimp 5- Year Review* for status and life history information (Service 2007a). This document can be downloaded from the world wide web at: http://www.fws.gov/cno/es/images/Graphics/VPFS_5-yr%20review%20CNO%20FINAL%2027Sept07.pdf

Vernal Pool Tadpole Shrimp

Refer to the *Vernal Pool Tadpole Shrimp 5- Year Review* for status and life history information (Service 2007b). This document can be downloaded from the world wide web at: http://www.fws.gov/cno/es/images/Graphics/VP%20Tadpole%20Shrimp_5%20yr%20review%20FINAL%20CNO%2027Sept07.pdf

Callipe Silverspot Butterfly

Refer to the *Callippe Silverspot Butterfly 5- Year Review* for status and life history information (Service 2009). This document can be downloaded from the world wide web at: http://ecos.fws.gov/docs/five_year_review/doc2518.pdf.

Valley Elderberry Longhorn Beetle

Refer to *Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus) 5-Year Review: Summary and Evaluation* (Service 2006b) for status and life history information. This document can be downloaded from the world wide web at: http://ecos.fws.gov/docs/five_year_review/doc779.pdf.

California Red-Legged Frog

The California red-legged frog was listed as a threatened species on May 23, 1996 (61 FR 25813). A recovery plan was published for the California red-legged frog on September 12, 2002 (Service 2002). A revised critical habitat was designated for this species on March 17, 2010 (75 FR 12816). At this time, the Service recognized the taxonomic change from *Rana aurora draytonii* to *Rana draytonii* (Shaffer *et al.* 2010).

The California red-legged frog is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches in length (Stebbins 2003). The abdomen and hind legs of adults are largely red, while the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background color. Dorsal spots usually have light centers (Stebbins 2003), and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

The historic range of the California red-legged frog extended from the vicinity of Elk Creek in Mendocino County, California, along the coast inland to the vicinity of Redding in Shasta County, California, and southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). The species was historically documented in 46 counties but the taxa now remains in 238 streams or drainages within 23 counties, representing a loss of 70 percent of its former range (Service 2002). California red-legged frogs are still locally abundant within portions of the San Francisco Bay area and the Central California Coast. Isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse Ranges. The species is believed to be extirpated from the

southern Transverse and Peninsular ranges, but is still present in Baja California, Mexico (CDFG 2011a).

California red-legged frogs predominately inhabit permanent water sources such as streams, lakes, marshes, natural and manmade ponds, and ephemeral drainages in valley bottoms and foothills up to 4,921 feet in elevation (Jennings and Hayes 1994, Bulger *et al.* 2003, Stebbins 2003). However, California red-legged frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. California red-legged frogs also can be found in disturbed areas such as channelized creeks and drainage ditches in urban and agricultural areas. For example, an adult California red-legged frog was observed in a shallow isolated pool on North Slough Creek in the American Canyon area of Napa County (Christine Gaber/PG&E personal communication with Chris Nagano/Service on October 22, 2008). This frog location was surrounded by vineyard development. Another adult California red-legged frog was observed under debris in an unpaved parking lot in a heavily industrialized area of Burlingame (Patrick Kobernus/Coast Ridge Ecology communication with Michelle Havens/Service on October 16, 2008). This Burlingame frog was likely utilizing a nearby drainage ditch. Caltrans also has discovered California red-legged frog adults, tadpoles, and egg masses within a storm drainage system within a major cloverleaf intersection of Millbrae Avenue and State Route 101 in a heavily developed area of San Mateo County (Caltrans 2007). The California red-legged frog has the potential to persist in disturbed areas as long as those locations provide at least one or more of their life history requirements.

California red-legged frogs typically breed between November and April, although earlier breeding records have been reported in southern localities. Breeding generally occurs in still or slow-moving water often associated with emergent vegetation, such as cattails, tules or overhanging willows (Storer 1925, Hayes and Jennings 1988). Female frogs deposit egg masses on emergent vegetation so that the egg mass floats on or near the surface of the water (Hayes and Miyamoto 1984).

Habitat includes nearly any area within 1 to 2 miles of a breeding site that stays moist and cool through the summer including vegetated areas with coyote brush, California blackberry thickets, and root masses associated with willow and California bay trees (Fellers 2005). Sheltering habitat for California red-legged frogs potentially includes all aquatic, riparian, and upland areas within the range of the species and includes any landscape feature that provides cover, such as animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

California red-legged frogs do not have a distinct breeding migration (Fellers 2005). Adults are often associated with permanent bodies of water. Some individuals remain at breeding sites year-round, while others disperse to neighboring water features. Dispersal distances are typically less than 0.5-mile, with a few individuals moving up to 1 to 2 miles (Fellers 2005). Movements are typically along riparian corridors, but some individuals, especially on rainy nights, move

directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005).

In a study of California red-legged frog terrestrial activity in a mesic area of the Santa Cruz Mountains, Bulger *et al.* (2003) categorized terrestrial use as migratory and non-migratory. The latter occurred from one to several days and was associated with precipitation events. Migratory movements were characterized as the movement between aquatic sites and were most often associated with breeding activities. Bulger *et al.* (2003) reported that non-migrating frogs typically stayed within 200 feet of aquatic habitat 90 percent of the time and were most often associated with dense vegetative cover, i.e., California blackberry, poison oak and coyote brush. Dispersing frogs in northern Santa Cruz County traveled distances from 0.25-mile to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003).

In a study of California red-legged frog terrestrial activity in a xeric environment in eastern Contra Costa County, Tatarian (2008) noted that the majority of frogs (57 percent) fitted with radio transmitters in the Round Valley study area stayed at their breeding pools, whereas 43 percent moved into adjacent upland habitat or to other aquatic sites. Her study reported a peak seasonal terrestrial movement occurring in the fall months associated with the first 0.2-inch of precipitation and tapering off into spring. Upland movement activities ranged from 3 to 233 feet, averaging 80 feet, and were associated with a variety of refugia including grass thatch, crevices, cow hoof prints, ground squirrel burrows at the base of trees or rocks, logs, and under man-made structures; others were associated with upland sites lacking refugia (Tatarian 2008). The majority of terrestrial movements lasted from one to four days; however, one adult female was reported to remain in upland habitat for 50 days (Tatarian 2008). Upland refugia closer to aquatic sites were used more often and were more commonly associated with areas exhibiting higher object cover, e.g., woody debris, rocks, and vegetative cover. Subterranean cover was not significantly different between occupied upland habitat and non-occupied upland habitat.

California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Egg masses containing 2,000 to 5,000 eggs are attached to vegetation below the surface and hatch after six to 14 days (Storer 1925, Jennings and Hayes 1994). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings *et al.* 1992). Eggs exposed to salinity levels greater than 4.5 parts per thousand resulted in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3½ to seven months following hatching and reach sexual maturity two to three years of age (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1985, 1990, 1994). Of the various life stages, larvae probably experience the highest mortality rates, with less than one percent of eggs laid reaching metamorphosis (Jennings *et al.* 1992). Under favorable conditions, California red-legged frogs may live eight to ten years (Jennings *et al.* 1992). Populations can fluctuate from year to year; favorable conditions allow the species to have extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of occupied sites. In contrast, the animal may temporarily disappear from an area when conditions are stressful (e.g., during periods of drought, disease, etc.).

The diet of California red-legged frogs is highly variable and changes with the life history stage. The diet of the larvae is not well studied, but is likely similar to that of other ranid frogs, which feed on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005; Kupferberg 1996a, 1996b, 1997). Hayes and Tennant (1985) analyzed the diets of California red-legged frogs from Cañada de la Gaviota in Santa Barbara County during the winter of 1981 and found invertebrates (comprising 42 taxa) to be the most common prey item consumed; however, they speculated that this was opportunistic and varied based on prey availability. They ascertained that larger frogs consumed larger prey and were recorded to have preyed on Pacific chorus frog, three-spined stickleback and, to a limited extent, California mice, which were abundant at the study site (Hayes and Tennant 1985, Fellers 2005). Although larger vertebrate prey was consumed less frequently, it represented over half of the prey mass eaten by larger frogs suggesting that such prey may play an energetically important role in their diets (Hayes and Tennant 1985). Juvenile and subadult/adult frogs varied in their feeding activity periods; juveniles fed for longer periods throughout the day and night, while subadult/adults fed nocturnally (Hayes and Tennant 1985). Juveniles were significantly less successful at capturing prey and all life history stages exhibited poor prey discrimination, feeding on several inanimate objects that moved through their field of view (Hayes and Tennant 1985).

The direction and type of habitat used by dispersing animals is especially important in fragmented environments (Forys and Humphrey 1996). Models of habitat patch geometry predict that individual animals will exit patches at more "permeable" areas (Buechner 1987; Stamps *et al.* 1987). A landscape corridor may increase the patch-edge permeability by extending patch habitat (La Polla and Barrett 1993), and allow individuals to move from one patch to another. The geometric and habitat features that constitute a "corridor" must be determined from the perspective of the animal (Forys and Humphrey 1996).

Because their habitats have been fragmented, many endangered and threatened species exist as metapopulations (Verboom and Apeldom 1990; Verboom *et al.* 1991). A metapopulation is a collection of spatially discrete subpopulations that are connected by the dispersal movements of the individuals (Levins 1970; Hanski 1991). For metapopulations of listed species, a prerequisite to recovery is determining if unoccupied habitat patches are vacant due to the attributes of the habitat patch (food, cover, and patch area) or due to patch context (distance of the patch to other patches and distance of the patch to other features). Subpopulations on patches with higher quality food and cover are more likely to persist because they can support more individuals. Large populations have less of a chance of extinction due to stochastic events (Gilpin and Soule 1986). Similarly, small patches will support fewer individuals, increasing the rate of extinction. Patches that are near occupied patches are more likely to be recolonized when local extinction occurs and may benefit from emigration of individuals via the "rescue" effect (Hanski 1982; Gotelli 1991, Holt 1993; Fahrig and Merriam 1985). For the metapopulation to persist, the rate of patches being colonized must exceed the rate of patches going extinct (Levins 1970). If some subpopulations go extinct regardless of patch context, recovery actions should be placed on patch attributes. Patches could be managed to increase the availability of food and/or cover

Movements and dispersal corridors likely are critical to California red-legged frog population dynamics, particularly because the animals likely currently persist as metapopulations with

disjunct population centers. Movement and dispersal corridors are important for alleviating over-crowding and intraspecific competition, and also they are important for facilitating the recolonization of areas where the animal has been extirpated. Movement between population centers maintains gene flow and reduced genetic isolation. Genetically isolated populations are at greater risk of deleterious genetic effects such as inbreeding, genetic drift, and founder effects. The survival of wildlife species in fragmented habitats may ultimately depend on their ability to move among patches to access necessary resources, retain genetic diversity, and maintain reproductive capacity within populations (Hilty and Merenlender 2004; Petit *et al.* 1995; Buza *et al.* 2000).

Most metapopulation or meta-population-like models of patchy populations do not directly include the effects of dispersal mortality on population dynamics (Hanski 1994; With and Crist 1995; Lindenmayer and Possingham 1996). Based on these models, it has become a widely held notion that more vagile species have a higher tolerance to habitat loss and fragmentation than less vagile species. But models that include dispersal mortality predict exactly the opposite: more vagile species should be more vulnerable to habitat loss and fragmentation because they are more susceptible to dispersal mortality (Fahrig 1998; Casagrandi and Gatto 1999). This prediction is supported by Gibbs (1998), who examined the presence-absence of five amphibian species across a gradient of habitat loss. He found that species with low dispersal rates are better able than more vagile species to persist in landscapes with low habitat cover. Gibbs (1998) postulated that the land between habitats serves as a demographic "drain" for many amphibians. Furthermore, Bonnet *et al.* (1999) found that snake species that frequently make long-distance movements have higher mortality rates than do sedentary species.

Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the California red-legged frog throughout its range. Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish, signal crayfish, and several species of warm water fish including sunfish, goldfish, common carp, and mosquitofish (Moyle 1976; Barry 1992; Hunt 1993; Fisher and Schaffer 1996). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs (*Rana aurora*), and suggested that bullfrogs could prey on subadult California red-legged frogs as well. Bullfrogs may also have a competitive advantage over California red-legged frogs. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Furthermore, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with California red-legged frog reproduction by eating adult male California red-legged frogs. Both California and northern red-legged frogs have been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; Jennings 1993). Thus bullfrogs are able to prey upon and out-compete California red-legged frogs, especially in sub-optimal habitat.

The urbanization of land within and adjacent to California red-legged frog habitat has also affected the threatened amphibian. These declines are attributed to channelization of riparian

areas, enclosure of the channels by urban development that blocks dispersal, and the introduction of predatory fishes and bullfrogs. Diseases may also pose a significant threat, although the specific effects of disease on the California red-legged frog are not known. Pathogens are suspected of causing global amphibian declines (Davidson *et al.* 2003). Chytridiomycosis and ranaviruses are a potential threat because these diseases have been found to adversely affect other amphibians, including the listed species (Davidson *et al.* 2003; Lips *et al.* 2006). Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frogs infected with an iridovirus, which was also presented in sympatric threespine sticklebacks in northwestern California. Non-native species, such as bullfrogs and non-native tiger salamanders that live within the range of the California red-legged frog have been identified as potential carriers of these diseases (Garner *et al.* 2006). Humans can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (i.e., contaminated boots, waders or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in the listed species being more susceptible to the effects of disease.

Negative effects to wildlife populations from roads and pavement may extend some distance from the actual road. The phenomenon can result from vehicle-related mortality, habitat degradation, noise and light pollution, and invasive exotic species. Forman and Deblinger (1998) described the area affected as the "road effect" zone. One study along a four-lane road in Massachusetts determined that this zone extended for an average of 980 feet to either side of the road for an average total zone width of approximately 1,970 feet. However, in some areas they detected an effect greater than 0.6-mile from the road. The road effect zone can also be subtle. Van der Zandt *et al.* (1980) reported that lapwings and black-tailed godwits feeding at 1,575 to 6,560 feet from roads were disturbed by passing vehicles. The heart rate, metabolic rate and energy expenditure of female bighorn sheep increases near roads (MacArthur *et al.* 1979). Trombulak and Frissell (2000) described another type of "road-zone" effect due to contaminants. Heavy metal concentrations from vehicle exhaust were greatest within 66 feet of roads and elevated levels of metals in soil and plants were detected at 660 feet of roads. The "road-zone" varies with habitat type and traffic volume. Based on responses by birds, Forman (2000) estimated the road-zone along primary roads of 1,000 feet in woodlands, 1,197 feet in grasslands, and 2,657 feet in natural lands near urban areas. Along secondary roads with lower traffic volumes, the effect zone was 656 feet. The road-zone with regard to California red-legged frogs has not been adequately investigated.

The necessity of moving between multiple habitats and breeding ponds means that many amphibian species, such as the California red-legged frog are especially vulnerable to roads and well-used large paved areas in the landscape. Amphibians appear especially vulnerable to traffic mortality because they readily attempt to cross roads, are small and slow-moving, and thus are not easily avoided by drivers (Carr and Fahrig 2001). Van Gelder (1973) and Cooke (1995) have examined the effect of roads on amphibians and found that because of their activity patterns, population structure, and preferred habitats, aquatic breeding amphibians are more vulnerable to traffic mortality than some other species. High-volume highways pose a nearly impenetrable barrier to amphibians and result in mortality to individual animals as well as significantly fragmenting habitat. Hels and Buchwald (2001) found that mortality rates for anurans on high traffic roads are higher than on low traffic roads. Vos and Chardon (1998) found a significant negative effect of road density on the occupation probability of ponds by the moor frog (*Rana*

arvalis) in the Netherlands. In addition, incidences of very large numbers of road-killed frogs are well documented (Ashley and Robinson 1996), and studies have shown strong population level effects of traffic density (Carr and Fahrig 2001) and high traffic roads on these amphibians (Van Gelder 1973; Vos and Chardon 1998). Most studies regularly count road mortalities from slow moving vehicles (Hansen 1982; Rosen and Lowe 1994; Drews 1995; Mallick *et al.* 1998) or by foot (Munguira and Thomas 1992). These studies assume that every victim is observed, which may be true for large conspicuous mammals, but may be an incorrect assumption for small animals, such as the California red-legged frog. The carcasses of small soft-bodied amphibians like frogs are quickly decimated under passing tires and are less likely to be detected by researchers and are unlikely to persist for more than a day (Santos *et al.* 2011).

The recovery plan for the California red-legged frog identifies eight recovery units (Service 2002). The establishment of these recovery units is based on the determination that various regional areas of the species' range are essential to its survival and recovery. These recovery units are delineated by major watershed boundaries as defined by USGS hydrologic units and the limits of its range. The goal of the recovery plan is to protect the long-term viability of all extant populations within each recovery unit. Within each recovery unit, core areas have been delineated and represent contiguous areas of moderate to high California red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations. Thus when combined with suitable dispersal habitat, will allow for the long term viability within existing populations. This management strategy will allow for the recolonization of habitats within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of California red-legged frogs.

Environmental Baseline

Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp

The majority of the action area, including the eastern end of the Business Center Drive Extension is located within the Solano-Colusa vernal pool region, which was designated based largely on presence of endemic vernal pool species identified in the Service's *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Recovery Plan) (Service 2005a). The vernal pool fairy shrimp and vernal pool tadpole shrimp have been adversely affected by development and modification of vernal pool and grassland habitat within the Solano-Colusa vernal pool region and are present in much of the undeveloped areas within the region.

Most of the seasonal wetland habitat in Solano County has not been surveyed for listed branchiopods. Of the 23 vernal pool fairy shrimp records in Solano County, the CNDDB includes at least three occurrences within 5 miles of the action area (CDFG 2011a, 2011b). Three of the 30 records for vernal pool tadpole shrimp occur within 5 miles of the action area (CDFG 2011a, 2011b).

Although Caltrans did not perform protocol-level surveys for listed branchiopods, they identified at least 14 seasonal wetland features within 250 feet of the construction footprint that provide habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp. According to Caltrans, half

of these habitat features would be directly affected by the proposed project.

The Service has determined that the vernal pool fairy shrimp and vernal pool tadpole shrimp are likely to occur within the action area due to the presence of appropriate seasonal wetland habitat within the action area such as impervious soils, the seasonal hydroperiod, and topographical features that provide the necessary habitat attributes to support one or all of these species' life history stages. Caltrans identified 14 seasonal wetland features within the action area. Furthermore, wading birds, that visit this and other nearby occupied wetlands, ponds and swales to forage or drink water, act as vectors to transport cysts or adults from one pond to another through their feces or on their feathers or legs. For these reasons, the Service has determined that it is reasonable to conclude that vernal pool fairy shrimp and vernal pool tadpole shrimp to inhabit the identified seasonal wetlands within 250 feet of the construction footprint.

Callippe Silverspot Butterfly

Much of the undeveloped land in Solano County is privately owned and knowledge of the current distribution of callippe silverspot butterfly in the county's remaining areas of potential habitat is limited.

Reported records of the callippe silverspot butterfly in Solano County are located in the hills between Vallejo and Cordelia and northward into Jameson Canyon (SCWA 2009; CDFG 2011a, 2011b). Most of the current knowledge in Solano County is derived from SLT's Swett and King Ranch properties south of I-80 where management activities are being proposed and implemented to enhance callippe silverspot butterfly habitat (SCWA 2009; Service personal communication with SLT 2011).

As defined by the Solano Draft HCP's *Callippe Silverspot Butterfly Conservation Area* the likely distribution of the callippe silverspot butterfly in Solano County extends from Vallejo to at least 4 to 5 miles north of I-80 towards Green Valley and includes the rolling hills south and north of Jameson Canyon Road (SCWA 2009). This conservation area encompasses the proposed project footprint for the Business Center Drive Extension. The 3,300-acre conservation area includes core silverspot habitat and connectivity between these core areas. Approximately 7,870 acres of the conservation area is currently managed as open space by SLT and the Greater Vallejo Recreation District and an additional 660 acres has been preserved as "mitigation lands" (SCWA 2009). These open space lands are subject to varying degrees of public access for the purpose of recreation. Funding for additional surveys, monitoring, management, and enhancement of callippe silverspot butterfly habitat within the conservation area has been limited and inconsistent.

The draft Solano HCP acknowledges that steep slopes are important to the life history of the callippe silverspot butterfly (SCWA 2009). Of the approximately 1,560 acres of callippe silverspot butterfly habitat identified within the urban growth zone in the draft HCP, it was estimated that at least 350 acres of those would be conserved for the species because the slopes were too steep to develop. According to the Solano draft HCP, the cities of Vallejo and Fairfield have adopted restrictions in their general plans that limit development on slopes greater than

30 percent. The analysis in the draft HCP assumes that development would be avoided on all slopes greater than 30 percent and approximately half of those greater than 20 percent.
A key element to callippe silverspot butterfly occupation is the distribution of their larval host plant, Johnny jump-up. This perennial violet is found throughout much of the grassland and oak woodlands of coastal California but little is known about its distribution within Solano County. Silverspot butterflies may rely on Johnny jump-up stands of a few to several acres. The annual densities of this rhizomous herb on the King and Swett Ranches is highly variable (Service personal communication with SLT 2011) which is likely true throughout the *Callippe Silverspot Conservation Area*. In 2004, Monk & Associates (Caltrans 2011) found two previously unrecorded Johnny jump-up stands immediately adjacent to the construction footprint for the proposed Business Center Drive Extension. Caltrans was still able to observe a violet flower in 2011 when they attempted to follow-up on the Monk & Associates 2004 observations. However, the investigation was conducted after the plant's prime blooming period at the King/Swett Ranches reference stands (May 17, 2011 Memo from ICF International to Caltrans). Monk & Associates' 2004 observation confirmed that the larval host plant occurs within the conservation area north of I-80 and there are at least two stands adjacent to the proposed action area. Much of the proposed construction footprint for the Business Center Drive Extension is located on eastern-facing slopes. Johnny jump-ups appear to remain in bloom longer on eastern-facing slopes which likely increase the potential for larvae to mature into adulthood (SCWA 2009).

Adult callippe silverspot butterflies are less limited in their use of nectar plants. They are known to utilize native and exotic flowers depending upon availability. The butterflies show particular preference for California buckeye, coyote wildmint, and various thistles within the King and Swett Ranches (personal communication with SLT, 2011). California buckeye occurs within the various riparian areas north of I-80 and along Jameson Canyon Creek. ICF International reported numerous thistle and other adult silverspot butterfly nectar plants in the proposed Business Center Drive Extension area in May 2011 (May 17, 2011 Memo from ICF International to Caltrans).

The *Callippe Silverspot Butterfly Conservation Area* is characterized by rolling hills associated with silverspot butterfly "hill-topping" breeding behavior. Adult butterflies congregate on ridgelines and hilltops for breeding purposes and adult males will defend territories along these topographical features. The majority of the proposed construction footprint for the Business Center Drive Extension includes these associated topographical features.

Caltrans did not conduct surveys for callippe silverspot butterfly but Monk & Associates identified two *Viola* populations during general biological surveys for a former Business Center Drive Extension alignment. Monk & Associates mapped *Viola* stands approximately 20 feet south and 300 feet north of the construction footprint. Monk & Associates did not indicate how many violets they observed in each population. Caltrans was unable to successfully monitor the *Viola* populations following the 2004 observations. In addition to finding the larval host plant, Caltrans also identified numerous adult nectar plants throughout the area.

The Service believes that the callippe silverspot butterfly is reasonably certain to occur within the action area because: (1) it is located within the species' range; and (2) larval host plants, adult nectar plants, and topographical breeding habitat features are located within and/or adjacent

to the proposed construction footprint.

Valley Elderberry Longhorn Beetle

The action area is located within the current range of the valley elderberry longhorn beetle. There are at least five known occurrences of valley elderberry longhorn beetle within 5 miles of the action area (CDFG 2011a, 2011b). The draft Solano HCP states that any elderberry shrub in Solano County has the potential to support the valley elderberry longhorn beetle even though a specific plant may not show evidence of beetle use (SCWA 2009). Caltrans identified the listed beetle's host plant, the elderberry shrub, in the action area as potential habitat (Caltrans 2011). According to the BA, ten elderberry shrubs will be directly affected by the project and will be removed and transplanted. Caltrans found a potential valley elderberry longhorn beetle exit hole in two of the shrubs with stems 1 inch or greater in diameter at ground level. Therefore, the Service has determined that the valley elderberry longhorn beetle is reasonably certain to occur within the action area because of the biology and ecology of the animal, and the presence of suitable habitat.

California Red-Legged Frog

The entirety of the proposed project is located within the species' range and current distribution. The proposed project cuts through a mosaic of industrial, residential, agricultural, fallow, and open space land uses, representing a range of highly modified and degraded to high quality California red-legged frog habitat. The alignment crosses and is adjacent to several creeks (Jameson Canyon Creek, Dan Wilson Creek, Suisun Creek, Ledgewood Creek, and Green Valley Creek), numerous constructed drainage features, and perennial and seasonal ponds and marshes that provide breeding and non-breeding aquatic habitat for the California red-legged frog. Riparian vegetation along creeks and drainages and landscape vegetation in the action area provide valuable refuge, forage, and dispersal habitat for red-legged frogs. Upland grassland areas with rodent burrows and other cover sites along constructed drainage features, in fallow, and grazed fields also provide refuge, forage, and dispersal habitat for the species.

The western portion of the action area, including the Business Center Drive Extension, is within and bisects Core Area #15 (Jameson Canyon-Lower Napa River) of the California red-legged frog Recovery Unit 3 (North Coast and North San Francisco Bay) (Service 2002). The conservation needs for the Jameson Canyon-Lower Napa River core area are: (1) protecting existing populations from current and future urbanization; (2) create and manage alternative breeding habitats; and (3) protecting dispersal corridors. The Jameson Canyon-Lower Napa River Core Area is described in the recovery plan as an important source population for the species.

The Business Center Drive Extension bisects the southeastern quarter of the SOL-2 California red-legged frog designated critical habitat unit (Jameson Canyon Unit). SOL-2 is considered essential for the California red-legged frog because it provides connectivity from Napa County south to unit SOL-3 (American Canyon Unit) which occupies a wedge of habitat located between Jameson Canyon Road and Interstate 80. Critical habitat unit SOL-1 (the Sky Valley Unit) is the southernmost unit in Solano County and extends south to Suisun Bay. The connectivity function

of the three Solano County units is dependent upon maintaining red-legged frog passage across I-80 and Jameson Canyon Road (SR 12W). The construction footprint also enters the eastern corner of SOL-3 at the proposed intersection of the Business Center Drive/Redtop Road and I-80.

The *California Red-Legged Frog Conservation Strategy* in the draft Solano HCP represents the most complete regional scientific data and analysis for the California red-legged frog in Solano County (SCWA 2009). The western portion of the construction footprint, beginning at the SR 12W/I-80 intersection, is located within the *California Red-Legged Frog Conservation Area* defined in the draft HCP According to the draft HCP analysis, the existing Jameson Canyon Road and Interstate 80 create barriers between the SOL-1, -2, and -3 critical habitat units and "severely restrict or eliminate the natural dispersal and migratory movements of individuals between these three blocks of habitat, reducing the resiliency of populations and limiting genetic diversity." One of the objectives of the draft HCP is to conserve 20 percent of the historic range of the California red-legged frog within Solano County which amounts to approximately 99 percent of the Jameson Canyon-Lower Napa River core recovery area.

Relatively little is known about the California red-legged frog population in Solano County. Much of the red-leg frog habitat in Solano County occurs on private land and has not been subject to protocol-level or other surveys. As directed by the draft Solano HCP, regional surveys will be conducted for California red-legged frogs within the Jameson Canyon-Lower Napa River Core Recovery Area within two years of adopting the final HCP and will continue every five years for the life of the HCP (SCWA 2009). The first California red-legged frog CNDDB record for Solano County was not recorded until 1993 (SCWA 2009). There are only two reported observations of the species in the SOL-2 critical habitat unit and both records are the result of surveys conducted by Monk & Associates for the former alignment of the Business Center Drive Extension (Caltrans 2011). The records are located between the proposed Business Center Drive Extension and I-80. One record includes adult and juvenile red-legged frogs found approximately 400 feet from the construction footprint in a plunge pool of an ephemeral drainage. The second record includes adult frogs and tadpoles in Mangle's Pond, approximately 300 feet north of the construction footprint and south of the Business Center Drive Extension. The CNDDB record identified red-legged frog breeding on the Mangels' Property. The Mangels' pond is likely the primary breeding pond within the SOL-2 California red-legged frog critical habitat unit. There are at least 13 other California red-legged frog occurrences reported to the CNDDB within 1 to 5 miles from the construction footprint (CDFG 2011a, 2011b).

Caltrans did not conduct standardized or protocol-level frog or other wildlife surveys in the action area or a wildlife movement analysis to support their baseline analysis for the project. Due to limited access, Caltrans and the Service used aerial photography and field observations from available access locations to independently assess habitat throughout the action area vicinity.

In addition to the Mangels' Pond, Caltrans determined that the marsh immediately south of the Mangels' Pond is potential red-legged frog breeding habitat. The southern edge of this marsh is within the construction footprint for work occurring at the SR 12W/I-80 interchange. Caltrans also identified a marsh immediately north of Green Valley Creek and I-80 as potential breeding

habitat.

There are numerous barriers and impediments to California red-legged frog movement in the action area vicinity. Existing roads, business, and other development fragments the landscape and prevent or encumber access between aquatic and upland habitat for foraging, movement, dispersal, refuge, and breeding. SR 12, I-80, I-680, and surrounding surface streets do not include barriers to exclude red-legged frogs from the roadway or direct them towards safe undercrossings. Frogs that attempt to cross these roads risk mortality due to vehicle collision and exposure.

The land west of I-80, north and south of SR 12W is primarily open grassland for grazing, with interspersed ranches and vineyards. This area is characterized by large expanses of rolling hills with ephemeral drainages, riparian corridors, stock ponds, and agricultural basins. Critical habitat units SOL-2 and SOL-3 are found within these contiguous blocks of habitat.

The Service believes that the California red-legged frog is reasonably certain to occur within the action area because: (1) it is located within the species' range and current distribution; (2) suitable aquatic, riparian, and upland California red-legged frog habitat intersect the action area in multiple locations; (3) the construction footprint is immediately adjacent to recent California red-legged frog observations; (4) the project is within the California Red-Legged Frog Conservation Area identified in the draft Solano HCP (SCWA 2009); (5) the project will construct a linear barrier between a recorded breeding pond and adjacent upland habitat; (6) all the elements needed to support the species' life history are located within the construction footprint; and (6) the biology and ecology of the animal, especially the ability of adults to move considerable distances.

Critical Habitat Status and Baseline

Critical habitat is defined in Section 3 of the Act as: (1) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation and that may require special management considerations or protection (50 CFR 424.12(b)). The Service is required to list the known Primary Constituent Elements (PCE's) together with the critical habitat description. Such physical and biological features include, but are not limited to, the following:

1 Space for individual and population growth, and for normal behavior;

2. Food, water, air, light, minerals, or other nutritional or physiological requirements;

3. Cover or shelter;

4. Sites for breeding, reproduction, rearing of offspring, or dispersal; and

5. Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

Contra Costa Goldfields Critical Habitat

The Service designated 14,730 acres of critical habitat for Contra Costa goldfields in 2005 (Service 2005b). In determining which areas to designate as critical habitat, the Service considers those physical and biological features (PCEs) that are essential to the conservation of the species, and that may require special management considerations and protections (50 CFR §424.14).

Critical habitat PCEs for goldfields are the habitat components that provide:

1. Topographic features characterized by isolated mound and intermound complex within a matrix of surrounding uplands that result in continuously, or intermittently, flowing surface water in the depressional features including swales connecting the pools, providing for dispersal and promoting hydroperiods of adequate length in the pools; and

2. Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water or whose soils are saturated for a period long enough to promote germination, flowering, and seed production of predominantly annual native wetland species and typically exclude both native and non-native upland plant species in all but the driest years. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands

The proposed project includes direct effects to 3.83 acres of Contra Costa goldfields critical habitat Unit 5B. This unit encompasses 736.72 acres and is essential to the conservation of the species because it is needed to maintain the current geographic and ecological distribution of the species. The project area lies along the northern boundary of Unit 5B whose boundary is defined by SR 12E. The action area parallels the existing SR 12E and the intrusion into Unit 5B is primarily limited to the existing SR 12E road embankment sloping down to the Gentry Suisun wetland.

California Red-Legged Frog Critical Habitat

The Service designated critical habitat for the California red-legged frog on April 13, 2006 (71 FR 19244) (Service 2006a) and a revised designation to the critical habitat was published on March 17, 2010 (75 FR 12816) (Service 2010).

The PCE's defined for the California red-legged frog provide aquatic habitat for breeding and non-breeding activities and upland habitat for shelter, foraging, predator avoidance, and dispersal across its range. The PCE's and, therefore, the resulting physical and biological features essential for the conservation of the species were determined from studies of California red-

legged frog ecology. Based on the above needs and our current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, the Service determined that the PCE's essential to the conservation of the California red-legged frog are:

1. Aquatic Breeding Habitat. Standing bodies of fresh water (with salinities less than 7.0 parts per thousand), including: natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years.

2. Non-Breeding Aquatic Habitat. Freshwater and wetted riparian habitats, as described above, that may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs. Other wetland habitats that would be considered to meet these elements include, but are not limited to: plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period.

3. Upland Habitat. Upland areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile in most cases and comprised of various vegetational series such as grasslands, woodlands, wetland, or riparian plant species that provide the frog shelter, forage, and predator avoidance. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the wetland or riparian habitat. These upland features contribute to the filling and drying of the wetland or riparian habitat and are responsible for maintaining suitable periods of pool inundation for larval frogs and their food sources, and provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), as well as small mammal burrows and moist leaf litter.

4. Dispersal Habitat. Accessible upland or riparian dispersal habitat within designated units and between occupied locations within a minimum of 1 mile of each other that allow for movement between such sites. Dispersal habitat includes various natural habitats and altered habitats such as agricultural fields, which do not contain barriers (e.g., heavily traveled road without bridges or culverts) to dispersal. Dispersal habitat does not include moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete, nor does it include large reservoirs over 50 acres in size, or other areas that do not contain those features identified by PCE's 1, 2, or 3 as essential to the conservation of the subspecies.

With the revised designation of critical habitat, the Service intends to conserve the geographic areas containing the physical and biological features that are essential to the conservation of the species, through the identification of the appropriate quantity and spatial arrangement of the

PCE's sufficient to support the life-history functions of the species. Because not all life-history functions require all the PCE's, not all areas designated as critical habitat will contain all the PCE's. Refer to the final designation of critical habitat for California red-legged frog for additional information (75 FR 12816).

The action area is within critical habitat units SOL-2 and SOL-3. The proposed action will directly affect 12.75 acres of SOL-2 and 0.46 acre of SOL-3.

SOL-2 comprises approximately 3,360 acres in southwestern Solano County and a portion of extreme southeastern Napa County, south of I-80 and west of I-680. SOL-2 is essential for the conservation of the species because it provides connectivity to adjacent units to the south in the interior Coast Range north of the Suisun Bay and is expected to prevent further fragmentation of habitat in this portion of the species' range. The unit contains high-quality permanent and ephemeral aquatic habitats (PCE 1 and PCE 2) consisting of stream and plunge pools as well as large freshwater marsh surrounded by open grassland, willow, and oak that provide for breeding, and upland areas (PCE 3 and PCE 4) for dispersal, shelter, and foraging. The unit consists entirely of private land.

The physical and biological features essential to the conservation of California red-legged frog in the SOL-2 unit may require special management considerations or protection due to nonnative animal species, over grazing of habitat, urbanization, habitat alteration from invasive plant species, and recreational use which may alter aquatic or upland habitats and thereby result in the direct or indirect loss of egg masses or adults due to habitat modification and predation.

SOL-3 comprises approximately 4,597 acres in southwestern Solano County and a portion of extreme southeastern Napa County, north of I-80 and south of SR 12W The unit contains high-quality permanent and ephemeral aquatic habitats (PCE 1 and PCE 2), consisting of pools, stream, and spring habitat surrounded by riparian tree species and annual grasslands that provide for breeding, and upland areas for dispersal, shelter, and foraging (PCE 3 and PCE 4). The designation of this unit was expected to prevent further fragmentation of habitat in this portion of the species' range and provides connectivity to other units farther north and south in the interior Coast Range north of the Suisun Bay. The unit consists of 1,087 acres of local nonprofit ownership and 3,510 acres of private land.

The physical and biological features essential to the conservation of California red-legged frog in the SOL-3 unit may require special management considerations or protection due to overgrazing of aquatic and riparian habitats, and loss and alteration of habitat due to urbanization, which may alter or eliminate aquatic or upland habitats and thereby result in the direct or indirect loss of egg masses or adults.

Effects of the Proposed Action

The DEIR/EIS (Caltrans 2010) notes that a HCP has been prepared for Solano County. The draft Solano HCP is based on a conservation strategy that has been developed for a number of species, including the vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, callippe silverspot butterfly, the Central Valley Distinct Population Segment of the

California tiger salamander, and California red-legged frog (SCWA 2009). The participants in this strategy include the cities of Vallejo, Fairfield, Suisun City, and the County of Solano. The goal of the conservation strategy is to establish a framework for complying with the Federal and State endangered species acts while accommodating future urban growth, development of infrastructure, and on-going operations and maintenance activities associated with flood control, irrigation facilities, and other public infrastructure undertaken under the permitting authority of the strategy participants within Solano County over the next 30 years. The amount and type of loss and destruction of habitat and the concomitant effects on the covered species is based on a comprehensive analysis of the biology and ecology of the taxa, amount and location of habitat types, and mitigation measures that are necessary to mitigate the adverse effects. The implementation of large scale projects that are not consistent with the strategy, specifically the type, amount, location and in-perpetuity management of appropriate habitat, likely will compromise the ability of the strategy to meet the conservation requirements of the species.

Vernal Pool Fairy Shrimp/ Vernal Pool Tadpole Shrimp

According to Caltrans, construction of the proposed project will result in the loss of 1.45 acres - acre of seasonal wetland habitat suitable for vernal pool fairy shrimp and vernal pool tadpole shrimp (Caltrans 2010). All vernal pool crustaceans occupying the 1.45 acres will be killed due to earth-moving activities and permanent filling of seasonal wetland habitat.

Indirect effects to 0.26 acre of vernal pool crustacean habitat will likely result from changes in hydrology or degradation of water quality resulting from upstream construction activities. The biota of vernal pools and swales can change when the hydrologic regime is altered and small changes can have deleterious effects on entire populations of vernal pool crustaceans (Bauder 1986, 1987). Survival of aquatic organisms like vernal pool fairy shrimp and vernal pool tadpole shrimp is directly linked to the water regime of their habitat (Zedler 1987). Although vernal pool hydrology is driven by the input of precipitation, water input to vernal pool basins also occurs from surface and subsurface flow from the swale and upland portions of the complex (Zedler 1987, Hanes *et al.* 1990, Hanes and Stromberg 1998). Surface flow through the swale portion of the complex allows vernal pool species to move directly from one vernal pool to another. Upland areas are a critical component of vernal pool hydrology because they directly influence the rate of vernal pool filling, the length of the inundation period, and the rate of vernal pool drying (Zedler 1987; Hanes and Stromberg 1998).

The timing, frequency, and duration of inundation are critical to the survival of vernal pool species. Alterations of the hydrology can be particularly harmful to vernal pool crustaceans due to premature pool dry-down before the life cycles of the species are completed, preventing reproduction and disrupting gene flow. Also longer periods of inundation and/or changes in water depth could effectively change seasonal wetland functions (*e.g.*, change from vernal pool to perennial/permanent wetlands). Therefore, construction activities within vernal pool areas will result in the decline of vernal pool crustaceans, including these two listed species.

Caltrans proposes to install and properly maintain erosion control (including dust control) and water quality protection measures that will minimize downstream effects on seasonal wetlands and listed branchiopods that occupy them.

The proposed landscape and habitat restoration is important in minimizing the indirect effects to seasonal wetland habitat and the surrounding uplands. However, restoration of hydrological conditions linked to vernal pools may be difficult if not impossible to achieve in areas such as the proposed Business Center Drive Extension where a dramatic cut will be made through the rolling topography in order to achieve an acceptable road grade. Removal of topographical features will also remove watershed and other functions that influence the inundation and character of the seasonal wetlands within at least 250 feet of the construction footprint.

Caltrans proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation of 1 71 acres and restoration of 1.45 acres of vernal pool fairy shrimp and vernal pool tadpole shrimp habitat in Solano County will likely offset the adverse effects of the project and provide a benefit for the species.

Conservation measures proposed along SR 12E, including the work window, retaining wall, erosion control and stormwater protection, off-limits fencing, and biological monitoring are likely to be effective in minimizing adverse effects to listed branchiopod habitat in the Gentry Suisun wetlands.

Callippe Silverspot Butterfly

The proposed project will result in the permanent loss of 38.82 acres of callippe silverspot butterfly habitat due to construction of the Business Center Drive Extension from approximately 500 feet west of the existing western terminus of Business Center Drive to the existing Red Top Road/1-80 Intersection as callippe silverspot habitat. Establishment of this new road will require extensive grading and recontouring of rolling grasslands that provide topographical features important for callippe silverspot butterfly hill-topping breeding behavior, foraging, and possible larval development. Construction of the road will result in replacement of butterfly habitat with hardscape and maintained ROW that will likely be inhospitable for the listed butterfly. In addition to the harm and harassment associated with the destruction of callippe silverspot butterfly habitat, the project is also likely to result in effects associated with habitat fragmentation.

Construction of the Business Center Drive Extension will also result in the temporary loss of 19.32 acres of callippe silverspot butterfly habitat. This habitat will be temporarily lost due to construction access, staging, and recontouring for borrow material. Successful restoration of temporarily disturbed areas with a grassland seed mix that includes callippe silverspot butterfly nectar plants is likely to limit the habitat loss to less than one year following the initial ground disturbance.

The construction of Business Center Drive Extension will result in the loss of hilltops and ridgelines likely utilized by the callippe silverspot butterfly for reproduction. The adults of this animal frequently engage in hilltopping (Murphy and Weiss undated; Shields 1967; Thomas Reid Associates 1982), which is the behavior where adults congregate on hilltops for the purpose of locating mates. Males are more likely than females to spend time on hilltops. In a study at San Bruno Mountain in San Mateo County, 62 percent of male callippe silverspot butterflies were caught on hilltops, while only 48 percent of females were caught on hilltops (Thomas Reid

Associates 1982). After mating, females spend less time hilltopping, and more time searching for oviposition sites and nectar sources. Males tended to utilize hilltops throughout their lifespans (Thomas Reid Associates 1982). Males actively patrol hilltops and ridgelines searching for females. Females are mated almost immediately upon emergence from pupae, because males emerge first and doggedly pursue females (Mattoon et al. 1971).

Hilltops and ridgelines play an important role in callippe silverspot butterfly breeding behavior. The importance of hilltops may vary with population density; at high population levels, males may patrol below hilltops, and congregate on them during periods of low population levels (Shields 1967; Baughman et al. 1988). Hilltops and ridge lines should be considered integral components of callippe silverspot butterfly habitat. Losing hilltops from habitat areas likely decreases mate location and genetic mixing over the long-term.

The callippe silverspot butterfly conservation strategy in the draft Solano HCP did not consider the adverse impacts associated with activities such as the proposed 1.3-mile Business Center Drive Extension from the western terminus of Business Center Drive to I-80. Construction of this road extension will involve the removal of topographical features with slopes greater than 20 or 30 percent. These slopes were identified in the draft Solano HCP as important butterfly hilltop habitat that would be conserved for the species. Based on topographical maps it appears that the majority of the 58.14 acres of callippe silverspot habitat that will be directly affected by the project is characterized by slopes that could be used by the callippe silverspot butterfly for breeding purposes.

Clearing and grading may result in temporary adverse effects to some or all the life history stages through crushing or burial during larval diapauses as this process often occurs in leaf litter at the base of the plant. The caterpillars are small and difficult to find. This inability to detect caterpillars prevents any form of site survey or capture and hold of caterpillars during construction.

Use of heavy earthmoving equipment and other ground-disturbing activity resulting in habitat destruction, dust, and prolonged disturbance will likely cause adult butterflies both in and near the construction footprint to flee the area, especially during the approximate mid-May to mid-July flight season for adult butterflies. These disturbances could disrupt essential behaviors such as reproduction and foraging which could lead to adverse effects such as decreased reproductive success due to moving to less suitable areas or increased difficulty in locating a mate.

Adult callippe silverspot butterflies are strong fliers. After road construction is complete, butterflies would likely avoid collision with vehicles by flying over road cuts for the Business Center Drive Extension. However, they would be susceptible to harm and mortality when crossing in areas where habitat on either side of the new road is at or near grade with the road. Road mortality can result in significant reliable loss of adult butterflies over time.

Construction and grading activities may produce dust which can interfere with the respiration and foraging of active adults. Insects breathe via spiracles and inhalation of small particles, such as dust, could prevent their respiration and result in their asphyxiation. Ehrlich (1984) speculated that the decline of the common alpine butterfly in the upper East River drainage of

Gunnison County. Colorado, was the result of an increase in dust from increased vehicular traffic.
Viola populations have been recorded adjacent to the construction footprint but the extent of the populations is not well known. There have been no additional larval host plant surveys since the reconnaissance-level surveys conducted in 2003 and 2004. The food plants of the callippe silverspot butterfly adult nectar plants could be eliminated by construction. Destruction of larval host and larval and adult nectar plants would result in a decrease in the amount of habitat available for reproduction and development of immature butterflies.

Successful propagation and establishment of *Viola* has not been successful to date. Therefore loss of larval host plants cannot be minimized through restoration alone. Successful establishment of adult food plants is feasible and will be an integral part of Caltrans' restoration plan.

Another potential effect of the proposed project on the listed butterfly is the elimination of their habitat due to non-native vegetation invading areas where restoration has not been implemented or is inadequate. Soil disturbance, such as that associated with project associated activities, facilitates the invasion of areas by non-native species. Increased human activity introduces new non-native species. These plants could eventually displace or otherwise out-compete the plants which are depended upon by the callippe silverspot butterfly.

The Business Center Drive Extension construction footprint is immediately adjacent to two previously identified *Viola* populations. The proximity of construction activities may deter livestock grazing in these locations and temporary and permanent road ROW fencing will exclude livestock from accessing these areas. The removal of livestock grazing pressure from patches of vegetation supporting *Viola* could result in a reduction in the abundance and distribution of this plant. This in turn could result in a reduction in available habitat for the early stages of callippe silverspot butterfly.

Caltrans' proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation or restoration of 126.12 estimated acres of callippe silverspot butterfly habitat in Solano County. This will likely offset the adverse effects of the project and provide a benefit for the species. This habitat will be permanently protected and a management plan will be implemented which will aid the species.

Valley Elderberry Longhorn Beetle

The proposed project will directly affect ten elderberry shrubs that are suitable habitat for the valley elderberry longhorn beetle within the proposed project area. Transplantation of the elderberry shrubs may cause them to die, experience stress, or become unhealthy due to changes in soil, hydrology, microclimate, or associated vegetation. This may reduce their quality as habitat for the valley elderberry longhorn beetle, or impair their production of habitat-quality stems in the future. Branches containing larvae may be cut, broken, or crushed as a result of the transplantation process. The actions described in the *Conservation Measure 23* will reduce, but not eliminate, the potential for these effects. Additionally, the proposed project will ultimately increase the value of the valley elderberry longhorn beetle habitat in the area chosen for

transplantation.
California Red-Legged Frog

The proposed project will likely adversely affect the threatened California red-legged frog during the construction and operational phases of the project. According to Caltrans, the proposed project will result in the permanent loss of 78.48 acres and the temporary loss of 19.32 acres of California red-legged frog habitat that is used by all life stages for breeding, feeding, sheltering, and dispersal. In addition to the harm and harassment associated with the destruction of California red-legged habitat (described further below), the project is also likely to result in effects associated with habitat fragmentation.

Caltrans proposes to minimize construction related effects by implementing the *Conservation Measures* and design features (undercrossings and directional fencing along the proposed Business Center Drive Extension) included in the project description section of this biological opinion. However, in spite of these measures the project has the potential to result in a variety of adverse effects that would result in take of the California red-legged frog.

Construction could result in the killing, harming and/or harassment of juveniles and adults inhabiting areas of suitable aquatic and upland habitat. The project as proposed by Caltrans in the project description of this biological opinion would result in the loss of approximately 97.8 acres of California red-legged frog habitat. The Service has determined that the permanent and temporary loss and/or degradation of California red-legged frog habitat will result in the take of all frogs within these areas as a direct result of habitat loss.

During the construction phase, permanent and temporal loss of aquatic and upland habitat will result from the removal and/or disturbance of soil and vegetation. Construction noise, vibration, lighting used for possible night work, and increased human activity during construction may interfere with normal behaviors such as feeding, sheltering, movement between refugia and foraging grounds, and other frog essential behaviors. This can result in avoidance of areas that have suitable habitat but intolerable levels of disturbance.

Unless identified by the biological monitor or site personnel, and rescued by the biological monitor, individual California red-legged frogs exposed during excavations likely will be crushed and killed or injured by construction-related activities. Even with biological monitoring, overall awareness, and proper escape ramps, California red-legged frogs could fall into the trenches, pits, or other excavations, and then risk being directly killed or be unable to escape and be killed due to desiccation, entombment, or starvation.

Red-legged frogs can be expected to fall or willingly enter into excavations created as a result of the project. Juvenile and adult frogs may have difficulty escaping pits. Entrapment may cause frogs to be more susceptible to predation and desiccation due to exposure. Frogs may take refuge in excavations, increasing their likelihood of being crushed, entombed, or otherwise injured. Such excavations are not part of the baseline environmental conditions and therefore Caltrans would have created a feature that could lead to harm and possible frog mortality.

Proper trash disposal is often difficult to enforce on a large construction site and is a common

non-compliance issue. Improperly disposed edible trash could attract predators, such as raccoons, crows, and ravens, to the sites, which could subsequently prey on the listed amphibian. Caltrans commitment to not use erosion control devices with mono-filament should be effective in avoiding the associated risk of entanglement that can result in death by predation, starvation, or desiccation (Stuart *et al.* 2001).

Caltrans proposes to limit initial ground-disturbing activities in California red-legged frog habitat (Caltrans 2011) between April 1 and November 1, when feasible. This measure would primarily avoid the wettest time of year and the onset of the breeding season when frogs are more likely to be involved in upland dispersal. When the work window is not feasible, biological monitoring will be performed when activities occur between November 1 and March 31 Frogs are more likely to move at night and more likely to be taking cover during the day. California red-legged frogs are cryptic and can be difficult for even experienced biological monitors to find. Monitoring will be occurring during the day when most frogs will be taking cover, making them even more difficult to find. Frogs that have moved into work areas at night and taken cover are unlikely to be found by biological monitors and will most likely be killed or harmed by activities. Frogs that are found, captured, and moved will be subjected to displacement and harassment that may lead to death or injury. Therefore allowing ground-disturbing activities with the implementation of biological monitoring during the wet and cool season (November 1 to March 31) likely will result in increased take relative to limiting ground-disturbing activities to the dry season.

Caltrans states they will attempt to minimize adverse effects by locating construction staging, storage and parking areas outside of California red-legged frog habitat; clearly marking construction work boundaries with high-visibility fencing, conducting preconstruction surveys and biological monitoring, and revegetating temporarily disturbed areas. The effects of construction activities and the removal of habitat will be partially minimized by installing wildlife exclusion fencing to deter frogs from wandering onto construction sites; educating workers; and requiring a Service-approved biologist to be present to monitor construction activities.

If unrestricted, the proposed construction activities could result in the introduction of chemical contaminants to frog habitat. Exposure pathways could include inhalation, dermal contact, direct ingestion, or secondary ingestion of contaminated soil, plants or prey species. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. However, Caltrans proposes to minimize these risks by implementing erosion control, stormwater control, and spill prevention plans to minimize the potential degradation of aquatic and upland habitat that could lead to mortality and harm of California red-legged frogs. If unrestricted, biologists and construction workers traveling to the action area from other project sites may transmit diseases by introducing contaminated equipment. The chance of a disease being introduced into a new area is greater today than in the past due to the increasing occurrences of disease throughout amphibian populations in California and the United States. It is possible that chytridiomycosis, caused by chytrid fungus, may exacerbate the effects of other diseases on amphibians or increase the sensitivity of the amphibian to environmental changes (e.g., water pH) that reduce normal immune response capabilities (Bosch *et al.* 2001, Weldon *et al.* 2004).

Preconstruction surveys and the relocation of individual California red-legged frogs may avoid injury or mortality; however, capturing and handling frogs may result in stress and/or inadvertent injury during handling, containment, and transport. Caltrans proposes to minimize these effects by using Service-approved biologists and relocating amphibians to suitable nearby habitat.

The Business Center Drive Extension will likely result in significant fragmentation of the landscape and ecosystem functions. Bridge work within the aquatic and riparian California red-legged frog habitat associated with Jameson Canyon Creek, Ledgewood Creek, and Green Valley Creek will include earth-moving, vegetation clearing, habitat loss, general disturbance, and temporary creek diversions. These activities have the potential to harm and harass frogs that use these areas for year-round refuge, dispersal, and foraging.

The majority of the approximately 1.3-mile road segment from Business Center Drive to SR 12W and then south to I-80 will be bordered by road cuts which limit the potential for wildlife movement or incorporating safe wildlife passage across the road. In conjunction with directional fencing, the three undercrossing will likely provide safe crossing for most wildlife, including the California red-legged frog; however, connectivity will be greatly reduced compared to existing conditions and we anticipate that fewer frogs will successfully find and successfully navigate the new undercrossings.

Of primary concern, the Business Center Drive Extension will limit movement to and from the Mangels' pond which is likely the primary population source for the western portion of the SOL-2 critical habitat unit. Isolation of this breeding pond from the remainder of the surrounding habitat will reduce the size and distribution of California red-legged frogs in the SOL-2 unit by severing or limiting connectivity of what is now largely contiguous habitat north and south of the proposed Business Center Drive Extension. With the addition of the three proposed undercrossings and directional fencing, frogs and other wildlife will be limited to 35 feet of crossing opportunities along the 0.79-mile Business Center Drive Extension from the western terminus of the existing Business Center Drive and Jameson Canyon Road (SR 12W). Construction of this barrier will reduce dispersal to 0.8 percent of the original topography that was available for movement. This adverse effect could be partially minimized if one or more breeding ponds would be constructed north of the Business Center Drive Extension.

The Business Center Drive Extension is within the City of Fairfield's urban growth boundary and establishment of the road will enable access for future industrial, residential, and recreational development within California red-legged frog habitat. This development is likely to result in additional habitat fragmentation, degradation, and loss. Caltrans has not proposed any measures to minimize this take from increased development due to this road extension.

The development associated with the proposed Business Center Drive Extension will further reduce available foraging and dispersal habitat for California red-legged frogs that breed in Mangels' pond and disperse widely to the north and west. This development, when combined with reduced connectivity of habitat caused by construction of the road extension itself, is likely to significantly reduce the size and distribution of frogs that occupy the area from Mangels' pond northward into Napa County as animals will become less successful at reaching Mangels' pond

to breed and disperse north as juveniles and lose the ability to live in the area south of the road extension as habitat is lost to development. The keys to minimizing these effects include:

1 Easements south of the proposed Business Center Drive Extension that connect Mangels' pond and the Business Center Drive Extension underpasses, and

2. Easements north of the Business Center Drive Extension.

The proposed project further precludes a key conservation need for the Jameson Canyon Lower Napa River Core Recovery Area, which is to protect the dispersal corridors between Jameson Canyon Creek and surrounding upland and breeding habitat. Planned infrastructure changes to SR 12W are likely to exacerbate the barrier effects as the roadway is widened and median barriers are installed.

Caltrans proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation of 245.1 acres of California red-legged frog habitat in Solano County will likely offset the adverse effects of the project and provide a benefit for the species. This habitat will be permanently protected and a management plan will be implemented which will aid the species.

Contra Costa Goldfields Critical Habitat

The proposed action is not expected to appreciably diminish the conservation and recovery value of critical habitat for Contra Costa goldfields. The proposed project will result in the loss of 3.83 acres (1.31 permanent + 2.52 temporary) of the 736.72-acre critical habitat unit 5B. The permanent loss is approximately 0.2 percent of the total unit. The effects will be limited to the northern edge of the unit and will occur on the existing raised SR 12E roadbed and parallel to the bottom of the slope. The completed project will not expand southward into Gentry Suisun wetland and has been designed to sustain existing hydrology. The project will avoid adverse effects to topographical features that influence the hydrology (PCE 1) and will not result in the modification of depressional features (PCE 2) within Contra Costa goldfields habitat

California Red-Legged Frog Critical Habitat

The proposed action is expected to diminish the value of the SOL-2 critical habitat in its intended function for the conservation and recovery of the California red-legged frog. The proposed project will result in the direct loss of 12.75 acres (8.30 permanent + 4.45 temporary) of the 3,360-acre unit.

The proposed project will result in the isolation of the only verified California red-legged frog breeding habitat (Mangels' Pond) in the SOL-2 unit. Mangels' Pond is also the largest pond in the unit. The Business Center Drive Extension will include three undercrossings and fencing intended to exclude frogs from the roadway and direct them towards the undercrossings. Movement, including juvenile dispersal from breeding habitat and adult movement to and from breeding habitat will be substantially limited due to a 99.2 percent reduction in the available north-south dispersal corridor.

Establishing the new road is also likely to be growth inducing, allowing access for development that will further constrict, degrade, and eliminate upland habitat adjacent to Mangels' Pond and the road undercrossings. Therefore, the proposed project has the potential to completely isolate what is likely a population source breeding pond from the remainder of SOL-2.

The Business Center Drive Extension along with the road widening and vertical barrier construction on SR 12W will severely limit connectivity that now exists between SOL-2 and SOL-3.
Therefore, the proposed project is likely to negatively modify the function of the SOL-2 unit by limiting or eliminating access to a primary breeding pond (PCE 1) and by severely limiting dispersal within the SOL-2 unit and between SOL-2 and SOL-3 (PCE 4). Caltrans' *Proposed Conservation Measures* are unlikely to sufficiently avoid adverse modification of these PCEs because the project includes limited features and the project creates limited potential for maintaining connectivity.

For purposes of the adverse modification determination, the effects on California red-legged frog critical habitat is evaluated in the context of the range-wide condition of the critical habitat at the provincial and range-wide scales. Although the proposed project is likely to significantly impair the habitat function and recovery value of the SOL-2 and SOL-3 units, it is unlikely to adversely modify the range-wide recovery role and functions of overall California red-legged frog critical habitat designation.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Although not a covered activity, the proposed project area is included in the zone of covered activities for the draft Solano HCP. The Fairfield General Plan designates much of this area for planned development. Adverse effects to showy Indian clover, Contra Costa goldfields and its critical habitat, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, Central California Distinct Population Segment of the California tiger salamander, and California red-legged frog and its critical habitat including habitat loss and further fragmentation in this area due to non-Federal actions would result in cumulative effects to listed species and their critical habitat. Realignment of the interchanges, particularly extension of Business Center Drive is likely to enhance urban growth potential.

Conclusion

After reviewing the current status of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog, the environmental baseline for the action area; the effects of the proposed I-80/I-680/SR 12 Interchange Phase 1 Project and the cumulative effects; it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of these listed species.

However, the proposed project likely will result in significant negative effects to critical habitat unit SOL-2 of the California red-legged frog. We based these determinations on the following: (1) pre-construction surveys will be conducted for listed species; (2) a Service-approved biologist will monitor all activities for compliance with this biological opinion; (3) effects to the valley elderberry beetle will be addressed by implementing programmatic conservation measures, including transplantation of elderberry shrubs; (4) directional fencing along and undercrossings across Business Center Drive will avoid complete isolation of a California red-legged frog breeding pond; (5) California red-legged frogs found in the project work area will be relocated to nearby suitable habitat; (6) habitat loss will be compensated with in-perpetuity preservation of vernal pool tadpole shrimp, vernal pool fairy shrimp, and California red-legged frog habitat; (7) callippe silverspot butterfly habitat loss will be compensated with in-perpetuity preservation of callippe silverspot butterfly habitat and/or enhancement of occupied habitat; and (8) other conservation measures, as described in the *Proposed Conservation Measures* of this biological opinion, that will be fully implemented by Caltrans.

The Service has also determined that the proposed action is not likely to result in the destruction or adverse modification of critical habitat for the Contra Costa goldfields due to limiting permanent effects to the existing road embankment.

The proposed action is not likely to result in the destruction or adverse modification of critical habitat for the California red-legged frog because although it will significantly reduce access to the only known breeding pond in this critical habitat unit, the effects likely will diminish the recovery, but not the survival value, of critical habitat units SOL-2 and SOL-3.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, movement, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including movement, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by Caltrans so that they become binding conditions of any grant or permit issued to Caltrans as appropriate, in order for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this Incidental Take Statement. If Caltrans: (1) fails to adhere to the

terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document; and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

Vernal Pool Fairy Shrimp/Vernal Pool Tadpole Shrimp

The Service expects that incidental take of vernal pool fairy shrimp and vernal pool tadpole shrimp may occur during this action. The extent of the take will be difficult to detect or quantify because of the ecology and biology of these species. Additionally, their size and cryptic nature makes the finding of a dead specimen unlikely. Seasonal population fluctuations also may mask the ability to determine the exact extent of take. Due to the difficulty in quantifying the number of vernal pool crustaceans that will be taken as a result of the proposed action, the Service is quantifying take incidental to the proposed project as the number of acres of seasonal wetlands (vernal pool crustacean habitat), that will become unsuitable for vernal pool crustaceans due to direct effects as a result of the action. Therefore, the Service estimates that the proposed action will result in the direct take of all vernal pool crustaceans inhabiting 1.45 acres of vernal pool habitat. Anticipated take is expected to be in the form of harm and mortality from habitat loss and modification, construction related disturbance, and reduced fitness.

Callippe Silverspot Butterfly

The Service anticipates incidental take of callippe silverspot butterfly will be difficult to detect or quantify because it is unlikely an injured or dead specimen will be found due to the elusive and cryptic nature of the early stages of this species (eggs, larvae, pupae), the difficulty of non-specialist to observe and identify the adults, and their small size. However, the level of incidental take of this animal can be anticipated by the effects to cover, foraging, and breeding habitat. Conservation measures in this biological opinion will reduce, but are unlikely to eliminate, the potential for incidental take of this listed species. The Service, therefore, anticipates incidental take of callippe silverspot butterfly will result from the proposed project. Upon implementation of the reasonable and prudent measures, all individuals of callippe silverspot butterfly inhabiting 58.14 acres of identified habitat will be subject to incidental take in the form of harm, harassment, injury, and mortality.

Valley Elderberry Longhorn Beetle

The Service expects that incidental take of the valley elderberry longhorn beetle will be difficult to detect or quantify because the life cycle of the beetle and its small body size make discovery of a dead specimen unlikely, losses may be masked by seasonal fluctuations in numbers or other causes, and the species occurs in habitat that makes them difficult to detect. It is not possible to make an accurate estimate of the number of valley elderberry longhorn beetles that will be harassed, harmed, injured, or killed as a result of construction activities. In instances when take is difficult to detect, the Service often estimates take relative to the number of elderberry stems, 1 inch or greater in diameter, that are lost or degraded as a result of the action. Therefore, the Service estimates that all valley elderberry longhorn beetles inhabiting the 62 stems of 1 inch or

greater in the ten identified elderberry shrubs in the action area may be harassed, harmed, injured, or killed, as a result of the proposed action.

California Red-Legged Frog

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect due to their small size, wariness, and cryptic nature. Finding an injured or dead California red-legged frog is unlikely due to their relatively small body size, rapid carcass deterioration, and likelihood that the remains will be removed by a scavenger. Losses of this species may also be difficult to quantify due to a lack of baseline survey data and seasonal/annual fluctuations in their numbers due to environmental or human-caused disturbances. There is a risk of harm, harassment, injury and mortality as a result of the proposed construction activities, the permanent and temporary loss/degradation of suitable habitat, and capture and relocation efforts; therefore, the Service is authorizing take incidental to the proposed action as: (1) the injury and mortality of two adult or juvenile California red-legged frogs; and (2) the capture, harm and harassment of all California red-legged frogs within the construction footprint.

Upon implementation of the following *Reasonable and Prudent Measures*, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterflies, valley elderberry longhorn beetles, and California red-legged frogs within the action area in proportion to the amount and type of take outlined above will become exempt from the prohibitions described under section 9 of the Act. No other forms of take are exempted under this opinion.

This biological opinion does not authorize take for Federal and non-Federal actions associated with the maintenance of roadways included in this action, and the associated Caltrans and STA ROWs. Routine Caltrans and STA maintenance activities such as the removal/displacement of sand, silt, sediment, debris, rubbish, vegetation, and other obstruction flow, the control of weeds, grasses and emergent vegetation, minor repair of existing facilities, rip-rap replacement, and culvert replacement may affect listed species. Such maintenance activities and their potential effects to listed species are not evaluated in this biological opinion.

Effect of the Take

The Service has determined that the level of anticipated take for the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog is not likely to jeopardize the continued existence of this species.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the effect of the proposed action on the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog. Caltrans will be responsible for implementation of and compliance with these measures:

1 Caltrans will minimize the effect of take to the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog.

Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the Act, Caltrans shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following *Terms and Conditions* implement *Reasonable and Prudent Measure* one (1):
   a. Caltrans shall minimize the potential for harm, harassment, or killing of vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog resulting from project related activities by implementing the conservation measures as described in the *Description of the Proposed Action* of this Biological Opinion.

   b. Caltrans shall require all contractors to comply with the Act in the performance of the action and shall perform the action as outlined in the *Description of the Proposed Action* of this Biological Opinion and all other supporting documentation submitted to the Service.

   c. Caltrans shall include language in their contracts that expressly requires contractors and subcontractors to work within the boundaries of the project footprints identified in this biological opinion, including vehicle parking, staging, laydown areas, and access roads.

   d. The Service, and/or their designated agents shall have direct access at any time or immediately upon verbal request to the action area and all Service-approved biologists to ensure compliance with this Biological Opinion. Access to areas outside of the Caltrans ROW or easements shall be coordinated by Caltrans with the respective property owners.

   e. Qualifications of proposed biological monitor(s) shall be submitted to the Service for approval at least 30 calendar days prior to initiating construction activities for the proposed project.

   f. Prior to approval, the biologist(s) shall submit a letter to the Service verifying that they possess a copy of this biological opinion and understand its Terms and Conditions. The biologist(s) shall keep a copy of this Biological Opinion in their possession when on-site.

   g. The Resident Engineer or their designee shall be responsible for implementing the conservation measures and Terms and Conditions of this Biological Opinion and shall be the point of contact for the project. The Resident Engineer or their designee shall maintain a copy of this Biological Opinion onsite whenever construction is taking place. Their name and telephone number shall be provided to the Service at least thirty (30) calendar days prior to groundbreaking for each of the construction packages. Prior to ground breaking, the Resident Engineer must submit a letter to the Service verifying that they possess a copy of this Biological Opinion and have read the Terms and Conditions.

   h. An outline of the Worker Environmental Awareness Training Program shall be submitted to the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife

Office within 30 days prior to the initial onset of construction activities. As needed, training will be conducted in Spanish for Spanish language speakers.

i. A Service-approved biologist(s) shall be onsite during all activities that may result in take of vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog as determined by the Service. A minimum of one Service-approved biologist shall be onsite throughout the project duration. The Service will consider the implementation of specific project activities without the oversight of a Service-approved biologist on a case-by-case basis.

j. During construction activities outside the existing hardscape, the Service-approved biologist shall conduct clearance surveys at the beginning of each day within or adjacent to suitable listed species habitat and regularly throughout the workday when construction is occurring within or adjacent to suitable habitat.

k. Vegetation clearing and construction operations shall be limited to the minimum necessary in areas of temporary access, work areas, and staging. Trees, snags, shrubs, other vegetation, woody debris, and uncompacted forest litter will be protected to the maximum extent practicable. Tree and shrub trimming shall be minimized to the extent possible. Trees shall be pruned, or shrubs that interfere with construction or project operation shall be pruned or topped. Shrubs shall be trimmed above ground and roots will be left intact. All vegetation trimmings shall either be hauled off-site and disposed of properly, or chipped and left on-site as determined by the Caltrans Resident Engineer. When possible, stockpiles of trimmed vegetation shall be kept at least 50 feet from the bed and bank.

l. In areas where valley elderberry longhorn beetle will affected, within sixty (60) calendar days prior to the initiation of ground disturbance, Caltrans shall provide a written description of how the valley elderberry longhorn beetle buffer areas will be restored, protected, and maintained after construction is completed.

m. The following measures are intended to minimize the effect of take in the form of harassment on the California red-legged frog.

i. Each California red-legged frog encounter shall be treated on a case-by-case basis in coordination with the Service but general guidance is as follows: (1) leave the non-injured frog if it is not in danger; or (2) move the frog to a nearby location if it is in danger.

These two options are further described below.

a) When a California red-legged frog is encountered in the action area the first priority is to stop all activities in the surrounding area that have the potential to result in the harm, harassment, injury, or death of the individual. Then the monitor needs to assess the situation in order to select a course of action that will minimize adverse effects to the individual. Contact the Service once the site is

secure. The contacts for this situation are Ryan Olah (ryan_olah@fws.gov) or John Cleckler (john_cleckler@fws.gov). They can be reached at (916) 414-6600. If you get voicemail message for these contacts then contact John Cleckler on his cell phone at (916) 712-6784. The issue of contacting people on the weekend or after office hours is addressed later.

The first priority is to avoid contact with the frog and allow it to move out of the action area and hazardous situation on its own to a safe location. The animal should not be picked up and moved based on it not moving fast enough or an inconvenience for construction activities. This guidance only applies to situations where a California red-legged frog is encountered on the move during conditions that make their upland travel feasible. This does not apply to California red-legged frogs that are uncovered or otherwise exposed or in areas where there is not sufficient adjacent habitat to support the life history of the California red-legged frog should the frogs move outside the immediate area.

Avoidance is the preferred option if a California red-legged frog is not moving and is using aquatic habitat or is within some sort of burrow or other refugia. The area should be well marked for avoidance by construction and a Service-approved biological monitor should be assigned to the area when work is taking place nearby.

b) The animal should be captured and moved when it is the only option to prevent harm.

If appropriate habitat is located immediately adjacent to the capture location then the preferred option is short-distance relocation to that habitat. This must be coordinated with the Service but the general guidance is the frog should not be moved outside of the radius it would have traveled on its own. Under no circumstances should a frog be relocated to another property without the owner's written permission. It is Caltrans' responsibility to arrange for that permission.

The release must be coordinated with the Service and will depend on where the individual was found and the opportunities for nearby release. In most situations the release location is likely to be into the mouth of a small burrow or other suitable refugia and in certain circumstances pools without non-native predators may be suitable.

Only Service-approved biologists for the project can capture California red-legged frogs. Nets or bare hands may be used to capture California red-legged frogs. Soaps, oils, creams, lotions, repellents, or solvents of any sort cannot be used on hands within two hours before and during periods when they are capturing and relocating California red-legged frogs. To avoid transferring disease or pathogens between sites during the course of surveys or handling of the frogs, Service-approved biologists must use the following guidance for disinfecting equipment and clothing. These recommendations are adapted from

the *Declining Amphibian Population Task Force's Code* which can be found in their entirety at: http://www.open.ac.uk/daptf/

1) All dirt and debris, including mud, snails, plant material (including fruits and seeds), and algae, must be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water and/or an amphibian. Cleaned items should be rinsed with clean water before leaving each site.

2) Boots, nets, traps, etc., must then be scrubbed with either a 70 percent ethanol solution, a bleach solution (0.5 to 1.0 cup of bleach to 1.0 gallon of water), QUAT 128 (quaternary ammonium, use 1:60 dilution), or a six percent sodium hypochlorite 3 solution and rinsed clean with water between sites. Avoid cleaning equipment in the immediate vicinity of a pond or wetland. All traces of the disinfectant must be removed before entering the next aquatic habitat.

3) Used cleaning materials (liquids, etc.) must be disposed of safely, and if necessary, taken back to the lab for proper disposal.

4) Service-approved biologists must limit the duration of handling and captivity. While in captivity, individual California red-legged frogs shall be kept in a cool, dark, moist, aerated environment, such as a clean and disinfected bucket or plastic container with a damp sponge. Containers used for holding or transporting should not contain any standing water.

ii. The Service-approved biologist(s) shall perform a California red-legged frog clearance survey immediately prior to the initial ground disturbance. Safety permitting, the Service-approved biologist(s) will investigate areas of disturbed soil for signs of the listed species within 30 minutes following the initial disturbance of that given area.

iii. Construction crews shall review the dewatering plan prior to any in-stream work within the bed and banks that requires the construction of coffer dams and/or dewatering.

iv. Removal of vegetation shall be accomplished by a progressive cutting of vegetation from the overstory level to the ground level to allow California red-legged frogs more opportunity move out of the work area under their own volition. Vegetation shall be cleared only where necessary and will be cut approximately 4 inches above soil level except in areas that will be excavated for roadway construction. This is intended to encourage plants that reproduce vegetatively to resprout after construction. All clearing and grubbing of woody vegetation shall be done using hand tools, small mechanical tools, or backhoes and excavators. All cleared vegetation shall be removed from the project footprint to prevent attracting animals to the project site.

v. If pumping is used for dewatering, intakes shall be completely screened with wire mesh no larger than 0.2 inch to prevent frogs from entering the pump.

vi. The Service-approved biologist(s) shall permanently remove, from the project site, any aquatic exotic wildlife species, such as bullfrogs and crayfish, to the extent possible.

n. Erosion control materials other than seeding only shall consist of hydraulically applied erosion control products, organic mulches free of non-native seeds, organic mulch control nettings with loose weave construction (the strands slide along cross strands) and openings over 4 centimeters, staked in straw bales or temporary erosion control fencing. Materials utilizing fixed weaves (strands cannot move), polypropylene, polymer or other synthetic materials shall not be used.

o. Through the Resident Engineer or their designee, the Service-approved biological monitor(s) will be given the authority to communicate either verbally, by telephone, e-mail message, or hardcopy with Caltrans personnel, construction personnel or any other person(s) at the project site or otherwise associated with the project to ensure that the terms and conditions of this biological opinion are being met. If situations arise where the terms and conditions may not be met or are not being met, the biological monitor will inform the Resident Engineer, who has the authority to stop work. If the Resident Engineer exercises this authority, the Service will be notified by telephone and e-mail message within one working day. The Service contact is the Coast-Bay/Forest Foothill Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600. Discussions with the Resident Engineer, biological monitor, Caltrans staff and Service staff, will take place to identify and inform actions to resolve the issue and to document decisions.

Reporting Requirements

Caltrans shall report to the Service any information about take or suspected take of listed wildlife species. Caltrans must notify the Service via an e-mail or telephone message within 24 hours of receiving such information. Notification must include the date, time, location of the incident or of the finding of a dead or injured animal, and photographs of the specific animal. The individual animal shall be preserved, as appropriate, and held in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600, and the Resident Agent-in-Charge of the Service's Law Enforcement Division at (916) 414-6660.

Caltrans shall submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within sixty (60) calendar days of the date of the completion of each Construction Package. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the vernal pool tadpole shrimp, vernal pool fairy

shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog, if any; (v) occurrences of incidental take to any listed species, if any; and (vii) other pertinent information. The final construction acreage of permanent and temporary habitat loss will be tabulated separately and provided to the Service. The extent of permanent and temporary habitat loss will be delineated with a handheld GPS device and a trackfile of each will be provided to the Service.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases. The Service requests notification of the implementation of any conservation recommendations in order to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats. We propose the following conservation recommendations:

1. Enhancing habitat connectivity and wildlife passage across roads as well as reducing road effects should be included in the *Purpose and Need* section of environmental documents. FHWA agreed to coordinate with the Service on wildlife movement issues in a June 2, 2010, letter addressed to Mr. Greg Costello of the Western Environmental Law Center. As their NEPA delegate, Caltrans District 4 is expected to adopt the commitments made by FHWA to consider wildlife movement in transportation planning and project development.

2. Caltrans District 4 should include a wildlife passage section in their BAs that includes an analysis of the existing passage and how the project will affect passage. The analysis should include identification of the species' resources on both sides of the project boundaries, an appropriately timed road mortality survey to identify "hot spots," and strategic locations where the species could benefit from the enhancement of an existing crossing or the installation of a new crossing. Caltrans District 4 should coordinate with their headquarters office and the University of California at Davis Road Ecology Center to develop a passage and road effects approach. Further guidance is provided by FHWA's *Wildlife Vehicle Collision Reduction Study* (available at: http://www.fhwa.dot.gov/environment/hconnect/wvc/index.htm) and Caltrans' *Wildlife Crossings Guidance Manual* (http://www.dot.ca.gov/hq/env/bio/wildlife_crossings/).

3. Efforts should be made to establish upland culverts designed specifically for wildlife movement as well as making accommodations for terrestrial wildlife movement through culverts that convey hydrology. Transportation agencies should also acknowledge the value of enhancing human safety by providing safe passage for wildlife in their early project design.

4. Caltrans should reference their internal system they have developed to keep track of road mortality records and the University of California at Davis, Road Ecology Center's

California Roadkill Observation System (http://www.wildlifecrossing.net/california/). Information from these databases should be referenced in road project assessments.

5. Caltrans should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog and other listed species. Such banking systems also may be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where appropriate. Efforts should be made to preserve habitat along roadways in association with established or planned wildlife crossings.

6. Caltrans should continue to develop and implement their *Early Statewide Biological Mitigation Planning Project* that has been developed by the University of California at Davis, Road Ecology Center to offset the effects of Caltrans' projects on listed species.

REINITIATION--CLOSING STATEMENT

This concludes formal consultation on the I-80/I-680/SR 12 Interchange Phase 1 Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, including work outside of the project footprint analyzed in this opinion and including vehicle parking, staging, lay down areas, and access roads; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion including use of rodenticides or herbicides; relocation of utilities; and use of vehicle parking, staging, lay down areas, and access roads; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

If you have any questions regarding this biological opinion for the I-80/I-680/SR 12 Interchange Phase 1 Project, please contact John Cleckler or Ryan Olah at the letterhead address or at (916) 414-6600.

Sincerely,

Susan K. Moore

Susan K. Moore
Field Supervisor

cc:
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Janet Adams, Solano Transportation Authority, Suisun City, California
Brendan Thompson, San Francisco Bay Regional Water Quality Control Board, Oakland, California
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Enclosure 10

U.S. Army Corps
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San Francisco District
Regulatory Division

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
81420-2009-F-0857-R001-2

APR 29 2013

Ms. Melanie Brent
California Department of Transportation
Environmental Division, MS-8E
111 Grand Avenue
Oakland, California 94612

Subject: Reinitiation of Formal Consultation for the Proposed Interstate 80/Interstate 680/State Route 12 Interchange Phase 1 Project's Peltier Creek Restoration Project, Solano County, California (Caltrans EA 0A5300)

Dear Ms. Brent:

This is in response to the California Department of Transportation's (Caltrans) March 26, 2013, request to reinitiate formal consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Interstate 80/Interstate 680/State Route 12 Interchange Phase 1 Project (Interchange Project). The request to reinitiate consultation was received in our office on March 28, 2013, and included a March 2013 Biological Assessment (BA). The original Biological Opinion (BO) for the Interchange Project (Service File #81420-2009-F-0857-7) was issued on April 16, 2012. The purpose of the request is to amend the original consultation to include actions to satisfy the U.S. Army Corps of Engineers and the Regional Water Quality Control Board mitigation associated with the Interchange Project. The proposed mitigation project also includes Service-approved compensation for the threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*)(VELB). The mitigation/compensation actions will occur off-site on the Water Hole Land Company, LLC's Suisun Creek Preserve in Solano County. The Service considered Caltrans' request for reinitiation complete on April 19, 2013.

The proposed Peltier Creek Restoration Project is interrelated to the Interchange Project but is well removed geographically from the parent project and is significantly different in its scope and purpose. Therefore, this reinitiation is being presented as a stand-alone document specific to the mitigation project rather than follow our typical format for reinitiation letters.

For the Peltier Creek Restoration Project, Caltrans has requested formal consultation on the threatened California red-legged frog (*Rana draytonii*). This document represents the Service's biological opinion on the effects of the proposed mitigation project on the California red-legged frog. Critical habitat has been designated for this species; however, the action area is not located

within designated critical habitat for the California red-legged frog. This document has been prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*) (Act).

The Service concurs with Caltrans' determination that the proposed Peltier Creek Restoration Project may affect, but is not likely to adversely affect the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*). The proposed project is located on historic tidal marsh habitat that has long since been drained and isolated from tidal influence by a series of managed levees. Occurrence of the salt marsh harvest mouse likely would be limited to infrequent mouse dispersal between areas of adjacent pickleweed habitat. The *Conservation Measures* section of the *Description of the Proposed Action* include appropriate measures proposed by Caltrans to address the potential occurrence of the salt marsh harvest mouse during project construction.

Consultation History

December 26, 2012	The Service visited the Suisun Creek Preserve.
March 22, 2013	Caltrans provided the Service with the revised March 2013 Suisun Creek Preserve Mitigation & Monitoring Plan (MMP)(Caltrans 2013).
March 28, 2013	The Service received Caltrans March 26, 2013, request to reinitiate formal consultation on the Interchange Project to cover the effects associated with the proposed Peltier Creek Restoration Project. The request included a March 2013 BA addressing the effects associated with the proposed restoration project.
April 10, 2013	The Service met with Caltrans and Solano Transportation Authority to discuss the restoration project and information needed to complete the reinitiation.
April 11, 2013	The Service issued a 30-day letter (Service File #81420-2009-F-0857-R001-1), with comments in response to Caltrans' March 2013 BA and a request for additional information to complete the reintiation.
April 19, 2013	The Service received Caltrans' response to the April 11, 2013, 30-day letter. According to the response, biologists found VELB exit holes within 8 of 26 elderberry shrubs found along Suisun Creek, adjacent to the northwest corner of the Suisun Creek Preserve. The response also included additional and revised project description information. The provided information fulfilled the Service's information needs to complete the reinitation.

BIOLOGICAL OPINION

Description of the Proposed Action

The following project description was provided by Caltrans in the March 2013 BA and the April 19, 2013, response, with minor modifications for reasons of clarity and accuracy provided by the Service.

General Scope of Work

1. Caltrans proposes to meet their wetland mitigation and VELB compensation commitments for the Interchange Project by completing the following within the 43-acre Suisun Creek Preserve: Establishment (creation) of a minimum of 2,682 linear feet of channel habitat.

2. Restoration of a minimum of 3.33 acres of riparian habitat.

3. Establishment (creation) of habitat for the VELB.

4. Establishment (creation) of a minimum of 9.50 acres of wetland habitat.

Construction Schedule
Associated construction activities, weed control, and native vegetation plantings are scheduled to occur in 2013 or 2014 depending upon receipt of agency approvals and permits. Work in drainages and wetlands would be restricted to the dry season (June 15-October 15). Success criteria monitoring and management of the Suisun Creek Preserve will continue in perpetuity.

Equipment
Construction is expected to require heavy equipment such as excavators, bobcats, bulldozers, hydraulic excavators or backhoes, scrapers, rubber-tired dump trucks, front-end loaders, load-haul-dumps, and sheepsfoot or drum rollers.

Access and Staging
Construction equipment would access the site from Chadbourne Road.

Caltrans has identified two staging areas for the project. A 0.6-acre material staging area will be located in an upland area along the north-central edge of the Suisun Creek Preserve. A 1.0-acre equipment staging area will be located in an upland area on the east-central edge of the Suisun Creek Preserve. The construction contractor may choose to use one or both of these areas. Staging sites will be used on a temporary basis during construction to store equipment, a port-a-potty, and for vehicle parking. Upon project completion, the staging area will be restored to pre-project or improved habitat conditions.

Project Activities and Methods
The five project components are discussed in greater detail as follows:

1. Peltier Channel Habitat Creation
   From the northwest corner of the Suisun Creek Preserve, 2,682 linear feet (0.06 acres) of channel habitat will be constructed along a historic section of Peltier Creek, flowing generally east and exiting the northeast corner of the Suisun Creek Preserve.

   The channel will be designed to retain and release captured overland flow. Hydrology to the created channel will also be provided by precipitation, groundwater seepage, and runoff irrigation water.

   The project requires a connection to an offsite water source(s) to provide secure water for the channel habitat in perpetuity. The water source will be an existing drainage located north of the Suisun Creek Preserve. An approximately 0.15-mile drainage will be constructed to connect the water source to the northwest end of the 2,682 foot section of Peltier Creek. The water source point and the constructed connection will be located on private land, north of the Suisun Creek Preserve.

   If water is present within the source drainage, temporary cofferdams (made of gravel, fabric, and pipe) would be constructed both up and downstream of the connection. If needed, a pipe water diversion system would be installed for dewatering. The cofferdams would be located approximately 10 to 20 feet from the limit of the connection.

   To the extent practicable, disturbed portions of the drainage would be restored to pre-project conditions upon completion of construction. This may include grading and/or contouring the site, and seeding or planting as appropriate.

2. Riparian Habitat Restoration
   A minimum of 3.33 acres of riparian habitat will be established primarily along the 2,682 foot section of Peltier Creek. Additional riparian habitat will occur in the southeast corner of the Suisun Creek Preserve.

3. Elderberry Plantings
   As stated in the April 2012 BO, Caltrans proposed compensating for the Interchange Project's effects to VELB with the successful establishment of 157 elderberry seedlings as well as an additional 177 native plantings along the 2,682 foot section of Peltier Creek.

   As part of their restoration of Peltier Creek riparian habitat, Caltrans proposes to plant 190 elderberry seedlings and 596 other native riparian plants. Other than blue elderberry, the planting pallet includes arroyo willow, red willow, black walnut, box-elder, California blackberry, California wild rose, coyote brush, creeping rye grass, gumplant, live oak, valley oak, and mugwort. The plantings will occur as part of the riparian habitat restoration.

The planting scheme, methodology, success monitoring, success criteria, and means of habitat protection will be described in the Suisun Creek Preserve MMP and will follow the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (Service 1999).

4. Wetland Habitat Creation
   A minimum of 9.50 acres of wetlands will be constructed within and adjacent to the 2,682 foot section of Peltier Creek. It will include 3.91 acres of seasonal drainage/seasonal wetland habitat within the restored Peltier Creek channel and 5.59 acres of seasonal wetlands in low elevation areas adjacent to the channel.

The proposed project will result in the combined creation of 9.83 acres of native habitat. An approximate 30-foot construction buffer will be needed around the habitat creation areas, which will result in approximately 3.7 acres of temporary disturbance. The temporary work area will also include a 1.0-acre equipment staging area and a 0.6-acre material staging area. The 792 foot-long water line connection will be completed within a 30-foot wide, 0.55-acre temporary construction corridor. The entire construction footprint will be 15.68 acres.

According to the March 2013 MMP, temporary work areas will be restored to original grade and replanted or reseeded with the appropriate plant species or monitored following construction to determine that vegetation comparable to the pre-existing conditions has naturally regenerated.

As described in the March 2013 MMP, in-perpetuity land use and protection of the 43-acre Suisun Creek Preserve will be accomplished by recording a conservation easement with Solano County, and managing the habitat in compliance with an agency approved resource management plan, and funding a nonwasting endowment to fund these activities.

Construction Methods
Construction of the staging areas will require a scraper and dozer to remove vegetation and clear areas for the placement of equipment and vehicles during construction.

The habitat creation areas will be cleared of vegetation with a scraper and a bulldozer. Bulldozers/excavators will be used to excavate the low-flow creek channel and seasonal wetlands. The low-flow channel is estimated to be approximately 1 foot deep by 2-5 feet wide. A slightly higher floodplain terrace will be constructed adjacent to sections of the low-flow channel. This terrace area will be routinely flooded during storm events and is anticipated to remain saturated for most of the year. Seasonal wetlands constructed adjacent to the floodplain terrace will be constructed to allow inflow from the creek to flush the seasonal wetlands with freshwater flows.

Construction of the water connection to the northern drainage ditch will require the use of a scraper, bulldozer, and excavator. Construction of this linear feature will be contained within a 40-foot wide temporary construction corridor. A scraper will remove vegetation at the beginning of construction, and a bulldozer and excavator will excavate the channel. Excavated material will be placed on both sides of the channel to construct a small berm/levee. The channel is

estimated to be approximately 20 feet wide and 2 feet deep, allowing conveyance of water from the northern ditch.

The riparian habitat, including elderberry plantings, will be positioned on elevated spoils areas. An irrigation system will be designed to irrigate the riparian area during the establishment period.

Proposed Conservation Measures
Caltrans proposes to avoid, minimize, and compensate for effects to the salt marsh harvest mouse and California red-legged frog by implementing the following measures:

1. At least 15 days prior to the onset of any construction-related activities, Caltrans will submit to the Service, for approval, the name(s) and credentials of biologists it wishes to conduct activities specified for this project. Information included in a request for authorization will include, at a minimum: (1) relevant education; (2) relevant training on species identification, survey techniques, handling individuals of different age classes, and handling of different life stages by a permitted biologist or recognized species expert authorized for such activities by the Service; (3) a summary of field experience conducting requested activities (to include project/research information); (4) a summary of BOs under which they were authorized to work with the listed species and at what level (such as construction monitoring versus handling), this will also include the names and qualifications of persons under which the work was supervised as well as the amount of work experience on the actual project; (5) A list of Federal Recovery Permits [10(a)1(A)] held or under which are authorized to work with the species (to include permit #, authorized activities, and name of permit holder); and (6) any relevant professional references with contact information. No project construction will begin until Caltrans has received written Service approval for biologists to conduct specified activities.

2. All construction personnel will attend a mandatory Worker Environmental Awareness Training Program delivered by a Service-approved biologist prior to working on the project site. The program will focus on the conservation measures that are relevant to employee's personal responsibility and will include an explanation as how to best avoid take of the salt marsh harvest mouse and California red-legged frog. The program will include an explanation of Federal laws protecting these listed species as well as the importance of compliance with this BO. Documentation of the training, including sign-in sheets, will be kept on file and will be available on request.

3. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

4. A Service-approved biologist(s) will be on-site during any ground-disturbing activities including vegetation trimming or removal.

5. Through the construction supervisor or their designee, the Service-approved biological monitor(s) will be given the authority to communicate either verbally, by telephone, e-mail message, or hardcopy with Caltrans personnel, construction personnel or any other person(s) at the project site or otherwise associated with the project to ensure that the *Terms and Conditions* of this BO are being met. If situations arise where the *Terms and Conditions* may not be met or are not being met, the biological monitor will inform the construction supervisor, who has the authority to stop work. If the construction supervisor exercises this authority, the Service will be notified by telephone and e-mail message within one working day. The Service contact is the Coast-Bay/Forest Foothill Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600. Discussions with the construction supervisor, biological monitor, Caltrans staff and Service staff, will take place to identify and inform actions to resolve the issue and to document decisions.

6. Prior to construction, the construction footprint boundaries will be clearly marked.

7. Construction access, staging, storage, and parking areas will be limited to what was described in information provided by Caltrans on March 19, 2013.

8. No more than twenty-four (24) hours prior to the date of initial ground disturbance, a pre-construction survey for the salt marsh harvest mouse and California red-legged frog will be conducted by a Service-approved biologist. These surveys will consist of walking surveys of the project limits and accessible adjacent areas within at least 50 feet of the project limits. The Service-approved biologist will investigate all potential areas that could be used by the species for feeding, breeding, sheltering, movement, and other essential behaviors. This includes thorough investigation of mammal burrows, appropriately sized soil cracks, and debris. Native vertebrates found in the cover sites will be documented. Those located within areas that will be subject to ground disturbance will be relocated to an adequate cover site within the Suisun Creek Preserve. The entrances and other refuge features within areas that will be subject to ground disturbance will be collapsed or removed following investigation and clearance.

9. If a salt marsh harvest mouse is encountered, the Service-approved biologist, through the construction supervisor, will halt all work and contact the Service to determine how to proceed.

10. Vegetation clearing will be done using hand tools in and within 50 feet of pickleweed vegetation.

11. To reduce the spread of invasive, nonnative plant species and minimize the potential decrease of palatable vegetation for wildlife species, Caltrans will comply with Executive Order 13112. This order is intended to prevent the introduction of invasive species and provide for their control to minimize adverse economic, ecological, and human health effects. In the event that noxious weeds are disturbed or removed during construction-

related activities, the contractor will be required to contain the plant material associated with these noxious weeds and dispose of them in a manner that will not promote the spread of the species. The contractor will be responsible for obtaining all permits, licenses, and environmental clearances for properly disposing of materials. Areas subject to noxious weed removal or disturbance will be replanted with fast-growing native grasses or a native erosion control seed mixture. If seeding is not possible, the area of disturbance will be covered to the extent practicable with heavy black plastic solarization material until the end of project construction.

12. All food and food-related trash items will be enclosed in sealed trash containers and removed completely from the site at the end of each day.

13. No firearms will be allowed in the action area except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

14. No nighttime construction work will be conducted.

15. Plastic monofilament netting (erosion control matting) or similar material will not be used in the action area because California red-legged frogs can become entangled and trapped in it. Instead, Caltrans will use alternative materials such as coconut coir matting or tacified hydroseeding compounds.

16. No pets will be permitted in the action area.

17. All equipment will be maintained such that there will be no leaks of automotive fluids such as gasoline, oils, or solvents, and a Spill Response Plan will be prepared.

18. If requested through the construction supervisor before, during, or upon completion of groundbreaking and construction activities, Caltrans will ensure that the Service and/or its designated agents can, immediately and without delay, access and inspect the project site for compliance with the proposed project description, conservation measures, and terms and conditions of the biological opinion, and to evaluate project effects on listed species and their habitat.

19. The construction supervisor will halt work immediately within a buffer area of 50 feet of any discovered California red-legged frog. The construction supervisor will also contact the Service-approved project biologist and the Service in the event that a California red-legged frog is found within the construction zone. The construction supervisor will suspend all construction activities in the immediate construction zone (50-foot radius) until the animal leaves the site voluntarily or is removed by the biologist to a release site using Service-approved transportation techniques.

20. California red-legged frogs that need to be relocated outside the construction area will be released at an appropriate cover site or aquatic habitat within the Suisun Creek Preserve by the Service-approved biologist.

21. To prevent inadvertent entrapment of a salt marsh harvest mouse or California red-legged frog during construction, all excavated, steep-walled holes or trenches more than 1 foot deep will be covered at the close of each working day with plywood or similar material, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the onsite biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and email within one (1) working day.

22. All construction equipment or construction debris left overnight within the action area will be inspected for salt marsh harvest mice and California red-legged frogs by the Service-approved biologist prior to the beginning of each day's activities and prior to being moved.

23. Injured salt marsh harvest mice or California red-legged frogs will be cared for by a licensed veterinarian or other qualified person such as the onsite biologist; dead individuals of any listed species will be preserved according to standard museum techniques and held in a secure location. The Service will be notified within one (1) working day of the discovery of death or injury to a listed species that results from project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a U.S. Geological Survey 7.5-minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. Dead animals will be placed in a sealed plastic bag with a piece of paper containing information on where and when the animal was found along with the name of the person who found it, the bag will be placed in a freezer located in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are the Coast-Bay/Forest Foothill Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600 and the Resident Agent-in-Charge of Service's Law Enforcement Division at (916) 569-8444.

Analytical Framework for the Jeopardy Determination

Refer to the original April 16, 2012, BO for the Interchange Project for information regarding the analytical framework for making a jeopardy determination for the effects of the proposed project on the California red-legged frog.

Action Area

The action area is defined in 50 Code of Federal Regulations (CFR) § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the proposed Peltier Creek Restoration Project, the action area includes the direct effects associated with the creation of channel, wetland, and riparian habitat. The proposed project includes a 31.76-acre construction footprint. The action area includes the 43-acre Suisun Creek Preserve and the 0.55-acre work area needed to complete offsite water diversion.

Status of the Species

Refer to the original April 16, 2012, BO for information regarding the status of the California red-legged frog.

Environmental Baseline

The Suisun Creek Preserve is located on land that was historically within the tidally influenced, Suisun Marsh. The land has long since been drained, leveled, and excluded from tidal action with a series of levees. Degraded remnant pockets of pickleweed vegetation remain but the property is no longer subject to tidal influence. The site has long been in agricultural use and was recently part of an upland game bird hunting preserve. It is now characterized as neglected graze land that is primarily overcome with tall non-native weedy vegetation. The site includes patches of wetland habitat interconnected through constructed ditches. The current site hydrology drains into the existing Peltier Creek alignment, at the end of which it is pumped into Chadbourne Slough.

Former modification of the area included rerouting of Suisun Creek and Peltier Creek. Suisun Creek now runs along the western edge of the Suisun Creek Preserve. Peltier Creek historically flowed through the Suisun Creek Preserve from the northeastern corner of the property. The Peltier Creek channel was dammed and partially filled. It is now a dry channel, lacking an associated riparian corridor.

The property is susceptible to flooding and projected sea level rise. The area is targeted for tidal wetland restoration in the Service's Draft Recovery Plan for Tidal Marsh Ecosystems of Northern and Central California (Service 2009). Therefore, successful creation of freshwater channel, wetland, and riparian habitat will continue to rely on the maintenance of the existing levee system.

The Suisun Creek Preserve is approximately 2.5 miles east of the SOL-1 California Red-Legged Frog Critical Habitat Unit, 2.4 miles east of the Jameson Canyon-Lower Napa River California Red-Legged Frog Core Recovery Unit, and within the North Coast and North San Francisco Bay Recovery Unit for the California red-legged frog (Service 2002).

The Suisun Creek and Peltier Creek are located within the Suisun Creek Preserve and are associated with the proposed restoration project. The two creeks provide potential aquatic habitat for the California red-legged frog. It is uncertain if the creeks provide potential breeding habitat and no fresh water breeding ponds are found on or adjacent to the Suisun Creek Preserve. According to the March 2013 MMP, a red-eared slider was observed within the Preserve segment of Peltier Creek. Presence of this turtle species is an indicator that Peltier Creek has sufficient hydrology and deep water retreat to support non-breeding life history needs of the California red-legged frog.

Suisun Creek and Peltier Creek include narrow but functional riparian corridors where the California red-legged frog would be expected to take refuge and forage. These corridors may also be important habitat for seasonal movements and frog dispersal.

Red-legged frogs are also likely to use the surrounding upland habitat for seasonal movement, dispersal, and foraging. Mammal burrows, debris, and other cover within the upland area provide frog refugia.

The California red-legged frog is reasonably certain to occur within the action area due to: (1) the project being located within the species' range and current distribution; (2) suitable aquatic and upland habitat for movement, foraging and cover are located within the action area; (3) the action area is adjacent to large contiguous system of undeveloped land managed in a way that does not dissuade red-legged frog occupancy; and (5) the biology and ecology of the animal.

Effects of the Proposed Action

Site access will be limited to established roads and staging will take place in a previously disturbed area, limiting the potential to adversely affect the California red-legged frog. Creation of channel, wetland, and riparian habitat will occur in areas that have been heavily modified due to past landscape modification and agricultural practices.

Caltrans proposes to minimize the potential for take associated with habitat construction by implementing the *Proposed Conservation Measures*. Effective implementation of *Conservation Measures* will likely minimize effects to the California red-legged frog during construction but incidental take is still likely to occur. Therefore, the proposed Peltier Creek Restoration Project has the potential to result in a variety of adverse effects to the California red-legged frog.

Injury, exposure, disorientation, and disruption of normal behaviors will likely result from planned earth moving activities. Construction noise, vibration, and increased human activity may interfere with normal behaviors such as feeding, sheltering, movement between refugia and foraging grounds, and other frog essential behaviors. This can result in avoidance of areas that have suitable habitat but intolerable levels of disturbance.

Red-legged frogs are cryptic and their cover sites can be difficult to identify and fully investigate. Unless identified by the biological monitor or site personnel, and rescued by the

biological monitor, individual California red-legged frogs exposed during earthwork likely will be crushed and killed or injured by construction-related activities. Even with biological monitoring, overall awareness, and proper escape ramps, California red-legged frogs could fall into excavations and then risk being directly killed or be unable to escape and be killed due to desiccation, entombment, or starvation. Proper trash disposal is often difficult to enforce on a large construction site. Improperly disposed edible trash could attract predators, such as raccoons, crows, and ravens, to the sites, which could subsequently prey on California red-legged frogs. Caltrans' commitment to use erosion control devices other than mono-filament should be effective in avoiding the associated risk of entrapment that can result in death by predation, starvation, or desiccation (Stuart *et al.* 2001). Caltrans will further minimize adverse effects by locating construction staging, storage, and parking areas within existing dirt roads and previously disturbed areas, clearly marking construction work boundaries, and conducting preconstruction surveys and biological monitoring. The adverse effects resulting from construction activities will be partially minimized by educating workers, and requiring a Service-approved biologist to be present to monitor construction activities.

If unrestricted, the proposed construction activities could result in the introduction of chemical contaminants to frog habitat. Exposure pathways could include inhalation, dermal contact, direct ingestion, or secondary ingestion of contaminated soil, plants or prey species. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. However, Caltrans proposes to minimize these risks by implementing standard fueling and spill prevention/cleanup best management practices.

Preconstruction surveys and the relocation of individual California red-legged frogs may avoid injury or mortality; however, capturing and handling frogs may result in stress and/or inadvertent injury during handling, containment, and transport. Caltrans proposes to minimize these effects by using Service-approved biologists, limiting the duration of handling, and relocating amphibians to suitable nearby habitat in accordance with Service guidance.

If unrestricted, biologists and construction workers traveling to the action area from other project sites may transmit diseases by introducing contaminated equipment. The chance of a disease being introduced into a new area is greater today than in the past due to the increasing occurrences of disease throughout amphibian populations in California and the United States. It is possible that chytridiomycosis, caused by chytrid fungus, may exacerbate the effects of other diseases on amphibians or increase the sensitivity of the amphibian to environmental changes (water pH) that reduce normal immune response capabilities (Bosch *et al.* 2001, Weldon *et al.* 2004). Caltrans will minimize these risks by implementing proper decontamination procedures prior to and following aquatic surveys and handling amphibians. These will minimize the risk of transferring diseases through contaminated equipment or clothing. Proper handling and relocation of frogs out of construction areas increases the likelihood of their survival.

Although frogs may be adversely affected during the construction/installation of the creek channel, wetland, and riparian vegetation, the end result of the actions are likely to benefit the California red-legged frog. Establishment of multi-canopy vegetation along the Peltier Creek

will provide additional shading, cover, and forage potential for the listed frog. Riparian vegetation typically establishes and matures more quickly than other California vegetation communities. Creating a more extensive and contiguous wooded riparian corridor along Peltier Creek is likely to increase the movement potential between red-legged frog habitat up and down stream of the Suisun Creek Preserve.

Cumulative Effects within the Action Area

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Service is not aware of any cumulative effects to the California red-legged frog that are reasonably certain to occur within the Peltier Restoration Project action area.

Conclusion

After reviewing the current status, the environmental baseline for the Peltier Creek Restoration Project portion of the Interchange Project action area; the effects of the overall proposed project, and the cumulative effects of the overall project, it is the Service's biological opinion that, as proposed, the Peltier Creek Restoration Project is not likely to jeopardize the continued existence of the California red-legged frog.

INCIDENTAL TAKE STATEMENT

The original Incidental Take Statement for the Interchange Project is amended as follows with the addition of the Peltier Creek Restoration Project.

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement [50 CFR § 402.14(i)(3)].

The measures described below are non-discretionary, and must be implemented by Caltrans so that they become binding conditions of any grant or permit issued to Caltrans as appropriate, in order for the exemption in section 7(o)(2) to apply. Caltrans and its designees have a continuing duty to regulate the activity covered by this amended Incidental Take Statement. If Caltrans or its designees (1) fail to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, and/or (2) fail to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse for the overall Interchange Project. In order to monitor the effects of the incidental take, Caltrans or its designees must report the progress of the action and its effects on the species to the Service as specified in the Incidental Take Statement

Amount or Extent of Take Specific to the Peltier Creek Restoration Project

The Service anticipates that incidental take of the California red-legged frog on the Peltier Creek Restoration Project will be difficult to detect due to their wariness, cryptic nature, and use of potential cover sites within the action area. Finding an injured or dead California red-legged frog is unlikely due to their relatively small body size, rapid carcass deterioration, and likelihood that the remains will be removed by a scavenger. Losses of the California red-legged frog may also be difficult to quantify due to a lack of baseline survey data and seasonal and annual fluctuations in their numbers due to environmental or human-caused disturbances. There is a risk of harm, harassment, injury and mortality as a result of the proposed activities, and capture and relocation efforts; therefore, the Service is authorizing take incidental to the proposed action as: (1) the injury and mortality of no more than one (1) California red-legged frog; and (2) the capture, harm, and harassment of all California red-legged frogs within the Peltier Creek Restoration Project footprint. Upon implementation of the following *Reasonable and Prudent Measures*, California red-legged frogs within the Peltier Creek Restoration Project action area in proportion to the amount and type of take outlined above will become exempt from the prohibitions described under section 9 of the Act. No other forms of take are exempted.

This BO does not authorize take for Federal or non-Federal actions associated with management of the Suisun Creek Preserve.

Effect of the Take

The Service has determined that this additional level of anticipated take associated with the Interchange Project for the California red-legged frog is not likely to jeopardize the continued existence of the species.

Reasonable and Prudent Measure

The following reasonable and prudent measure is necessary and appropriate to minimize the effect of the proposed action on the California red-legged frog. Caltrans and its designees will be responsible for the implementation and compliance with this measure:

1. Caltrans and its designees shall minimize the effect of take to the California red-legged frog.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, Caltrans shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measure described above. These terms and conditions are nondiscretionary.

1. The following Terms and Conditions implement Reasonable and Prudent Measure one (1):

    a. Caltrans and its designees shall minimize the potential for harm, harassment, or killing of the California red-legged frog, resulting from project related activities by implementing the conservation measures as described in the *Description of the Proposed Action* of this document.

    b. Caltrans and its designees shall require all contractors to comply with the Act in the performance of the action and shall perform the action as outlined in the *Description of the Proposed Action* of this document.

    c. Caltrans and its designees shall include language in their contracts that expressly requires contractors and subcontractors to work within the boundaries of the project footprints identified in this document, including vehicle parking, staging, laydown areas, and access roads.

    d. Each California red-legged frog encounter shall be treated on a case-by-case basis in coordination with the Service but general guidance is as follows: (1) leave the non-injured frog if it is not in danger; or (2) move the frog to a nearby location if it is in danger. These two options are further described as follows.

        1) When a California red-legged frog is encountered in the action area the first priority is to stop all activities in the surrounding area that have the potential to result in the harm, harassment, injury, or death of the individual. Then the monitor needs to assess the situation in order to select a course of action that will minimize adverse effects to the individual. Contact the Service once the site is secure. The contacts for this situation are Ryan Olah, Coast Bay/Forest Foothill Division Chief (*ryan_olah@fws.gov*) or John Cleckler, Caltrans

Liaison (*john_cleckler@fws.gov*). They can be reached at (916) 414-6600. If you get voicemail message for these contacts then contact John Cleckler on his cell phone at (916) 712-6784.

The first priority is to avoid contact with the frog and allow it to move out of the action area and hazardous situation on its own to a safe location. The animal shall not be picked up and moved because it is not moving fast enough or it is inconvenient for the construction schedule. This guidance only applies to situations where a California red-legged frog is encountered on the move during conditions that make their upland travel feasible. This does not apply to California red-legged frogs that are uncovered or otherwise exposed or in areas where there is not sufficient adjacent habitat to provide escape cover and safe access to breeding, feeding, and sheltering habitat should they move outside the construction footprint.

Avoidance is the preferred option if a frog is not moving and is using aquatic habitat or if the frog is within some sort of burrow or other refugia. The area shall be well-marked for avoidance by construction and a Service-approved biological monitor shall be assigned to the area when work is taking place nearby.

2) The animal shall be captured and moved when it is the only option to prevent its death or injury.

If appropriate habitat is located immediately adjacent to the capture location then the preferred option is short distance relocation to that habitat. This must be coordinated with the Service but the general guidance is the frog shall not be moved outside of the area it would have traveled on its own. Under no circumstances should a California red-legged frog be relocated to another property without the owner's written permission. It is Caltrans' and its designees' responsibility to arrange for that permission.

The release must be coordinated with the Service and will depend on where the individual was found and the opportunities for nearby release. In most situations the release location is likely to be into the mouth of a small burrow or other suitable refugia and in certain circumstances pools without non-native predators may be suitable for frogs.

Only Service-approved biologists for the project can capture California red-legged frogs. Nets or bare hands may be used to capture California red-legged frogs. Soaps, oils, creams, lotions, repellents, or solvents of any sort cannot be used on hands within two hours before and during periods when they are capturing and relocating California red-legged frogs. To avoid transferring disease or pathogens between sites during the course of surveys or handling of

the frogs, Service-approved biologists must use the following guidance for disinfecting equipment and clothing. These recommendations are adapted from the *Declining Amphibian Population Task Force's Code* which can be found in their entirety at: *http://www.open.ac.uk/daptf/.*

i. All dirt and debris, including mud, snails, plant material (including fruits and seeds), and algae, shall be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water and/or an amphibian. Cleaned items shall be rinsed with clean water before leaving each site.

ii. Boots, nets, traps, and other equipment, shall then be scrubbed with either a 70 percent ethanol solution, a bleach solution (0.5 to 1.0 cup of bleach to 1.0 gallon of water), QUAT 128 (quaternary ammonium, use 1:60 dilution), or a 6 percent sodium hypochlorite 3 solution and rinsed clean with water between sites. Avoid cleaning equipment in the immediate vicinity of a pond or wetland. All traces of the disinfectant shall be removed before entering the next aquatic habitat.

iii. Used cleaning materials (liquids, etc.) shall be disposed of safely, and if necessary, taken back to the lab for proper disposal.

iv. Service-approved biologists shall limit the duration of handling and captivity. While in captivity, individual California red-legged frogs shall be kept in a cool, dark, moist, aerated environment, such as a clean and disinfected bucket or plastic container with a damp sponge. Containers used for holding or transporting shall not contain any standing water.

Reporting Requirements

Caltrans or its designees shall report to the Service any information about take or suspected take of listed-species not authorized in this document. Injured California red-legged frogs shall be cared for by a licensed veterinarian or other qualified person such as the onsite biologist; dead individuals of any listed species shall be preserved according to standard museum techniques and held in a secure location. The Service shall be notified within one working day of the discovery of death or injury to a listed species that results from project related activities or is observed at the project site. Notification shall include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a U.S. Geological Survey 7.5-minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. Dead individual animals shall be placed in a sealed plastic bag with a piece of paper containing information on where and when the animal was found along with the name of the person who found it, the bag shall be frozen in a freezer located in a secure location until instructions are received from the Service regarding the disposition of the specimen or the

Service takes custody of the specimen. The Service contacts are the Coast-Bay/Forest Foothill Division Chief of the Endangered Species Program in the Sacramento Fish and Wildlife Office at (916) 414-6600 and the Resident Agent-in-Charge of Service's Office of Law Enforcement at (916) 569-8444.

Caltrans or its designees shall submit a post-project summary and compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within sixty (60) calendar days of the date of the completion of construction activity. This report will be specific to the Peltier Creek Restoration Project and shall detail (i) dates that activities occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the California red-legged frog, if any; (v) occurrences of incidental take to listed species, if any; and (vi) other pertinent information.

REINITIATION--CLOSING STATEMENT

This concludes reinitiation of formal consultation on the proposed Interchange Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, including work outside of the project footprint analyzed in this opinion and including vehicle parking, staging, lay down areas, and access roads; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion including use of rodenticides or herbicides; relocation of utilities; and use of vehicle parking, staging, lay down areas, and access roads; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any additional take will not be exempt from the prohibitions of section 9 until consultation has been completed on a reinitiation.

If you have questions concerning this reinitiation addressing the Peltier Creek Restoration Project, please contact John Cleckler or Ryan Olah, Coast-Bay/Forest Foothills Division Chief, at the letterhead address or at (916) 414-6600.

Sincerely,

E. Tattersall

for Jan Knight
Acting Field Supervisor

cc:
Christopher States, Frances Malamud-Roam, and Carie Montero, Caltrans, Oakland, California
Janet Adams, Solano Transportation Authority, Suisun City, California
Melissa Escaron, California Department of Fish and Wildlife, Yountville, California
Paula Gill, U.S. Army Corps of Engineers, San Francisco, California
Carolyn Mulvihill, U.S. Environmental Protection Agency, San Francisco, California
Brendan Thompson, San Francisco Bay Regional Water Quality Control Board, Oakland, California

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U.S. Army Corps
of Engineers
San Francisco District
Regulatory Division

Enclosure 11

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

January 14, 2011

In response, refer to:
2010/06180

James Richards, Deputy District Director
Department of Transportation
Caltrans District 4
Office of Environmental Analysis
111 Grand Avenue
Oakland, California 94610

Dear Mr. Richards:

Thank you for your letter of December 8, 2010, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Effective July 1, 2007, the Federal Highway Administration assigned, and the California Department of Transportation (Caltrans) has assumed all responsibilities for consultation and approval on most highway projects in California. Therefore, Caltrans is now considered the Federal action agency for ESA consultations with NMFS for Federally funded projects. This letter also serves as consultation under the authority of, and in accordance with, the Essential Fish Habitat (EFH) provisions of the Magnuson Stevens Fishery Conservation and Management Act (MSA), and the provisions of the Fish and Wildlife Coordination Act of 1934 (FWCA), as amended. These consultations pertain to Caltrans' proposed Interstate-80/Interstate-680/State Route 12 Interchange Improvement Project in Solano County, California.

The Interstate-80/Interstate-680/State Route 12 (I-80/I-680/SR 12) Interchange Improvement Project covers several miles of roadway around the City of Fairfield in Solano County, California. The western boundary of the Project is the Red Top Road crossings of I-680, I-80, and SR 12; the eastern boundary of the Project is the Suisun Valley Road crossing on I-80 and the Ledgewood Creek road crossing on SR 12. Surface water in the action area includes Green Valley Creek and Ledgewood Creek. The purpose of the project is to improve the I-80/I-680/SR 12 interchange complex to meet traffic demands and alleviate cut-through traffic on local roads. The project consists of construction or realignment of the following interchanges: 1) I-80/I-680/SR 12 West; 2) I-680 and Red Top Road; 3) I-80 and Green Valley Road; 4) I-80/Red Top Road and Business Center Drive; and 5) and SR 12 West and Red Top Road. Construction will also involve widening of I-80 and a new lane on eastbound SR 12, which will require a new bridge and off-ramp over Green Valley Creek, and widening of the culvert over Ledgewood Creek. All proposed in-stream work will occur during the dry season (June 1 through October 15).

Green Valley Creek originates in Green Valley, northwest of Rockville Hills Regional Park, and flow south to Cordelia Slough which is a tributary of Grizzly Bay. At the existing I-80 and I-680/I-80 West Interchange overcrossing, Green Valley Creek flows in a concrete-lined, trapezoidal channel approximately 670 feet long and 70 feet wide. The proposed action will remove the existing I-80 West bridge and replace it with a single span structure measuring approximately 103 feet long and 133 feet wide. Additionally, a single span structure to carry the Green Valley Road off-ramp over the creek will replace the existing I-680/I-80 West interchange.

In-stream construction at Green Valley Creek is proposed to occur between June 1st and October 15th, over approximately four construction seasons. Construction at Green Valley Creek will occur within a 10-20 year time frame. The first phase will involve construction of the outside (northernmost) westbound lanes on I-80 while maintaining traffic flow on the existing structure. Demolition of the existing I-80 West bridge, and completion of the new I-80 West bridge and the new off-ramp structure will follow.

Piles for the new free-spanning structures will be located at the top of the creek bank and are anticipated to be 12-inch square piles driven to a depth of approximately 70 feet. Approximately 40 piles per abutment will be installed for the westbound I-80 bridge, and approximately 24 piles per abutment will be installed for the new off-ramp structure. Vibratory hammers will be used for pile driving to the maximum practicable extent. Pile driving will only occur during low precipitation periods (June 1 to October 15) and any work occurring before June 1 or after October 15 will be restricted to road or bridge surface only, with water quality control measures in place.

Ledgewood Creek originates in the Vaca Mountains, north of the Solano/Napa County line, and flows south to Paytonia Slough which is a tributary of Grizzly Bay. In the vicinity of the existing SR 12 overcrossing, Ledgewood Creek is confined to a levee-lined trapezoidal channel. Beneath the five-span bridge at SR 12, Ledgewood Creek is conveyed through concrete-lined box culverts. Within the action area, riparian and riverine cover is limited to areas downstream of these culverts. The culverts at SR 12 and Ledgewood Creek is proposed to be extended 15 feet to the south (downstream) to accommodate an additional lane on SR 12; this would permanently impact 15 linear feet of the existing earthen channel. Construction associated with the culvert is expected to last only one season from June 1 to October 15.

Dewatering of both Ledgewood Creek and Green Valley Creek will involve construction of the following in-channel features: 1) temporary cofferdams (made of gravel and fabric) constructed 20-50 feet beyond the limit of bridge/culvert widening; and a pipe diversion to facilitate dewatering of the channel and bypass creek flow; 2) cofferdams constructed utilizing the same methods to facilitate excavation of existing bridge/culvert footings; and 3) falsework placed within the banks and channel to support construction of the cast-in-place concrete box girder structures of the new bridges/culverts. No construction related material (including dewatering and bypass structures) will remain in the channel between October 15 and June 1. When construction is completed, falsework will be removed and any disturbed portions of the creek bed and bank temporarily affected during construction will be restored to pre-project conditions. Additionally, the channel under the new bridges at Green Valley Creek will be restored to an

earthen channel; and a concrete fish passage structure involving a low flow channel and possibly baffles will be constructed in the culvert at SR 12 and Ledgewood Creek.

Standard best management practices (BMPs) for construction site and sediment and stormwater runoff control will be utilized on this project. Biofiltration swales and biostrips will be used when possible to control runoff. Vegetation will be trimmed rather than removed when possible. Temporarily disturbed riparian areas will be replanted with the native species prior to October 15 to minimize erosion and creek sedimentation, and revegetation will be monitored annually for 3 years.

Endangered Species Act

In its December 8, 2010, letter Caltrans asked for concurrence with a finding that the project is not likely to adversely affect Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*). Reaches of Green Valley Creek and Ledgewood Creek within the project area are not designated critical habitat for CCC steelhead. Available information indicates the following DPS may occur in the project area:

Central California Coast steelhead Distinct Population Segment (*O. mykiss*) **DPS**
Threatened (January 5, 2006; 71 FR 834).

The life history of steelhead is summarized in Busby *et al.* (1996). Steelhead typically immigrate to tributaries of San Francisco Bay between November and April, peaking in January and February (Fukushima and Lesh 1998). Adult CCC steelhead are generally not present in streams between May and October; warm summer water temperature and poor habitat quality within the project area further reduce the likelihood of adult steelhead presence during summer months. Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows. Emigrating CCC steelhead use Green Valley Creek and portions of the San Francisco Bay for rearing and as a migration corridor to the ocean. In summmer months, reaches of Green Valley Creek and Ledgewood Creek within the action area are unsuitable for salmonid rearing due to poor water and habitat quality. Although data regarding the emigration timing of steelhead smolts from Green Valley Creek and Ledgewood Creek is lacking, steelhead from other streams draining to San Francisco Bay typically emigrate from March through June (Fukushima and Lesh 1998). NMFS assumes that steelhead from Green Valley Creek and Ledgewood Creek emigrate at the same time and smolting steelhead should be absent during the in-channel construction window of June 1 through October 15.

O. mykiss have been collected in Green Valley Creek from the 1950s to the present, and unpublished data indicates *O. mykiss* were collected 1 mile upstream of I-80 in January 1997 (Leidy *et al.* 2005). Therefore, it is likely that steelhead spawning and rearing occur above the I-80 crossing of Green Valley Creek. Beneath I-80 and the I-680/I-80 West interchange Green Valley Creek passes through a 670 foot long, concrete-lined trapezoidal channel and primarily provides a migration corridor for salmonids at this location. This crossing contains an engineered low-flow channel and concrete weirs to enhance fish passage, but lacks significant riparian canopy and natural instream cover due to the concrete channel invert.

Caltrans proposes to restore approximately 300 feet of Green Valley Creek to natural earthen channel and in the process enhance habitat at the site. Proposed actions will not inhibit fish passage at the site, and could provide additional rearing habitat for juvenile salmonids. Salmonids are not likely to be present during summer in-channel construction and pile driving work windows. Construction activities that are proposed to occur when migratory steelhead are likely to be present will be restricted to road or bridge surfaces only, with water quality control measures in place. Therefore, CCC steelhead are not likely to be adversely affected by the proposed actions at Green Valley Creek.

In the vicinity of the SR 12 crossing, levees line both banks of Ledgewood Creek and the channel has a trapezoidal cross section. SR 12 crosses Ledgewood Creek over a five-span bridge. At low flows Ledgewood Creek passes through the second culvert from the east bank, which forms a V-shaped channel to maximize water depths at low flows. No observations of steelhead have been reported in Ledgewood Creek. The Ledgewood Creek drainage, however, is adjacent to the Suisun Creek Watershed which is known to support steelhead populations. Furthermore, Chinook salmon have been observed spawning in Ledgewood Creek above the project site, indicating that Ledgewood Creek supports migratory habitat for anadromous salmonids (NMFS 2011).

Proposed activities at Ledgewood Creek involve widening the SR 12 crossing by 15 linear feet to the south. This will permanently impact 15 linear feet of the existing earthen channel by converting it to a concrete invert slab. This action will exacerbate the existing shallow water depth issues at low flows; and concrete low-flow walls and potentially baffles will be constructed to enhance low-flow fish passage of the culvert. Ledgewood Creek is not designated critical habitat for CCC steelhead, and there is no confirmed documentation of *O. mykiss* within the drainage. The proximity of Ledgewood Creek to the Suisun Creek watershed, however, indicates migratory steelhead could be present during periods of higher flows. All construction activities associated with the culvert will occur over one dry season, from June 1 to October 15. Therefore, the presence of CCC steelhead is unlikely during proposed construction activities, and CCC steelhead are not likely to be adversely affected by the proposed actions at Ledgewood Creek. Proposed passage improvements at Ledgewood Creek will address the addition of 15 linear feet of hardened creek bottom, and potentially make higher quality habitat above the culvert more accessible to CCC steelhead.

Based on the best available information, NMFS concurs with Caltran's determination that threatened CCC steelhead are not likely to be adversely affected by the I-80/I-680/SR 12 Interchange Improvement Project. This concludes informal consultation in accordance with 50 CFR 402.13(a) for the proposed I-80/I-680/SR 12 Interchange Improvement Project in Solano County, California. However, further consultation may be required if: (1) new information becomes available indicating that listed species or critical habitat may be affected by the project in a manner or to an extent not previously considered; (2) current project plans change in a manner that causes an effect to listed species or critical habitat in a manner not previously considered; or (3) a new species is listed or critical habitat designated that may be affected by the action.

Magnuson-Stevens Fishery Conservation and Management Act

The project area is located within an area identified as EFH for Central Valley fall/late fall-run Chinook salmon, managed with the Pacific Coast Salmon Fishery Management Plan under the MSA. As discussed in the above ESA section, no in-water construction will take place when Chinook salmon are likely to be present. However, adverse effects to EFH could occur from increased sedimentation and turbidity following construction activities. While these impacts are considered minor and temporary, NMFS has made the determination that the proposed action would adversely affect EFH for this species. However, the proposed action contains adequate measures to avoid, minimize, mitigate, or otherwise offset any adverse effects to EFH. Therefore, NMFS has no additional EFH Conservation Recommendations to provide.

This concludes EFH consultation for Caltrans' proposed I-80/I-680/SR 12 Interchange Improvement Project, Solano County, California. Pursuant to 50 CFR 600.920(l) of the EFH regulations, Caltrans must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations.

Fish and Wildlife Coordination Act

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development [16 U.S.C. 661]. The FWCA establishes a consultation requirement for Federal departments and agencies that undertake any action that proposes to modify any stream or other body of water for any purpose, including navigation and drainage [16 U.S.C 662(a)]. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources. With implementation of the previously-referenced EFH conservation recommendations, NMFS has no further comments to provide.

Please contact Mr. Joseph Heublein at (707) 575-1251, or via e-mail at joe.heublein@noaa.gov should you have any questions.

Sincerely,

for Rodney R. McInnis
Regional Administrator

cc: Chris Yates, NMFS, Long Beach
Bob Hoffman, NMFS, Long Beach
Bryant Chesney, NMFS, Long Beach
Ahmad Hashemi, Caltrans District 4
Copy to File ARN: 151422-SWR-2010-SR00524

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U.S. Army Corps
of Engineers
San Francisco District
Regulatory Division

PROGRAMMATIC AGREEMENT BETWEEN THE CALIFORNIA DEPARTMENT OF TRANSPORTATION AND THE CALIFORNIA STATE HISTORIC PRESERVATION OFFICER REGARDING THE I-80/I-680/SR-12 INTERCHANGE PROJECT, SOLANO COUNTY, CALIFORNIA

WHEREAS, the Federal Highway Administration (FHWA) has assigned and the California Department of Transportation (Caltrans) has assumed FHWA responsibility for environmental review, consultation, and coordination under the provisions of the *Memorandum of Understanding (MOU) between the Federal Highway Administration and the California Department of Transportation Concerning the State of California's Participation in the Surface Transportation Project Delivery Pilot Program*, which became effective on July 1, 2007 and applies to this project; and,

WHEREAS, Caltrans and the Solano Transportation Authority (STA) propose to implement the I-80/I-680/SR-12 Project (Undertaking), located near the cities of Fairfield and Suisun City in Solano County, that currently consists of two ultimate alternatives (Alternatives B and C) and two fundable alternatives (Alternative B Phase I and Alternative C Phase 1) that will be constructed in a number of stages; and,

WHEREAS, Caltrans has consulted with the State Historic Preservation Officer (SHPO) pursuant to the 1 January 2004 *Programmatic Agreement Among The Federal Highway Administration, The Advisory Council On Historic Preservation, The California State Historic Preservation Officer, And The California Department Of Transportation Regarding Compliance With Section 106 Of The National Historic Preservation Act, As It Pertains To The Administration Of The Federal-Aid Highway Program In California* (Federal-Aid Highway PA), and, where the Federal-Aid Highway PA so directs, in accordance with 36 CFR Part 800, the regulation implementing Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f), as amended (NHPA), regarding the Undertaking's potential to affect historic properties, has decided to prepare a programmatic agreement (PA) pursuant to 36 CFR §800.4(b)(2) and 800.14(b), and has notified the Advisory Council on Historic Preservation (ACHP) that a PA will be prepared, pursuant to 36 CFR § 800.6(a)(1)(i)(C), who is not participating by their letter dated March 7, 2011; and

WHEREAS, Caltrans has chosen to prepare this PA to ensure completion of the identification and evaluation of potential historic properties within the Undertaking's Area of Potential Effects (APE), and provide for the resolution of any adverse effects on identified historic properties subsequent to its approval of the Undertaking; and

WHEREAS, the Undertaking, as currently proposed, has the potential to affect historic properties, including the Village of Cordelia Historic District, the Suisun City Historic District, and the Suisun City Train Depot that have been determined eligible for listing in the National Register of Historic Places (NRHP), and may affect archaeological properties and resources of significance to Native Americans that have not yet been identified; and

WHEREAS, the Yocha Dehe Wintun Nation has participated in the consultation and has been invited to concur in this PA, and Caltrans will continue to afford them, should they so desire, with the opportunity to participate in the implementation of this PA and the undertaking; and

WHEREAS, Caltrans has initiated consultation with the Cortina Band of Indians regarding the proposed undertaking and its effects on historic properties, and will continue to afford them, should they so desire, with the opportunity to participate in the implementation of this PA and the undertaking; and

WHEREAS, Caltrans District 04 (District 04) and the STA have participated in the consultation and have been invited to concur in this PA;

NOW, THEREFORE, Caltrans and the SHPO agree that, upon Caltrans' decision to proceed with the Undertaking, Caltrans shall ensure that the Undertaking is implemented in accordance with the following stipulations in order to take into account the effects of the Undertaking on historic properties and further agree that these stipulations shall govern the Undertaking and all of its parts until this PA expires or is terminated.

STIPULATIONS

Caltrans shall ensure that the following measures are carried out:

I. AREA OF POTENTIAL EFFECTS

A. The APE for the Undertaking is described and depicted in the 2009 Historic Property Survey Report (HPSR) for the Undertaking. The APE encompasses the maximum extent of the area anticipated to be potentially affected, directly or indirectly, by construction of either of the ultimate alternatives. The APE is included within Attachment 1 of this PA.

B. If Caltrans determines modifications to the Undertaking subsequent to the execution of this PA or identification results necessitate revision of the APE, Caltrans will submit the appropriate APE revisions to the PA parties along with any documentation prepared to complete identification, evaluation and effects assessments for each stage of the proposed project. In this manner, the APE may be amended without amending the PA. Revisions to the APE will be consistent with guidance in Attachment 3 of the Federal-Aid Highway PA.

II. PHASED IDENTIFICATION, EVALUATION, AND APPLICATION OF THE CRITERIA OF ADVERSE EFFECTS

Caltrans shall, upon its decision to proceed with future stages of the Undertaking, and prior to the start of construction for that stage, complete its efforts to identify, evaluate, and apply the criteria of adverse effect to historic properties within the APE for that stage in accordance with 36 CFR §800.4(b)(1), §800.4(c)-(d), and §800.5(a)(1) as follows:

A. Archaeological Resources

1. All work regarding the identification, evaluation, assessment of effects, and mitigation of any adverse effects on archaeological resources shall be completed for future stages of the Undertaking with the approval of Caltrans Professionally Qualified Staff (CTPQS) in the appropriate discipline and in accordance with the Federal-Aid Highway PA.

2. Due to the general lack of surface visibility, access limitations, lack of design detail, and potential for subsurface archaeological resources within the APE, STA in consultation with District 04 and the Yocha Dehe Wintun Nation, prior to the construction of each stage, shall assess the impacts of that stage against the extent of the previous efforts to identify archaeological resources and the archaeological sensitivity of the location, and prepare for District 04 approval, a Historic Properties Identification Proposal (HPIP) detailing what additional actions will be taken to identify archaeological resources within the footprint of that stage. The assessment shall include impacts associated with utility relocation and tree removal. The HPIP may include more than one stage, provided sufficient design detail has been prepared to assess the impacts and any access limitations have been resolved.

3. If a conclusion that no further efforts to identify archaeological resources is justified in the HPIP, and District 04 agrees, District 04 will notify the other PA parties of this finding and allow 30 days for the parties to comment. Any objection received within 30 days will be resolved in accordance with Stipulation VIII.C of this PA.

4. If subsurface exploration is indicated, the HPIP shall include an Extended Phase I (XPI) proposal, consistent with Caltrans policies and guidelines and the October 2010 *Historic Properties Treatment Plan, I-80/I-680/SR-12 Interchange Project* (Treatment Plan), and any subsequent addenda to the Treatment Plan. The Treatment Plan is included as Attachment 1 of this PA.

5. Any approved XPI investigations shall occur prior to construction. An XPI report, consistent with Caltrans guidelines, documenting the results of any XPI investigations, shall be submitted to the Yocha Dehe Wintun Nation for 30 day review and District 04 for review and approval. If archaeological resources are identified as a result of XPI investigations or during construction of any stage, and those resources can be protected during construction from any project effects by the establishment and effective enforcement of an Environmentally Sensitive Area (ESA), those resources may be considered eligible for the NRHP for the purposes of the Undertaking without conducting additional subsurface testing or surface collecting in accordance with Stipulation VIII.C.3 of the Federal-Aid Highway PA.

6. If archaeological resources are identified that do not appear eligible for listing in the NRHP, documentation supporting that determination shall be included in the XPI report. If the Yocha Dehe Wintun Nation and District 04 agree with the determination, District 04 will submit the documentation to SHPO for concurrence in accordance with Stipulation VIII.C.5 of the Federal-Aid Highway PA.

7. If archaeological resources considered eligible for listing in the NRHP are identified as a result of XPI investigations or the monitoring of construction excavations for any stage, and those resources cannot be protected from any potential effects by the establishment of an ESA, Caltrans shall follow section C of this stipulation and the Treatment Plan.

B. Built Environment Resources

1. All work regarding the identification, evaluation, assessment of effects, and mitigation of any adverse effects on built environment resources shall be completed for future stages of the Undertaking with the approval of Caltrans Professionally Qualified Staff (CTPQS) in the appropriate discipline and in accordance with the Federal-Aid Highway PA.

2. STA, in consultation with District 04, shall include in the HPIP an assessment of the adequacy of the previous built environment studies against the design details of that stage, and include any additional built environment properties in an amended APE. The assessment shall also consider the need to re-evaluate properties due to the passage of time and changing conditions.

3. If any additional built environment properties are identified within an amended APE that do not qualify as exempt under Stipulation VIII.C.1 and Attachment 04 of the Federal-Aid Highway PA, prior to the construction of each stage, STA in consultation with District 04,

shall evaluate the properties in accordance with stipulation VIII.C.2 of the Federal-Aid Highway PA and the Treatment Plan.

4. As currently proposed the Undertaking will have no adverse effect on NRHP eligible built environment properties. For any future stage of the project that will potentially affect NRHP listed or eligible built environment properties, Caltrans shall follow section C of this stipulation.

C. Assessment of Effects

STA in consultation with District 04 shall assess the effects of each stage of the Undertaking on any properties listed, eligible, or considered eligible for the NRHP within the APE for that stage in accordance with Stipulation X of the Federal-Aid Highway PA and Caltrans policies and guidelines.

1. If District 04 determines that a stage of the Undertaking meets the conditions of Stipulation X.B.2.a of the Federal-Aid Highway PA, District 04 shall notify Caltrans and SHPO of a finding of No Adverse Effect with Standard Conditions in accordance with Stipulation X.B.2.b of the Federal-Aid Highway PA. Documentation, consistent with Caltrans guidance, supporting the finding shall be submitted with the notification.

2. If District 04 concludes that a stage of the Undertaking will have an effect on properties listed, eligible, or considered eligible for the NRHP, but the effect is not considered adverse, District 04 shall propose a finding of No Adverse Effect to Caltrans in accordance with Stipulation X.B.1.a of the Federal-Aid Highway PA. Following approval, Caltrans shall consult with SHPO regarding the finding, after which SHPO shall have 30 days to provide comment. If SHPO does not comment within 30 days of receipt of the documentation, Caltrans may proceed with the No Adverse Effect finding in accordance with Stipulation X.B.1.b of the Federal-Aid Highway PA.

3. If District 04 concludes that a stage of the Undertaking will have an adverse effect on properties listed, eligible or considered eligible for the NRHP, District 04 shall propose a finding of Adverse Effect to Caltrans in accordance with Stipulation X.C of the Federal-Aid Highway PA. Following approval, Caltrans shall consult with SHPO regarding the finding, after which SHPO shall have 30 days to provide comment. If SHPO does not comment within 30 days of receipt of documentation, Caltrans may assume the SHPO's concurrence with the finding in accordance with Stipulation X.C.2 of the Federal-Aid Highway PA.

III. TREATMENT OF HISTORIC PROPERTIES

Caltrans shall, upon its decision to proceed with construction of a stage of the Undertaking, and prior to implementation of that stage, resolve adverse effects to historic properties within the APE for that stage of the Undertaking in accordance with 36 CFR § 800.6, as follows:

A. Archaeological Resources

1. Caltrans may, as a result of consultation to resolve adverse effects for any stage of the Undertaking, conduct data recovery work on historic properties determined to be significant exclusively under Criterion D of the NRHP pursuant to Stipulation X.C.2 of the Federal-Aid Highway PA. STA, in consultation with District 04 and the Yocha Dehe Wintun Nation, shall prepare a Data Recovery Proposal (Proposal), to be included as an addendum to the Treatment Plan, detailing the treatment for historic properties specific to that stage.

Following Caltrans approval, Caltrans shall consult with SHPO regarding the Proposal, after which SHPO shall have 45 days to provide comment. This comment period is to run concurrently with that provided in Stipulation II.C.3 if the Proposal accompanies the finding of adverse affect. If SHPO does not comment within 45 days of receipt of the documentation, Caltrans may proceed with the implementation of the Proposal.

2. In order to avoid adverse effects to deposits that contribute to the NRHP eligibility of archaeological sites described in stipulation III.A.1, above, where data recovery is not prescribed, Caltrans will protect those contributing deposits from any potential effects during construction by establishment and effective enforcement of ESA(s). Provisions for the protection of the ESA(s) will be described, and the locations depicted, in information included in the final construction plans for that stage of the Undertaking. The ESA provisions will indicate that no work will take place within the ESA(s), either horizontally or to a depth that may impact the deposits, and that temporary fencing will be placed between the areas of impact and the location of the contributing deposits of the archaeological sites. Caltrans shall further ensure that a professional archaeologist will coordinate the installation of the fence. A Yocha Dehe Tribal Monitor will be invited to be present during installation of the fence. Caltrans shall be responsible for ensuring its integrity is maintained for the duration of construction activities in the vicinity of deposits that contribute to the NRHP eligibility of the archaeological sites.

B. Built Environment Resources

In the event that a stage of the Undertaking will result in an unavoidable Adverse Effect to built environment properties in accordance with stipulation II.C.3 above, Caltrans shall consult to resolve the adverse effect in accordance with stipulation XI.A of the Federal-Aid Highway PA and 36 CFR § 800.6(a) and 36 CFR § 800.6(b)(1). To support the consultation, STA shall prepare, for Caltrans review and approval, a Built Environment Treatment Plan (BETP) outlining an approach to resolve the adverse effect. Caltrans shall ensure that the agreed upon resolution is thereafter implemented.

C. Treatment Plan Amendments

Any PA party may propose amendments to the Treatment Plan. Such amendment will not require amendment of this PA. Disputes regarding amendments proposed hereunder shall be addressed through further consultation among the PA parties. Consultation regarding the proposed amendment shall extend for 30 days. If the dispute is resolved within this time frame, the PA parties shall proceed in accordance with the terms of that resolution. If the dispute is not resolved within this time frame, Caltrans shall render a final decision regarding the dispute and the PA parties shall proceed in accordance with the terms of that decision.

D. Caltrans Authorization

Caltrans shall not authorize the execution of any Undertaking activity, for any stage, that may affect (36 CFR § 800.16(i)) historic properties in the Undertaking's APE prior to the completion of the fieldwork and appropriate consultation stipulated in this PA and the Treatment Plan found in Attachment 1 of this PA.

IV. REPORTING REQUIREMENTS AND RELATED REVIEWS

A. For any XPI, Phase II or Phase III investigations, reporting will follow the guidance found in Caltrans Standard Environmental Reference and the Treatment Plan, which is included as Attachment 1 of this PA.

B. Reporting for built environment studies will follow stipulations VIII.C.5 and stipulations IX-X of the Federal-Aid Highway PA, as appropriate. Mitigation measures developed through consultation conducted in accordance with stipulation III.B of this PA shall be reported as a result of such consultation.

V. NATIVE AMERICAN CONSULTATION

The Yocha Dehe Wintun Nation and the Cortina Band of Indians have been consulted regarding the proposed undertaking and its effect on historic properties, will continue to be consulted, and will be afforded, should they so desire, the opportunity to participate in the implementation of the PA and of the Undertaking. Should any of the parties consulted with desire, individually, to participate as a PA party as herein set forth, Caltrans will make an effort to reach a consensus with each such party regarding the manner in which they may participate in the implementation of this PA and the Undertaking, and regarding any time frames or other matters that may govern the nature, scope, and frequency of such participation.

VI. TREATMENT OF HUMAN REMAINS OF NATIVE AMERICAN ORIGIN

The PA parties agree that human remains and related items discovered during the implementation of the terms of this PA and of the Undertaking will be treated in accordance with the requirements of § 7050.5(b) of the California Health and Safety Code. If, pursuant to § 7050.5(c) of the California Health and Safety Code, the county coroner/medical examiner determines that the human remains are or may be of Native American origin, then the discovery shall be treated in accordance with the provisions of § 5097.98(a)-(d) of the California Public Resources Code.

VII. LATE DISCOVERIES AND UNANTICIPATED EFFECTS

If Caltrans determines, after commencement of any stage of the Undertaking, that construction of that stage will affect a previously unidentified property that may be eligible for the National Register, or affect a known historic property in an unanticipated manner, Caltrans will address the discovery or unanticipated effect in accordance with 36 CFR § 800.13(b)(3). Caltrans at its discretion may hereunder assume any discovered property to be eligible for the National Register in accordance with 36 CFR § 800.13(c).

VIII. ADMINISTRATIVE PROVISIONS

A. Standards

1. **Definitions.** The definitions provided at 36 CFR § 800.16 are applicable throughout this PA.

2. **Professional Qualifications.** All activities prescribed by stipulations I. II, III, IV, V, VI and VII of this PA shall be carried out under the authority of Caltrans by or under the direct supervision of a person or persons meeting at a minimum *Secretary of the Interior's Professional Qualification Standards* (48 FR 44738-39) (PQS) in appropriate disciplines. Nothing in this stipulation, however, may be interpreted to preclude Caltrans or any agent or contractor thereof from using the properly supervised services of persons who do not meet the PQS.

3. **Documentation Standards.** Written documentation of activities prescribed by stipulations II, III, IV, VI, and VII of this PA shall conform to the *Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716-44740), as well as to applicable standards and guidelines established by the SHPO.

4. **Curation Standards.** Caltrans shall ensure that, to the extent permitted under § 5097.98 and § 5097.991 of the California Public Resources Code, the materials and records resulting from the activities prescribed by this PA are curated in accordance with 36 CFR § 79. Caltrans shall ensure that the views of the PA parties are taken into consideration when decisions are made about the final disposition of archaeological materials resulting from activities prescribed by this PA.

B. Confidentiality.

The parties to this PA acknowledge that historic properties covered by this PA are subject to the provisions of § 304 of the NHPA and § 6254.10 of the California Government Code (Public Records Act), relating to the disclosure of archaeological site information and, having so acknowledged, will ensure that all actions and documentation prescribed by this PA are consistent with said sections.

C. Resolving Objections

1. Should any party to this PA object to the manner in which the terms of this PA are implemented, to any action carried out or proposed with respect to implementation of the PA (other than the Undertaking itself), or to any documentation prepared in accordance with and subject to the terms of this PA, Caltrans shall immediately notify the other PA parties of those objections, and shall consult with the objecting party and with the other parties for no more than 14 days to resolve the objection. Caltrans shall reasonably determine when this consultation will commence. If the objection is resolved through such consultation, the action subject to dispute may proceed in accordance with the terms of that resolution. If, after initiating such consultation, Caltrans determines that the objection cannot be resolved through consultation, Caltrans shall forward all documentation relevant to the objection, including Caltrans' proposed response to the objection, to the ACHP, with the expectation that the ACHP will, within thirty (30) days after receipt of such documentation, do one of the following:

   a. advise Caltrans that the ACHP concurs in Caltrans' proposed response to the objection, whereupon Caltrans will respond to the objection accordingly. The objection shall thereby be resolved; or

   b. provide Caltrans with recommendations, which Caltrans will take into account in reaching a final decision regarding its response to the objection. The objection shall thereby be resolved; or

   c. notify Caltrans that the objection will be referred for comment pursuant to 36 CFR § 800.7(c) and proceed to refer the objection and comment. Caltrans shall take the resulting comments into account in accordance with 36 CFR § 800.7(c)(4) and Section 110(1) of the NHPA. The objection shall thereby be resolved.

2. Should the ACHP not exercise one of the above options within 30 days after receipt of all pertinent documentation, Caltrans may proceed to implement their proposed response. The objection shall thereby be resolved.

3. Caltrans shall take into account any of the ACHP's recommendations or comments provided in accordance with section C of this stipulation with reference only to the subject of the objection. Caltrans' responsibility to carry out all actions under this PA that are not the subjects of the objection shall remain unchanged.

4. At any time during implementation of the measures stipulated in this PA, should an objection pertaining to such implementation be raised by a member of the public, Caltrans notify the PA parties in writing of the objection and take the objection into consideration. Caltrans shall consult with the objecting party and, if the objecting party so requests, with the other PA parties, for no more than 15 days. Within 10 days following closure of the consultation period, Caltrans will render a decision regarding the objection and notify all consulting parties hereunder of its decision in writing. The objection will thereby be resolved. In reaching its decision, Caltrans will take into account any comments from the consulting parties regarding the objection, including the objecting party. Caltrans' decision regarding the resolution will be final.

5. Caltrans shall provide all PA parties, the ACHP when the ACHP has issued comments hereunder, and any parties that have objected pursuant to section C.4 of this stipulation, with a copy of its final written decision regarding any objection addressed pursuant to this stipulation.

6. Caltrans may authorize any action subject to objection under section C.4 of this stipulation to proceed after the objection has been resolved in accordance with the terms of section C.5, above.

D. Amendments

Any PA party may propose that this PA be amended, whereupon the PA parties will consult for no more than 30 days to consider such amendment. Caltrans may extend this consultation period. The amendment process shall comply with will 36 CFR §§ 800.6(c)(1) and 800.6(c)(7). This PA may be amended only upon written agreement of the signatory parties. If it is not amended, this PA may be terminated by any of the signatory parties in accordance with section E of this stipulation, below.

E. Termination

1. If this PA is not amended as provided for in section D of this stipulation, above, or if any signatory proposes termination of this PA for other reasons, the signatory party proposing termination shall, in writing, notify the other PA parties, explain the reasons for proposing termination, and consult with the other PA parties for at least 30 days to seek alternatives to termination. Such consultation shall not be required if Caltrans proposes termination because the Undertaking no longer meets the definition set forth in 36 CFR § 800.16(y).

2. Should such consultation result in an agreement on an alternative to termination, the signatory parties shall proceed in accordance with the terms of that agreement.

3. Should such consultation fail, the signatory party proposing termination may terminate this PA by promptly notifying the other PA parties in writing. Termination hereunder shall render this PA without further force or effect.

4. If this PA is terminated hereunder, and if Caltrans determines that the Undertaking will nonetheless proceed, then Caltrans shall either consult in accordance with 36 CFR § 800.6 to develop a new PA, or request the comments of the ACHP, pursuant to 36 CFR Part 800.

F. Duration of the PA

1. Unless terminated pursuant to section E. of this stipulation, or unless it is superseded by an amended PA, this PA will be in effect following execution by the signatory parties until Caltrans, in consultation with the other PA parties, determines that all of its stipulations have been satisfactorily fulfilled. This PA will terminate and have no further force or effect on the day that Caltrans notifies the other PA parties in writing of its determination that all stipulations of this PA have been satisfactorily fulfilled.

2. The terms of this PA shall be satisfactorily fulfilled within ten (10) years following the date of execution by the signatory parties. If Caltrans determines that this requirement cannot be met, the PA parties will consult to reconsider its terms. Reconsideration may include continuation of the PA as originally executed, amendment of the PA, or termination. In the event of termination, Caltrans will comply with section E of this stipulation if it determines that the Undertaking will proceed notwithstanding termination of this PA.

3. If the Undertaking has not been implemented within ten (10) years following execution of this PA by the signatory parties, this PA shall automatically terminate and have no further force or effect. Prior to such time, Caltrans may consult with the other consulting parties to reconsider the terms of the PA and extend its duration through amendment pursuant to section D of this stipulation. If not amended, Caltrans shall notify the other PA parties in writing and, if it chooses to continue with the Undertaking, shall reinitiate review of the Undertaking in accordance with 36 CFR Part 800.

G. Effective Date

This PA will take effect on the date that it has been executed by Caltrans and the SHPO.

EXECUTION of this PA by Caltrans and the SHPO, its transmittal by Caltrans to the ACHP in accordance with 36 CFR §800.6(b)(1)(iv), and subsequent implementation of its terms, shall evidence, pursuant to 36 CFR§800.6(c), that this PA is an agreement with the ACHP for purposes of Section 110(1) of the NHPA, and shall further evidence that Caltrans has taken into account the effects of the Undertaking on historic properties and has afforded the ACHP an opportunity to comment on the Undertaking and its effects on historic properties.

SIGNATORY PARTIES:

California Department of Transportation

By _____ Date 11/3/11

Jay Norvell, Chief
Division of Environmental Analysis

California State Historic Preservation Officer

By for _____ Date 11/7/11

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

CONCURRING PARTIES:

California Department of Transportation

By: _____ Date: _____
Bijan Sartipi, Director
District 04, Oakland

Solano Transportation Authority

By: _____ Date: _____
Daryl K. Halls, Executive Director

Yocha Dehe Wintun Nation

By: _____ Date: _____
Marshall Mckay, Chairman

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
81420-2009-F-0857-7

April 16, 2012

Ms. Moujan Mostaghimi
California Department Transportation
Environmental Division, MS 8E
111 Grand Avenue
Oakland, California 94612

Subject: Biological Opinion on the Effects of the Proposed Interstate 80/Interstate 680/State Route 12 Interchange Phase 1 Project, Solano County, California (EA 0A5300)

Dear Ms. Mostaghimi:

This is in response to your April 20, 2011, request for consultation with the U.S. Fish and Wildlife Service (Service) on the proposed Interstate 80 (I-80)/Interstate 680 (I-680) /State Route 12 (SR 12) Interchange Phase 1 Project in Solano County, California. At issue are the effects of the proposed action on the endangered showy Indian clover (*Trifolium amoenum*), endangered Contra Costa goldfields (*Lasthenia conjugans*) and its critical habitat, endangered vernal pool tadpole shrimp (*Lepidurus packardii*), threatened vernal pool fairy shrimp (*Branchinecta lynchi*), endangered callippe silverspot butterfly (*Speyeria callippe callippe*), threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), threatened Central California Distinct Population Segment of the California tiger salamander (*Ambystoma californiense*), the threatened California red-legged frog (*Rana draytonii*) and its critical habitat, and the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*).

The Service concurs with the California Department of Transportation's (Caltrans) determination that the proposed project may affect, but is not likely to adversely affect the showy Indian clover, Contra Costa goldfields, and the Central California Distinct Population Segment of the California tiger salamander.

Caltrans has not completed protocol-level surveys for showy Indian clover in the entire action area due to access problems. Due to its extreme rarity we concur that the proposed project may affect, but is not likely to adversely affect this listed plant. Caltrans has committed to conducting Service protocol-level plant surveys of the previously inaccessible parcels on the Mangels' property north of SR 12 West (SR 12W) for showy Indian clover prior to the initial groundbreaking for Construction Package 3. Caltrans will reinitiate consultation pursuant to section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq.*)(Act) if

the listed plant is found, with the understanding that the presence of any additional listed species could lead to additional conservation measures that will be determined in conjunction with the Service. In the case of reinitiation, Caltrans' course of action with this species could lead to project delays, project redesign, or other significant effects on the project.

Caltrans has minimized potential effects such that it will not adversely affect the Contra Costa goldfields, Central California Distinct Population Segment of the California tiger salamander, and salt marsh harvest mouse. This determination was based upon: (1) the proposed retaining wall along the south shoulder of SR 12 East (SR 12E) between Ledgewood Creek and approximately 300 feet east of Pennsylvania Avenue and (2) information provided in the April 2011 Biological Assessment (BA) stating that the proposed construction activities and project design would not adversely affect the hydrology of the Gentry Suisun wetlands. The adjacent Gentry Suisun wetlands are occupied by Contra Costa goldfields and this lowland area is designated critical habitat for the species. The area provides potential habitat for the Central California Distinct Population Segment of the California tiger salamander and sufficient surveys have not been conducted to discount species presence. There are records of the salt marsh harvest mouse from within the pickleweed habitat in the Gentry Suisun wetlands (CDFG 2011a, 2011b). Along with *Proposed Conservation Measure 23*, the proposed retaining wall will avoid intrusion of proposed road widening into the low-lying wetland and will be of sufficient height to prevent salamanders that may inhabit the area from entering the SR 12E roadway.

In their April 20, 2011, letter, Caltrans requested formal consultation on the valley elderberry longhorn beetle and the California red-legged frog. Caltrans determined the project may affect, but is unlikely to adversely affect the Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, and callippe silverspot butterfly. Pursuant to 50 CFR 402.13(d), we do not concur with the determination by Caltrans on the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. During the technical assistance phase, the Service informed Caltrans and Solano Transit Authority (STA) that it is our biological opinion that the project may affect and is likely to adversely affect the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. This adverse effects determination was reflected in the DEIR/EIR and was not challenged by Caltrans or STA during the technical assistance phase, prior to issuance of the April 2011 BA. The Service repeated the biological reasoning for our determinations in our June 30, 2011 30-Day Letter and subsequent meetings with Caltrans and STA after Caltrans issued contrary effects determinations in their April 2011 BA. The Service disagreed with the biological rationale provided by Caltrans to support their not likely to adversely affect determinations for the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly in their April 2011 BA, their August 17, 2011 response to the 30-day letter, and in meetings with the Service subsequent to the issuance of the April 2011 BA. Therefore, we are issuing this biological opinion on the adverse effects of your project.

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users legislation (23 U.S.C. § 327) allows the Secretary of the U.S. Department of Transportation acting through the Federal Highway Administration (FHWA) to establish a Surface Transportation Project Delivery Pilot Program, whereby a State may assume the FHWA responsibilities under the National Environmental Policy Act (NEPA) for environmental review,

responsibilities under the National Environmental Policy Act (NEPA) for environmental review, agency consultation and other actions pertaining to the review or approval of a specific project. Caltrans assumed these responsibilities for the FHWA on July 1, 2007 through a Memorandum of Understanding within the State of California (http://www.dot.ca.gov/ser/downloads/MOUs/nepa_delegation /sec6005mou.pdf) and are exercising this authority as the Federal nexus for section 7 consultation on this project.

This biological opinion is based on: (1) the April 2011 BA, (2) the September 15, 2011 meeting with Caltrans and STA, (3) site visits and meetings during the technical assistance phase of the consultation; (4) discussions with Sue Wickham of the Solano Land Trust (SLT) regarding listed species in nearby SLT holdings; (5) miscellaneous correspondence and electronic mail (e-mail) messages between the Service and Caltrans; (6) results from the joint resolution process; and (7) other information available to the Service.

Consultation History

March 26, 2007	The Service received meeting notes from a March 15, 2007, NEPA/404 Integration Memorandum of Understanding checkpoint meeting. The Service did not attend the meeting.
March 10, 2009	The Service received a California red-legged frog habitat assessment for the project from STA's consultant.
May 29, 2009	The Service received meeting notes for a February 10, 2009, presentation of the alternatives for inclusion in the Draft Environmental Impact Statement (EIS) for the project and the criteria for the selection of alternatives from Caltrans. The Service did not attend this meeting.
November 19, 2009	The Service met with Caltrans and STA's consultant to discuss future consultation on the project. The expectations for the BA and the need to incorporate wildlife passage into the project design were discussed. The Service was informed that the first project phase was expected to begin in 2012 and later phases may not start for 30 years or more. Caltrans and STA stated that each project phase had independent utility and Caltrans planned to initiate separate consultation on Phase 1 Their current EIS was limited to Phase 1 but the Environmental Impact Report (EIR) included Phase 1 and 2.
June 28, 2010	The Service attended a meeting with Caltrans and STA to discuss the consultation process and a revised project description.
July 15, 2010	The Service provided technical assistance via an e-mail message to STA's consultant in response to the March 2009 California red-legged frog habitat assessment.

July 19, 2010 The Service visited Solano Land Trust land holdings with STA's consultant to discuss needed funding to complete and perform California red-legged frog-associated restoration and habitat management projects. STA was exploring compensation opportunities to minimize the effects of the proposed project on the listed frog. The Service emphasized that preservation and management of red-legged frog breeding and upland habitat adjacent to the proposed Business Center Drive Extension is the preferred option for minimizing the projects' adverse effects on the frog. A conservation easement on this land would preserve the proposed road undercrossing connections between a primary breeding pond and the remainder of the SOL-2 California red-legged frog critical habitat unit.

July 20, 2010 The Service received Wildlife and Fish addendums for the DEIR/EIS from Caltrans for review.

August 13, 2010 The Service received Volumes 1 and 2 of the DEIR/EIS from Caltrans. Although a final alternative has not been selected, Caltrans decided to pursue section 7 consultation on what is identified as Alternative C Phase 1 in the DEIR/EIS. Caltrans included the Solano County Draft Habitat Conservation Plan (HCP) (SCWA 2009) in the *Consistency with State, Regional, and Local Plans and Programs*, Section 3.1.1.2. The DEIR/EIS acknowledged the draft Solano HCP as establishing a framework for complying with State and Federal endangered species regulations. According to the DEIR/EIS, all the proposed project alternatives would result in impacts to callippe silverspot butterfly, vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, California red-legged frog and their habitat. The document stated that Alternative C, Phase 1 had the potential to destroy or disturb callippe silverspot butterfly or its habitat. The DEIR/EIS also stated that Alternative C Phase 1 would result in impacts to 1.71 acres (1.45 acres direct impacts + 0.26 acre indirect impacts) of vernal pool fairy shrimp/vernal pool tadpole shrimp habitat. In the DEIR/EIS, Caltrans committed to compensating for direct effects to vernal pool fairy shrimp and vernal pool tadpole shrimp at 3:1 and at a minimum of 1.1:1 for indirect effects. The DEIR/EIS stated that the actual ratios would be determined through consultation with the Service and that credits would be purchased through a Service-approved conservation bank. Although the analysis was not included in the April 2011 BA, the DEIR/EIS acknowledged that the proposed Business Center Drive Extension would reduce dispersal opportunities within the California red-legged frog SOL-2 critical habitat unit. The DEIR/EIS concluded that this reduction in dispersal could result in substantial frog mortality. The DEIR/EIS stated that the effects to the California red-legged frog would be compensated by habitat enhancement or contribution to a California red-legged frog conservation bank. In the *Growth-Inducing Impacts* section of the DEIR/EIS, Caltrans concluded that the proposed project would accommodate growth and that it would indirectly

	lead to development and intensification of land uses by improving access and roadway capacity.
October 18, 2010	The Service issued a DEIR comment letter (Service File #81420-2009-TA-0857-1) to Caltrans.
November 4, 2010	The Service met with STA and their consultant to discuss our DEIR/EIS comments relevant to the consultation. We explained the need for adequate passage to allow listed species and wildlife to safely cross roads, wildlife passage structures and directional fencing designs, construction scheduling, conservation measures, effects determinations on Contra Costa goldfields critical habitat, and the California tiger salamander habitat assessment.
November 10, 2010	The Service sent STA's consultant comments regarding their draft of the November 4, 2010, meeting notes. The Service recommended that the two large crossings on the Business Center Drive Extension be spanned structures rather than culverts and that the western crossing (the third undercrossing on the Business Center Drive Extension) be at least 78 inches wide with a natural bottom. The Service clarified that the use of vegetation would not be an effective alternative to fencing to direct California red-legged frogs to safe undercrossings or exclude them from the road.
November 18, 2010	The Service visited the proposed project site with Caltrans and STA's consultant to discuss the Business Center Drive Extension and the Contra Costa goldfields critical habitat, potential branchiopod habitat, and potential California tiger salamander habitat in the Gentry Suisun wetland area.
November 29, 2010	The Service attended a NEPA/Section 404 Integration Process checkpoint meeting. The Service recommended that the planned relocation of businesses displaced by the project should be covered in the section 7 consultation because the relocations would not occur if not for the proposed project. Caltrans and STA informed the Service that a BA would be provided for the project within a week of the meeting.
April 21, 2011	The Service received a digital and hard copy of an April 2011 BA from Caltrans with a letter requesting formal consultation for the California red-legged frog and valley elderberry longhorn beetle, and informal consultation on Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, and the Central California Distinct Population Segment of the California tiger salamander.
May 24, 2011	The Service received a letter from Caltrans stating that the Service was beyond the 30-day review period for the BA. However, the BA that had been provided to us by Caltrans was incomplete and it did not contain all

	of the information necessary to initiate formal consultation pursuant to 50 CFR 402.14(c).
June 30, 2011	The Service issued a 30-day letter (Service File #81420-2009-0857-2) to Caltrans in response to the April 2011 BA.
August 19, 2011	The Service received Caltrans' August 17, 2011 response to the Service's June 30, 2011 30-day letter. In the letter, Caltrans requested the issuance of a draft biological opinion.
August 26, 2011	Caltrans notified the Service via an e-mail message that they were entering the formal elevation process to resolve consultation conflicts. This is a procedure both agencies have to agree to in order to resolve impasses on projects.
September 15, 2011	The Service met with Caltrans and STA to discuss Caltrans' August 19, 2011, response to the June 30, 2011, 30-day letter. The issues and requests for adequate project and species information were not resolved during the meeting. Caltrans asserts that under section 7 they do not recognize in-perpetuity preservation of habitat as a means to minimize the project's effects on listed species. The Service explained the biological reasons why the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly are likely to be affected by the proposed project. Caltrans and STA stated they were reluctant to seek take coverage for these species because of their concerns of the costs associated with conservation measures for these species. Caltrans and STA requested a list of conservation measures that would be appropriate to minimize the adverse effects on these listed animals. Caltrans requested that the Service issue a biological opinion for the project without authorization for incidental take for these three species with the acknowledgement they would accept the risk of violating the prohibitions of section 9.
October 7, 2011	The Service Caltrans Liaison preparing the draft biological opinion was instructed to stop work on the project while Caltrans considered approval to provide additional funding to complete consultation.
November 3, 2011	In response to a request made during the September 15, 2011 meeting, the Service sent a written list of recommended conservation measures to minimize the proposed project's effects on listed species to Caltrans and STA (Service File #81420-2009-F-0857-3).
November 17, 2011	The Service received Caltrans' November 15, 2011 letter response to the Service's November 3, 2011 letter via e-mail. Caltrans declined to change their determination and request formal consultation for the vernal pool fairy shrimp, vernal pool tadpole shrimp, and callippe silverspot butterfly. However, they provided no biological explanation for their determination.

	Caltrans also declined adoption of the appropriate conservation measures listed in the Service's November 3, 2011 letter to minimize effects to the vernal pool fairy shrimp, vernal pool tadpole shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog.
November 30, 2011	The Service Caltrans Liaison received approval from Caltrans to resume work on the consultation.
December 1, 2011	The Service attended a NEPA/Section 404 checkpoint meeting. Caltrans and STA discussed the project alternatives and avoidance and minimization measures with a collection of State and Federal regulatory agencies. A final project alternative had not been selected. Caltrans is still in the process of finalizing a Least Environmentally Damaging Practicable Alternative determination and approval of a Conceptual Mitigation Plan.
December 15, 2011-April 11, 2012	Caltrans and the Service entered into and completed the joint dispute resolution elevation process to resolve outstanding issues on the consultation

BIOLOGICAL OPINION

Description of the Proposed Action

The following project description was provided by Caltrans with minor modifications for reasons of clarity and accuracy provided by the Service.

Caltrans' full-build project involves comprehensive transportation improvements to the I- 80/ I-680 /SR 12 interchange complex intended to meet the future traffic demand over a 20-year planning horizon. The full-build includes the widening of I-680 and I-80 and the relocation, upgrade, and expansion of the I-80 westbound truck scales. The full scope of these improvements is not currently funded under the Metropolitan Transportation Commission's Regional Transportation Plan, 2035. Consequently, a fundable first phase of the full-build project has been developed (referred to as Phase 1). Phase 1 is the subject of evaluation under NEPA and the action for which a record of decision will be issued. STA has provided rationale for why Phase 1 has independent utility and therefore is the proposed action for this section 7 consultation.

General Scope of Work

The proposed Phase 1 project is comprised of the following components:

1. Improvements to the I-80/I-680/SR 12W) interchange;

2. Realignment of I-680;

3. A new interchange at I-680 and Red Top Road;

4. A new road connecting the I-80/Red Top Road interchange to Business Center Drive (Business Center Drive Extension);

5. A new interchange at SR 12W and the new Red Top Road alignment;

6. A modified interchange at I-80 and Green Valley Road;

7 New I-80 bridges over Green Valley Creek;

8. Widening I-80;

9. A new lane on eastbound SR 12E; and

10. Widening of the SR 12E bridge over Ledgewood Creek.

Construction Schedule and Funding

The proposed project will be constructed in a series of seven discrete Construction Packages over an eight-year period, as funding becomes available. A summary of the anticipated construction packages, associated activities, and their sequencing is shown in Table 1.

Table 1. Construction Packages and Scheduling

Construction Package Number	Main Construction Elements	Scheduling
1	1. Construct the westbound I-80 to westbound SR 12W (Jameson Canyon) Connector. 2. Widen westbound I-80 between the existing I-80/I-680 separation and SR 12W. 3. Reconstruct the west half of the I-80 Green Valley Road interchange.	Start in 2013 with approximate two-year duration.
2	1. Construct the I-680/Red Top Road interchange. 2. Realign Lopes Road and Fermi Road. 3. Realign Ramsey Road around the proposed I-680/Red Top Road interchange.	Start in 2014 with approximate 1.5-year duration.
3	1. Construct the westbound I-80 to southbound I-680 connector. 2. Widen westbound I-80 between the I-80/Suisun Valley Road and the I-80/ Green Valley Road interchanges. 3. Reconstruct the westbound I-80 bridge over Green Valley Creek. 4. Construct a new westbound on-ramp from I-80 at Suisun Valley Road. 5. Construct a new westbound off-ramp from I-80 to Green Valley Road. 6. Construct new bridge over Green Valley Creek carrying westbound off-ramp to Green Valley Road. 7. Remove the existing I-80/I-680 connector bridges over I-80 and Green Valley Creek. 8. Remove Neitzel Road. 9. Remove eastbound I-80 to SB I-680 connector. 10. Excavation and grading of the Business Center Drive Extension.	Start in 2014 with approximate two-year duration.

4	1. Construct the northbound I-680 to eastbound I-80 connector. 2. Reconstruct the eastbound SR 12W connector to eastbound I-80. 3. Reconstruct the eastbound I-80 off-ramp to Green Valley Road. 4. Reconstruct Green Valley Road on-ramp to eastbound I-80. 5. Realign both Lopes Road and Green Valley Road to connect to the original I-680 alignment. 6. Widen SR 12E one lane to the south, including widening the culvert for Ledgewood Creek.	Start in 2014 with approximate two-year duration. FHWA and Caltrans will adopt the full new alignment of I-680 and transfer the original alignment to local control.
5	1. Construct the northbound I-680 to westbound SR 12W connector. 2. Reconstruct the I-80/Red Top interchange. 3. Construct a new SR 12W/Red Top Road interchange. 4. Construct the Red Top Road/Business Center Drive extension.	Start in 2018 with approximate two-year duration.
6	1. Construct the I-80/I-680 HOV connectors.	Start in 2018 with approximate two-year duration.
7	1. Construct the northbound I-680/WB I-80 loop on-ramp. 2. Construct the eastbound I-80 connector to southbound I-680. 3. Reconstruct the Union Pacific Railroad underpass.	Start in 2018 with approximate 1.5-year duration.

NOTE: This schedule is approximate and subject to change.

Work in drainages and wetlands will be restricted to the dry season (April 15–October 15, or as otherwise specified in regulatory permits). Work in drainages that support habitat for anadromous fish, such as Green Valley Creek and Ledgewood Creek, will be restricted to the time when fish are not as likely to be present. To the extent possible, vegetation removal will be limited to between September 1 and January 31 to minimize adverse effects to migratory birds. Nighttime construction will be minimized.

Construction Activities

Highway and Road Construction

Highway construction for Phase 1 will consist of widening I-80 to the north for approximately 1 mile between a point west of Suisun Valley Road and SR 12W, realignment of I-680 and realignment of the connector between westbound I-80 and SR 12W Caltrans will acquire additional ROWs to accommodate the widening. Some highway construction will take place in all seven Construction Packages.

Highway construction will generally consist of cutting and filling to create a roadbed, grading to a maximum depth of 3.3 feet, paving or repaving, and striping or restriping. Highway sections will be constructed or altered to encourage drainage to the sides of the highway.

Roadway excavation will be conducted using equipment such as scrapers, front-end loaders, and motor graders to excavate the area and haul material to construct the embankments necessary to support the proposed roadways. Surplus excavated material will be hauled offsite to an approved commercial disposal site using dump trucks when necessary. The location(s) of material borrow and location and type of material disposal will be determined by the contractor. Caltrans will require the contractor to obtain any necessary environmental clearances associated with obtaining a material borrow site, or with the disposal or reuse of surplus materials. Once the roadbed has been excavated, the soil will be rolled and vibrated with a sheepsfoot or drum roller to 95 percent relative compaction.

SR 12E Widening
In Construction Package 4, a third eastbound lane and standard shoulder will be constructed along SR 12E from I-80 east to the existing Webster Street off-ramp immediately east of the SR 12E/Pennsylvania Avenue intersection. Construction of the lane and shoulder will include retaining walls to minimize temporary and permanent disturbance south of SR 12E, and the existing ROW fence would remain in its current location. Drainage improvements along SR 12E would maintain existing hydrological conditions and patterns.

Business Center Drive Extension
Construction of the extension of Red Top Road to Business Center Drive will include excavation to a maximum depth of 95 feet in some areas prior to grading and paving. Excavation and grading will occur during Construction Package 3 and roadway construction will occur during Construction Package 5. Three undercrossings will be included in the Business Center Drive Extension between the existing terminus of Business Center Drive and the proposed intersection with Jameson Canyon Road (SR 12W). The undercrossings will include two approximately 15 by 14 feet span style undercrossings corresponding with two existing dirt access roads. The easternmost large undercrossing will allow continued vehicle access to an existing residence and the second undercrossing will enable access for vehicles and cattle to the Mangels' Pond. The third culvert will be located between the pond access and Jameson Canyon Road. This 60-inch diameter round culvert will convey an ephemeral drainage and will be designed to have a natural bottom (dirt or gravel). The extension from the Jameson Canyon Road intersection to I-80 will include a span bridge over Jameson Canyon Creek.

Approximately 2.5 miles of directional fencing will be attached to the ROW fencing paralleling the Business Center Drive Extension. The ROW fencing is intended to define the ROW, deter access to adjacent private land, and keep livestock from entering the ROW The attached directional fencing is intended to exclude California red-legged frogs from the ROW and guide them to the three undercrossings and Jameson Canyon Creek Bridge described in the previous paragraph. The fencing will consist of hard plastic or a combination of permanent hardware cloth and flashing with a lip sufficient to deflect frogs on the top, or similar material and design. Directional fencing will be attached to the newly installed ROW fence on both sides of the new roadway constructed between Business Center Drive and I-80. The fence will be constructed along Business Center Drive, which is a local road off the State highway system, and its long-term maintenance will be the responsibility of STA.

Culverts and Bridge/Box Culvert Construction
The project would require the extension/widening of 12 existing culverts and bridges.

Bridge Replacement Construction Activities. The existing I-80 bridges over Green Valley Creek will be replaced with single-span structures. In Construction Package 3, the existing westbound I-80 bridge will be removed and replaced with a single-span structure approximately 103 feet long and 133 feet wide. A new single-span Green Valley Creek bridge for the I-80 Green Valley Road off-ramp will be approximately 180 feet long and 39 feet wide.

Bridge replacement will occur in two segments to maintain traffic on I-80. The work within Green Valley Creek bed and bank for each segment is expected to take approximately four

months and will be scheduled between June 15 and October 15. Bridge demolition will occur when Central Valley fall-run/late-fall-run Chinook salmon and central California coast steelhead are less likely to be present. Any work occurring before June 15 or after October 15 will be restricted to the road or bridge surface, and all work in or adjacent to a creek will be done with the implementation of water quality best management practices (BMPs).

Construction equipment would access the site from the north side of I-80. A staging area will be located within the curve of the I-680 entrance to westbound I-80. Bridge construction will involve the following activities.

1. Bridge abutment locations will be scarified and then excavated to the bottom of the abutment or pile cap using backhoes or bobcats. In some cases, the area adjacent to the abutment will be over-excavated by several feet to ensure that low-expansion material is adjacent to the abutment and wing walls.

2. Temporary cofferdams will be constructed both upstream and downstream of the bridge, and a piped water diversion system will be installed. The cofferdams will be at least 20 feet from the limit of the existing bridge.

3. Pile driving will be necessary to construct new bridge abutments for both bridges over Green Valley Creek. Piles will be located at the top of the creek bank and are anticipated to be 12-inch-square piles driven to a depth of approximately 70 feet. A vibratory hammer will be used when feasible. The number of strikes will depend on the loading and soil characteristics. Pile driving equipment will be operated from beyond the top bank.

4. Concrete abutments or pile caps will be constructed above the piles.

5. Wooden or steel falsework will be placed within the creek (banks and channel) once the abutments and columns have been constructed as necessary to support the construction of the cast-in-place concrete box girder structures.

6. When the reinforcement is set, the concrete will be placed for the superstructure. Once the concrete for the superstructure has hardened the tendons will be tensioned.

7. The last elements of major construction for the bridges will be bridge railings, approach slabs (placed on the embankment approaches to the bridge), and slope paving.

8. To the extent practicable, disturbed portions of Green Valley Creek (bed and bank) will be restored to pre-project conditions upon completion of construction. This may include grading and contouring the site, and seeding or planting with native plants as appropriate.

Culvert Construction Activities. Culvert construction will take place at Ledgewood Creek in Construction Package 3 and at Jameson Canyon Creek in Construction Packages 3 and 4. Construction associated with the culverts is expected to take approximately four months and will be scheduled during the driest time of the year (June 15–October 15).

Culvert construction will involve the following activities:

1. Temporary cofferdams (made of gravel, fabric, and pipe) will be constructed upstream and downstream from the culvert; a water diversion system using pipes will be installed to facilitate dewatering of the channel within the cofferdam during construction while bypassing creek flow. The cofferdams will be approximately 20 feet from the limit of the existing culvert.

2. Temporary cofferdams will be constructed to facilitate excavation of existing footings. The cofferdams will consist of gravel wrapped in fabric and would be slightly larger than the footing plan dimensions.

3. Vibratory equipment will be used to compact soil if feasible.

4. Falsework will be placed within the creek (banks and channel) as necessary to support construction of the cast-in-place (poured) concrete box culvert.

5. Falsework will be removed after concrete has set.

6. The concrete invert slab (i.e., invert of the culvert) will be extended to the edge of the widened culvert.

7. To the extent practicable, disturbed portions of Ledgwood Creek and Jameson Canyon Creek (bed and bank) will be restored to pre-project conditions when construction is complete. This may include grading and contouring the site, and seeding or planting with native plants as appropriate.

Ledgewood Creek Culvert. The Ledgewood Creek culvert will be extended 15 feet to the south to accommodate an additional lane for SR 12E (Construction Package 4). The existing crossing consists of a series of five culverts, each measuring 16.5 feet wide and supported by wall piers.

Construction associated with the culvert is expected to take approximately four months and will be scheduled during the driest time of the year (June 15–October 15) for ease of operation and to avoid potential effects to anadromous fish.

Jameson Canyon Creek Culvert. The Jameson Canyon Creek culvert will be constructed under the new I-680 alignment. It will be a two-box culvert, with each box approximately 12 feet wide and 8 feet high. Construction associated with the culvert is expected to last approximately four months and will be scheduled during the driest time of the year (June 15–October 15).

Utilities

As part of the proposed project, utilities within the project footprint will be relocated, realigned, or extended as necessary to accommodate project construction and operation. The maximum extent of disturbance from utilities falls within the project footprint. Utilities that will be affected are water, electrical, gas, cable/fiber, and telephone lines. Actions affecting these utilities will be coordinated with the respective operators. Caltrans will submit detailed

descriptions of utility relocations should the area of disturbance exceed the limits of the current proposed project footprint.

Staging Locations

Caltrans has identified potential construction staging areas within the proposed action area. Should construction contractors determine that other staging areas within or outside the state ROW and proposed action area are necessary to complete work, the contractor will be required by Caltrans or STA to obtain all necessary environmental clearances associated with the alternative staging areas prior to their use for staging purposes. Staging locations will be used for temporary placement of heavy construction equipment and vehicles; construction materials such as shotcrete (a mixture of concrete, fine aggregate, and water blown pneumatically through a hose), gravel, road base, and rebar; equipment maintenance shops; field offices; and rest rooms.

Access roads linking staging areas to the various work areas will be cleared and graded using equipment such as excavators, bobcats, and bulldozers. Upon project completion, and to the extent practicable, staging location and access roads will be returned to their pre-project conditions.

Construction Site Restoration

Caltrans plans to restore areas of temporary ground disturbances, including storage and staging areas, and temporary roads. These areas will be re-contoured, if appropriate, and revegetated with seeds and/or cuttings of appropriate native plant species to promote restoration of the area. Caltrans has developed a restoration plan that will be submitted to the Service for approval prior to initial ground breaking. This plan includes immediate application of permanent erosion control measures for all areas disturbed by construction activities. The permanent erosion control measures will include native (here referring to species naturally occurring in Solano County) grass and forb seed, fertilizer, compost and mulch for soil protection. The restoration plan also includes planting at each creek crossing using a combination of wetland, riparian and upland/transitional species appropriate for the conditions at the specific creek crossings and is informed by local reference sites. To the maximum extent practicable (i.e., presence of natural lands), topsoil will be removed, cached, and returned to the site according to successful restoration protocols. Loss of soil from run-off or erosion will be prevented with straw bales, straw wattles, or similar means provided they do not entangle or block California red-legged frog escape or dispersal routes.

Equipment

Construction is expected to require heavy equipment such as cranes, pile drivers, vibratory and hydraulic hammers, excavators, bobcats, bulldozers, roadheaders, hydraulic excavators or backhoes, scrapers, rubber-tired dump trucks, front-end loaders, load-haul-dumps, drill jumbos, front-end loaders and motor graders, sheepsfoot or drum rollers, and asphalt-paving machines.

Temporary construction areas will be cleared, graded, and reestablished using equipment such as excavators, bulldozers, and/or bobcats.

Routine Maintenance

Routine maintenance activities are anticipated within the R-O-Ws. Within R-O-Ws determined to be temporarily impacted, routine maintenance may have restrictions.

Proposed Conservation Measures

Caltrans proposes to avoid and minimize effects to the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, Central California Distinct Population Segment of the California tiger salamander, and California red-legged frog by implementing the following measures:

1 All construction personnel will attend a mandatory Worker Environmental Awareness Training Program delivered by a Service-approved biologist prior to working on the project site. The program will focus on the conservation measures that are relevant to employee's personal responsibility and will include an explanation as how to best avoid take of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog. The program will include an explanation of Federal laws protecting these listed species as well as the importance of compliance with this biological opinion. Documentation of the training, including sign-in sheets, will be kept on file and will be available on request.

2. Project employees will be provided with written guidance governing vehicle use, speed limits on unpaved roads, fire prevention, and other hazards.

3. A Service-approved biologist(s) will be on-site during any ground-disturbing activities that have the potential to adversely affect the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, California tiger salamander, and California red-legged frog.

4. A Service-approved biologist will be present during all construction-related activities in sensitive habitats. If special-status species are discovered during these activities, the Service-approved biologist, through the Resident Engineer, will halt all work within 50 feet of the species and contact the Service to determine how to proceed.

5. Prior to construction, Environmentally Sensitive Areas will be delineated using high-visibility orange construction fencing installed along the perimeter of the work areas to clearly delineate the extent of the construction area. The project plans will show the locations where fencing will be installed. The plans will also define the fencing installation procedure. The project's special provisions package will provide clear language regarding acceptable fencing material and prohibited construction-related activities, vehicle operation, material and equipment storage, and other surface-disturbing activities within sensitive areas.

6. No more than 20 calendar days prior to any ground disturbance in a given location, pre-construction surveys will be conducted by a Service-approved biologist for the showy Indian clover, Contra Costa goldfields, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, elderberry plants, and California red-legged frog where habitat was identified for each respective species. These surveys will consist of walking surveys of the project limits and accessible adjacent areas within at least 50 feet of the project limits. The biologist(s) will investigate all potential California red-legged frog cover sites. This includes thorough investigation of mammal burrows, appropriately sized soil cracks, and debris. Native vertebrates found in the cover sites will be documented and relocated to an adequate cover site in the action area vicinity. The entrances and other refuge features within the project limits will be collapsed or removed following investigation and clearance.

7 Vegetation clearing will be limited throughout the proposed project area to the non-nesting season (September 1–January 31) to the extent possible. Vegetation removal work outside this window will be preceded by preconstruction nest clearance surveys.

8. Vegetation will be cleared only where necessary and will be cut approximately 4 inches above soil level except in areas that will be excavated for roadway construction. This will allow plants that reproduce vegetatively to resprout after construction. All clearing and grubbing of woody vegetation will be done using hand tools, small mechanical tools, or backhoes and excavators. All cleared vegetation will be removed from the project footprint to prevent attracting animals to the project site.

9. All slopes or unpaved areas temporarily disturbed by construction activities will be stabilized to prevent erosion at least three days prior to a forecasted rain event. After construction activities, the temporarily disturbed areas will be restored to pre-project conditions to the maximum extent practicable. Where disturbance includes the removal of trees, native species will be replanted.

10. To reduce the spread of invasive, nonnative plant species and minimize the potential decrease of palatable vegetation for wildlife species, Caltrans will comply with Executive Order 13112. This order is intended to prevent the introduction of invasive species and provide for their control to minimize adverse economic, ecological, and human health effects. In the event that noxious weeds are disturbed or removed during construction-related activities, the contractor will be required to contain the plant material associated with these noxious weeds and dispose of them in a manner that will not promote the spread of the species. The contractor will be responsible for obtaining all permits, licenses, and environmental clearances for properly disposing of materials. Areas subject to noxious weed removal or disturbance will be replanted with fast-growing native grasses or a native erosion control seed mixture. If seeding is not possible, the area of disturbance will be covered to the extent practicable with heavy black plastic solarization material until the end of project construction.

11. Construction access, staging, storage, and parking areas will be located within the project ROW or temporary easements and outside of designated Environmentally Sensitive

Areas. Access routes and the number and size of staging and work areas will be limited to the minimum necessary to construct the proposed project. Routes and boundaries of roadwork will be clearly marked prior to initiating construction or grading.

12. All food and food-related trash items will be enclosed in sealed trash containers and removed completely from the site at the end of each day.

13. No firearms will be allowed in the action area except for those carried by authorized security personnel, or local, State, or Federal law enforcement officials.

14. Caltrans and STA will install bio-swales and bio-filtration in the area adjacent to roadways to avoid and minimize sediment loading and point source pollutants.

15. Stormwater pollution prevention plans (SWPPPs) and erosion control BMPs will be developed and implemented to minimize any wind- or water-related erosion and will be in compliance with the requirements of the Regional Water Quality Control Board. The design staff will include provisions in construction contracts for measures to protect sensitive areas and prevent and minimize stormwater and nonstormwater discharges. Protective measures will include, at a minimum, those listed below.

    a. No discharge of pollutants from vehicle or equipment cleaning will be allowed into any storm drains or water courses.

    b. Vehicle and equipment fueling and maintenance operations will be at least 50 feet away from water courses, except at established commercial gas stations or established vehicle maintenance facilities.

    c. Concrete waste and water from curing operations will be collected in washouts and will be disposed of and not allowed into water courses.

    d. Spill containment kits will be maintained onsite at all times during construction operations and/or staging or fueling of equipment.

    e. Dust control measures will include use of water trucks and organic tackifiers to control dust in excavation-and-fill areas, covering temporary access road entrances and exits with rock (rocking), and covering of temporary stockpiles when weather conditions require.

    f. Silt fences, coir rolls, or straw wattles will be installed along or at the base of slopes during construction to capture sediment.

16. All equipment will be maintained such that there will be no leaks of automotive fluids such as gasoline, oils, or solvents, and a Spill Response Plan will be prepared.

17 To prevent inadvertent entrapment of animals during construction, all excavated, steep-walled holes or trenches more than 1 foot deep will be covered at the close of each

working day with plywood or other suitable material, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled they must be thoroughly inspected for trapped animals. All replacement pipes, culverts, or similar structures stored in the action area overnight will be inspected before they are subsequently moved, capped, or buried. If at any time a listed species is discovered, the Resident Engineer and Service-approved biologist will be immediately informed. The animal will be allowed to move out of the area on its own volition.

18. If requested through the Resident Engineer or Construction Inspector before, during, or upon completion of groundbreaking and construction activities, Caltrans will ensure that the Service and/or its designated agents can, immediately and without delay, access and inspect the project site for compliance with the proposed project description, conservation measures, and terms and conditions of the biological opinion, and to evaluate project effects on listed species and their habitat.

19. The following measures are intended to avoid and minimize effects to the showy Indian clover.

    a. Prior to groundbreaking for Construction Package 3, protocol-level surveys of the inaccessible parcels on the Mangels' property north of SR 12W will be conducted for showy Indian clover in accordance with the Service protocol.

    b. If protocol-level surveys identify showy Indian clover plants within 250 feet of the project footprint, the project footprint will be fenced and flagged to ensure that construction equipment and construction activities are confined and completely avoid any potential direct or indirect effects on individual showy Indian clover plants during construction. In the event of a positive survey finding, Caltrans will implement the following specific measures.

        i. Orange Environmentally Sensitive Area construction barrier fencing at least 4 feet in height will be installed to protect Environmentally Sensitive Areas. A Service-approved biologist will identify sensitive biological resources adjacent to the construction area; the Environmentally Sensitive Areas to be fenced will be included in the contract plans and specifications.

        ii. A Service-approved biologist will identify potential showy Indian clover habitat, and a protective silt fence, described in the Caltrans Standard BMPs, will be installed to protect down-gradient habitat for showy Indian clover from being affected by sediment loading.

        iii. Construction activities conducted within the area of potential showy Indian clover habitat will be confined to the driest season (June 1–October 15) to protect down-gradient, showy Indian clover habitat and minimize potential indirect dust effects on identified flowering showy Indian clover plants.

iv. A Service-approved biologist will be present during all ground-disturbing activities occurring within 250 feet of occupied showy Indian clover habitat to ensure that showy Indian clover habitat is avoided.

v. Vegetation removal within 250 feet of occupied showy Indian clover habitat will be limited to the maximum extent practicable.

vi. A Service-approved biologist will develop and conduct environmental education training for construction employees working on ground-disturbing activities. The program will include the following: a description of showy Indian clover and its habitat needs, photographs of the plant species, an explanation of its legal status and protection under the Act, and a list of the measures that will be implemented to minimize and avoid potential effects on showy Indian clover.

vii. The Service-approved monitor will coordinate with the Resident Engineer to ensure that the contractor maintains the staked, fenced, and flagged perimeters of the construction area and staging areas adjacent to sensitive biological resources, including occupied or potential showy Indian clover habitat.

20. The following measures are intended to minimize direct and indirect effects to callippe silverspot butterfly.

a. Caltrans will minimize harm to the callippe silverspot butterfly resulting from the adverse effects to 58.14 acres of habitat. Compensation implemented within Service-approved areas that are both California red-legged frog habitat and Callippe silverspot butterfly may be overlaid on common acreage as long as it is appropriate habitat for each species. The area will receive conservation credit from the Service for both species. The compensation will be phased to coincide with project construction packages as presented in Table 1and implemented 60 calendar days prior to the date of initial ground disturbance.

Compensation will be based on the amount of permanent and temporary loss of callippe silverspot butterfly habitat. Temporary habitat loss will be compensated at rates based on the amount of time it takes to restore the habitat to baseline conditions following the date of initial habitat disturbance and whether the restored habitat will be subjected to ongoing roadway maintenance activities that would not be entirely beneficial to the species. Off-site conservation will offset routine maintenance activities that are short in duration, e.g. mowing. Habitat value in these R-O-W areas is diminished but not permanently destroyed. Should the determination of permanent versus temporary habitat loss change after Caltrans has provided this compensation, Caltrans will provide additional compensation, if necessary, or apply excess compensation towards future projects that adversely affect the callippe silverspot butterfly.

The maintained ROW is defined as the ROW between the edge of pavement or denuded road shoulder and the Caltrans ROW fence. Permanent effects will

occur within the bounds of the maintained ROW (road surface and area between edge of pavement and ROW fence).

Callippe Silverspot Butterfly Habitat Compensation

Level of Effect	Duration [1]	Compensation Ratio	Acres of Effects[2]	Acres of Compensation[3]
Permanent	Permanent	3:1	38.82	116.46
Temporary	Within 1 year	1:1on-site 0.5 off-site	19.32	9.66
	Within 2 years	1:1 on-site 1.5:1 off-site	0	0
	Greater than 2 years	3:1 off-site **OR** 2:1 off-site **AND** 1:1 on-site	0	
TOTAL			**58.14**	**126.12**

[1]period of time from the date of initial ground disturbance until the success criteria described in the restoration/revegetation plan are met.
[2] as per GIS map dated March 2012, potential to be adjusted at final project design, with subsequent reinitiation.
[3] Acres of compensation = off-site areas.

Caltrans will compensate for adverse effects to callippe silverspot butterfly habitat by implementing one of the following two options:

i. Caltrans will establish in-perpetuity callippe silverspot butterfly habitat preservation by purchasing habitat or purchasing callippe silverspot butterfly habitat credits from a Service-approved conservation bank.

Compensation will be implemented with in-perpetuity preservation of callippe silverspot butterfly habitat with high conservation values and (1) include ridge line topographical features associated with callippe silverspot butterfly breeding behavior and adult and/or larval nectar plants, and (2) preference given to areas located within the Callippe Silverspot Butterfly Conservation Area defined in the Draft Solano HCP (SCWA 2009). Location of the proposed conservation areas will be submitted to the Service for review and approval.

The habitat will include a Service-approved conservation easement, held by a third party. An approved ecologically-based conservation easement will include managed public access, a management plan, and an in-perpetuity endowment or other permanent non-wasting management fund based on a PAR-like property analysis. The management plan will include a description of the site, management needs (e.g. grazing plan, non-native vegetation and animal control, etc), when the management activities will be implemented, how often and to what level monitoring of the site will occur, and an action/contingency plan to address potential management issues.

ii. Caltrans will implement or fund restoration and enhancement actions within occupied callippe silverspot butterfly habitat that will have beneficial effects on the species. Such measures shall be implemented on lands with in-perpetuity conservation beneficial to the callippe silverspot butterfly.

Implementation includes identification of land to be restored or enhanced, associated agreements to fund restoration or enhancement activities, and a restoration plan and schedule approved by the Service.

b. Caltrans will survey for the presence of adult nectar and larval host plants and adult nectar sources within areas that will be subject to temporary effects within callippe silverspot habitat. The surveys will be conducted during the blooming season (March to May) no more than one year prior to the excavation and grading of the Business Center Drive Extension proposed to occur during Construction Packages within Callippe silverspot butterfly habitat. SLT will be contacted in order to synchronize the surveys with peak *Viola* blooming on the Swett Ranch. Observed adult nectar plants and *Viola* will be mapped and flagged. Caltrans will modify the boundaries of temporary work areas to avoid the nectar and host plants when feasible.

c. To the maximum extent possible, Caltrans will avoid areas of *Viola* delineated prior to construction and during preconstruction surveys within temporary affected areas.

d. The project footprint will be clearly delineated with Environmentally Sensitive Area fencing and signage to limit construction activities to the described footprint and to maintain awareness. All Environmentally Sensitive Areas will be shown on the final construction drawings.

e. Grading activities within callippe silverspot butterfly habitat will be conducted between August 1 and April 1, to the extent practicable as determined during constructability review. When grading activities must take place after April 1 and before August 1, daily biological monitoring will occur for the callippe silverspot butterfly.

f. Insecticides or herbicides in the Business Center Drive Extension ROW will not be applied during road construction or long-term operational maintenance within 300 feet of the host plant occurrences mapped by Monk & Associates in 2004 or otherwise identified or adult nectar plants or from other locations where the chemical treatments can be carried in by wind or surface flow.

g. Standard erosion and dust control measures will be implemented to minimize the deposition of dust, soil, and silt on callippe silverspot butterfly habitat.

h. Caltrans and STA will ensure there is no drift of sprayable dust control formulations used for dust and erosion control towards callippe silverspot butterfly habitat during construction. Appropriate spray devices and application methods, such as spray pressures, nozzle opening size, and additives such as spray retardants, will be used to prevent drift. Applications will be made on calm days or when the wind speed is low and blowing away from callippe silverspot butterfly habitat. Spray applications will not be made within 200 yards by air or 40 yards by ground upwind from callippe silverspot butterfly habitat. Applications will not occur during rain events.

i. No equipment will be driven or parking or laydown areas established within 20 feet of larval host plants located outside the defined construction footprint and, to the extent feasible, within 20 feet of adult nectar plants located outside the defined construction footprint.

j. If any other life history phases of the callippe silverspot butterfly are found such as adults, pupae, larvae, or eggs, the Service shall be immediately contacted for further guidance.

21 The following measures are intended to avoid and minimize direct and indirect effects to vernal pool fairy shrimp and vernal pool tadpole shrimp.

a. The potential vernal pool fair shrimp and vernal pool tadpole shrimp habitat within the action area is within what is described in the draft Solano HCP as having a low conservation value. Caltrans will compensate for the effects to 1 71 acres (1.45 acres direct effects + 0.26 acre indirect effects) of vernal pool habitat based on the conservation strategy in the draft Solano HCP as follows:

Listed Vernal Pool Crustacean Compensation

Type of Effect	Compensation Ratio	Acres of Effects	Acres of Compensation	Type of Compensation
Direct	1:1	1.45	1.45	Preservation of vernal pool and swale habitat
Direct	1:1	1.45	1.45	Restoration of vernal pool and swale habitat
Indirect	1:1	0.26	0.26	Preservation of vernal pool and swale habitat

i. The above compensation of 1.71 acres of preservation and 1.45 acres of restoration will be implemented no later than sixty (60) calendar days prior to the date of initial ground disturbance of the specific construction packages. The compensation will be phased to coincide with the initiation of the individual project construction packages as presented in Table 1.

ii. Preservation and restoration for adverse effects to Low Value Conservation Areas shall occur within Medium to High Value Conservation Areas identified in the draft Solano HCP The location of the compensation will be submitted for Service approval. Preservation and restoration ratios reflected

above are based on the premise that effects to low value conservation areas will be compensated in medium to high value areas.

b. To the extent practicable, Caltrans and its contractors will initiate all work in or within 250 feet of potential habitat for vernal pool crustaceans between May 1 and November 1. When construction activities must take place after November 1 and before May 1, daily biological monitoring will occur for the vernal pool crustaceans.

c. To the extent practicable, Caltrans will incorporate design modifications to avoid direct permanent effects on potential habitat for federally listed branchiopods.

d. Caltrans will avoid potential vernal pool fairy shrimp and vernal pool tadpole shrimp habitat, to the maximum extent practicable, during construction activities in temporary work areas. All potential vernal pool fairy shrimp and vernal pool tadpole shrimp habitat not directly affected will be designated as an Environmentally Sensitive Area and protected with appropriate fencing and signage. All Environmentally Sensitive Areas will be shown on the final construction drawings.

e. Caltrans will perform all work in accordance with a SWPPP BMPs will be implemented and may include the use of silt fences, sandbags, detention basins, and other means as appropriate to prevent erosion into any potential habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp.

22. The following measures are intended to avoid direct and indirect effects to Contra Costa goldfields, and effects to potential listed branchiopods and California tiger salamander habitat immediately south of SR 12E, between Ledgewood Creek and Suisun City.

a. Caltrans will construct a retaining wall along SR 12E, between Ledgewood Creek and Suisun City. This design feature will limit the roadway expansion to the existing raised roadbed and avoid permanent intrusion into the immediately adjacent seasonal wetland habitat (Gentry Suisun wetland).

b. The boundaries of this habitat along SR 12E will be identified as inaccessible by an orange construction barrier fence and depicted on final design plans. The fence will be at least 4 feet high, it will include signage as the boundary of an Environmentally Sensitive Area, and the installation will be guided and monitored by a Service-approved biologist.

c. A Service-approved biologist will identify potential Contra Costa goldfields habitat prior to ground-disturbing activities, and a protective silt fence, described in the Caltrans Standard BMPs, will be installed to protect down-gradient areas from being affected by sediment loading. This fencing will prevent direct impacts on wetlands south of SR 12E between Ledgewood Creek and the eastern end of the construction area.

d. A Service-approved biologist will conduct construction monitoring in and adjacent to all sensitive special-status plant populations. Construction monitoring frequency will range from daily to weekly depending on the biological resource and the construction activities.

e. A Service-approved biologist will coordinate with the Resident Engineer to ensure that the contractor maintains the staked, fenced, and flagged perimeters of the construction area and staging areas adjacent to sensitive biological resources, including potential Contra Costa goldfields habitat.

f. Vegetation removal on the south side of the existing SR 12E will be limited to the minimum necessary.

g. The Service-approved biologist will be present during all ground-disturbing activities occurring within 250 feet of vernal pool habitat.

h. Construction activities conducted within the area between Ledgewood Creek and Suisun City will be confined to the driest season (April 15–October 15, or as otherwise specified in regulatory permits) to protect down-gradient habitat.

i. Caltrans or STA will survey the seasonal wetland / pools south of their Biological Study Area located between SR 12E, Pennsylvania Avenue, Ledgewood Creek, and the SPRR rail line for California tiger salamander prior to construction. Should these surveys find occurrences of California tiger salamander within the action area, Caltrans and STA will reinitiate formal Section 7 consultation with the Service.

23. The following measures are intended to avoid and minimize direct and indirect effects to valley elderberry longhorn beetle.

a. Caltrans will install Environmentally Sensitive Area fencing and flag all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer has been approved by the Service, the fencing will provide a minimum 2-foot setback from the drip line of each elderberry plant.

b. Caltrans will provide contractors with training educating them on the status of the valley elderberry longhorn beetle and its host plant and emphasize the need to avoid damaging elderberry plants.

c. Caltrans will erect signs every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs will be clearly readable from a distance of 20 feet, and will be maintained for the duration of construction.

d. Caltrans will restore, to the maximum extent practicable, any damage or disturbance to the buffer area (areas within 100 feet of elderberry plants) during construction. Caltrans will provide erosion control and revegetate the areas with appropriate native plants.

e. Caltrans will prohibit the use of insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant in the buffer areas or within 100 feet of any elderberry plant with one or more stems measuring 1.0 inch or more in diameter at ground level.

f. Caltrans and STA will work with the Solano County Resource Conservation District or a Service-approved bank to facilitate the plant removal and transplanting effort. Transplantation of ten elderberry shrubs that are within the construction footprint will be done prior to ground-disturbing activities within 100 feet of the shrubs and will be conducted according to the Service's 1999 *Conservation Guidelines for the Valley Elderberry Longhorn Beetle*. A Service-approved biologist will be on-site to monitor the transplanting of the elderberry plants.

g. Caltrans will implement one or a combination of the following:

i. Provide replacement plantings and associated native plantings as described in Table 1 at a Service-approved location.

Table 1. Minimization ratios based on location, stem diameter of affected elderberry plants at ground level, and presence or absence of exit holes.

Location	Stem Diameter (inches)	Exit Holes Present (No/Yes)	Number of Stems	Elderberry Seedling Ratio	Elderberry Seedling Plantings	Associated Native Plant Ratio	Associated Native Plantings
Non-riparian	1-3	N	8	1:1	8	1:1	8
		Y	2	2:1	4	2:1	8
	3-5	N	7	2:1	14	1:1	14
		Y	1	4:1	4	2:1	8
	> 5	N	5	3:1	15	1:1	15
		Y	2	6:1	12	2:1	24
Riparian	1-3	N	20	2:1	40	1:1	40
		Y	0	4:1	0	2:1	0
	3-5	N	8	3:1	24	1:1	24
		Y	0	6:1	0	2:1	0
	> 5	N	9	4:1	36	1:1	36
		Y	0	8:1	0	2:1	0
Total			**62**		**157**		**177**

ii. Purchase valley elderberry longhorn beetle credits from a Service-approved conservation bank.

h. Two elderberry shrubs are located within 100 feet of the limit of disturbance. These shrubs will be protected by:

i. Fencing and flagging all areas to be avoided during construction activities. In areas where encroachment on the 100-foot buffer has been approved by the Service, Caltrans will provide a minimum setback of at least 20 feet from the dripline of each elderberry plant.

ii. Erecting signs every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs should be clearly readable from a distance of 20 feet, and must be maintained for the duration of construction.

24. The following measures are intended to avoid and minimize direct and indirect effects to California red-legged frog.

a. Caltrans will compensate for harm resulting from adverse effects to the California red-legged frog and 97.80 acres of its habitat, and the adverse effects critical habitat for the California red-legged frog by providing appropriate habitat compensation.

The compensation will be based on the amount of permanent and temporary loss of red-legged frog habitat. Temporary habitat loss will be compensated at rates based on the amount of time it takes to restore the habitat to baseline conditions following the date of initial habitat disturbance and whether the restored habitat will be subjected to ongoing Caltrans routine maintenance activities, e.g. mowing, that may affect the species.

The maintained ROW is defined as the ROW between the edge of pavement or denuded road shoulder and the Caltrans ROW fence. Permanent effects will occur in areas of maintained ROW that include barriers to frog movement. Areas of ROW within and adjacent to retaining walls will be permanently affected by the project. Caltrans commits to installing a Service-approved frog exclusion fence along the proposed Business Center Drive Extension from the existing Business Center Drive to Jameson Canyon Road in order to direct California red-legged frogs to the three proposed undercrossings. Since the exclusion fence will likely prevent individuals of this threatened species from entering the maintained ROW, the entirety of the ROW within this area will be permanently affected by the proposed project. However, less compensation is necessary as the directional fence also results in a beneficial effect to California red-legged frogs by directing them to safe undercrossings. Off-site compensation is proposed to offset temporary impacts within the maintained R-O-W since habitat will continue to be impacted by on-going routine maintenance activities, e.g. mowing. Lastly, additional off-site compensation is necessary for temporal loss of habitat.

Caltrans will compensate for the loss of habitat of the California red-legged frog by implementing the following:

California Red-Legged Frog Habitat Compensation

Level of Effect	Location of disturbance	Duration[1]	Compensation Ratio	Acres of Effects[2]	Acres of Compensation[3]
Permanent	Within or beyond maintained ROW	Permanent	3:1	78.48	235.44
	Within maintained ROW and excluded by directional fence	Permanent	2:1	0	0
Temporary	Within the maintained ROW	Within 1 year	1:1 on-site 1:1 off-site	0	0
	Beyond the maintained ROW	Within 1 year	1:1on-site 0.5:1 off-site	19.32	9.66
	Within the maintained ROW	Within 2 years	1:1 on-site 1.5:1 off-site	0	0
	Beyond the maintained ROW	Within 2 years	1:1 on-site 1:1 off-site	0	0
	Within or beyond maintained ROW	Greater than 2 years	3:1 off-site **OR:** 2:1 off-site **AND** 1:1 on-site	0	0
TOTAL				**97.80**	**245.1**

[1]period of time from the date of initial ground disturbance until the success criteria described in the restoration/revegetation plan are met.
[2] as per GIS map dated March 2012, potential to be adjusted at final project design, with subsequent reinitiation.
[3] Acres of compensation = off-site lands.

Compensation implemented within areas that are both California red-legged frog habitat and Callippe silverspot butterfly habitat may be overlaid on common acreage as long as the area is appropriate habitat for each species. With Service approval, the conservation lands would receive compensation credit from the Service for both species.

Compensation will be implemented with in-perpetuity preservation of California red-legged frog habitat with high conservation values, consistent with the parameters described in the Draft Solano HCP (SCWA 2009) within sixty (60) calendar days prior to the date of initial ground disturbance at the project.

California red-legged frog habitat used for conservation will be: (1) preferably located within the California Red-Legged Frog Conservation Area defined in the Draft Solano HCP (SCWA 2009), (2) within 0.7 mile of unobstructed California red-legged frog breeding habitat and non-breeding aquatic habitats, (3) within a California red-legged frog critical habitat unit or within the vicinity of frog critical habitat, and (4) approval by the Service.

b. The Resident Engineer will stop work at the request of the Service-approved biologist(s) if activities are identified that may result in take of a California red-legged frog. Should the biologist(s) or Resident Engineer exercise this authority, the Service will be notified by telephone and email within one working day. The Service contact will be the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600.

c. The Resident Engineer will halt work immediately and contact the Service-approved project biologist and the Service in the event that a California red-legged frog is found within the construction zone. The Resident Engineer will suspend all construction activities in the immediate construction zone until the animal leaves the site voluntarily or is removed by the biologist to a release site using Service-approved transportation techniques.

d. To the extent practicable, initial ground-disturbing activities will be avoided between November 1 and March 31 to avoid the period when California red-legged frogs are most likely to be moving through upland areas. When ground-disturbing activities must take place between November 1 and March 31, daily monitoring will occur for California red-legged frogs.

e. Exclusionary fencing will be placed at the edge of active construction areas (cleared by biological surveys) in areas identified as California red-legged frog habitat. The fencing is intended to restrict frog access from the adjacent upland and riparian habitat. The fence will consist of taut silt fabric: 24 inches high, stacked at 10-foot intervals, with the bottom buried 6 inches below grade. The bid solicitation package Special Provisions will clearly describe acceptable fencing material and proper fence installation and maintenance. The wildlife exclusion fence will remain in place throughout the duration of construction activities and will be regularly inspected and fully maintained. The fence will be completely removed upon completion of project-related activities within these areas and the areas returned to preconstruction condition or better

f. California red-legged frogs that need to be relocated outside the construction area will be released beyond the exclusion fence within the same riparian area or watershed by the Service-approved biologist. If relocation of the frog outside the fence is not feasible (i.e., there are too many frogs observed per day), the biologist will relocate frogs to a preapproved location determined by Caltrans and the Service. Prior to construction, Caltrans will obtain approval of the relocation protocol from the Service in the event that a California red-legged frog is encountered and needs to be relocated away from the immediate project area.

g. To prevent inadvertent entrapment of a California red-legged frog during construction, all excavated, steep-walled holes or trenches more than 1 foot deep will be covered at the close of each working day with plywood or similar material, or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals. If at any time a trapped listed animal is discovered, the onsite biologist will immediately place escape ramps or other appropriate structures to allow the animal to escape, or the Service will be contacted by telephone for guidance. The Service will be notified of the incident by telephone and email within one working day.

h. Within and adjacent to California red-legged frog habitat, all construction equipment or construction debris left overnight within the action area will be inspected for

California red-legged frogs by the Service-approved biologist prior to the beginning of each day's activities and prior to being moved.

i. Injured California red-legged frogs will be cared for by a licensed veterinarian or other qualified person such as the onsite biologist; dead individuals of any listed species will be preserved according to standard museum techniques and held in a secure location. The Service will be notified within one working day of the discovery of death or injury to a listed species that results from project related activities or is observed at the project site. Notification will include the date, time, and location of the incident or of the finding of a dead or injured animal clearly indicated on a U.S. Geological Survey (USGS) 7.5-minute quadrangle and other maps at a finer scale, as requested by the Service, and any other pertinent information. Dead frogs will be placed in a sealed plastic bag with a piece of paper containing information on where and when the animal was found along with the name of the person who found it, the bag will be placed in a freezer located in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are the Coast-Bay/Forest Foothill Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600 and the Resident Agent-in-Charge of Service's Law Enforcement Division at (916) 414-6660.

j. To the extent practicable, nighttime construction will be minimized, especially for those areas adjacent to California red-legged frog habitat. When nighttime work is to be conducted in areas adjacent to potential habitat, all lighting will face away from potential habitat.

k. Plastic monofilament netting (erosion control matting) or similar material will not be used in the action area because California red-legged frogs can become entangled and trapped in it. Instead, Caltrans will use alternative materials such as coconut coir matting or pacified hydroseeding compounds.

l. Vehicle and equipment speed will be limited to 20 miles per hour in unpaved portions of the action area.

m. No pets will be permitted in the action area.

n. For onsite storage of pipes and conduits and other materials that could provide shelter for California red-legged frogs, an open-top trailer will be used to elevate the materials above ground. This is intended to reduce the potential for animals to climb into the conduits and other materials.

25. Caltrans will provide a Funding Assurance Letter stating that sufficient funds for habitat compensation have been budgeted in the Interstate I-80/I-680/SR 12 Interchange Phase 1 Project Expenditure Authorization. The Funding Assurance Letter will be signed by the District Deputy Director of Project Management and the District Deputy Director of Environmental Planning and Engineering. The Funding Assurance Letter provides

evidence that Caltrans has allocated sufficient funding to implement the proposed compensation.

26. Land used for habitat compensation will include a Service-approved conservation easement. An approved ecologically-based conservation easement will include managed public access, a management plan, and an in-perpetuity endowment or other permanent non-wasting management fund based on a PAR-like property analysis. The management plan will include a description of the site, management needs (e.g. grazing plan, non-native vegetation and animal control, etc), when the management activities will be implemented, how often and to what level monitoring of the site will occur, and a action/contingency plan to address potential management issues.

27 Caltrans will provide a restoration and revegetation plan for each construction package to be reviewed and approved by the Service no later than sixty (60) calendar days prior to date of its initial groundbreaking of each construction package. The plan will include, but will not be limited to: schedule, methodology, a list of the seed mixes and container plants, plant material source, irrigation, maintenance schedule, monitoring program, success criteria, control of invasive, noxious weeds, and remediation and adaptive management. In addition, annual monitoring reports on the success of the plantings shall be provided to the Service following the completion for each construction package. The reports will be submitted on or before December 31 of each year monitoring is conducted.

The revegetation plan will include a photo monitoring plan. The plan will include, but is not limited, to the following:

a. An adequate number of photo monitoring stations will be established to provide representative views of project restoration and construction activities. Stations will be located in areas that allow for unobstructed views and a field of vision of approximately 2000 feet, to the extent allowed by surrounding vegetative cover and topography. Each station will provide a representative panoramic view of the restoration footprint. Caltrans will ensure that photo monitoring stations numbers and locations are sufficient to document restoration success.

b. Baseline photographs will be taken during the spring growing season prior to construction. Following the completion of ground disturbance, photo documentation will be conducted quarterly to document restoration relative to four seasons. Photo documentation will conclude when the Service has agreed that success criteria have been met.

c. Photo monitoring station locations will be provided to the Service in an acceptable geographic format with the coordinate system identified.

d. If the Service or the biological monitor(s) determines that additional monitoring stations are necessary, the locations will be added to the inventory of photo monitoring stations prior to the date of the next photo documentation.

e. During each photo monitoring cycle all stations will be visited within a two day period.

f. At the conclusion of restoration, the acreage of restored areas will be tabulated and provided to the Service. The extent of restoration will be delineated with a handheld GPS device and a trackfile provided to the Service Representative.

28. Routine maintenance activities will be identified in the Restoration/Revegetation Plan. Maintained R-O-Ws may include routine maintenance activities that are short in duration, such as spraying and mowing. Specific restrictions may apply for the valley elderberry longhorn beetle, callippe silverspot butterfly , California red-legged frog, and the showy Indian clover.

Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the proposed action, the action area includes: (1) all lands associated with the approximately 258.14-acre construction footprint (of which 136.72 acres is existing hardscape) including roads (except for County roads, and State and Federal highways) and other areas accessed by project vehicles, and (2) lands within 1,000 feet of the construction footprint subjected to project-related lighting, noise, vibration, runoff, and fugitive dust.

Analytical Framework for the Jeopardy and Adverse Modification Analysis

Jeopardy Determination

The following analysis relies on four components to support the jeopardy determination for the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog: (1) the *Status of the Species*, which evaluates the species' range wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the role of the action area in the species' survival and recovery; (3) the *Effects of the Action*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the species.

In accordance with the implementing regulations for section 7 and Service policy, the jeopardy determination is made in the following manner: the effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the species' current status and, for non-Federal activities in the action area, those actions likely to affect the species in the future, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

The following analysis places an emphasis on using the range-wide survival and recovery needs of the species and the role of the action area in providing for those needs as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

This Biological Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR §402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this Biological Opinion relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range wide condition of designated critical habitat for Contra Costa goldfields and California red-legged frog in terms of PCEs, the factors responsible for that condition, and the intended recovery function of the critical habitat at the provincial and range-wide scale; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect effects of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and (4) *Cumulative Effects* which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units. For purposes of the adverse modification determination, the effects of the proposed Federal action on Contra Costa goldfields and California red-legged frog critical habitats are evaluated in the context of the range-wide condition of the critical habitat at the provincial and range-wide scales, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for Contra Costa goldfields and the California red-legged frog.

The analysis in this Biological Opinion places an emphasis on using the intended range-wide recovery function of Contra Costa goldfields and California red-legged frog critical habitat and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

Status of the Species

Vernal Pool Fairy Shrimp

Refer to the *Vernal Pool Fairy Shrimp 5- Year Review* for status and life history information (Service 2007a). This document can be downloaded from the world wide web at: http://www.fws.gov/cno/es/images/Graphics/VPFS_5-yr%20review%20CNO%20FINAL%2027Sept07.pdf

Vernal Pool Tadpole Shrimp

Refer to the *Vernal Pool Tadpole Shrimp 5- Year Review* for status and life history information (Service 2007b). This document can be downloaded from the world wide web at: http://www.fws.gov/cno/es/images/Graphics/VP%20Tadpole%20Shrimp_5%20yr%20review%20FINAL%20CNO%2027Sept07.pdf

Callipe Silverspot Butterfly

Refer to the *Callippe Silverspot Butterfly 5- Year Review* for status and life history information (Service 2009). This document can be downloaded from the world wide web at: http://ecos.fws.gov/docs/five_year_review/doc2518.pdf.

Valley Elderberry Longhorn Beetle

Refer to *Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus) 5-Year Review: Summary and Evaluation* (Service 2006b) for status and life history information. This document can be downloaded from the world wide web at: http://ecos.fws.gov/docs/five_year_review/doc779.pdf.

California Red-Legged Frog

The California red-legged frog was listed as a threatened species on May 23, 1996 (61 FR 25813). A recovery plan was published for the California red-legged frog on September 12, 2002 (Service 2002). A revised critical habitat was designated for this species on March 17, 2010 (75 FR 12816). At this time, the Service recognized the taxonomic change from *Rana aurora draytonii* to *Rana draytonii* (Shaffer *et al.* 2010).

The California red-legged frog is the largest native frog in the western United States (Wright and Wright 1949), ranging from 1.5 to 5.1 inches in length (Stebbins 2003). The abdomen and hind legs of adults are largely red, while the back is characterized by small black flecks and larger irregular dark blotches with indistinct outlines on a brown, gray, olive, or reddish background color. Dorsal spots usually have light centers (Stebbins 2003), and dorsolateral folds are prominent on the back. Larvae (tadpoles) range from 0.6 to 3.1 inches in length, and the background color of the body is dark brown and yellow with darker spots (Storer 1925).

The historic range of the California red-legged frog extended from the vicinity of Elk Creek in Mendocino County, California, along the coast inland to the vicinity of Redding in Shasta County, California, and southward to northwestern Baja California, Mexico (Fellers 2005; Jennings and Hayes 1985; Hayes and Krempels 1986). The species was historically documented in 46 counties but the taxa now remains in 238 streams or drainages within 23 counties, representing a loss of 70 percent of its former range (Service 2002). California red-legged frogs are still locally abundant within portions of the San Francisco Bay area and the Central California Coast. Isolated populations have been documented in the Sierra Nevada, northern Coast, and northern Transverse Ranges. The species is believed to be extirpated from the

southern Transverse and Peninsular ranges, but is still present in Baja California, Mexico (CDFG 2011a).

California red-legged frogs predominately inhabit permanent water sources such as streams, lakes, marshes, natural and manmade ponds, and ephemeral drainages in valley bottoms and foothills up to 4,921 feet in elevation (Jennings and Hayes 1994, Bulger *et al.* 2003, Stebbins 2003). However, California red-legged frogs also have been found in ephemeral creeks and drainages and in ponds that may or may not have riparian vegetation. California red-legged frogs also can be found in disturbed areas such as channelized creeks and drainage ditches in urban and agricultural areas. For example, an adult California red-legged frog was observed in a shallow isolated pool on North Slough Creek in the American Canyon area of Napa County (Christine Gaber/PG&E personal communication with Chris Nagano/Service on October 22, 2008). This frog location was surrounded by vineyard development. Another adult California red-legged frog was observed under debris in an unpaved parking lot in a heavily industrialized area of Burlingame (Patrick Kobernus/Coast Ridge Ecology communication with Michelle Havens/Service on October 16, 2008). This Burlingame frog was likely utilizing a nearby drainage ditch. Caltrans also has discovered California red-legged frog adults, tadpoles, and egg masses within a storm drainage system within a major cloverleaf intersection of Millbrae Avenue and State Route 101 in a heavily developed area of San Mateo County (Caltrans 2007). The California red-legged frog has the potential to persist in disturbed areas as long as those locations provide at least one or more of their life history requirements.

California red-legged frogs typically breed between November and April, although earlier breeding records have been reported in southern localities. Breeding generally occurs in still or slow-moving water often associated with emergent vegetation, such as cattails, tules or overhanging willows (Storer 1925, Hayes and Jennings 1988). Female frogs deposit egg masses on emergent vegetation so that the egg mass floats on or near the surface of the water (Hayes and Miyamoto 1984).

Habitat includes nearly any area within 1 to 2 miles of a breeding site that stays moist and cool through the summer including vegetated areas with coyote brush, California blackberry thickets, and root masses associated with willow and California bay trees (Fellers 2005). Sheltering habitat for California red-legged frogs potentially includes all aquatic, riparian, and upland areas within the range of the species and includes any landscape feature that provides cover, such as animal burrows, boulders or rocks, organic debris such as downed trees or logs, and industrial debris. Agricultural features such as drains, watering troughs, spring boxes, abandoned sheds, or hay stacks may also be used. Incised stream channels with portions narrower and depths greater than 18 inches also may provide important summer sheltering habitat. Accessibility to sheltering habitat is essential for the survival of California red-legged frogs within a watershed, and can be a factor limiting frog population numbers and survival.

California red-legged frogs do not have a distinct breeding migration (Fellers 2005). Adults are often associated with permanent bodies of water. Some individuals remain at breeding sites year-round, while others disperse to neighboring water features. Dispersal distances are typically less than 0.5-mile, with a few individuals moving up to 1 to 2 miles (Fellers 2005). Movements are typically along riparian corridors, but some individuals, especially on rainy nights, move

directly from one site to another through normally inhospitable habitats, such as heavily grazed pastures or oak-grassland savannas (Fellers 2005).

In a study of California red-legged frog terrestrial activity in a mesic area of the Santa Cruz Mountains, Bulger *et al.* (2003) categorized terrestrial use as migratory and non-migratory. The latter occurred from one to several days and was associated with precipitation events. Migratory movements were characterized as the movement between aquatic sites and were most often associated with breeding activities. Bulger *et al.* (2003) reported that non-migrating frogs typically stayed within 200 feet of aquatic habitat 90 percent of the time and were most often associated with dense vegetative cover, i.e., California blackberry, poison oak and coyote brush. Dispersing frogs in northern Santa Cruz County traveled distances from 0.25-mile to more than 2 miles without apparent regard to topography, vegetation type, or riparian corridors (Bulger *et al.* 2003).

In a study of California red-legged frog terrestrial activity in a xeric environment in eastern Contra Costa County, Tatarian (2008) noted that the majority of frogs (57 percent) fitted with radio transmitters in the Round Valley study area stayed at their breeding pools, whereas 43 percent moved into adjacent upland habitat or to other aquatic sites. Her study reported a peak seasonal terrestrial movement occurring in the fall months associated with the first 0.2-inch of precipitation and tapering off into spring. Upland movement activities ranged from 3 to 233 feet, averaging 80 feet, and were associated with a variety of refugia including grass thatch, crevices, cow hoof prints, ground squirrel burrows at the base of trees or rocks, logs, and under man-made structures; others were associated with upland sites lacking refugia (Tatarian 2008). The majority of terrestrial movements lasted from one to four days; however, one adult female was reported to remain in upland habitat for 50 days (Tatarian 2008). Upland refugia closer to aquatic sites were used more often and were more commonly associated with areas exhibiting higher object cover, e.g., woody debris, rocks, and vegetative cover. Subterranean cover was not significantly different between occupied upland habitat and non-occupied upland habitat.

California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Egg masses containing 2,000 to 5,000 eggs are attached to vegetation below the surface and hatch after six to 14 days (Storer 1925, Jennings and Hayes 1994). In coastal lagoons, the most significant mortality factor in the pre-hatching stage is water salinity (Jennings *et al.* 1992). Eggs exposed to salinity levels greater than 4.5 parts per thousand resulted in 100 percent mortality (Jennings and Hayes 1990). Increased siltation during the breeding season can cause asphyxiation of eggs and small larvae. Larvae undergo metamorphosis 3½ to seven months following hatching and reach sexual maturity two to three years of age (Storer 1925; Wright and Wright 1949; Jennings and Hayes 1985, 1990, 1994). Of the various life stages, larvae probably experience the highest mortality rates, with less than one percent of eggs laid reaching metamorphosis (Jennings *et al.* 1992). Under favorable conditions, California red-legged frogs may live eight to ten years (Jennings *et al.* 1992). Populations can fluctuate from year to year; favorable conditions allow the species to have extremely high rates of reproduction and thus produce large numbers of dispersing young and a concomitant increase in the number of occupied sites. In contrast, the animal may temporarily disappear from an area when conditions are stressful (e.g., during periods of drought, disease, etc.).

The diet of California red-legged frogs is highly variable and changes with the life history stage. The diet of the larvae is not well studied, but is likely similar to that of other ranid frogs, which feed on algae, diatoms, and detritus by grazing on the surface of rocks and vegetation (Fellers 2005: Kupferberg 1996a, 1996b, 1997). Hayes and Tennant (1985) analyzed the diets of California red-legged frogs from Cañada de la Gaviota in Santa Barbara County during the winter of 1981 and found invertebrates (comprising 42 taxa) to be the most common prey item consumed; however, they speculated that this was opportunistic and varied based on prey availability. They ascertained that larger frogs consumed larger prey and were recorded to have preyed on Pacific chorus frog, three-spined stickleback and, to a limited extent, California mice, which were abundant at the study site (Hayes and Tennant 1985, Fellers 2005). Although larger vertebrate prey was consumed less frequently, it represented over half of the prey mass eaten by larger frogs suggesting that such prey may play an energetically important role in their diets (Hayes and Tennant 1985). Juvenile and subadult/adult frogs varied in their feeding activity periods; juveniles fed for longer periods throughout the day and night, while subadult/adults fed nocturnally (Hayes and Tennant 1985). Juveniles were significantly less successful at capturing prey and all life history stages exhibited poor prey discrimination, feeding on several inanimate objects that moved through their field of view (Hayes and Tennant 1985).

The direction and type of habitat used by dispersing animals is especially important in fragmented environments (Forys and Humphrey 1996). Models of habitat patch geometry predict that individual animals will exit patches at more "permeable" areas (Buechner 1987; Stamps *et al.* 1987). A landscape corridor may increase the patch-edge permeability by extending patch habitat (La Polla and Barrett 1993), and allow individuals to move from one patch to another. The geometric and habitat features that constitute a "corridor" must be determined from the perspective of the animal (Forys and Humphrey 1996).

Because their habitats have been fragmented, many endangered and threatened species exist as metapopulations (Verboom and Apeldom 1990; Verboom *et al.* 1991). A metapopulation is a collection of spatially discrete subpopulations that are connected by the dispersal movements of the individuals (Levins 1970; Hanski 1991). For metapopulations of listed species, a prerequisite to recovery is determining if unoccupied habitat patches are vacant due to the attributes of the habitat patch (food, cover, and patch area) or due to patch context (distance of the patch to other patches and distance of the patch to other features). Subpopulations on patches with higher quality food and cover are more likely to persist because they can support more individuals. Large populations have less of a chance of extinction due to stochastic events (Gilpin and Soule 1986). Similarly, small patches will support fewer individuals, increasing the rate of extinction. Patches that are near occupied patches are more likely to be recolonized when local extinction occurs and may benefit from emigration of individuals via the "rescue" effect (Hanski 1982; Gotelli 1991, Holt 1993; Fahrig and Merriam 1985). For the metapopulation to persist, the rate of patches being colonized must exceed the rate of patches going extinct (Levins 1970). If some subpopulations go extinct regardless of patch context, recovery actions should be placed on patch attributes. Patches could be managed to increase the availability of food and/or cover

Movements and dispersal corridors likely are critical to California red-legged frog population dynamics, particularly because the animals likely currently persist as metapopulations with

disjunct population centers. Movement and dispersal corridors are important for alleviating over-crowding and intraspecific competition, and also they are important for facilitating the recolonization of areas where the animal has been extirpated. Movement between population centers maintains gene flow and reduced genetic isolation. Genetically isolated populations are at greater risk of deleterious genetic effects such as inbreeding, genetic drift, and founder effects. The survival of wildlife species in fragmented habitats may ultimately depend on their ability to move among patches to access necessary resources, retain genetic diversity, and maintain reproductive capacity within populations (Hilty and Merenlender 2004; Petit *et al.* 1995; Buza *et al.* 2000).

Most metapopulation or meta-population-like models of patchy populations do not directly include the effects of dispersal mortality on population dynamics (Hanski 1994; With and Crist 1995; Lindenmayer and Possingham 1996). Based on these models, it has become a widely held notion that more vagile species have a higher tolerance to habitat loss and fragmentation than less vagile species. But models that include dispersal mortality predict exactly the opposite: more vagile species should be more vulnerable to habitat loss and fragmentation because they are more susceptible to dispersal mortality (Fahrig 1998; Casagrandi and Gatto 1999). This prediction is supported by Gibbs (1998), who examined the presence-absence of five amphibian species across a gradient of habitat loss. He found that species with low dispersal rates are better able than more vagile species to persist in landscapes with low habitat cover. Gibbs (1998) postulated that the land between habitats serves as a demographic "drain" for many amphibians. Furthermore, Bonnet *et al.* (1999) found that snake species that frequently make long-distance movements have higher mortality rates than do sedentary species.

Habitat loss, non-native species introduction, and urban encroachment are the primary factors that have adversely affected the California red-legged frog throughout its range. Several researchers in central California have noted the decline and eventual local disappearance of California and northern red-legged frogs in systems supporting bullfrogs (Jennings and Hayes 1990; Twedt 1993), red swamp crayfish, signal crayfish, and several species of warm water fish including sunfish, goldfish, common carp, and mosquitofish (Moyle 1976; Barry 1992; Hunt 1993; Fisher and Schaffer 1996). This has been attributed to predation, competition, and reproduction interference. Twedt (1993) documented bullfrog predation of juvenile northern red-legged frogs (*Rana aurora*), and suggested that bullfrogs could prey on subadult California red-legged frogs as well. Bullfrogs may also have a competitive advantage over California red-legged frogs. For instance, bullfrogs are larger and possess more generalized food habits (Bury and Whelan 1984). In addition, bullfrogs have an extended breeding season (Storer 1933) during which an individual female can produce as many as 20,000 eggs (Emlen 1977). Furthermore, bullfrog larvae are unpalatable to predatory fish (Kruse and Francis 1977). Bullfrogs also interfere with California red-legged frog reproduction by eating adult male California red-legged frogs. Both California and northern red-legged frogs have been observed in amplexus (mounted on) with both male and female bullfrogs (Jennings and Hayes 1990; Twedt 1993; Jennings 1993). Thus bullfrogs are able to prey upon and out-compete California red-legged frogs, especially in sub-optimal habitat.

The urbanization of land within and adjacent to California red-legged frog habitat has also affected the threatened amphibian. These declines are attributed to channelization of riparian

areas, enclosure of the channels by urban development that blocks dispersal, and the introduction of predatory fishes and bullfrogs. Diseases may also pose a significant threat, although the specific effects of disease on the California red-legged frog are not known. Pathogens are suspected of causing global amphibian declines (Davidson *et al.* 2003). Chytridiomycosis and ranaviruses are a potential threat because these diseases have been found to adversely affect other amphibians, including the listed species (Davidson *et al.* 2003; Lips *et al.* 2006). Mao *et al.* (1999 cited in Fellers 2005) reported northern red-legged frogs infected with an iridovirus, which was also presented in sympatric threespine sticklebacks in northwestern California. Non-native species, such as bullfrogs and non-native tiger salamanders that live within the range of the California red-legged frog have been identified as potential carriers of these diseases (Garner *et al.* 2006). Humans can facilitate the spread of disease by encouraging the further introduction of non-native carriers and by acting as carriers themselves (i.e., contaminated boots, waders or fishing equipment). Human activities can also introduce stress by other means, such as habitat fragmentation, that results in the listed species being more susceptible to the effects of disease.

Negative effects to wildlife populations from roads and pavement may extend some distance from the actual road. The phenomenon can result from vehicle-related mortality, habitat degradation, noise and light pollution, and invasive exotic species. Forman and Deblinger (1998) described the area affected as the "road effect" zone. One study along a four-lane road in Massachusetts determined that this zone extended for an average of 980 feet to either side of the road for an average total zone width of approximately 1,970 feet. However, in some areas they detected an effect greater than 0.6-mile from the road. The road effect zone can also be subtle. Van der Zandt *et al.* (1980) reported that lapwings and black-tailed godwits feeding at 1,575 to 6,560 feet from roads were disturbed by passing vehicles. The heart rate, metabolic rate and energy expenditure of female bighorn sheep increases near roads (MacArthur *et al.* 1979). Trombulak and Frissell (2000) described another type of "road-zone" effect due to contaminants. Heavy metal concentrations from vehicle exhaust were greatest within 66 feet of roads and elevated levels of metals in soil and plants were detected at 660 feet of roads. The "road-zone" varies with habitat type and traffic volume. Based on responses by birds, Forman (2000) estimated the road-zone along primary roads of 1,000 feet in woodlands, 1,197 feet in grasslands, and 2,657 feet in natural lands near urban areas. Along secondary roads with lower traffic volumes, the effect zone was 656 feet. The road-zone with regard to California red-legged frogs has not been adequately investigated.

The necessity of moving between multiple habitats and breeding ponds means that many amphibian species, such as the California red-legged frog are especially vulnerable to roads and well-used large paved areas in the landscape. Amphibians appear especially vulnerable to traffic mortality because they readily attempt to cross roads, are small and slow-moving, and thus are not easily avoided by drivers (Carr and Fahrig 2001). Van Gelder (1973) and Cooke (1995) have examined the effect of roads on amphibians and found that because of their activity patterns, population structure, and preferred habitats, aquatic breeding amphibians are more vulnerable to traffic mortality than some other species. High-volume highways pose a nearly impenetrable barrier to amphibians and result in mortality to individual animals as well as significantly fragmenting habitat. Hels and Buchwald (2001) found that mortality rates for anurans on high traffic roads are higher than on low traffic roads. Vos and Chardon (1998) found a significant negative effect of road density on the occupation probability of ponds by the moor frog (*Rana*

arvalis) in the Netherlands. In addition, incidences of very large numbers of road-killed frogs are well documented (Ashley and Robinson 1996), and studies have shown strong population level effects of traffic density (Carr and Fahrig 2001) and high traffic roads on these amphibians (Van Gelder 1973; Vos and Chardon 1998). Most studies regularly count road mortalities from slow moving vehicles (Hansen 1982; Rosen and Lowe 1994; Drews 1995; Mallick *et al.* 1998) or by foot (Munguira and Thomas 1992). These studies assume that every victim is observed, which may be true for large conspicuous mammals, but may be an incorrect assumption for small animals, such as the California red-legged frog. The carcasses of small soft-bodied amphibians like frogs are quickly decimated under passing tires and are less likely to be detected by researchers and are unlikely to persist for more than a day (Santos *et al.* 2011).

The recovery plan for the California red-legged frog identifies eight recovery units (Service 2002). The establishment of these recovery units is based on the determination that various regional areas of the species' range are essential to its survival and recovery. These recovery units are delineated by major watershed boundaries as defined by USGS hydrologic units and the limits of its range. The goal of the recovery plan is to protect the long-term viability of all extant populations within each recovery unit. Within each recovery unit, core areas have been delineated and represent contiguous areas of moderate to high California red-legged frog densities that are relatively free of exotic species such as bullfrogs. The goal of designating core areas is to protect metapopulations. Thus when combined with suitable dispersal habitat, will allow for the long term viability within existing populations. This management strategy will allow for the recolonization of habitats within and adjacent to core areas that are naturally subjected to periodic localized extinctions, thus assuring the long-term survival and recovery of California red-legged frogs.

Environmental Baseline

Vernal Pool Fairy Shrimp and Vernal Pool Tadpole Shrimp

The majority of the action area, including the eastern end of the Business Center Drive Extension is located within the Solano-Colusa vernal pool region, which was designated based largely on presence of endemic vernal pool species identified in the Service's *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (Recovery Plan) (Service 2005a). The vernal pool fairy shrimp and vernal pool tadpole shrimp have been adversely affected by development and modification of vernal pool and grassland habitat within the Solano-Colusa vernal pool region and are present in much of the undeveloped areas within the region.

Most of the seasonal wetland habitat in Solano County has not been surveyed for listed branchiopods. Of the 23 vernal pool fairy shrimp records in Solano County, the CNDDB includes at least three occurrences within 5 miles of the action area (CDFG 2011a, 2011b). Three of the 30 records for vernal pool tadpole shrimp occur within 5 miles of the action area (CDFG 2011a, 2011b).

Although Caltrans did not perform protocol-level surveys for listed branchiopods, they identified at least 14 seasonal wetland features within 250 feet of the construction footprint that provide habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp. According to Caltrans, half

of these habitat features would be directly affected by the proposed project.

The Service has determined that the vernal pool fairy shrimp and vernal pool tadpole shrimp are likely to occur within the action area due to the presence of appropriate seasonal wetland habitat within the action area such as impervious soils, the seasonal hydroperiod, and topographical features that provide the necessary habitat attributes to support one or all of these species' life history stages. Caltrans identified 14 seasonal wetland features within the action area. Furthermore, wading birds, that visit this and other nearby occupied wetlands, ponds and swales to forage or drink water, act as vectors to transport cysts or adults from one pond to another through their feces or on their feathers or legs. For these reasons, the Service has determined that it is reasonable to conclude that vernal pool fairy shrimp and vernal pool tadpole shrimp to inhabit the identified seasonal wetlands within 250 feet of the construction footprint.

Callippe Silverspot Butterfly

Much of the undeveloped land in Solano County is privately owned and knowledge of the current distribution of callippe silverspot butterfly in the county's remaining areas of potential habitat is limited.

Reported records of the callippe silverspot butterfly in Solano County are located in the hills between Vallejo and Cordelia and northward into Jameson Canyon (SCWA 2009; CDFG 2011a, 2011b). Most of the current knowledge in Solano County is derived from SLT's Swett and King Ranch properties south of I-80 where management activities are being proposed and implemented to enhance callippe silverspot butterfly habitat (SCWA 2009; Service personal communication with SLT 2011).

As defined by the Solano Draft HCP's *Callippe Silverspot Butterfly Conservation Area* the likely distribution of the callippe silverspot butterfly in Solano County extends from Vallejo to at least 4 to 5 miles north of I-80 towards Green Valley and includes the rolling hills south and north of Jameson Canyon Road (SCWA 2009). This conservation area encompasses the proposed project footprint for the Business Center Drive Extension. The 3,300-acre conservation area includes core silverspot habitat and connectivity between these core areas. Approximately 7,870 acres of the conservation area is currently managed as open space by SLT and the Greater Vallejo Recreation District and an additional 660 acres has been preserved as "mitigation lands" (SCWA 2009). These open space lands are subject to varying degrees of public access for the purpose of recreation. Funding for additional surveys, monitoring, management, and enhancement of callippe silverspot butterfly habitat within the conservation area has been limited and inconsistent.

The draft Solano HCP acknowledges that steep slopes are important to the life history of the callippe silverspot butterfly (SCWA 2009). Of the approximately 1,560 acres of callippe silverspot butterfly habitat identified within the urban growth zone in the draft HCP, it was estimated that at least 350 acres of those would be conserved for the species because the slopes were too steep to develop. According to the Solano draft HCP, the cities of Vallejo and Fairfield have adopted restrictions in their general plans that limit development on slopes greater than

30 percent. The analysis in the draft HCP assumes that development would be avoided on all slopes greater than 30 percent and approximately half of those greater than 20 percent.
A key element to callippe silverspot butterfly occupation is the distribution of their larval host plant, Johnny jump-up. This perennial violet is found throughout much of the grassland and oak woodlands of coastal California but little is known about its distribution within Solano County. Silverspot butterflies may rely on Johnny jump-up stands of a few to several acres. The annual densities of this rhizomous herb on the King and Swett Ranches is highly variable (Service personal communication with SLT 2011) which is likely true throughout the *Callippe Silverspot Conservation Area*. In 2004, Monk & Associates (Caltrans 2011) found two previously unrecorded Johnny jump-up stands immediately adjacent to the construction footprint for the proposed Business Center Drive Extension. Caltrans was still able to observe a violet flower in 2011 when they attempted to follow-up on the Monk & Associates 2004 observations. However, the investigation was conducted after the plant's prime blooming period at the King/Swett Ranches reference stands (May 17, 2011 Memo from ICF International to Caltrans). Monk & Associates' 2004 observation confirmed that the larval host plant occurs within the conservation area north of I-80 and there are at least two stands adjacent to the proposed action area. Much of the proposed construction footprint for the Business Center Drive Extension is located on eastern-facing slopes. Johnny jump-ups appear to remain in bloom longer on eastern-facing slopes which likely increase the potential for larvae to mature into adulthood (SCWA 2009).

Adult callippe silverspot butterflies are less limited in their use of nectar plants. They are known to utilize native and exotic flowers depending upon availability. The butterflies show particular preference for California buckeye, coyote wildmint, and various thistles within the King and Swett Ranches (personal communication with SLT, 2011). California buckeye occurs within the various riparian areas north of I-80 and along Jameson Canyon Creek. ICF International reported numerous thistle and other adult silverspot butterfly nectar plants in the proposed Business Center Drive Extension area in May 2011 (May 17, 2011 Memo from ICF International to Caltrans).

The *Callippe Silverspot Butterfly Conservation Area* is characterized by rolling hills associated with silverspot butterfly "hill-topping" breeding behavior. Adult butterflies congregate on ridgelines and hilltops for breeding purposes and adult males will defend territories along these topographical features. The majority of the proposed construction footprint for the Business Center Drive Extension includes these associated topographical features.

Caltrans did not conduct surveys for callippe silverspot butterfly but Monk & Associates identified two *Viola* populations during general biological surveys for a former Business Center Drive Extension alignment. Monk & Associates mapped *Viola* stands approximately 20 feet south and 300 feet north of the construction footprint. Monk & Associates did not indicate how many violets they observed in each population. Caltrans was unable to successfully monitor the *Viola* populations following the 2004 observations. In addition to finding the larval host plant, Caltrans also identified numerous adult nectar plants throughout the area.

The Service believes that the callippe silverspot butterfly is reasonably certain to occur within the action area because: (1) it is located within the species' range; and (2) larval host plants, adult nectar plants, and topographical breeding habitat features are located within and/or adjacent

to the proposed construction footprint.

Valley Elderberry Longhorn Beetle

The action area is located within the current range of the valley elderberry longhorn beetle. There are at least five known occurrences of valley elderberry longhorn beetle within 5 miles of the action area (CDFG 2011a, 2011b). The draft Solano HCP states that any elderberry shrub in Solano County has the potential to support the valley elderberry longhorn beetle even though a specific plant may not show evidence of beetle use (SCWA 2009). Caltrans identified the listed beetle's host plant, the elderberry shrub, in the action area as potential habitat (Caltrans 2011). According to the BA, ten elderberry shrubs will be directly affected by the project and will be removed and transplanted. Caltrans found a potential valley elderberry longhorn beetle exit hole in two of the shrubs with stems 1 inch or greater in diameter at ground level. Therefore, the Service has determined that the valley elderberry longhorn beetle is reasonably certain to occur within the action area because of the biology and ecology of the animal, and the presence of suitable habitat.

California Red-Legged Frog

The entirety of the proposed project is located within the species' range and current distribution. The proposed project cuts through a mosaic of industrial, residential, agricultural, fallow, and open space land uses, representing a range of highly modified and degraded to high quality California red-legged frog habitat. The alignment crosses and is adjacent to several creeks (Jameson Canyon Creek, Dan Wilson Creek, Suisun Creek, Ledgewood Creek, and Green Valley Creek), numerous constructed drainage features, and perennial and seasonal ponds and marshes that provide breeding and non-breeding aquatic habitat for the California red-legged frog. Riparian vegetation along creeks and drainages and landscape vegetation in the action area provide valuable refuge, forage, and dispersal habitat for red-legged frogs. Upland grassland areas with rodent burrows and other cover sites along constructed drainage features, in fallow, and grazed fields also provide refuge, forage, and dispersal habitat for the species.

The western portion of the action area, including the Business Center Drive Extension, is within and bisects Core Area #15 (Jameson Canyon-Lower Napa River) of the California red-legged frog Recovery Unit 3 (North Coast and North San Francisco Bay) (Service 2002). The conservation needs for the Jameson Canyon-Lower Napa River core area are: (1) protecting existing populations from current and future urbanization; (2) create and manage alternative breeding habitats; and (3) protecting dispersal corridors. The Jameson Canyon-Lower Napa River Core Area is described in the recovery plan as an important source population for the species.

The Business Center Drive Extension bisects the southeastern quarter of the SOL-2 California red-legged frog designated critical habitat unit (Jameson Canyon Unit). SOL-2 is considered essential for the California red-legged frog because it provides connectivity from Napa County south to unit SOL-3 (American Canyon Unit) which occupies a wedge of habitat located between Jameson Canyon Road and Interstate 80. Critical habitat unit SOL-1 (the Sky Valley Unit) is the southernmost unit in Solano County and extends south to Suisun Bay. The connectivity function

of the three Solano County units is dependent upon maintaining red-legged frog passage across I-80 and Jameson Canyon Road (SR 12W). The construction footprint also enters the eastern corner of SOL-3 at the proposed intersection of the Business Center Drive/Redtop Road and I-80.

The *California Red-Legged Frog Conservation Strategy* in the draft Solano HCP represents the most complete regional scientific data and analysis for the California red-legged frog in Solano County (SCWA 2009). The western portion of the construction footprint, beginning at the SR 12W/I-80 intersection, is located within the *California Red-Legged Frog Conservation Area* defined in the draft HCP According to the draft HCP analysis, the existing Jameson Canyon Road and Interstate 80 create barriers between the SOL-1, -2, and -3 critical habitat units and "severely restrict or eliminate the natural dispersal and migratory movements of individuals between these three blocks of habitat, reducing the resiliency of populations and limiting genetic diversity." One of the objectives of the draft HCP is to conserve 20 percent of the historic range of the California red-legged frog within Solano County which amounts to approximately 99 percent of the Jameson Canyon-Lower Napa River core recovery area.

Relatively little is known about the California red-legged frog population in Solano County. Much of the red-leg frog habitat in Solano County occurs on private land and has not been subject to protocol-level or other surveys. As directed by the draft Solano HCP, regional surveys will be conducted for California red-legged frogs within the Jameson Canyon-Lower Napa River Core Recovery Area within two years of adopting the final HCP and will continue every five years for the life of the HCP (SCWA 2009). The first California red-legged frog CNDDB record for Solano County was not recorded until 1993 (SCWA 2009). There are only two reported observations of the species in the SOL-2 critical habitat unit and both records are the result of surveys conducted by Monk & Associates for the former alignment of the Business Center Drive Extension (Caltrans 2011). The records are located between the proposed Business Center Drive Extension and I-80. One record includes adult and juvenile red-legged frogs found approximately 400 feet from the construction footprint in a plunge pool of an ephemeral drainage. The second record includes adult frogs and tadpoles in Mangle's Pond, approximately 300 feet north of the construction footprint and south of the Business Center Drive Extension. The CNDDB record identified red-legged frog breeding on the Mangels' Property. The Mangels' pond is likely the primary breeding pond within the SOL-2 California red-legged frog critical habitat unit. There are at least 13 other California red-legged frog occurrences reported to the CNDDB within 1 to 5 miles from the construction footprint (CDFG 2011a, 2011b).

Caltrans did not conduct standardized or protocol-level frog or other wildlife surveys in the action area or a wildlife movement analysis to support their baseline analysis for the project. Due to limited access, Caltrans and the Service used aerial photography and field observations from available access locations to independently assess habitat throughout the action area vicinity.

In addition to the Mangels' Pond, Caltrans determined that the marsh immediately south of the Mangels' Pond is potential red-legged frog breeding habitat. The southern edge of this marsh is within the construction footprint for work occurring at the SR 12W/I-80 interchange. Caltrans also identified a marsh immediately north of Green Valley Creek and I-80 as potential breeding

habitat.

There are numerous barriers and impediments to California red-legged frog movement in the action area vicinity. Existing roads, business, and other development fragments the landscape and prevent or encumber access between aquatic and upland habitat for foraging, movement, dispersal, refuge, and breeding. SR 12, I-80, I-680, and surrounding surface streets do not include barriers to exclude red-legged frogs from the roadway or direct them towards safe undercrossings. Frogs that attempt to cross these roads risk mortality due to vehicle collision and exposure.

The land west of I-80, north and south of SR 12W is primarily open grassland for grazing, with interspersed ranches and vineyards. This area is characterized by large expanses of rolling hills with ephemeral drainages, riparian corridors, stock ponds, and agricultural basins. Critical habitat units SOL-2 and SOL-3 are found within these contiguous blocks of habitat.

The Service believes that the California red-legged frog is reasonably certain to occur within the action area because: (1) it is located within the species' range and current distribution; (2) suitable aquatic, riparian, and upland California red-legged frog habitat intersect the action area in multiple locations; (3) the construction footprint is immediately adjacent to recent California red-legged frog observations; (4) the project is within the California Red-Legged Frog Conservation Area identified in the draft Solano HCP (SCWA 2009); (5) the project will construct a linear barrier between a recorded breeding pond and adjacent upland habitat; (6) all the elements needed to support the species' life history are located within the construction footprint; and (6) the biology and ecology of the animal, especially the ability of adults to move considerable distances.

Critical Habitat Status and Baseline

Critical habitat is defined in Section 3 of the Act as: (1) The specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (a) essential to the conservation of the species and (b) that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. In determining which areas to designate as critical habitat, the Service considers those physical and biological features that are essential to a species' conservation and that may require special management considerations or protection (50 CFR 424.12(b)). The Service is required to list the known Primary Constituent Elements (PCE's) together with the critical habitat description. Such physical and biological features include, but are not limited to, the following:

1 Space for individual and population growth, and for normal behavior;

2. Food, water, air, light, minerals, or other nutritional or physiological requirements;

3. Cover or shelter;

4. Sites for breeding, reproduction, rearing of offspring, or dispersal; and

5. Generally, habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

Contra Costa Goldfields Critical Habitat

The Service designated 14,730 acres of critical habitat for Contra Costa goldfields in 2005 (Service 2005b). In determining which areas to designate as critical habitat, the Service considers those physical and biological features (PCEs) that are essential to the conservation of the species, and that may require special management considerations and protections (50 CFR §424.14).

Critical habitat PCEs for goldfields are the habitat components that provide:

1. Topographic features characterized by isolated mound and intermound complex within a matrix of surrounding uplands that result in continuously, or intermittently, flowing surface water in the depressional features including swales connecting the pools, providing for dispersal and promoting hydroperiods of adequate length in the pools; and

2. Depressional features including isolated vernal pools with underlying restrictive soil layers that become inundated during winter rains and that continuously hold water or whose soils are saturated for a period long enough to promote germination, flowering, and seed production of predominantly annual native wetland species and typically exclude both native and non-native upland plant species in all but the driest years. As these features are inundated on a seasonal basis, they do not promote the development of obligate wetland vegetation habitats typical of permanently flooded emergent wetlands

The proposed project includes direct effects to 3.83 acres of Contra Costa goldfields critical habitat Unit 5B. This unit encompasses 736.72 acres and is essential to the conservation of the species because it is needed to maintain the current geographic and ecological distribution of the species. The project area lies along the northern boundary of Unit 5B whose boundary is defined by SR 12E. The action area parallels the existing SR 12E and the intrusion into Unit 5B is primarily limited to the existing SR 12E road embankment sloping down to the Gentry Suisun wetland.

California Red-Legged Frog Critical Habitat

The Service designated critical habitat for the California red-legged frog on April 13, 2006 (71 FR 19244) (Service 2006a) and a revised designation to the critical habitat was published on March 17, 2010 (75 FR 12816) (Service 2010).

The PCE's defined for the California red-legged frog provide aquatic habitat for breeding and non-breeding activities and upland habitat for shelter, foraging, predator avoidance, and dispersal across its range. The PCE's and, therefore, the resulting physical and biological features essential for the conservation of the species were determined from studies of California red-

legged frog ecology. Based on the above needs and our current knowledge of the life history, biology, and ecology of the species, and the habitat requirements for sustaining the essential life-history functions of the species, the Service determined that the PCE's essential to the conservation of the California red-legged frog are:

1. Aquatic Breeding Habitat. Standing bodies of fresh water (with salinities less than 7.0 parts per thousand), including: natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years.

2. Non-Breeding Aquatic Habitat. Freshwater and wetted riparian habitats, as described above, that may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs. Other wetland habitats that would be considered to meet these elements include, but are not limited to: plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period.

3. Upland Habitat. Upland areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile in most cases and comprised of various vegetational series such as grasslands, woodlands, wetland, or riparian plant species that provide the frog shelter, forage, and predator avoidance. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the wetland or riparian habitat. These upland features contribute to the filling and drying of the wetland or riparian habitat and are responsible for maintaining suitable periods of pool inundation for larval frogs and their food sources, and provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), as well as small mammal burrows and moist leaf litter.

4. Dispersal Habitat. Accessible upland or riparian dispersal habitat within designated units and between occupied locations within a minimum of 1 mile of each other that allow for movement between such sites. Dispersal habitat includes various natural habitats and altered habitats such as agricultural fields, which do not contain barriers (e.g., heavily traveled road without bridges or culverts) to dispersal. Dispersal habitat does not include moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete, nor does it include large reservoirs over 50 acres in size, or other areas that do not contain those features identified by PCE's 1, 2, or 3 as essential to the conservation of the subspecies.

With the revised designation of critical habitat, the Service intends to conserve the geographic areas containing the physical and biological features that are essential to the conservation of the species, through the identification of the appropriate quantity and spatial arrangement of the

PCE's sufficient to support the life-history functions of the species. Because not all life-history functions require all the PCE's, not all areas designated as critical habitat will contain all the PCE's. Refer to the final designation of critical habitat for California red-legged frog for additional information (75 FR 12816).

The action area is within critical habitat units SOL-2 and SOL-3. The proposed action will directly affect 12.75 acres of SOL-2 and 0.46 acre of SOL-3.

SOL-2 comprises approximately 3,360 acres in southwestern Solano County and a portion of extreme southeastern Napa County, south of I-80 and west of I-680. SOL-2 is essential for the conservation of the species because it provides connectivity to adjacent units to the south in the interior Coast Range north of the Suisun Bay and is expected to prevent further fragmentation of habitat in this portion of the species' range. The unit contains high-quality permanent and ephemeral aquatic habitats (PCE 1 and PCE 2) consisting of stream and plunge pools as well as large freshwater marsh surrounded by open grassland, willow, and oak that provide for breeding, and upland areas (PCE 3 and PCE 4) for dispersal, shelter, and foraging. The unit consists entirely of private land.

The physical and biological features essential to the conservation of California red-legged frog in the SOL-2 unit may require special management considerations or protection due to nonnative animal species, over grazing of habitat, urbanization, habitat alteration from invasive plant species, and recreational use which may alter aquatic or upland habitats and thereby result in the direct or indirect loss of egg masses or adults due to habitat modification and predation.

SOL-3 comprises approximately 4,597 acres in southwestern Solano County and a portion of extreme southeastern Napa County, north of I-80 and south of SR 12W The unit contains high-quality permanent and ephemeral aquatic habitats (PCE 1 and PCE 2), consisting of pools, stream, and spring habitat surrounded by riparian tree species and annual grasslands that provide for breeding, and upland areas for dispersal, shelter, and foraging (PCE 3 and PCE 4). The designation of this unit was expected to prevent further fragmentation of habitat in this portion of the species' range and provides connectivity to other units farther north and south in the interior Coast Range north of the Suisun Bay. The unit consists of 1,087 acres of local nonprofit ownership and 3,510 acres of private land.

The physical and biological features essential to the conservation of California red-legged frog in the SOL-3 unit may require special management considerations or protection due to overgrazing of aquatic and riparian habitats, and loss and alteration of habitat due to urbanization, which may alter or eliminate aquatic or upland habitats and thereby result in the direct or indirect loss of egg masses or adults.

Effects of the Proposed Action

The DEIR/EIS (Caltrans 2010) notes that a HCP has been prepared for Solano County. The draft Solano HCP is based on a conservation strategy that has been developed for a number of species, including the vernal pool fairy shrimp, vernal pool tadpole shrimp, valley elderberry longhorn beetle, callippe silverspot butterfly, the Central Valley Distinct Population Segment of the

California tiger salamander, and California red-legged frog (SCWA 2009). The participants in this strategy include the cities of Vallejo, Fairfield, Suisun City, and the County of Solano. The goal of the conservation strategy is to establish a framework for complying with the Federal and State endangered species acts while accommodating future urban growth, development of infrastructure, and on-going operations and maintenance activities associated with flood control, irrigation facilities, and other public infrastructure undertaken under the permitting authority of the strategy participants within Solano County over the next 30 years. The amount and type of loss and destruction of habitat and the concomitant effects on the covered species is based on a comprehensive analysis of the biology and ecology of the taxa, amount and location of habitat types, and mitigation measures that are necessary to mitigate the adverse effects. The implementation of large scale projects that are not consistent with the strategy, specifically the type, amount, location and in-perpetuity management of appropriate habitat, likely will compromise the ability of the strategy to meet the conservation requirements of the species.

Vernal Pool Fairy Shrimp/ Vernal Pool Tadpole Shrimp

According to Caltrans, construction of the proposed project will result in the loss of 1.45 acres - acre of seasonal wetland habitat suitable for vernal pool fairy shrimp and vernal pool tadpole shrimp (Caltrans 2010). All vernal pool crustaceans occupying the 1.45 acres will be killed due to earth-moving activities and permanent filling of seasonal wetland habitat.

Indirect effects to 0.26 acre of vernal pool crustacean habitat will likely result from changes in hydrology or degradation of water quality resulting from upstream construction activities. The biota of vernal pools and swales can change when the hydrologic regime is altered and small changes can have deleterious effects on entire populations of vernal pool crustaceans (Bauder 1986, 1987). Survival of aquatic organisms like vernal pool fairy shrimp and vernal pool tadpole shrimp is directly linked to the water regime of their habitat (Zedler 1987). Although vernal pool hydrology is driven by the input of precipitation, water input to vernal pool basins also occurs from surface and subsurface flow from the swale and upland portions of the complex (Zedler 1987, Hanes *et al.* 1990, Hanes and Stromberg 1998). Surface flow through the swale portion of the complex allows vernal pool species to move directly from one vernal pool to another. Upland areas are a critical component of vernal pool hydrology because they directly influence the rate of vernal pool filling, the length of the inundation period, and the rate of vernal pool drying (Zedler 1987; Hanes and Stromberg 1998).

The timing, frequency, and duration of inundation are critical to the survival of vernal pool species. Alterations of the hydrology can be particularly harmful to vernal pool crustaceans due to premature pool dry-down before the life cycles of the species are completed, preventing reproduction and disrupting gene flow. Also longer periods of inundation and/or changes in water depth could effectively change seasonal wetland functions (*e.g.*, change from vernal pool to perennial/permanent wetlands). Therefore, construction activities within vernal pool areas will result in the decline of vernal pool crustaceans, including these two listed species.

Caltrans proposes to install and properly maintain erosion control (including dust control) and water quality protection measures that will minimize downstream effects on seasonal wetlands and listed branchiopods that occupy them.

The proposed landscape and habitat restoration is important in minimizing the indirect effects to seasonal wetland habitat and the surrounding uplands. However, restoration of hydrological conditions linked to vernal pools may be difficult if not impossible to achieve in areas such as the proposed Business Center Drive Extension where a dramatic cut will be made through the rolling topography in order to achieve an acceptable road grade. Removal of topographical features will also remove watershed and other functions that influence the inundation and character of the seasonal wetlands within at least 250 feet of the construction footprint.

Caltrans proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation of 1 71 acres and restoration of 1.45 acres of vernal pool fairy shrimp and vernal pool tadpole shrimp habitat in Solano County will likely offset the adverse effects of the project and provide a benefit for the species.

Conservation measures proposed along SR 12E, including the work window, retaining wall, erosion control and stormwater protection, off-limits fencing, and biological monitoring are likely to be effective in minimizing adverse effects to listed branchiopod habitat in the Gentry Suisun wetlands.

Callippe Silverspot Butterfly

The proposed project will result in the permanent loss of 38.82 acres of callippe silverspot butterfly habitat due to construction of the Business Center Drive Extension from approximately 500 feet west of the existing western terminus of Business Center Drive to the existing Red Top Road/1-80 Intersection as callippe silverspot habitat. Establishment of this new road will require extensive grading and recontouring of rolling grasslands that provide topographical features important for callippe silverspot butterfly hill-topping breeding behavior, foraging, and possible larval development. Construction of the road will result in replacement of butterfly habitat with hardscape and maintained ROW that will likely be inhospitable for the listed butterfly. In addition to the harm and harassment associated with the destruction of callippe silverspot butterfly habitat, the project is also likely to result in effects associated with habitat fragmentation.

Construction of the Business Center Drive Extension will also result in the temporary loss of 19.32 acres of callippe silverspot butterfly habitat. This habitat will be temporarily lost due to construction access, staging, and recontouring for borrow material. Successful restoration of temporarily disturbed areas with a grassland seed mix that includes callippe silverspot butterfly nectar plants is likely to limit the habitat loss to less than one year following the initial ground disturbance.

The construction of Business Center Drive Extension will result in the loss of hilltops and ridgelines likely utilized by the callippe silverspot butterfly for reproduction. The adults of this animal frequently engage in hilltopping (Murphy and Weiss undated; Shields 1967; Thomas Reid Associates 1982), which is the behavior where adults congregate on hilltops for the purpose of locating mates. Males are more likely than females to spend time on hilltops. In a study at San Bruno Mountain in San Mateo County, 62 percent of male callippe silverspot butterflies were caught on hilltops, while only 48 percent of females were caught on hilltops (Thomas Reid

Associates 1982). After mating, females spend less time hilltopping, and more time searching for oviposition sites and nectar sources. Males tended to utilize hilltops throughout their lifespans (Thomas Reid Associates 1982). Males actively patrol hilltops and ridgelines searching for females. Females are mated almost immediately upon emergence from pupae, because males emerge first and doggedly pursue females (Mattoon et al. 1971).

Hilltops and ridgelines play an important role in callippe silverspot butterfly breeding behavior. The importance of hilltops may vary with population density; at high population levels, males may patrol below hilltops, and congregate on them during periods of low population levels (Shields 1967; Baughman et al. 1988). Hilltops and ridge lines should be considered integral components of callippe silverspot butterfly habitat. Losing hilltops from habitat areas likely decreases mate location and genetic mixing over the long-term.

The callippe silverspot butterfly conservation strategy in the draft Solano HCP did not consider the adverse impacts associated with activities such as the proposed 1.3-mile Business Center Drive Extension from the western terminus of Business Center Drive to I-80. Construction of this road extension will involve the removal of topographical features with slopes greater than 20 or 30 percent. These slopes were identified in the draft Solano HCP as important butterfly hilltop habitat that would be conserved for the species. Based on topographical maps it appears that the majority of the 58.14 acres of callippe silverspot habitat that will be directly affected by the project is characterized by slopes that could be used by the callippe silverspot butterfly for breeding purposes.

Clearing and grading may result in temporary adverse effects to some or all the life history stages through crushing or burial during larval diapauses as this process often occurs in leaf litter at the base of the plant. The caterpillars are small and difficult to find. This inability to detect caterpillars prevents any form of site survey or capture and hold of caterpillars during construction.

Use of heavy earthmoving equipment and other ground-disturbing activity resulting in habitat destruction, dust, and prolonged disturbance will likely cause adult butterflies both in and near the construction footprint to flee the area, especially during the approximate mid-May to mid-July flight season for adult butterflies. These disturbances could disrupt essential behaviors such as reproduction and foraging which could lead to adverse effects such as decreased reproductive success due to moving to less suitable areas or increased difficulty in locating a mate.

Adult callippe silverspot butterflies are strong fliers. After road construction is complete, butterflies would likely avoid collision with vehicles by flying over road cuts for the Business Center Drive Extension. However, they would be susceptible to harm and mortality when crossing in areas where habitat on either side of the new road is at or near grade with the road. Road mortality can result in significant reliable loss of adult butterflies over time.

Construction and grading activities may produce dust which can interfere with the respiration and foraging of active adults. Insects breathe via spiracles and inhalation of small particles, such as dust, could prevent their respiration and result in their asphyxiation. Ehrlich (1984) speculated that the decline of the common alpine butterfly in the upper East River drainage of

Gunnison County. Colorado, was the result of an increase in dust from increased vehicular traffic.
Viola populations have been recorded adjacent to the construction footprint but the extent of the populations is not well known. There have been no additional larval host plant surveys since the reconnaissance-level surveys conducted in 2003 and 2004. The food plants of the callippe silverspot butterfly adult nectar plants could be eliminated by construction. Destruction of larval host and larval and adult nectar plants would result in a decrease in the amount of habitat available for reproduction and development of immature butterflies.

Successful propagation and establishment of *Viola* has not been successful to date. Therefore loss of larval host plants cannot be minimized through restoration alone. Successful establishment of adult food plants is feasible and will be an integral part of Caltrans' restoration plan.

Another potential effect of the proposed project on the listed butterfly is the elimination of their habitat due to non-native vegetation invading areas where restoration has not been implemented or is inadequate. Soil disturbance, such as that associated with project associated activities, facilitates the invasion of areas by non-native species. Increased human activity introduces new non-native species. These plants could eventually displace or otherwise out-compete the plants which are depended upon by the callippe silverspot butterfly.

The Business Center Drive Extension construction footprint is immediately adjacent to two previously identified *Viola* populations. The proximity of construction activities may deter livestock grazing in these locations and temporary and permanent road ROW fencing will exclude livestock from accessing these areas. The removal of livestock grazing pressure from patches of vegetation supporting *Viola* could result in a reduction in the abundance and distribution of this plant. This in turn could result in a reduction in available habitat for the early stages of callippe silverspot butterfly.

Caltrans' proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation or restoration of 126.12 estimated acres of callippe silverspot butterfly habitat in Solano County. This will likely offset the adverse effects of the project and provide a benefit for the species. This habitat will be permanently protected and a management plan will be implemented which will aid the species.

Valley Elderberry Longhorn Beetle

The proposed project will directly affect ten elderberry shrubs that are suitable habitat for the valley elderberry longhorn beetle within the proposed project area. Transplantation of the elderberry shrubs may cause them to die, experience stress, or become unhealthy due to changes in soil, hydrology, microclimate, or associated vegetation. This may reduce their quality as habitat for the valley elderberry longhorn beetle, or impair their production of habitat-quality stems in the future. Branches containing larvae may be cut, broken, or crushed as a result of the transplantation process. The actions described in the *Conservation Measure 23* will reduce, but not eliminate, the potential for these effects. Additionally, the proposed project will ultimately increase the value of the valley elderberry longhorn beetle habitat in the area chosen for

transplantation.
California Red-Legged Frog

The proposed project will likely adversely affect the threatened California red-legged frog during the construction and operational phases of the project. According to Caltrans, the proposed project will result in the permanent loss of 78.48 acres and the temporary loss of 19.32 acres of California red-legged frog habitat that is used by all life stages for breeding, feeding, sheltering, and dispersal. In addition to the harm and harassment associated with the destruction of California red-legged habitat (described further below), the project is also likely to result in effects associated with habitat fragmentation.

Caltrans proposes to minimize construction related effects by implementing the *Conservation Measures* and design features (undercrossings and directional fencing along the proposed Business Center Drive Extension) included in the project description section of this biological opinion. However, in spite of these measures the project has the potential to result in a variety of adverse effects that would result in take of the California red-legged frog.

Construction could result in the killing, harming and/or harassment of juveniles and adults inhabiting areas of suitable aquatic and upland habitat. The project as proposed by Caltrans in the project description of this biological opinion would result in the loss of approximately 97.8 acres of California red-legged frog habitat. The Service has determined that the permanent and temporary loss and/or degradation of California red-legged frog habitat will result in the take of all frogs within these areas as a direct result of habitat loss.

During the construction phase, permanent and temporal loss of aquatic and upland habitat will result from the removal and/or disturbance of soil and vegetation. Construction noise, vibration, lighting used for possible night work, and increased human activity during construction may interfere with normal behaviors such as feeding, sheltering, movement between refugia and foraging grounds, and other frog essential behaviors. This can result in avoidance of areas that have suitable habitat but intolerable levels of disturbance.

Unless identified by the biological monitor or site personnel, and rescued by the biological monitor, individual California red-legged frogs exposed during excavations likely will be crushed and killed or injured by construction-related activities. Even with biological monitoring, overall awareness, and proper escape ramps, California red-legged frogs could fall into the trenches, pits, or other excavations, and then risk being directly killed or be unable to escape and be killed due to desiccation, entombment, or starvation.

Red-legged frogs can be expected to fall or willingly enter into excavations created as a result of the project. Juvenile and adult frogs may have difficulty escaping pits. Entrapment may cause frogs to be more susceptible to predation and desiccation due to exposure. Frogs may take refuge in excavations, increasing their likelihood of being crushed, entombed, or otherwise injured. Such excavations are not part of the baseline environmental conditions and therefore Caltrans would have created a feature that could lead to harm and possible frog mortality.

Proper trash disposal is often difficult to enforce on a large construction site and is a common

non-compliance issue. Improperly disposed edible trash could attract predators, such as raccoons, crows, and ravens, to the sites, which could subsequently prey on the listed amphibian. Caltrans commitment to not use erosion control devices with mono-filament should be effective in avoiding the associated risk of entanglement that can result in death by predation, starvation, or desiccation (Stuart *et al.* 2001).

Caltrans proposes to limit initial ground-disturbing activities in California red-legged frog habitat (Caltrans 2011) between April 1 and November 1, when feasible. This measure would primarily avoid the wettest time of year and the onset of the breeding season when frogs are more likely to be involved in upland dispersal. When the work window is not feasible, biological monitoring will be performed when activities occur between November 1 and March 31 Frogs are more likely to move at night and more likely to be taking cover during the day. California red-legged frogs are cryptic and can be difficult for even experienced biological monitors to find. Monitoring will be occurring during the day when most frogs will be taking cover, making them even more difficult to find. Frogs that have moved into work areas at night and taken cover are unlikely to be found by biological monitors and will most likely be killed or harmed by activities. Frogs that are found, captured, and moved will be subjected to displacement and harassment that may lead to death or injury. Therefore allowing ground-disturbing activities with the implementation of biological monitoring during the wet and cool season (November 1 to March 31) likely will result in increased take relative to limiting ground-disturbing activities to the dry season.

Caltrans states they will attempt to minimize adverse effects by locating construction staging, storage and parking areas outside of California red-legged frog habitat; clearly marking construction work boundaries with high-visibility fencing, conducting preconstruction surveys and biological monitoring, and revegetating temporarily disturbed areas. The effects of construction activities and the removal of habitat will be partially minimized by installing wildlife exclusion fencing to deter frogs from wandering onto construction sites; educating workers; and requiring a Service-approved biologist to be present to monitor construction activities.

If unrestricted, the proposed construction activities could result in the introduction of chemical contaminants to frog habitat. Exposure pathways could include inhalation, dermal contact, direct ingestion, or secondary ingestion of contaminated soil, plants or prey species. Exposure to contaminants could cause short- or long-term morbidity, possibly resulting in reduced productivity or mortality. However, Caltrans proposes to minimize these risks by implementing erosion control, stormwater control, and spill prevention plans to minimize the potential degradation of aquatic and upland habitat that could lead to mortality and harm of California red-legged frogs. If unrestricted, biologists and construction workers traveling to the action area from other project sites may transmit diseases by introducing contaminated equipment. The chance of a disease being introduced into a new area is greater today than in the past due to the increasing occurrences of disease throughout amphibian populations in California and the United States. It is possible that chytridiomycosis, caused by chytrid fungus, may exacerbate the effects of other diseases on amphibians or increase the sensitivity of the amphibian to environmental changes (e.g., water pH) that reduce normal immune response capabilities (Bosch *et al.* 2001, Weldon *et al.* 2004).

Preconstruction surveys and the relocation of individual California red-legged frogs may avoid injury or mortality; however, capturing and handling frogs may result in stress and/or inadvertent injury during handling, containment, and transport. Caltrans proposes to minimize these effects by using Service-approved biologists and relocating amphibians to suitable nearby habitat.

The Business Center Drive Extension will likely result in significant fragmentation of the landscape and ecosystem functions. Bridge work within the aquatic and riparian California red-legged frog habitat associated with Jameson Canyon Creek, Ledgewood Creek, and Green Valley Creek will include earth-moving, vegetation clearing, habitat loss, general disturbance, and temporary creek diversions. These activities have the potential to harm and harass frogs that use these areas for year-round refuge, dispersal, and foraging.

The majority of the approximately 1.3-mile road segment from Business Center Drive to SR 12W and then south to I-80 will be bordered by road cuts which limit the potential for wildlife movement or incorporating safe wildlife passage across the road. In conjunction with directional fencing, the three undercrossing will likely provide safe crossing for most wildlife, including the California red-legged frog; however, connectivity will be greatly reduced compared to existing conditions and we anticipate that fewer frogs will successfully find and successfully navigate the new undercrossings.

Of primary concern, the Business Center Drive Extension will limit movement to and from the Mangels' pond which is likely the primary population source for the western portion of the SOL-2 critical habitat unit. Isolation of this breeding pond from the remainder of the surrounding habitat will reduce the size and distribution of California red-legged frogs in the SOL-2 unit by severing or limiting connectivity of what is now largely contiguous habitat north and south of the proposed Business Center Drive Extension. With the addition of the three proposed undercrossings and directional fencing, frogs and other wildlife will be limited to 35 feet of crossing opportunities along the 0.79-mile Business Center Drive Extension from the western terminus of the existing Business Center Drive and Jameson Canyon Road (SR 12W). Construction of this barrier will reduce dispersal to 0.8 percent of the original topography that was available for movement. This adverse effect could be partially minimized if one or more breeding ponds would be constructed north of the Business Center Drive Extension.

The Business Center Drive Extension is within the City of Fairfield's urban growth boundary and establishment of the road will enable access for future industrial, residential, and recreational development within California red-legged frog habitat. This development is likely to result in additional habitat fragmentation, degradation, and loss. Caltrans has not proposed any measures to minimize this take from increased development due to this road extension.

The development associated with the proposed Business Center Drive Extension will further reduce available foraging and dispersal habitat for California red-legged frogs that breed in Mangels' pond and disperse widely to the north and west. This development, when combined with reduced connectivity of habitat caused by construction of the road extension itself, is likely to significantly reduce the size and distribution of frogs that occupy the area from Mangels' pond northward into Napa County as animals will become less successful at reaching Mangels' pond

to breed and disperse north as juveniles and lose the ability to live in the area south of the road extension as habitat is lost to development. The keys to minimizing these effects include:

1 Easements south of the proposed Business Center Drive Extension that connect Mangels' pond and the Business Center Drive Extension underpasses, and

2. Easements north of the Business Center Drive Extension.

The proposed project further precludes a key conservation need for the Jameson Canyon Lower Napa River Core Recovery Area, which is to protect the dispersal corridors between Jameson Canyon Creek and surrounding upland and breeding habitat. Planned infrastructure changes to SR 12W are likely to exacerbate the barrier effects as the roadway is widened and median barriers are installed.

Caltrans proposal to compensate for permanent and temporal habitat loss with in-perpetuity preservation of 245.1 acres of California red-legged frog habitat in Solano County will likely offset the adverse effects of the project and provide a benefit for the species. This habitat will be permanently protected and a management plan will be implemented which will aid the species.

Contra Costa Goldfields Critical Habitat

The proposed action is not expected to appreciably diminish the conservation and recovery value of critical habitat for Contra Costa goldfields. The proposed project will result in the loss of 3.83 acres (1.31 permanent + 2.52 temporary) of the 736.72-acre critical habitat unit 5B. The permanent loss is approximately 0.2 percent of the total unit. The effects will be limited to the northern edge of the unit and will occur on the existing raised SR 12E roadbed and parallel to the bottom of the slope. The completed project will not expand southward into Gentry Suisun wetland and has been designed to sustain existing hydrology. The project will avoid adverse effects to topographical features that influence the hydrology (PCE 1) and will not result in the modification of depressional features (PCE 2) within Contra Costa goldfields habitat

California Red-Legged Frog Critical Habitat

The proposed action is expected to diminish the value of the SOL-2 critical habitat in its intended function for the conservation and recovery of the California red-legged frog. The proposed project will result in the direct loss of 12.75 acres (8.30 permanent + 4.45 temporary) of the 3,360-acre unit.

The proposed project will result in the isolation of the only verified California red-legged frog breeding habitat (Mangels' Pond) in the SOL-2 unit. Mangels' Pond is also the largest pond in the unit. The Business Center Drive Extension will include three undercrossings and fencing intended to exclude frogs from the roadway and direct them towards the undercrossings. Movement, including juvenile dispersal from breeding habitat and adult movement to and from breeding habitat will be substantially limited due to a 99.2 percent reduction in the available north-south dispersal corridor.

Establishing the new road is also likely to be growth inducing, allowing access for development that will further constrict, degrade, and eliminate upland habitat adjacent to Mangels' Pond and the road undercrossings. Therefore, the proposed project has the potential to completely isolate what is likely a population source breeding pond from the remainder of SOL-2.

The Business Center Drive Extension along with the road widening and vertical barrier construction on SR 12W will severely limit connectivity that now exists between SOL-2 and SOL-3.
Therefore, the proposed project is likely to negatively modify the function of the SOL-2 unit by limiting or eliminating access to a primary breeding pond (PCE 1) and by severely limiting dispersal within the SOL-2 unit and between SOL-2 and SOL-3 (PCE 4). Caltrans' *Proposed Conservation Measures* are unlikely to sufficiently avoid adverse modification of these PCEs because the project includes limited features and the project creates limited potential for maintaining connectivity.

For purposes of the adverse modification determination, the effects on California red-legged frog critical habitat is evaluated in the context of the range-wide condition of the critical habitat at the provincial and range-wide scales. Although the proposed project is likely to significantly impair the habitat function and recovery value of the SOL-2 and SOL-3 units, it is unlikely to adversely modify the range-wide recovery role and functions of overall California red-legged frog critical habitat designation.

Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Although not a covered activity, the proposed project area is included in the zone of covered activities for the draft Solano HCP. The Fairfield General Plan designates much of this area for planned development. Adverse effects to showy Indian clover, Contra Costa goldfields and its critical habitat, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, Central California Distinct Population Segment of the California tiger salamander, and California red-legged frog and its critical habitat including habitat loss and further fragmentation in this area due to non-Federal actions would result in cumulative effects to listed species and their critical habitat. Realignment of the interchanges, particularly extension of Business Center Drive is likely to enhance urban growth potential.

Conclusion

After reviewing the current status of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog, the environmental baseline for the action area; the effects of the proposed I-80/I-680/SR 12 Interchange Phase 1 Project and the cumulative effects; it is the Service's biological opinion that the project, as proposed, is not likely to jeopardize the continued existence of these listed species.

However, the proposed project likely will result in significant negative effects to critical habitat unit SOL-2 of the California red-legged frog. We based these determinations on the following: (1) pre-construction surveys will be conducted for listed species; (2) a Service-approved biologist will monitor all activities for compliance with this biological opinion; (3) effects to the valley elderberry beetle will be addressed by implementing programmatic conservation measures, including transplantation of elderberry shrubs; (4) directional fencing along and undercrossings across Business Center Drive will avoid complete isolation of a California red-legged frog breeding pond; (5) California red-legged frogs found in the project work area will be relocated to nearby suitable habitat; (6) habitat loss will be compensated with in-perpetuity preservation of vernal pool tadpole shrimp, vernal pool fairy shrimp, and California red-legged frog habitat; (7) callippe silverspot butterfly habitat loss will be compensated with in-perpetuity preservation of callippe silverspot butterfly habitat and/or enhancement of occupied habitat; and (8) other conservation measures, as described in the *Proposed Conservation Measures* of this biological opinion, that will be fully implemented by Caltrans.

The Service has also determined that the proposed action is not likely to result in the destruction or adverse modification of critical habitat for the Contra Costa goldfields due to limiting permanent effects to the existing road embankment.

The proposed action is not likely to result in the destruction or adverse modification of critical habitat for the California red-legged frog because although it will significantly reduce access to the only known breeding pond in this critical habitat unit, the effects likely will diminish the recovery, but not the survival value, of critical habitat units SOL-2 and SOL-3.

INCIDENTAL TAKE STATEMENT

Section 9(a)(1) of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened fish and wildlife species without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, movement, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including movement, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by Caltrans so that they become binding conditions of any grant or permit issued to Caltrans as appropriate, in order for the exemption in section 7(o)(2) to apply. Caltrans has a continuing duty to regulate the activity covered by this Incidental Take Statement. If Caltrans: (1) fails to adhere to the

terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document; and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

Vernal Pool Fairy Shrimp/Vernal Pool Tadpole Shrimp

The Service expects that incidental take of vernal pool fairy shrimp and vernal pool tadpole shrimp may occur during this action. The extent of the take will be difficult to detect or quantify because of the ecology and biology of these species. Additionally, their size and cryptic nature makes the finding of a dead specimen unlikely. Seasonal population fluctuations also may mask the ability to determine the exact extent of take. Due to the difficulty in quantifying the number of vernal pool crustaceans that will be taken as a result of the proposed action, the Service is quantifying take incidental to the proposed project as the number of acres of seasonal wetlands (vernal pool crustacean habitat), that will become unsuitable for vernal pool crustaceans due to direct effects as a result of the action. Therefore, the Service estimates that the proposed action will result in the direct take of all vernal pool crustaceans inhabiting 1.45 acres of vernal pool habitat. Anticipated take is expected to be in the form of harm and mortality from habitat loss and modification, construction related disturbance, and reduced fitness.

Callippe Silverspot Butterfly

The Service anticipates incidental take of callippe silverspot butterfly will be difficult to detect or quantify because it is unlikely an injured or dead specimen will be found due to the elusive and cryptic nature of the early stages of this species (eggs, larvae, pupae), the difficulty of non-specialist to observe and identify the adults, and their small size. However, the level of incidental take of this animal can be anticipated by the effects to cover, foraging, and breeding habitat. Conservation measures in this biological opinion will reduce, but are unlikely to eliminate, the potential for incidental take of this listed species. The Service, therefore, anticipates incidental take of callippe silverspot butterfly will result from the proposed project. Upon implementation of the reasonable and prudent measures, all individuals of callippe silverspot butterfly inhabiting 58.14 acres of identified habitat will be subject to incidental take in the form of harm, harassment, injury, and mortality.

Valley Elderberry Longhorn Beetle

The Service expects that incidental take of the valley elderberry longhorn beetle will be difficult to detect or quantify because the life cycle of the beetle and its small body size make discovery of a dead specimen unlikely, losses may be masked by seasonal fluctuations in numbers or other causes, and the species occurs in habitat that makes them difficult to detect. It is not possible to make an accurate estimate of the number of valley elderberry longhorn beetles that will be harassed, harmed, injured, or killed as a result of construction activities. In instances when take is difficult to detect, the Service often estimates take relative to the number of elderberry stems, 1 inch or greater in diameter, that are lost or degraded as a result of the action. Therefore, the Service estimates that all valley elderberry longhorn beetles inhabiting the 62 stems of 1 inch or

greater in the ten identified elderberry shrubs in the action area may be harassed, harmed, injured, or killed, as a result of the proposed action.

California Red-Legged Frog

The Service anticipates that incidental take of the California red-legged frog will be difficult to detect due to their small size, wariness, and cryptic nature. Finding an injured or dead California red-legged frog is unlikely due to their relatively small body size, rapid carcass deterioration, and likelihood that the remains will be removed by a scavenger. Losses of this species may also be difficult to quantify due to a lack of baseline survey data and seasonal/annual fluctuations in their numbers due to environmental or human-caused disturbances. There is a risk of harm, harassment, injury and mortality as a result of the proposed construction activities, the permanent and temporary loss/degradation of suitable habitat, and capture and relocation efforts; therefore, the Service is authorizing take incidental to the proposed action as: (1) the injury and mortality of two adult or juvenile California red-legged frogs; and (2) the capture, harm and harassment of all California red-legged frogs within the construction footprint.

Upon implementation of the following *Reasonable and Prudent Measures*, vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterflies, valley elderberry longhorn beetles, and California red-legged frogs within the action area in proportion to the amount and type of take outlined above will become exempt from the prohibitions described under section 9 of the Act. No other forms of take are exempted under this opinion.

This biological opinion does not authorize take for Federal and non-Federal actions associated with the maintenance of roadways included in this action, and the associated Caltrans and STA ROWs. Routine Caltrans and STA maintenance activities such as the removal/displacement of sand, silt, sediment, debris, rubbish, vegetation, and other obstruction flow, the control of weeds, grasses and emergent vegetation, minor repair of existing facilities, rip-rap replacement, and culvert replacement may affect listed species. Such maintenance activities and their potential effects to listed species are not evaluated in this biological opinion.

Effect of the Take

The Service has determined that the level of anticipated take for the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog is not likely to jeopardize the continued existence of this species.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the effect of the proposed action on the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog. Caltrans will be responsible for implementation of and compliance with these measures:

1 Caltrans will minimize the effect of take to the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog.

Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the Act, Caltrans shall ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following *Terms and Conditions* implement *Reasonable and Prudent Measure* one (1):
   a. Caltrans shall minimize the potential for harm, harassment, or killing of vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog resulting from project related activities by implementing the conservation measures as described in the *Description of the Proposed Action* of this Biological Opinion.

   b. Caltrans shall require all contractors to comply with the Act in the performance of the action and shall perform the action as outlined in the *Description of the Proposed Action* of this Biological Opinion and all other supporting documentation submitted to the Service.

   c. Caltrans shall include language in their contracts that expressly requires contractors and subcontractors to work within the boundaries of the project footprints identified in this biological opinion, including vehicle parking, staging, laydown areas, and access roads.

   d. The Service, and/or their designated agents shall have direct access at any time or immediately upon verbal request to the action area and all Service-approved biologists to ensure compliance with this Biological Opinion. Access to areas outside of the Caltrans ROW or easements shall be coordinated by Caltrans with the respective property owners.

   e. Qualifications of proposed biological monitor(s) shall be submitted to the Service for approval at least 30 calendar days prior to initiating construction activities for the proposed project.

   f. Prior to approval, the biologist(s) shall submit a letter to the Service verifying that they possess a copy of this biological opinion and understand its Terms and Conditions. The biologist(s) shall keep a copy of this Biological Opinion in their possession when on-site.

   g. The Resident Engineer or their designee shall be responsible for implementing the conservation measures and Terms and Conditions of this Biological Opinion and shall be the point of contact for the project. The Resident Engineer or their designee shall maintain a copy of this Biological Opinion onsite whenever construction is taking place. Their name and telephone number shall be provided to the Service at least thirty (30) calendar days prior to groundbreaking for each of the construction packages. Prior to ground breaking, the Resident Engineer must submit a letter to the Service verifying that they possess a copy of this Biological Opinion and have read the Terms and Conditions.

   h. An outline of the Worker Environmental Awareness Training Program shall be submitted to the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife

Office within 30 days prior to the initial onset of construction activities. As needed, training will be conducted in Spanish for Spanish language speakers.

i. A Service-approved biologist(s) shall be onsite during all activities that may result in take of vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog as determined by the Service. A minimum of one Service-approved biologist shall be onsite throughout the project duration. The Service will consider the implementation of specific project activities without the oversight of a Service-approved biologist on a case-by-case basis.

j. During construction activities outside the existing hardscape, the Service-approved biologist shall conduct clearance surveys at the beginning of each day within or adjacent to suitable listed species habitat and regularly throughout the workday when construction is occurring within or adjacent to suitable habitat.

k. Vegetation clearing and construction operations shall be limited to the minimum necessary in areas of temporary access, work areas, and staging. Trees, snags, shrubs, other vegetation, woody debris, and uncompacted forest litter will be protected to the maximum extent practicable. Tree and shrub trimming shall be minimized to the extent possible. Trees shall be pruned, or shrubs that interfere with construction or project operation shall be pruned or topped. Shrubs shall be trimmed above ground and roots will be left intact. All vegetation trimmings shall either be hauled off-site and disposed of properly, or chipped and left on-site as determined by the Caltrans Resident Engineer. When possible, stockpiles of trimmed vegetation shall be kept at least 50 feet from the bed and bank.

l. In areas where valley elderberry longhorn beetle will affected, within sixty (60) calendar days prior to the initiation of ground disturbance, Caltrans shall provide a written description of how the valley elderberry longhorn beetle buffer areas will be restored, protected, and maintained after construction is completed.

m. The following measures are intended to minimize the effect of take in the form of harassment on the California red-legged frog.

i. Each California red-legged frog encounter shall be treated on a case-by-case basis in coordination with the Service but general guidance is as follows: (1) leave the non-injured frog if it is not in danger; or (2) move the frog to a nearby location if it is in danger.

These two options are further described below.

a) When a California red-legged frog is encountered in the action area the first priority is to stop all activities in the surrounding area that have the potential to result in the harm, harassment, injury, or death of the individual. Then the monitor needs to assess the situation in order to select a course of action that will minimize adverse effects to the individual. Contact the Service once the site is

secure. The contacts for this situation are Ryan Olah (ryan_olah@fws.gov) or John Cleckler (john_cleckler@fws.gov). They can be reached at (916) 414-6600. If you get voicemail message for these contacts then contact John Cleckler on his cell phone at (916) 712-6784. The issue of contacting people on the weekend or after office hours is addressed later.

The first priority is to avoid contact with the frog and allow it to move out of the action area and hazardous situation on its own to a safe location. The animal should not be picked up and moved based on it not moving fast enough or an inconvenience for construction activities. This guidance only applies to situations where a California red-legged frog is encountered on the move during conditions that make their upland travel feasible. This does not apply to California red-legged frogs that are uncovered or otherwise exposed or in areas where there is not sufficient adjacent habitat to support the life history of the California red-legged frog should the frogs move outside the immediate area.

Avoidance is the preferred option if a California red-legged frog is not moving and is using aquatic habitat or is within some sort of burrow or other refugia. The area should be well marked for avoidance by construction and a Service-approved biological monitor should be assigned to the area when work is taking place nearby.

b) The animal should be captured and moved when it is the only option to prevent harm.

If appropriate habitat is located immediately adjacent to the capture location then the preferred option is short-distance relocation to that habitat. This must be coordinated with the Service but the general guidance is the frog should not be moved outside of the radius it would have traveled on its own. Under no circumstances should a frog be relocated to another property without the owner's written permission. It is Caltrans' responsibility to arrange for that permission.

The release must be coordinated with the Service and will depend on where the individual was found and the opportunities for nearby release. In most situations the release location is likely to be into the mouth of a small burrow or other suitable refugia and in certain circumstances pools without non-native predators may be suitable.

Only Service-approved biologists for the project can capture California red-legged frogs. Nets or bare hands may be used to capture California red-legged frogs. Soaps, oils, creams, lotions, repellents, or solvents of any sort cannot be used on hands within two hours before and during periods when they are capturing and relocating California red-legged frogs. To avoid transferring disease or pathogens between sites during the course of surveys or handling of the frogs, Service-approved biologists must use the following guidance for disinfecting equipment and clothing. These recommendations are adapted from

the *Declining Amphibian Population Task Force's Code* which can be found in their entirety at: http://www.open.ac.uk/daptf/

1) All dirt and debris, including mud, snails, plant material (including fruits and seeds), and algae, must be removed from nets, traps, boots, vehicle tires and all other surfaces that have come into contact with water and/or an amphibian. Cleaned items should be rinsed with clean water before leaving each site.

2) Boots, nets, traps, etc., must then be scrubbed with either a 70 percent ethanol solution, a bleach solution (0.5 to 1.0 cup of bleach to 1.0 gallon of water), QUAT 128 (quaternary ammonium, use 1:60 dilution), or a six percent sodium hypochlorite 3 solution and rinsed clean with water between sites. Avoid cleaning equipment in the immediate vicinity of a pond or wetland. All traces of the disinfectant must be removed before entering the next aquatic habitat.

3) Used cleaning materials (liquids, etc.) must be disposed of safely, and if necessary, taken back to the lab for proper disposal.

4) Service-approved biologists must limit the duration of handling and captivity. While in captivity, individual California red-legged frogs shall be kept in a cool, dark, moist, aerated environment, such as a clean and disinfected bucket or plastic container with a damp sponge. Containers used for holding or transporting should not contain any standing water.

ii. The Service-approved biologist(s) shall perform a California red-legged frog clearance survey immediately prior to the initial ground disturbance. Safety permitting, the Service-approved biologist(s) will investigate areas of disturbed soil for signs of the listed species within 30 minutes following the initial disturbance of that given area.

iii. Construction crews shall review the dewatering plan prior to any in-stream work within the bed and banks that requires the construction of coffer dams and/or dewatering.

iv. Removal of vegetation shall be accomplished by a progressive cutting of vegetation from the overstory level to the ground level to allow California red-legged frogs more opportunity move out of the work area under their own volition. Vegetation shall be cleared only where necessary and will be cut approximately 4 inches above soil level except in areas that will be excavated for roadway construction. This is intended to encourage plants that reproduce vegetatively to resprout after construction. All clearing and grubbing of woody vegetation shall be done using hand tools, small mechanical tools, or backhoes and excavators. All cleared vegetation shall be removed from the project footprint to prevent attracting animals to the project site.

v. If pumping is used for dewatering, intakes shall be completely screened with wire mesh no larger than 0.2 inch to prevent frogs from entering the pump.

vi. The Service-approved biologist(s) shall permanently remove, from the project site, any aquatic exotic wildlife species, such as bullfrogs and crayfish, to the extent possible.

n. Erosion control materials other than seeding only shall consist of hydraulically applied erosion control products, organic mulches free of non-native seeds, organic mulch control nettings with loose weave construction (the strands slide along cross strands) and openings over 4 centimeters, staked in straw bales or temporary erosion control fencing. Materials utilizing fixed weaves (strands cannot move), polypropylene, polymer or other synthetic materials shall not be used.

o. Through the Resident Engineer or their designee, the Service-approved biological monitor(s) will be given the authority to communicate either verbally, by telephone, e-mail message, or hardcopy with Caltrans personnel, construction personnel or any other person(s) at the project site or otherwise associated with the project to ensure that the terms and conditions of this biological opinion are being met. If situations arise where the terms and conditions may not be met or are not being met, the biological monitor will inform the Resident Engineer, who has the authority to stop work. If the Resident Engineer exercises this authority, the Service will be notified by telephone and e-mail message within one working day. The Service contact is the Coast-Bay/Forest Foothill Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600. Discussions with the Resident Engineer, biological monitor, Caltrans staff and Service staff, will take place to identify and inform actions to resolve the issue and to document decisions.

Reporting Requirements

Caltrans shall report to the Service any information about take or suspected take of listed wildlife species. Caltrans must notify the Service via an e-mail or telephone message within 24 hours of receiving such information. Notification must include the date, time, location of the incident or of the finding of a dead or injured animal, and photographs of the specific animal. The individual animal shall be preserved, as appropriate, and held in a secure location until instructions are received from the Service regarding the disposition of the specimen or the Service takes custody of the specimen. The Service contacts are the Coast-Bay/Forest Foothills Division Chief in the Sacramento Fish and Wildlife Office at (916) 414-6600, and the Resident Agent-in-Charge of the Service's Law Enforcement Division at (916) 414-6660.

Caltrans shall submit a post-construction compliance report prepared by the on-site biologist to the Sacramento Fish and Wildlife Office within sixty (60) calendar days of the date of the completion of each Construction Package. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on the vernal pool tadpole shrimp, vernal pool fairy

shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog, if any; (v) occurrences of incidental take to any listed species, if any; and (vii) other pertinent information. The final construction acreage of permanent and temporary habitat loss will be tabulated separately and provided to the Service. The extent of permanent and temporary habitat loss will be delineated with a handheld GPS device and a trackfile of each will be provided to the Service.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases. The Service requests notification of the implementation of any conservation recommendations in order to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats. We propose the following conservation recommendations:

1. Enhancing habitat connectivity and wildlife passage across roads as well as reducing road effects should be included in the *Purpose and Need* section of environmental documents. FHWA agreed to coordinate with the Service on wildlife movement issues in a June 2, 2010, letter addressed to Mr. Greg Costello of the Western Environmental Law Center. As their NEPA delegate, Caltrans District 4 is expected to adopt the commitments made by FHWA to consider wildlife movement in transportation planning and project development.

2. Caltrans District 4 should include a wildlife passage section in their BAs that includes an analysis of the existing passage and how the project will affect passage. The analysis should include identification of the species' resources on both sides of the project boundaries, an appropriately timed road mortality survey to identify "hot spots," and strategic locations where the species could benefit from the enhancement of an existing crossing or the installation of a new crossing. Caltrans District 4 should coordinate with their headquarters office and the University of California at Davis Road Ecology Center to develop a passage and road effects approach. Further guidance is provided by FHWA's *Wildlife Vehicle Collision Reduction Study* (available at: http://www.fhwa.dot.gov/environment/hconnect/wvc/index.htm) and Caltrans' *Wildlife Crossings Guidance Manual* (http://www.dot.ca.gov/hq/env/bio/wildlife_crossings/).

3. Efforts should be made to establish upland culverts designed specifically for wildlife movement as well as making accommodations for terrestrial wildlife movement through culverts that convey hydrology. Transportation agencies should also acknowledge the value of enhancing human safety by providing safe passage for wildlife in their early project design.

4. Caltrans should reference their internal system they have developed to keep track of road mortality records and the University of California at Davis, Road Ecology Center's

California Roadkill Observation System (http://www.wildlifecrossing.net/california/). Information from these databases should be referenced in road project assessments.

5. Caltrans should consider establishing functioning preservation and creation conservation banking systems to further the conservation of the vernal pool tadpole shrimp, vernal pool fairy shrimp, callippe silverspot butterfly, valley elderberry longhorn beetle, and California red-legged frog and other listed species. Such banking systems also may be utilized for other required mitigation (i.e., seasonal wetlands, riparian habitats, etc.) where appropriate. Efforts should be made to preserve habitat along roadways in association with established or planned wildlife crossings.

6. Caltrans should continue to develop and implement their *Early Statewide Biological Mitigation Planning Project* that has been developed by the University of California at Davis, Road Ecology Center to offset the effects of Caltrans' projects on listed species.

REINITIATION--CLOSING STATEMENT

This concludes formal consultation on the I-80/I-680/SR 12 Interchange Phase 1 Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, including work outside of the project footprint analyzed in this opinion and including vehicle parking, staging, lay down areas, and access roads; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion including use of rodenticides or herbicides; relocation of utilities; and use of vehicle parking, staging, lay down areas, and access roads; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

If you have any questions regarding this biological opinion for the I-80/I-680/SR 12 Interchange Phase 1 Project, please contact John Cleckler or Ryan Olah at the letterhead address or at (916) 414-6600.

Sincerely,

Susan K. Moore

Susan K. Moore
Field Supervisor

cc:
Scott Wilson and Brenda Blinn, California Department of Fish and Game, Yountville, California
Janet Adams, Solano Transportation Authority, Suisun City, California
Brendan Thompson, San Francisco Bay Regional Water Quality Control Board, Oakland, California
Carolyn Mulvihill, U.S. Environmental Protection Agency, San Francisco, California
Paula Gill, U.S. Army Corps of Engineers, San Francisco, California
Joe Heublein, National Marine Fisheries Service, Santa Rosa, California
Christopher States, Jeffrey Jenson, Frances Malamud-Roam, and Howell Chan, California Department of Transportation, Oakland, California
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

January 14, 2011

In response, refer to:
2010/06180

James Richards, Deputy District Director
Department of Transportation
Caltrans District 4
Office of Environmental Analysis
111 Grand Avenue
Oakland, California 94610

Dear Mr. Richards:

Thank you for your letter of December 8, 2010, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Effective July 1, 2007, the Federal Highway Administration assigned, and the California Department of Transportation (Caltrans) has assumed all responsibilities for consultation and approval on most highway projects in California. Therefore, Caltrans is now considered the Federal action agency for ESA consultations with NMFS for Federally funded projects. This letter also serves as consultation under the authority of, and in accordance with, the Essential Fish Habitat (EFH) provisions of the Magnuson Stevens Fishery Conservation and Management Act (MSA), and the provisions of the Fish and Wildlife Coordination Act of 1934 (FWCA), as amended. These consultations pertain to Caltrans' proposed Interstate-80/Interstate-680/State Route 12 Interchange Improvement Project in Solano County, California.

The Interstate-80/Interstate-680/State Route 12 (I-80/I-680/SR 12) Interchange Improvement Project covers several miles of roadway around the City of Fairfield in Solano County, California. The western boundary of the Project is the Red Top Road crossings of I-680, I-80, and SR 12; the eastern boundary of the Project is the Suisun Valley Road crossing on I-80 and the Ledgewood Creek road crossing on SR 12. Surface water in the action area includes Green Valley Creek and Ledgewood Creek. The purpose of the project is to improve the I-80/I-680/SR 12 interchange complex to meet traffic demands and alleviate cut-through traffic on local roads. The project consists of construction or realignment of the following interchanges: 1) I-80/I-680/SR 12 West; 2) I-680 and Red Top Road; 3) I-80 and Green Valley Road; 4) I-80/Red Top Road and Business Center Drive; and 5) and SR 12 West and Red Top Road. Construction will also involve widening of I-80 and a new lane on eastbound SR 12, which will require a new bridge and off-ramp over Green Valley Creek, and widening of the culvert over Ledgewood Creek. All proposed in-stream work will occur during the dry season (June 1 through October 15).

Green Valley Creek originates in Green Valley, northwest of Rockville Hills Regional Park, and flow south to Cordelia Slough which is a tributary of Grizzly Bay. At the existing I-80 and I-680/I-80 West Interchange overcrossing, Green Valley Creek flows in a concrete-lined, trapezoidal channel approximately 670 feet long and 70 feet wide. The proposed action will remove the existing I-80 West bridge and replace it with a single span structure measuring approximately 103 feet long and 133 feet wide. Additionally, a single span structure to carry the Green Valley Road off-ramp over the creek will replace the existing I-680/I-80 West interchange.

In-stream construction at Green Valley Creek is proposed to occur between June 1st and October 15th, over approximately four construction seasons. Construction at Green Valley Creek will occur within a 10-20 year time frame. The first phase will involve construction of the outside (northernmost) westbound lanes on I-80 while maintaining traffic flow on the existing structure. Demolition of the existing I-80 West bridge, and completion of the new I-80 West bridge and the new off-ramp structure will follow.

Piles for the new free-spanning structures will be located at the top of the creek bank and are anticipated to be 12-inch square piles driven to a depth of approximately 70 feet. Approximately 40 piles per abutment will be installed for the westbound I-80 bridge, and approximately 24 piles per abutment will be installed for the new off-ramp structure. Vibratory hammers will be used for pile driving to the maximum practicable extent. Pile driving will only occur during low precipitation periods (June 1 to October 15) and any work occurring before June 1 or after October 15 will be restricted to road or bridge surface only, with water quality control measures in place.

Ledgewood Creek originates in the Vaca Mountains, north of the Solano/Napa County line, and flows south to Paytonia Slough which is a tributary of Grizzly Bay. In the vicinity of the existing SR 12 overcrossing, Ledgewood Creek is confined to a levee-lined trapezoidal channel. Beneath the five-span bridge at SR 12, Ledgewood Creek is conveyed through concrete-lined box culverts. Within the action area, riparian and riverine cover is limited to areas downstream of these culverts. The culverts at SR 12 and Ledgewood Creek is proposed to be extended 15 feet to the south (downstream) to accommodate an additional lane on SR 12; this would permanently impact 15 linear feet of the existing earthen channel. Construction associated with the culvert is expected to last only one season from June 1 to October 15.

Dewatering of both Ledgewood Creek and Green Valley Creek will involve construction of the following in-channel features: 1) temporary cofferdams (made of gravel and fabric) constructed 20-50 feet beyond the limit of bridge/culvert widening; and a pipe diversion to facilitate dewatering of the channel and bypass creek flow; 2) cofferdams constructed utilizing the same methods to facilitate excavation of existing bridge/culvert footings; and 3) falsework placed within the banks and channel to support construction of the cast-in-place concrete box girder structures of the new bridges/culverts. No construction related material (including dewatering and bypass structures) will remain in the channel between October 15 and June 1. When construction is completed, falsework will be removed and any disturbed portions of the creek bed and bank temporarily affected during construction will be restored to pre-project conditions. Additionally, the channel under the new bridges at Green Valley Creek will be restored to an

earthen channel; and a concrete fish passage structure involving a low flow channel and possibly baffles will be constructed in the culvert at SR 12 and Ledgewood Creek.

Standard best management practices (BMPs) for construction site and sediment and stormwater runoff control will be utilized on this project. Biofiltration swales and biostrips will be used when possible to control runoff. Vegetation will be trimmed rather than removed when possible. Temporarily disturbed riparian areas will be replanted with the native species prior to October 15 to minimize erosion and creek sedimentation, and revegetation will be monitored annually for 3 years.

Endangered Species Act

In its December 8, 2010, letter Caltrans asked for concurrence with a finding that the project is not likely to adversely affect Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*). Reaches of Green Valley Creek and Ledgewood Creek within the project area are not designated critical habitat for CCC steelhead. Available information indicates the following DPS may occur in the project area:

> **Central California Coast steelhead Distinct Population Segment** (*O. mykiss*) **DPS**
> Threatened (January 5, 2006; 71 FR 834).

The life history of steelhead is summarized in Busby *et al.* (1996). Steelhead typically immigrate to tributaries of San Francisco Bay between November and April, peaking in January and February (Fukushima and Lesh 1998). Adult CCC steelhead are generally not present in streams between May and October; warm summer water temperature and poor habitat quality within the project area further reduce the likelihood of adult steelhead presence during summer months. Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows. Emigrating CCC steelhead use Green Valley Creek and portions of the San Francisco Bay for rearing and as a migration corridor to the ocean. In summmer months, reaches of Green Valley Creek and Ledgewood Creek within the action area are unsuitable for salmonid rearing due to poor water and habitat quality. Although data regarding the emigration timing of steelhead smolts from Green Valley Creek and Ledgewood Creek is lacking, steelhead from other streams draining to San Francisco Bay typically emigrate from March through June (Fukushima and Lesh 1998). NMFS assumes that steelhead from Green Valley Creek and Ledgewood Creek emigrate at the same time and smolting steelhead should be absent during the in-channel construction window of June 1 through October 15.

O. mykiss have been collected in Green Valley Creek from the 1950s to the present, and unpublished data indicates *O. mykiss* were collected 1 mile upstream of I-80 in January 1997 (Leidy *et al.* 2005). Therefore, it is likely that steelhead spawning and rearing occur above the I-80 crossing of Green Valley Creek. Beneath I-80 and the I-680/I-80 West interchange Green Valley Creek passes through a 670 foot long, concrete-lined trapezoidal channel and primarily provides a migration corridor for salmonids at this location. This crossing contains an engineered low-flow channel and concrete weirs to enhance fish passage, but lacks significant riparian canopy and natural instream cover due to the concrete channel invert.

Caltrans proposes to restore approximately 300 feet of Green Valley Creek to natural earthen channel and in the process enhance habitat at the site. Proposed actions will not inhibit fish passage at the site, and could provide additional rearing habitat for juvenile salmonids. Salmonids are not likely to be present during summer in-channel construction and pile driving work windows. Construction activities that are proposed to occur when migratory steelhead are likely to be present will be restricted to road or bridge surfaces only, with water quality control measures in place. Therefore, CCC steelhead are not likely to be adversely affected by the proposed actions at Green Valley Creek.

In the vicinity of the SR 12 crossing, levees line both banks of Ledgewood Creek and the channel has a trapezoidal cross section. SR 12 crosses Ledgewood Creek over a five-span bridge. At low flows Ledgewood Creek passes through the second culvert from the east bank, which forms a V-shaped channel to maximize water depths at low flows. No observations of steelhead have been reported in Ledgewood Creek. The Ledgewood Creek drainage, however, is adjacent to the Suisun Creek Watershed which is known to support steelhead populations. Furthermore, Chinook salmon have been observed spawning in Ledgewood Creek above the project site, indicating that Ledgewood Creek supports migratory habitat for anadromous salmonids (NMFS 2011).

Proposed activities at Ledgewood Creek involve widening the SR 12 crossing by 15 linear feet to the south. This will permanently impact 15 linear feet of the existing earthen channel by converting it to a concrete invert slab. This action will exacerbate the existing shallow water depth issues at low flows; and concrete low-flow walls and potentially baffles will be constructed to enhance low-flow fish passage of the culvert. Ledgewood Creek is not designated critical habitat for CCC steelhead, and there is no confirmed documentation of *O. mykiss* within the drainage. The proximity of Ledgewood Creek to the Suisun Creek watershed, however, indicates migratory steelhead could be present during periods of higher flows. All construction activities associated with the culvert will occur over one dry season, from June 1 to October 15. Therefore, the presence of CCC steelhead is unlikely during proposed construction activities, and CCC steelhead are not likely to be adversely affected by the proposed actions at Ledgewood Creek. Proposed passage improvements at Ledgewood Creek will address the addition of 15 linear feet of hardened creek bottom, and potentially make higher quality habitat above the culvert more accessible to CCC steelhead.

Based on the best available information, NMFS concurs with Caltran's determination that threatened CCC steelhead are not likely to be adversely affected by the I-80/I-680/SR 12 Interchange Improvement Project. This concludes informal consultation in accordance with 50 CFR 402.13(a) for the proposed I-80/I-680/SR 12 Interchange Improvement Project in Solano County, California. However, further consultation may be required if: (1) new information becomes available indicating that listed species or critical habitat may be affected by the project in a manner or to an extent not previously considered; (2) current project plans change in a manner that causes an effect to listed species or critical habitat in a manner not previously considered; or (3) a new species is listed or critical habitat designated that may be affected by the action.

Magnuson-Stevens Fishery Conservation and Management Act

The project area is located within an area identified as EFH for Central Valley fall/late fall-run Chinook salmon, managed with the Pacific Coast Salmon Fishery Management Plan under the MSA. As discussed in the above ESA section, no in-water construction will take place when Chinook salmon are likely to be present. However, adverse effects to EFH could occur from increased sedimentation and turbidity following construction activities. While these impacts are considered minor and temporary, NMFS has made the determination that the proposed action would adversely affect EFH for this species. However, the proposed action contains adequate measures to avoid, minimize, mitigate, or otherwise offset any adverse effects to EFH. Therefore, NMFS has no additional EFH Conservation Recommendations to provide.

This concludes EFH consultation for Caltrans' proposed I-80/I-680/SR 12 Interchange Improvement Project, Solano County, California. Pursuant to 50 CFR 600.920(l) of the EFH regulations, Caltrans must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations.

Fish and Wildlife Coordination Act

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development [16 U.S.C. 661]. The FWCA establishes a consultation requirement for Federal departments and agencies that undertake any action that proposes to modify any stream or other body of water for any purpose, including navigation and drainage [16 U.S.C 662(a)]. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources. With implementation of the previously-referenced EFH conservation recommendations, NMFS has no further comments to provide.

Please contact Mr. Joseph Heublein at (707) 575-1251, or via e-mail at joe.heublein@noaa.gov should you have any questions.

Sincerely,

for Rodney R. McInnis
Regional Administrator

cc: Chris Yates, NMFS, Long Beach
Bob Hoffman, NMFS, Long Beach
Bryant Chesney, NMFS, Long Beach
Ahmad Hashemi, Caltrans District 4
Copy to File ARN: 151422-SWR-2010-SR00524

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FOUNDATION REPORT

GREEN VALLEY ROAD OVERCROSSING
(BR. NO. 23-0246)
SOLANO COUNTY, CALIFORNIA
04-SOL-80 PM 12.8 EA 04-0A5341

For

MARK THOMAS & CO., INC. | NOLTE VERTICAL FIVE
A Joint Venture

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September 6, 2012 Job No. 2009-130-GDR

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APPENDIX VI **CALTRANS REVIEW COMMENTS AND RESPONSES**

FOUNDATION REPORT
GREEN VALLEY ROAD OVERCROSSING (BR. NO. 23-0246)
SOLANO COUNTY, CALIFORNIA
04-SOL-80 PM 12.8 EA 04-0A5341

1.0 SCOPE OF WORK

The purpose of this investigation was to evaluate the general soil conditions at the project site, to evaluate their engineering properties, and to provide foundation design recommendations for the proposed Green Valley Road Overcrossing, as part of the I-80/I-680/SR 12 Interchange project, located in Solano County, California. The scope of work performed for this investigation included a review of the readily available geologic literature pertaining to the site, obtaining representative soil samples and logging soil materials encountered in the exploratory borings, conducting Cone Penetration Tests (CPT), laboratory testing of the collected samples, engineering analysis of the field and laboratory data, and preparation of this report. This report presents the results of our geotechnical engineering investigation for the proposed overcrossing structure. The approximate location of the site is shown on the Site Map (Plate I-1) in Appendix I of the report.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. These recommendations should not be used directly for bidding purposes or for construction cost estimates.

2.0 PROJECT DESCRIPTION

A new overcrossing structure is proposed to replace the existing Green Valley Road Overcrossing at I-80. The new overcrossing structure will be located approximately 250 feet northeast of the existing structure, and it will be a two-span cast-in-place concrete box girder structure,

approximately 374 feet long. During 95% design phase, it was decided to widen the bridge to about 84 feet wide to accommodate one more lane. Future widening is still anticipated along the east side of the new structure at a later date. Deep abutments are planned for both abutments to reduce the length of the structure. It is planned to use 16-inch diameter open ended steel pipe piles (Caltrans standard Class 200 Alt. "W") for foundation support.

New approach embankments up to 30 to 40 feet are required at both abutments. The embankment at Abutment 1 will be supported by a Mechanically Stabilized Earth (MSE) wall (Retaining Wall No. 8) on the east side and a cantilever retaining wall (Caltrans Standard Type 1 (Mod.), Retaining Wall No. 9) on the west side. The embankment at Abutment 3 will have side slopes of 4H:1V on the northeast side and 2H:1V on the southwest side.

Due to the presence of the liquefiable soils, the lateral spreading potential is considered high for the embankment at Abutment 1, which will be supported by Retaining Walls 8 and 9. Therefore, it is proposed to conduct ground treatment with Controlled Low Strength Material (CLSM) columns to mitigate the potential hazard. We engaged Acacia Consultants & Engineers (Acacia CE) to perform the design of the CLSM treatment.

3.0 EXCEPTIONS TO POLICY

Normal procedures were assumed for construction of the bridge structure throughout our analysis and represent one of the bases of recommendations presented herein. The investigation and design for the proposed foundations has followed Caltrans policy. Exception to policy is not needed.

4.0 FIELD INVESTIGATION AND TESTING PROGRAM

Based on the readily available information (as-built plans), three exploratory borings (Borings A-09-003, A-09-005, and A-09-130) and three CPTs (CPT-10-003A, CPT-09-004, and CPT-10-005A), were conducted to a maximum depth of 120 feet below the existing ground surface. After our discussion with Caltrans engineers, two additional borings (R-10-003A and R-10-004A) were drilled along the proposed alignment of the overcrossing in order to collect more

samples and to refine the evaluation of the liquefaction potential. The borings were drilled to a maximum depth of 161 feet below the existing ground surface. The approximate locations of the boring are shown on the Log of Test Borings in Appendix II.

The test borings were advanced with truck-mounted drill rigs. Both hollow stem auger (using 8-inch diameter augers) and rotary wash drilling methods were utilized to advance the borings. The borings were drilled under the technical supervision of one of our engineers, who classified and logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were obtained during drilling and by driving 2.5 inches I.D. Modified California and 1.4 inches I.D. Standard Penetration Test samplers into the subsurface soils under the impact of a 140 lb hammer falling through 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the "Log of Test Borings", Appendix II. After visual examination, the collected samples were sealed and transported to our laboratory for further evaluation and testing.

The Cone Penetration Tests (CPT) were performed by Gregg Drilling & In Situ, Inc. of Martinez, California. The CPT was conducted using a 60-degree cone attached to a 1.7-inch diameter (tip area of 15 cm^2) rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil behavior type and strength characteristics.

The bore logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations.

5.0 LABORATORY TESTING PROGRAM

Laboratory tests were performed on selected samples in the laboratory to evaluate the physical and engineering properties of the subsoils. The tests performed for the study include the following: Laboratory determination of Moisture (California Test Method 226), Unit Weight (California Test Method 212), Atterberg Limits (California Test Method 204), Grain Size Analysis (California Test Method 202), Unconfined Compression Test (California Test Method 221), Consolidation Test (California Test Method 219), and Corrosion Test (California Test Methods 643, 417 & 422). The laboratory test results are attached in Appendix III.

6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1 Site Geology

The Jameson Canyon area and to the north is largely underlain by broadly folded Eocene Markley Formation and flat or gently tilted Pliocene Sonoma Volcanics. The Sonoma Volcanics are mostly andesitic tuff and breccias, but there is also some basalt and rhyolite. The area east of the Green Valley Fault, is largely underlain by late Pleistocene to Holocene alluvial fan deposits.

The Green Valley Fault, which intersects the project area, separates the Sonoma Volcanics from the Cretaceous. Great Valley Sequence on the east. (CGS 2002, Bezore, S.P., Wagner, D.L, and Sowers, J.M., Geologic Map of Cordelia 7.5' Quadrangle, Solano and Napa Counties, California).

General geologic features pertaining to the site were evaluated with reference to the "Geologic Map and Map Database of Northeastern San Francisco Bay Region, California", by R.W. Graymer, D.L. Jones, and E.E. Brabb (U.S.G.S., Miscellaneous Field Studies Map MF-2403, 2002)". Based on the map, the subsoils at the project site mainly consist of Alluvial Fan Deposits (Qhf & Qpf). A geologic map of the general project area is shown on Plate I-2. Descriptions of the main geologic units are presented as follows:

Qhf – Alluvial Fan Deposits (Holocene): Moderately to poorly sorted and moderately to poorly bedded sand, gravel, silt, and clay deposited where streams emanate from upland regions onto more gently sloping valley floors or plains. In places, Holocene deposits may only form a thin layer over Pleistocene deposits.

6.2 Subsurface Conditions

Per our discussion with the design team and Caltrans engineers, a total of five borings (A-09-003, A-09-005, R-10-004A, R-10-003A and A-09-130) and three Cone Penetration Tests (CPT-09-004, CPT-10-003A & CPT-10-005A) were conducted along the planned location of the overcrossing. We have also reviewed the as-built boring data (Green Valley Road Overcrossing, Caltrans, 1957) provided by the designer. In general, the subsoils along the proposed overcrossing structure generally consist of interbedded clay and sand. The subsurface conditions at each support are summarized in the following paragraphs.

Abutment 1 (south abutment). Based on the boring/CPT data (A-09-003, CPT-10-003A, R-10-003A), the subsoils at the vicinity of Abutment 1 consist of about 50 to 60 feet of low-plasticity clay and silt interbedded with silty sand at various depths, underlain by stiff to hard silt to 80-foot depth. Submerged, loose sand were encountered at 12.5- to 22.5-foot depths and 32.5- to 40-foot depths. A relatively thin layer of loose sand was encountered at about 44-foot depth. Dense sand layer was encountered between 80- and 100-foot depth, and relatively hard silt was encountered below 100-foot depth to 120-foot, the maximum depth explored.

Bent 2. Based on the boring/CPT data (A-09-005 & CPT-10-005A), the subsoils at the vicinity of Bent 2 consist of about 54 feet of clayey/silty sand, followed by about 10 feet of stiff sandy silt overlie medium dense silty sand and silt.

Abutment 3 (north abutment). Based on the boring/CPT data (A-09-130, CPT-09-004 & R-10-004A), the subsoils at the vicinity of Abutment 3 consist of about 30 feet of clay/silt

overlying 20 feet of silty sand. Below 50-foot depth, the boring/CPT generally encountered another 20 feet of silt and 20 feet of sand layer to about 100 feet, underlain by very stiff to hard silt to 161 feet, the maximum depth explored.

Groundwater level was encountered at 12 feet and 26 feet deep in Borings A-09-003 and A-09-005, respectively. The as-built boring data (Caltrans 1957) indicate that the groundwater was measured or encountered at Elev. 15 feet, approximately 7 to 8 feet below grade. The groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off, tide, and other factors that may not be present at the time of our investigation. We have assumed groundwater at Elev. 15 feet, approximately 8 feet below grade, for design purpose.

7.0 SCOUR EVALUATION

The subject was considered and was determined to be not applicable for the project since there is no water body passes the project site.

8.0 CORROSION EVALUATION

The corrosion investigation for this project was performed on selected samples in general accordance with the provisions of California Test Methods 643, 417 & 422. The test results are presented in Appendix IV. A summary of the corrosion test results is presented in the following table.

TABLE 1 – CORROSION TEST RESULTS

Boring No.	Location	Depth (ft)	pH	Minimum Resistivity (ohms-cm)	Chloride Content (ppm)	Sulfate Content (ppm)
R-10-003A	71+45 “G” Line	10	7.90	1550	98.8	50.1
R-10-004A	77+60 “G” Line	11	8.37	1660	102.2	64.1
A-09-005	74+00 “G” Line	4.5	8.67	190	2114.8	142.3

The test result of the sample obtained from 4.5-foot depth in Boring A-09-005 indicates corrosive environment according to the Caltrans corrosion guidelines (resistivity less than 1000 ohm-cm and chloride content greater than 500 ppm). Per Caltrans Memo-to-Designer 3-1, a corrosion allowance (sacrificial metal loss) should be assumed for the foundation design for the planned Caltrans Class 200 Alt. "W" piles, and the region of greatest concern for corrosion is the portion of the pile from the bottom of the pile cap or footing down to 3 feet below the water table. This region of the soil typically has a replenishible source of oxygen needed to sustain corrosion. According to the boring data, we have assumed a corrosion allowance of 0.05 inch (a corrosion rate of 0.001 inch per year with a design life of 50 years) above Elev. -13 feet.

Alternatively, corrosion mitigation measures, such as coatings and/or cathodic protection, may be considered.

9.0 SEISMIC RECOMMENDATIONS

9.1 Seismic Sources

The project site is located in a seismically active part of northern California. Many faults in the San Francisco Bay Area are capable of producing earthquakes, which may cause strong ground shaking at the site. Maximum moment magnitudes of some of the closest faults in the area based on 2007 Caltrans Deterministic PGA Map and ARS Online Report are summarized below. These maximum magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment.

TABLE 2 – FAULT DATA

Fault	Fault ID	Fault Type	Maximum Magnitude (M_{max})	Approximate Distance From Site
Cordelia Fault	212	RLSS	6.7	0.15 mile
Green Valley Fault	213	RLSS	6.9	1.0 mile

Based on the publication, the proposed structure is located between Cordelia Fault and Green Valley Fault. It is our understanding that site-specific fault study was performed by another

consultant. Caltrans is currently reviewing the report for final acceptance. However, this should not have significant impact on the proposed structure.

9.2 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic data, the possibility of the site to experience strong ground shaking is considered high.

9.3 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and low plasticity silts of low relative density are the type of soils which usually are susceptible to liquefaction. Clays of medium to high plasticity are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001) using the boring and CPT data. As indicated by recent advances in soil liquefaction engineering (Bray, 2006), for soils with sufficient fines content so as to separate the coarser particles and control behavior, liquefaction appears to occur primarily in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their LL (W%> 0.85LL).

The Peak Ground Acceleration (PGA) was estimated based on the latest Caltrans ARS Online website, which is based on several input parameters, including the site location (longitude/latitude), average shear wave velocity for the top 30m/100 feet (Vs_{30m}). We have adopted an average PGA of 0.7g along the project limit for liquefaction analysis. As mentioned in the previous section, we have assumed groundwater at about 8 feet below existing grade. With the high PGA, submerged granular materials with $N_{1,60,CS}$ less than 30 are generally found to

be potentially liquefiable. Submerged soils with CPT data showing I_C<2.6 (most likely granular) and $q_{C1N,CS}$ less than 160 tons/ft^2 are also considered liquefiable, unless sampling and laboratory data from neighboring borings suggested otherwise.

Based on our analysis, potentially liquefiable soils were identified at various depths. We have reviewed and compared all the available data from the borings and CPTs. After our discussion with the Caltrans engineer, the liquefaction potential was mainly evaluated according to the soil borings advanced by rotary-wash drilling method. Those borings were performed by Technicon Engineering Services, Inc. of Fresno, California. All samples were obtained from the 1.4-inch I.D. Standard Penetration Tess (SPT) samplers at various depths, and the samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. The average hammer energy is about 88% based on the calibration results provided by the driller. For liquefaction analysis, a lower hammer energy ratio of 85% was conservatively assumed in the calculation to account for variations.

Based on the analysis results, liquefaction potential is considered moderate to high. However, the corrected $N_{1,60,CS}$ in some of the liquefiable soils are relatively high and close to 30. The laboratory test results also indicate that the fines contents are generally high (greater than 35%) for most of the sand layers encountered. The anticipated 100% development of pore pressure in such materials (i.e. high $N_{1,60,CS}$ and high fines content) may be more correctly ascribed to "cyclic mobility", which results in limited soil deformations without liquid-like flow. In our opinion, the engineering consequences of such phenomenon in those layers may be limited to temporarily loss of strength (cyclic softening). Volumetric strain induced by liquefaction, i.e. post-liquefaction settlement, is considered relatively small.

In general, liquefaction hazards are most severe in the upper 50 feet of the surface as mentioned in Special Publication 117A (CGS, 2008). In our opinion, the impact due to the potential liquefiable soils below 50 feet is considered insignificant, especially when the layer is relatively thin and discontinuous.

Based on the above, the soil layers that may be subject to liquefaction under the design earthquake event are summarized as follows:

Abutment 1 (south abutment). Based on the boring/CPT data (A-09-003, CPT-10-003A, R-10-003A), the potentially liquefiable soils were identified at various depths. We have used the data from Boring R-10-003A as the prime source for liquefaction evaluation. Liquefiable soils were identified in the following layers:

Soil Layer Below Grade (ft)	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
12.5' to 15.0'	14	SM	0.46	18.1	19%	0.75 (1)
15.0' to 22.5'	17	ML/SM	0.73	26.6	35%	- (2)
	21	ML/SM	0.86	29.0	10%	- (2)
	26	ML/SM	0.72	28.1	35%	- (2)
32.5' to 40.0'	36	ML/SM	0.57	26.4	49%	- (2)
	39	ML/SM	0.54	25.7	49%	- (2)

Note:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992).
(2) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was relatively insignificant.
(3) The depth of the liquefiable soils is greater than 50 feet below existing grade. The impact is considered insignificant.

Low plasticity silt was encountered in Boring R-10-003A between about 67- and 70-foot depths. However, this is relatively deep with high fines content. Therefore, the impact to the foundation design of this liquefiable layer is considered low.

Bent 2. To evaluate the liquefaction potential, we have reviewed the boring (A-09-005) and CPT (CPT-10-005A) data, and also compared with the recently conducted rotary wash borings in the vicinity. Based on the available data, liquefiable soils were identified in the following layers:

Soil Layer Below Grade (ft)	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
30.0' to 40.0'	29.5, 34.5	SM	<1.0	~30	35%, 16%	- (1)
65.0' to 75.0'	69.5	SM	0.36	17.3	28%	- (2)

Note:
(1) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was relatively insignificant.
(2) The depth of the liquefiable soils is greater than 50 feet below existing grade. The impact is considered insignificant.

Clayey sand/sandy lean clay was encountered at shallow depth (approx. 7.5- to 22-foot depths) in both Boring A-09-005 and CPT-10-005A. According to the laboratory test results, the fines contents is on the order to 50% and the plasticity is considered medium to high (P.I. of 24 and 25). Therefore, the liquefaction potential is deemed low of this material.

Per Boring A-09-005, liquefaction potential of the sand layer between 30- and 40-foot depths appears to be low. However, the results from CPT-10-005A indicate low factor of safety against liquefaction at the same depth. In addition, similar soil stratum was also encountered in the nearby borings, where liquefiable soils were identified. Therefore, this layer was conservatively assumed liquefiable for the foundation design.

The low plasticity silt was encountered in Boring A-09-005 between about 52- and 64-foot depths. However, the blow counts are relatively high, and the liquefaction potential appears low at the similar depths from other exploration. Therefore, the liquefaction potential of this layer is considered low and has little impact.

Abutment 3 (north abutment). Between the boring (R-10-004A) and the CPT (CPT-09-004) data, we have used the data from Boring R-10-004A as the prime source for liquefaction evaluation. Liquefiable soils were identified in the following layers:

Soil Layer Below Grade (ft)	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
30.0' to 36.0'	31	SM	0.38	19.6	16%	2.0(1)
	36	SM	0.29	15.3	16%	
45.0' to 50.0'	45	SM	0.62	27.8	18%	2.0(1)
	48	SM	0.30	15.6	2%	
60.0' to 67.5'	61	ML	0.65	27.2	30%	- (2)(3)
	66	ML	0.68	27.5	30%	

Note:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992)
(2) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was relatively insignificant.
(3) The depth of the liquefiable soils is greater than 50 feet below existing grade. The impact is considered insignificant.

Low plasticity silt was encountered in Boring R-10-004A between about 60- and 67.5-foot depths. However, this is relatively deep, and the $N_{1,60,CS}$ and the fines content are high. Therefore, the impact to the foundation design of this liquefiable layer is considered low.

Based on the above, the liquefaction potential is considered high at the project site. Liquefaction has been considered for foundation design. The vertical pile capacity contribution is neglected within the liquefiable soils. Down drag loads have been considered where the post-liquefaction settlement is more than 0.6 inch (per D.M. 7.2). For lateral pile capacity analysis, the effect of liquefaction was accounted for by using the p-y relationship for liquefied sand presented by Rollins et al (2003). More detailed discussions are presented in Sections 11.2 and 11.3.

9.3.1 Liquefaction Mitigation

Due to the high liquefaction potential at the project site, we have evaluated the potential of lateral spreading per Caltrans latest guideline (February 2011). As a result, the liquefaction induced lateral spreading will be a design issue for the embankment and Retaining Wall No. 8 (MSE wall) and Retaining Wall No. 9 (Caltrans Standard Type 1) at Abutment 1.

Consequently, ground improvement is proposed to mitigate the potential hazard. More detailed information are provided in the document provided by Acacia CE (Appendix V).

Several ground improvement methods, such as dynamic compaction, stone columns, cement deep soil mixing (CDSM) and Controlled Low Strength Material (CLSM) columns are commonly used in California. However, based on the subsurface condition, CLSM column ground improvement method is deemed more appropriate and cost-effective for the proposed project. CLSM Columns may be a proprietary method and its applicability should be verified with the contract requirement.

The CLSM columns are formed in drilled or displaced soil cavity. The columns replace or displace the compressible or liquefiable soil with cemented CLSM. It is recommended that these ground improvement columns be separated from the bottom of the footings using a layer of compacted Aggregate Base (AB). No connectivity of the ground improvement columns and overlying structural element should be anticipated. Lateral resistance is provided by the friction at the footing/concrete to crushed rock interface and passive resistance of the side of the footing. In addition, CLSM ground improvement columns provide enhanced engineering properties for the matrix soil/CLSM column composite. The composite improved ground provides increased density and shear capacity to resist liquefaction and increased shear resistance for global stability of supported structures.

The target strengths of the CLSM backfill material are generally on the order of 200 to 750 psi at 28 days, depending on load demands. The CLSM strength is tested using standard sampling and loading methods. The settlement properties of the improved soil/CLSM composite can be verified using a full scale modulus load test.

The CLSM columns generally are constructed with a minimum 18 inch diameter and maximum 36 inch diameter displacement barrels above a short section of standard auger.

For Drill Displacement CLSM columns the expanded cavities are filled with CLSM under pressure as the displacement auger is withdrawn.

9.4 Seismic Design Criteria

The recommended response spectrum was determined based on the new 2007 Caltrans Deterministic PGA Map and the Caltrans ARS Online (Ver. 1.0.4) per Caltrans Seismic Design Criteria (SDC, Version 1.6, dated November 2010). The development of the design ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 30 m/100 feet (V_{S30m}), and other site parameters, such as fault characteristics, site-to-fault distances. The design methods incorporate both deterministic and probabilistic seismic hazards to produce the Design Response Spectrum.

Average shear wave velocity (Vs) for the top 30m (100 feet) at the site was estimated by using established correlations and the procedure provided in the Caltrans Design Manual (Ver. 1.0.4, August 2009). As mentioned in the previous section, liquefaction potential is considered high at the project site. Therefore, when estimating the V_{30m}, we have assumed the residual shear strengths and modeled those as soft clays for the potential liquefiable soils.

For developing the ARS curve, we have considered both profiles: (1) liquefaction case; and (2) non-liquefaction case. Based on our calculation, we have estimated Vs_{30m} of 200 m/s and 225 m/s for liquefaction case and non-liquefaction case, respectively. According to the analysis results, the recommended response spectrum for structure design is based on the data from 2008 USGS Deaggregation Hazard (beta). Lower V_{S30m} yields higher spectral acceleration at longer periods (>0.5 sec.), and the higher V_{S30m} yields higher spectral accelerations at shorter periods (<0.5 sec.). The envelope of these two curves is recommended.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented in Appendix V.

1. Site Location: 38.2161°N/122.1387°W
2. Estimated V_{S30m} = 200 m/s (liquefaction case); 225 m/s (non-liquefaction case)
3. The recommended ARS curve is the envelope of the two curves based on different Vs_{30m}, which were governed by the 2008 USGS Deaggregation Hazard (beta).

10.0 AS-BUILT FOUNDATION DATA

The proposed new structure will be located about 250 feet northeast of the existing Green Valley Road Overcrossing (Br. No. 23-138). This existing overcrossing was built in 1961. Based on the as-built plans, the existing structure is a four-span structure of about 304 feet long and 34 feet wide. The General Plan indicates that the structure is supported on P.C.C. piles (presumably Portland Cement Concrete Piles) with a design load of 45 tons. According to the Pile Details, several different pile types were listed. However, the actual pile type used is not noted. The specified pile tip elevations vary from location to location. The foundation data are summarized in the following table:

TABLE 3 – AS-BUILT FOUNDATION DATA

Pile Location	Pile Type	Design Load	Footing Elev. (ft)	Specified Pile Tip Elev. (ft)
Abutment 1	P.C.C. Piles	45 tons	32.5	-23
Bent 2			18.5	-23
Bent 3			18.5	-23
Bent 4			18.5	-13
Abutment 5			32.0	-13

11.0 FOUNDATION RECOMMENDATIONS

11.1 General

This report was prepared specifically for the proposed project as described earlier. Normal procedures were assumed for construction of the bridge structure throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations. In addition,

bridge plans should be reviewed by our office prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

11.2 Foundation

Based on the subsurface condition, the subsoils at the project site consist of interbedded clay/silt and sand layers, and groundwater level appears relatively shallow. Liquefiable soils have been identified within the project limit, and liquefaction has been considered for foundation design. The pile capacity contribution is neglected within the soil layers where potential liquefaction or cyclic mobility is anticipated. Based on the liquefaction analysis results, down drag loads have been considered when estimating the pile capacity, where the post-liquefaction settlement is more than 0.6 inch.

Dense sand formation was encountered at depths, and there appears to be variable dense sand lenses through the profile. Therefore, concrete driven piles are not recommended due to potential hard-driving condition. Per our discussion with the designer, steel open-ended pipe piles (Caltrans standard Class 200 Alt. "W") will be used for foundation support.

The use of large diameter Cast-In-Drilled-Hole (CIDH) concrete piles was considered at Bent 2 during 35% design phase. However, the subsoils consist of loose sand and low plasticity silt with relatively shallow groundwater. These materials are prone to caving-in during drilling, and the construction of the CIDH concrete piles may be difficult. This foundation option is not considered cost-effective.

According to the latest plans, the footing bottom elevations are at Elev. 17.5, 13.5 and 16.5 feet for Abutment 1, Bent 2 and Abutment 3, respectively. The design pile cut-off elevations are about 5 inches/0.4 foot above the footing bottom elevations at Elev. 17.9 feet, 13.9 feet and 16.9 feet for Abutment 1, Bent 2 and Abutment 3, respectively. The recommended minimum pile spacing is three times the pile diameter (3D) to minimize the group effect for vertical pile capacities.

Consistent with the current Caltrans requirements, the abutment foundations are evaluated for the foundation design data and loading conditions using Working Stress Design (WSD) methods. The Bent 2 foundation of the proposed structure is evaluated for the foundation design data and loading conditions using AASHTO LRFD Bridge Design Specifications – 4th Edition, with California Amendments.

For the proposed structure, pertinent foundation design information are provided by the designer, including Foundation Design Data (Table 4.1) and Foundation Design Loads (Table 4.2). Based on the load demand and subsoil information, the recommended specified pile tip elevations are summarized in the following tables (Tables 4.3 to 4.5) per Memo-To-Designers 3-1.

TABLE 4 – FOUNDATION DESIGN SUMMARY

TABLE 4.1 – FOUNDATION DESIGN DATA

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (in)	No. of Piles per Support
					B	L		
Abut 1	WSD	Class 200 (Alt. W)	23.73	17.9	21	96.15	1.0	65
Bent 2	LRFD	Class 200 (Alt. W)	24.73	13.9	15	31	1.0	28
Abut 3	WSD	Class 200 (Alt. W)	32.75	16.9	19	85.95	1.0	50

Note: Pile cut-off elevations are about 5 inches above the bottom of the footings.

TABLE 4.2 – FOUNDATION DESIGN LOADS

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Perma-nent Loads	Compression		Tension		Compression		Tension	
	Per Support	Per Pile	Per Support	Per Support	Max. Per Pile.	Per Support	Max. Per Pile.	Per Support	Max. Per Pile.	Per Support	Max. Per Pile.
Abut 1	10510	210	9950	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	5320	190	4740	7110	260	0	0	6160	270	0	0
Abut 3	8140	210	7630	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: For Bent 2, per support load is per column.

TABLE 4.3 – FOUNDATION RECOMMENDATIONS FOR ABUTMENTS

Support	Pile Type	Cut-off Elev. (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance Required (kips)
			Total	Perma-nent					
Abut 1	Class 200 Alt. "W"	17.9	10510	9950	210	420	-72.1 (a) -12.1 (c) -17.1 (d)	-72.1	525
Abut 3	Class 200 Alt. "W"	16.9	8140	7630	210	420	-88.1 (a) -13.1 (c) -13.1 (d)	-88.1	700

Design tip elevations are controlled by (a) compression, (c) settlement, (d) lateral

TABLE 4.4 – FOUNDATION RECOMMENDATIONS FOR BENT

Support Location	Pile Type	Cut-off Elev. (ft)	Service-I Limit State Load (kips) per Support	Total Permissible Support Settlement (in.)	Required Factored Nominal Resistance (kips)				Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (ϕ=0.7)	Ten. (ϕ=0.7)	Comp. (ϕ=1)	Ten. (ϕ=1)			
Bent 2	Class 200 Alt. "W"	13.9	5320	1	260	0	270	0	-61.5 (a-I) -46.5 (a-II) -16.4 (c) -16.1 (d)	-61.5	450

Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (b-I) Tension (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (c) Settlement, (d) Lateral Load.

TABLE 4.5 – PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut 1	Class 200 Alt. "W"	420	0	-72.1 (a), -12.1 (c), -17.1 (d)	-72.1	525
Bent 2	Class 200 Alt. "W"	380	0	-61.5 (a); -16.1 (c); -16.1 (d)	-61.5	450
Abut 3	Class 200 Alt. "W"	420	0	-88.1 (a), -13.1 (c), -13.1 (d)	-88.1	700

Design tip elevations are controlled by (a) compression; (c) settlement; (d) lateral Loads

The pile capacities of the open end steel pipe piles (Caltrans Standard Class Alt. "W") were estimated based on procedures published by American Petroleum Institute (API) from "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design" (API RP 2A-WSD, 2002). We have utilized computer program "APILE Plus" (ENSOFT, v5.0) for calculation purpose.

Liquefaction was considered when estimating the pile capacities. The vertical pile capacity contribution is neglected within the liquefiable soils. Down drag loads have been considered where the post-liquefaction settlement is more than 0.6 inch for the piles at Abutments 1 and 3. In addition, due to the corrosive environment, we have assumed a corrosion allowance of 0.05 inch (a corrosion rate of 0.001 inch per year with a design life of 50 years) above Elev. -13 feet. The impact appears to be relatively minor as the capacities along the corrosive zones have already been neglected due to liquefaction concern. The pile group settlement was evaluated, and it does not appear to be a governing factor for foundation design.

New embankment up to about 40 feet is anticipated at Abutment 1 and about 30 feet at Abutment 3. Based on available boring information, the estimated ground settlements at Abutment 3 (north abutment) are expected to be on the order of 8 inches. The settlements are expected mainly within the over-consolidated (OC) range, which should occur relatively fast and probably during earthwork construction. To reduce potential down drag load on abutment piles, a waiting period of 60 days is recommended after embankment/MSE wall construction prior to the pile construction at abutments.

Due to the potential lateral spreading at Abutment 1, ground treatment with CLSM Columns is recommended to mitigate the potential hazard. It is expected that the amount of settlement will be on the order of 3 inches. The settlements are expected mainly within the elastic range, which should also occur relatively fast and probably during earthwork construction. A waiting period of 30 days is recommended after embankment/MSE wall construction prior to the pile construction at abutments. More discussions regarding anticipated ground settlement are presented in Section 11.5 of this report.

11.3 Lateral Pile Capacity

Under seismic loading conditions, lateral load analyses were performed for the proposed steel open-ended pipe piles (Caltrans standard Class Alt. “W”) using the LPILE program (ENSOFT, v6.0). The effect of liquefaction was accounted for by using the p-y relationship for liquefied

sand presented by Rollins et al (2003). An average "p-y Curve Modification Factor" of 0.6 was adopted for non-liquefiable soils in the lateral pile analysis for pile spacing of 3 times the pile diameter.

In addition, due to the corrosive potential (see Section 8.0), a corrosive allowance of 0.05 inch (a corrosion rate of 0.001 inch per year with a design life of 50 years) was assumed for the shell thickness above Elev. -13 feet per Caltrans Memo-To-Designer 3-1. The results of lateral pile analyses, with the plots of the pile deflection, moment, shear and soil reaction along the pile length and the input files are included in the Appendix C.

11.4 Lateral Earth Pressures

Abutment retaining walls should be designed to resist the following Applied Lateral Earth Pressures and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil.

<u>Applied Lateral Earth Pressure</u>

Active Condition	36 pcf Equivalent Fluid Pressure (EFP) for the engineered backfill.
At-Rest Condition	55 pcf Equivalent Fluid Pressure (EFP) for the engineered backfill.
Passive Resistance	5 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet high or greater); for activated height less than 5.5 feet modify proportionally, i.e. 5×(H/5.5) ksf. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive pressure is required.

Cantilever walls which are free to rotate at least 0.004 radian may be assumed flexible for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.3 and 0.5 may be

used to determine the additional earth pressure resulting from the surcharge for active and at-rest conditions, respectively.

11.5 Embankments

11.5.1 Embankment Settlements & Settlement Monitoring

New approach embankments are planned at the abutments of the Green Valley Road Overcrossing. The height of the embankment is up to 40 feet at Abutment 1 and 30 feet at Abutment 3. Consequently, consolidation settlement is expected from the additional load exerted from the embankment.

In order to estimate the amount of settlement, consolidation tests were conducted on selected samples obtained from the borings. We have reviewed and adopted correlations from various references with revision to the site-specific laboratory test results for estimating the indexes for settlement calculation.

The estimation of pre-consolidation pressure is based Su/p per Skempton (1957) and NAVFAC D.M. 7.1. The modified compression index ($C_c/(1+e_0)$) and the modified recompression index ($C_r/(1+e_0)$) were obtained from the laboratory test results, and these indices were compared to the correlation with natural moisture contents suggested by Lambe and Whitman (1969). After reviewing the laboratory data and the correlation, we have revised the correlation for estimating the modified compression index accordingly. For the recompression index (C_r, in the over-consolidated range), it is typically 10% of the compression index (per Holtz and Kovacs, 1982). According to the test data, the ratio of C_r/C_c range from 13% to 30%, which is in general accordance with the suggested value. Therefore, we have assumed a ratio of 20% (C_r/C_c) for estimating the modified recompression index ($C_r/(1+e_0)$).

Ground treatment has been considered under the embankment south of Abutment 1 to mitigate the potential lateral spreading due to the presence of liquefiable soils. With the

proposed ground treatment, the consolidation settlement under the embankment up to 40 feet at Abutment 1 (south abutment) is expected to be on the order of 3 inches.

At Abutment 3 (north abutment), new embankments up to about 30 feet are anticipated at the north abutment of the Green Valley Road OC. In general, the subsoils consist of interbedded very stiff to hard silt/clay in the upper depths overlying medium dense to dense sand. It appears that granular materials are more prominent toward the northeast and the clay thicknesses appear to be thicker on the southwest. Based on the results of the settlement analyses, the amount of consolidation settlements is estimated to be on the order of 8 inches. The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast.

A waiting period of 30 days and 60 days is recommended for the embankment at Abutment 1 and 3, respectively, prior to pile construction at the abutment of the new structure and the construction of the pavement. It will reduce potential down drag load on abutment piles due to consolidation settlement. The settlement monitoring is recommended and should be performed as per Caltrans Standard Test Method 112. In addition, the method of constructing the concrete facing (panels) might have to be delayed. Special details would be required to allow for the settlement of the panels or to attach them after the settlement has occurred.

11.5.2 Evaluation of Embankment Stability

After the Type Selection meeting in January 2011, Caltrans issued a new publication regarding lateral spreading, “Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading” in February 2011. Consequently, we have re-visited the analyses that were performed during 35% design accordingly. Specifically, more analyses were performed along longitudinal direction to evaluate the potential of lateral spreading and its impact to the abutments.

Previously (during the 35% design phase), due to the presence of liquefiable soils on site, the stability of the embankment was evaluated under three different scenarios: 1) Static Condition (short-term, immediately after construction); 2) Seismic Condition (pseudo-static with seismic coefficient, k); and 3) Post-Liquefaction Condition. Per our previous discussion with Caltrans engineer, short-term, undrained shear strength (non-liquefied) parameters were used for seismic condition, since liquefaction generally is not expected to occur in conjunction with the peak ground acceleration. Residual shear strengths (Sr) were adopted only for the post-liquefaction condition without seismic coefficient.

According to the latest Caltrans guideline of lateral spreading, we have revised our pseudo-static analysis by using residual shear strengths (Sr, estimated based on Kramer and Wang (2007) as cited in Caltrans guideline) for liquefiable soils. As mentioned previously, liquefaction is generally not expected to occur in conjunction with peak ground acceleration. Therefore, this approach (pseudo-static analysis coupled with residual shear strengths) appears relatively conservative.

In our opinion, if the derived factor of safety is greater than unity, the design seismic coefficient is considered less than the yield acceleration (ky), and the ground deformation under the design earthquake event should be relatively insignificant and should not pose impact to the structure/foundation design. On the other hand, if the derived factor of safety is less than unity, the ground deformation can be excessive and lateral spreading should be considered.

For the seismic coefficient (k), we have referenced to Caltrans guidelines (Guidelines for Structures Foundation Reports manual, Ver. 2.0, 2006), which recommends that the seismic factor equal to one third of the horizontal peak acceleration and not exceeding 0.2g. An average PGA of 0.7g was assumed for design at the project site. Therefore, a seismic coefficient (k) of 0.2g was used for pseudo-static analysis. In addition, the

strengths of the non-liquefiable fine-grained materials were increased by 30% due to the effect of rapid loading (per Ishihara, 1985) and strength increase from the consolidation under the embankment/retaining walls. For the proposed structure, stability analyses were conducted at both abutments. The analysis results are summarized in the following table.

TABLE 5 – SUMMARY OF SLOPE STABILITY ANALYSIS

Location	Factor of Safety	
	Static Condition – Short term (immediately after construction)	**Pseudo-Static Analysis (k=0.2+residual shear strength)**
Abutment 1 (South)	2.71	0.70
Abutment 3 (North)	2.17	1.00

Based on our analysis, for the embankment/retaining walls at Abutment 1 located between Green Valley Road OC and Green Valley Road OC (Over SB 680 On-Ramp), the stability under pseudo-static analysis (with residual shear strengths) is not satisfactory (F.S. less than 1). The results indicate that the potential deformation during the design seismic event can be excessive. Per Bray and Travasarou (2007) as cited in Caltrans guideline, the anticipated deformation is estimated on the order of 12 inches (with an yield acceleration, ky, of 0.145g). Therefore, the potential of lateral spreading is considered high, and it will impose additional loads onto the abutment wall and the foundations at Abutment 1. This will complicate the design considerably.

Consequently, ground treatment by using CLSM columns is recommended. We have engaged Acacia CE to perform the design of the CLSM system. According to their evaluation, the planned ground treatment will consist of 24-inch diameter Drill Displacement Column (DDC) with a typical spacing of 4’-10” on center. The proposed treatment ratio is about 17% under the footprint of Retaining Wall No. 9 (Type 1) and about 15.5% under the embankment and Retaining Wall No. 8 (MSE wall). The CLSM columns will extend to Elev. -15 feet (approximate 39 feet below grade). It is

recommended that the CLSM have an average 28-day unconfined compressive strength of at least 750 psi.

Based on the assumptions, a composite shear strength of 9,800 psf is recommended under Retaining Wall No. 9 and 9,000 psf under Retaining Wall No. 8 and embankment are recommended. The composite strength is calculated based on a residual shear strength of 750 psf for the liquefiable soils.

We have performed pseudo-static slope stability analysis with an average improved composite shear strength of 9 ksf under the embankment and retaining walls. The results indicate the stability to be satisfactory.

12.0 NOTES TO DESIGNER

It is recommended that the structure engineer verify the pile tip elevations when finalizing the pile data table. Should the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Geotechnical Engineer must be contacted for further recommendations.

13.0 CONSTRUCTION CONSIDERATIONS

13.1 General

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of grading operations should be carried out by Caltrans and/or Solano County. If the encountered subsurface conditions differ from those forming the basis of our recommendations, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

13.2 Open End Steel Pipe Piles

Based on the boring data, the site is underlain by alluvial materials with some relatively thick granular layers. For the proposed open end steel pipe piles, local hard driving conditions should be expected. In our opinion, the overall drivability should not be an issue. However, this will depend on the type and setup of the pile driving hammer. We recommend that the piles be driven to the specified tip elevations. The pile capacity will be derived primarily from frictional resistance along the pile shaft.

In the event that unanticipated pile driving conditions are encountered, it is recommended that the Gates formula per Caltrans standard specifications (Section 49-1.08) be used in the field for driving and capacity verification. Should difficult driving be encountered where the vertical compression requirement is met (per Gates formula), pile driving should be allowed to terminate short of the specified tip elevation provided that either one of the following conditions are satisfied:

- Other requirements including tension and lateral demands are met;
- Any pile refusal within 5 feet above the specified tip elevation, which may be considered acceptable and cut off at the option of the contractor.

If the piles do not attain the nominal driving resistance at the specified tip elevation (per Gates Formula), the piles may be allowed to stand for a “set period” of minimum 12 hours without driving. If the nominal driving resistance is attained for each pile designated to be re-driven, the remaining piles in that footing are considered acceptable.

14.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge.

Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Frank Wang, P.E., G.E. 2862
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

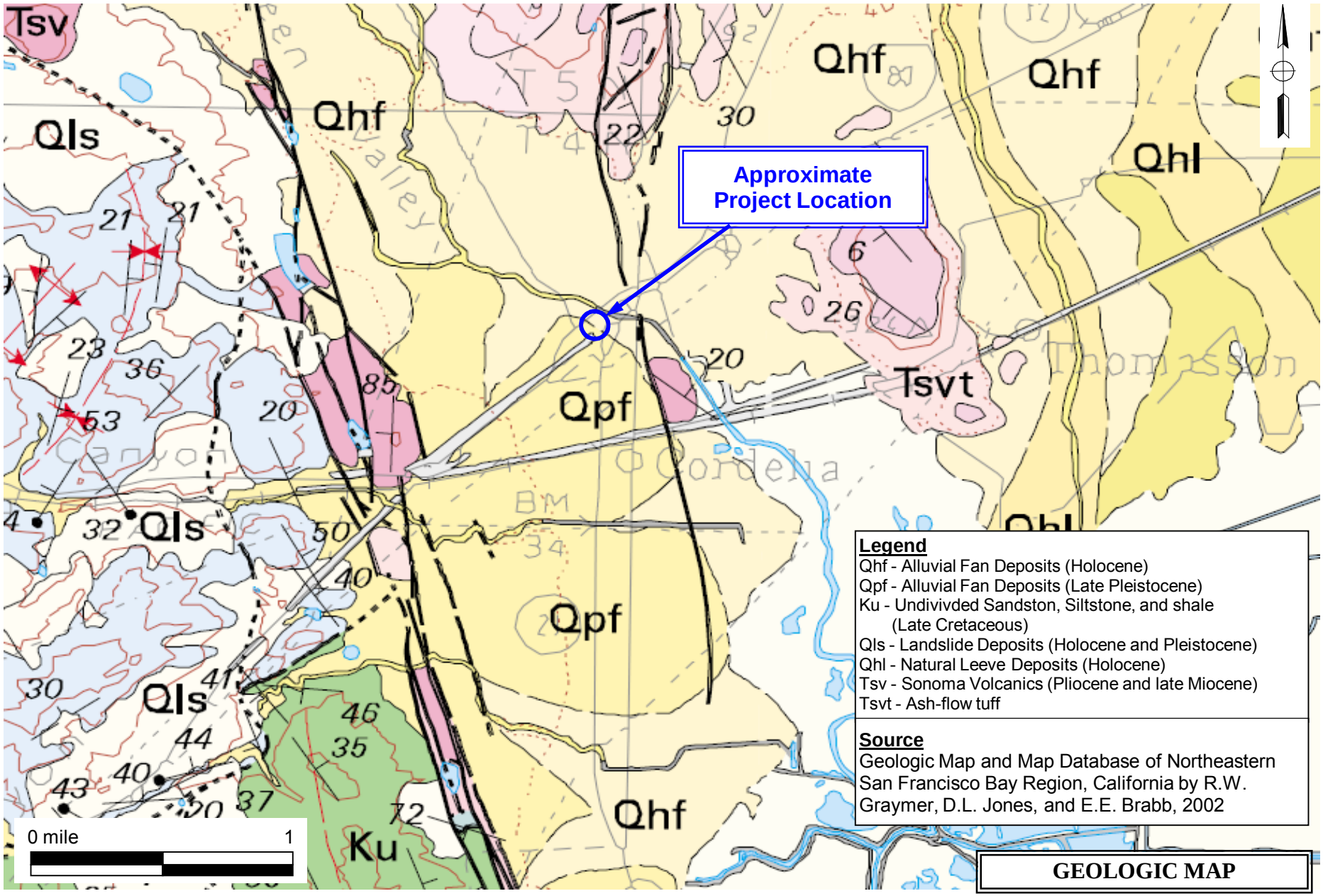
APPENDIX I

SITE MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR	PLATE NO.: I-1



PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR | **PLATE NO.: I-2**

APPENDIX II

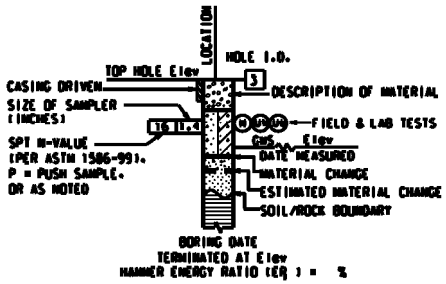
REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

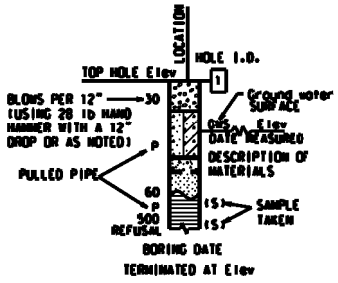
CEMENTATION	
DESCRIPTION	CRITERIA
WEAK	CRUMBLES OR BREAKS WITH HANDLING OR LITTLE FINGER PRESSURE.
MODERATE	CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE.
STRONG	WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE.

BOREHOLE IDENTIFICATION		
SYMBOL	HOLE TYPE	DESCRIPTION
	A	AUGER BORING (HOLLOW OR SOLID STEM BUCKET)
	R RW RC P	ROTARY DRILLED BORING (CONVENTIONAL) ROTARY DRILLED WITH SELF-CASING WIRE-LINE ROTARY CORE WITH CONTINUOUSLY-SAMPLED, SELF-CASING WIRE-LINE ROTARY PERCUSSION BORING (AIR)
	R	ROTARY DRILLED DIAMOND CORE
	HD HA	HAND DRIVEN (1-INCH SOIL TUBE) HAND AUGER
	D	DYNAMIC CONE PENETRATION BORING
	CPT	CONE PENETRATION TEST (ASTM D 5778)
	O	OTHER (NOTE ON LOTB)
Note: Size in inches.		

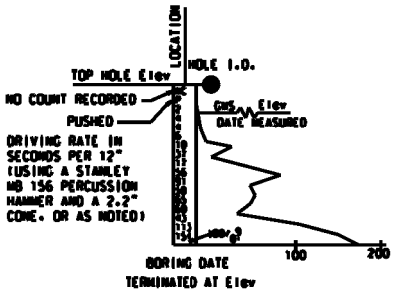
CONSISTENCY OF COHESIVE SOILS				
DESCRIPTION	SHEAR STRENGTH (tsf)	POCKET PENETROMETER MEASUREMENT, PP, (tsf)	TORVANE MEASUREMENT, TV, (tsf)	VANE SHEAR MEASUREMENT, VS, (tsf)
VERY SOFT	LESS THAN 0.12	LESS THAN 0.25	LESS THAN 0.12	LESS THAN 0.12
SOFT	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
MEDIUM STIFF	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
STIFF	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
VERY STIFF	1 - 2	2 - 4	1 - 2	1 - 2
HARD	GREATER THAN 2	GREATER THAN 4	GREATER THAN 2	GREATER THAN 2



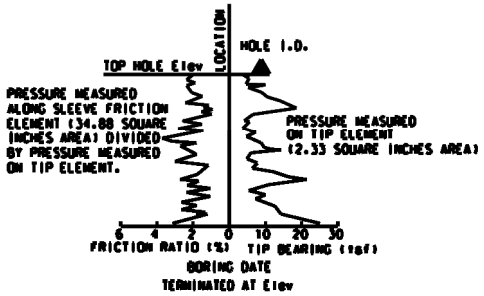
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

LEGEND – SOIL
(SHEET 1 OF 2)
NO SCALE

A10F

2010 STANDARD PLAN A10F

5-24-10

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

GROUP SYMBOLS AND NAMES

GRAPHIC/SYMBOL	GROUP NAMES
GW	WELL-GRADED GRAVEL WELL-GRADED GRAVEL WITH SAND
GP	POORLY-GRADED GRAVEL POORLY-GRADED GRAVEL WITH SAND
GW-GM	WELL-GRADED GRAVEL WITH SILT WELL-GRADED GRAVEL WITH SILT AND SAND
GW-GC	WELL-GRADED GRAVEL WITH CLAY (OR SILTY CLAY) WELL-GRADED GRAVEL WITH CLAY AND SAND (OR SILTY CLAY AND SAND)
GP-GM	POORLY-GRADED GRAVEL WITH SILT POORLY-GRADED GRAVEL WITH SILT AND SAND
GP-GC	POORLY-GRADED GRAVEL WITH CLAY (OR SILTY CLAY) POORLY-GRADED GRAVEL WITH CLAY AND SAND (OR SILTY CLAY AND SAND)
GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL WITH SAND
SW	WELL-GRADED SAND WELL-GRADED SAND WITH GRAVEL
SP	POORLY-GRADED SAND POORLY-GRADED SAND WITH GRAVEL
SW-SM	WELL-GRADED SAND WITH SILT WELL-GRADED SAND WITH SILT AND GRAVEL
SW-SC	WELL-GRADED SAND WITH CLAY (OR SILTY CLAY) WELL-GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
SP-SM	POORLY-GRADED SAND WITH SILT POORLY-GRADED SAND WITH SILT AND GRAVEL
SP-SC	POORLY-GRADED SAND WITH CLAY (OR SILTY CLAY) POORLY-GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
SM	SILTY SAND SILTY SAND WITH GRAVEL
SC	CLAYEY SAND CLAYEY SAND WITH GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND WITH GRAVEL
PT	PEAT
	COBBLES COBBLES AND BOULDERS BOULDERS

GRAPHIC/SYMBOL	GROUP NAMES
CL	LEAN CLAY LEAN CLAY WITH SAND LEAN CLAY WITH GRAVEL SANDY LEAN CLAY SANDY LEAN CLAY WITH GRAVEL GRAVELLY LEAN CLAY GRAVELLY LEAN CLAY WITH SAND
CL-ML	SILTY CLAY SILTY CLAY WITH SAND SILTY CLAY WITH GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY WITH GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY WITH SAND
ML	SILT SILT WITH SAND SILT WITH GRAVEL SANDY SILT SANDY SILT WITH GRAVEL GRAVELLY SILT GRAVELLY SILT WITH SAND
OL	ORGANIC LEAN CLAY ORGANIC LEAN CLAY WITH SAND ORGANIC LEAN CLAY WITH GRAVEL SANDY ORGANIC LEAN CLAY SANDY ORGANIC LEAN CLAY WITH GRAVEL GRAVELLY ORGANIC LEAN CLAY GRAVELLY ORGANIC LEAN CLAY WITH SAND
OL	ORGANIC SILT ORGANIC SILT WITH SAND ORGANIC SILT WITH GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT WITH GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT WITH SAND
CH	FAT CLAY FAT CLAY WITH SAND FAT CLAY WITH GRAVEL SANDY FAT CLAY SANDY FAT CLAY WITH GRAVEL GRAVELLY FAT CLAY GRAVELLY FAT CLAY WITH SAND
MH	ELASTIC SILT ELASTIC SILT WITH SAND ELASTIC SILT WITH GRAVEL SANDY ELASTIC SILT SANDY ELASTIC SILT WITH GRAVEL GRAVELLY ELASTIC SILT GRAVELLY ELASTIC SILT WITH SAND
OH	ORGANIC FAT CLAY ORGANIC FAT CLAY WITH SAND ORGANIC FAT CLAY WITH GRAVEL SANDY ORGANIC FAT CLAY SANDY ORGANIC FAT CLAY WITH GRAVEL GRAVELLY ORGANIC FAT CLAY GRAVELLY ORGANIC FAT CLAY WITH SAND
OH	ORGANIC ELASTIC SILT ORGANIC ELASTIC SILT WITH SAND ORGANIC ELASTIC SILT WITH GRAVEL SANDY ORGANIC ELASTIC SILT SANDY ORGANIC ELASTIC SILT WITH GRAVEL GRAVELLY ORGANIC ELASTIC SILT GRAVELLY ORGANIC ELASTIC SILT WITH SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL WITH SAND ORGANIC SOIL WITH GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL WITH GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL WITH SAND

FIELD AND LABORATORY TESTING

- (C) CONSOLIDATION (ASTM D 2435)
- (CL) COLLAPSE POTENTIAL (ASTM D 5333)
- (CP) COMPACTION CURVE (CTM 216)
- (CR) CORROSIVITY TESTING (CTM 643, CTM 422, CTM 417)
- (CU) CONSOLIDATED UNDRAINED TRIAXIAL (ASTM D 4767)
- (DS) DIRECT SHEAR (ASTM D 3080)
- (EI) EXPANSION INDEX (ASTM D 4829)
- (M) MOISTURE CONTENT (ASTM D 2216)
- (OC) ORGANIC CONTENT-% (ASTM D 2974)
- (P) PERMEABILITY (CTM 220)
- (PA) PARTICLE SIZE ANALYSIS (ASTM D 422)
- (PI) PLASTICITY INDEX (AASHTO T 90)
LIQUID LIMIT (AASHTO T 89)
- (PL) POINT LOAD INDEX (ASTM D 5731)
- (PM) PRESSURE METER
- (R) R-VALUE (CTM 301)
- (SE) SAND EQUIVALENT (CTM 217)
- (SG) SPECIFIC GRAVITY (AASHTO T 100)
- (SL) SHRINKAGE LIMIT (ASTM D 427)
- (SW) SWELL POTENTIAL (ASTM D 4546)
- (UC) UNCONFINED COMPRESSION-SOIL (ASTM D 2166)
UNCONFINED COMPRESSION-ROCK (ASTM D 2938)
- (UU) UNCONSOLIDATED UNDRAINED TRIAXIAL (ASTM D 2850)
- (UW) UNIT WEIGHT (ASTM D 4767)

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APPARENT DENSITY OF COHESIONLESS SOILS

DESCRIPTION	SPT N_{60} (BLOWS / 12 INCHES)
VERY LOOSE	0 - 5
LOOSE	5 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	GREATER THAN 50

MOISTURE

DESCRIPTION	CRITERIA
DRY	NO DISCERNABLE MOISTURE
MOIST	MOISTURE PRESENT, BUT NO FREE WATER
WET	VISIBLE FREE WATER

PERCENT OR PROPORTION OF SOILS

DESCRIPTION	CRITERIA
TRACE	PARTICLES ARE PRESENT BUT ESTIMATED TO BE LESS THAN 5%
FEW	5% - 10%
LITTLE	15% - 25%
SOME	30% - 45%
MOSTLY	50% - 100%

PARTICLE SIZE

DESCRIPTION		SIZE
BOULDER		GREATER THAN 12"
COBBLE		3" - 12"
GRAVEL	COARSE	3/4" - 3"
	FINE	1/5" - 3/4"
SAND	COARSE	1/16" - 1/5"
	MEDIUM	1/64" - 1/16"
	FINE	1/300" - 1/64"
SILT AND CLAY		LESS THAN 1/300"

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

LEGEND – SOIL
(SHEET 2 OF 2)
NO SCALE

A10G

2010 STANDARD PLAN A10G

5-5-10

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	12.80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL 9/10/12 DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER G. PARIKH NO. 666 EXP. 12/31/13 GEOTECHNICAL STATE OF CALIFORNIA

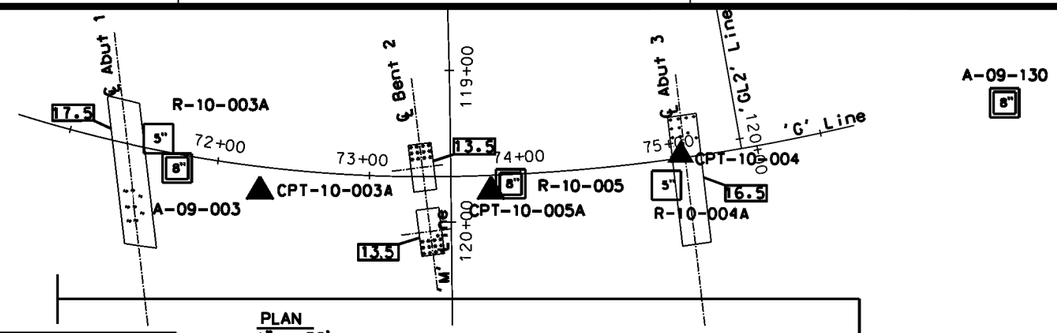
SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

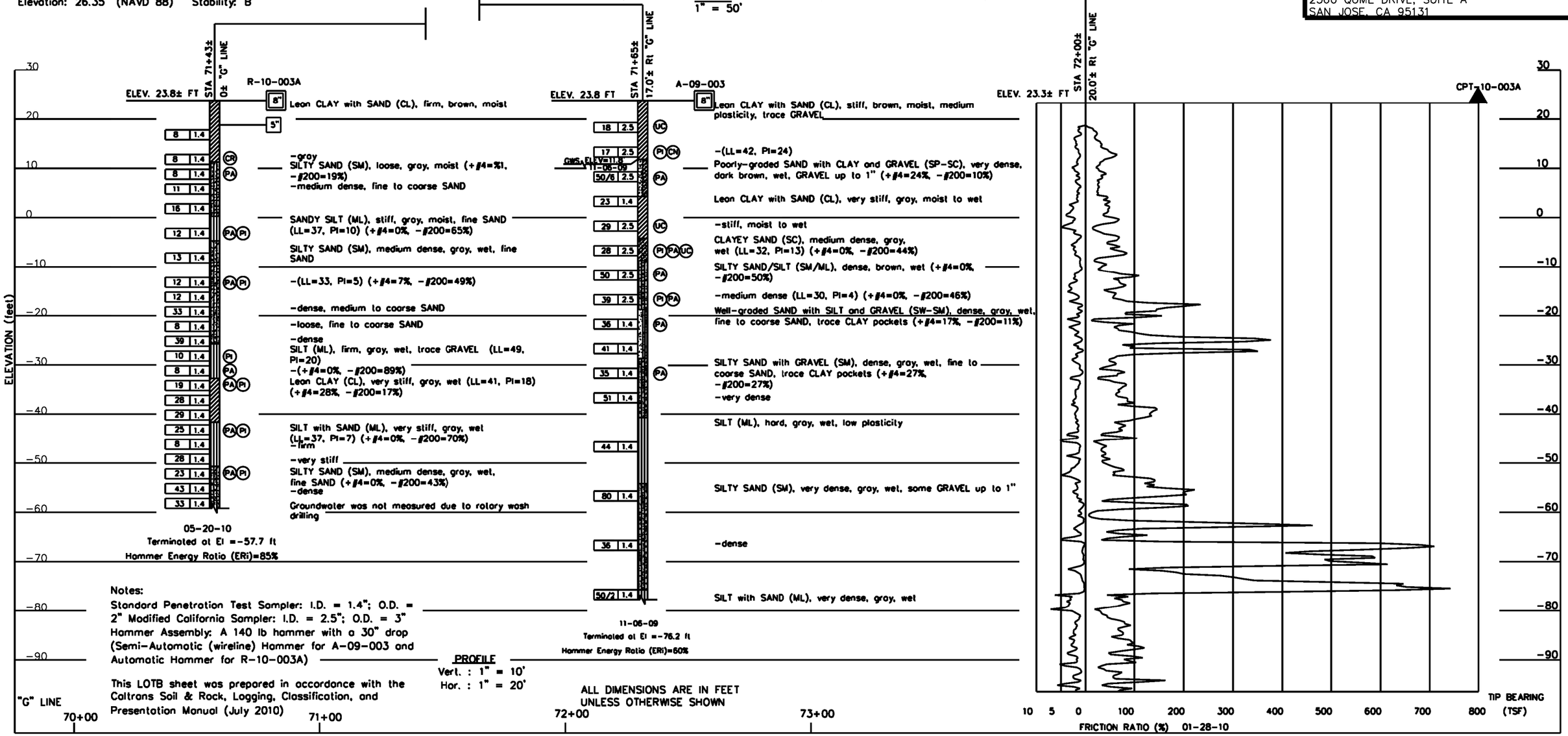
BENCH MARKS

BENCHMARK NO. A 1393 (NGS PID JT9519)
Brass disc set vertically in the east face of the first concrete pier east of the west abutment of the Union Pacific (formerly Southern Pacific) Railroad overcrossing of Interstate Highway 80, 21.7 feet northwest of the center of the most northwesterly westbound lane of the highway. The disc is stamped "A 1393 1987"
Northing: 1837422 Easting: 6518256
(NAD83, CCSII)
Elevation: 67.07 (NAVD 88) Stability: B

HPGN D CA 10 LC (NGS PID AC9890)
Survey disc set on aluminum alloy rod encased in a PVC pipe with access cover set in concrete flush with the parking lot pavement in the Park and Ride Lot, 92 feet west of the centerline of Green Valley Road and 48 feet southeast of the Green Valley Road onramp to westbound Interstate Highway 80. The disc is stamped "CADT 10 LC"
Northing: 1840653.06 Easting: 6521452.79
(HPGN 1991.35, CCSII)
Elevation: 26.35 (NAVD 88) Stability: B



PLAN
1" = 50'



Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Semi-Automatic (wireline) Hammer for A-09-003 and Automatic Hammer for R-10-003A)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 20'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DRAWN BY L. DUDDU	L.S. BHANGOO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED BY F. WANG	DATE: NOVEMBER 2009 & MAY 2010	F. WANG PROJECT ENGINEER

BRIDGE NO. 23-0246 | POST MILES 12.8

GREEN VALLEY ROAD OVERCROSSING

LOG OF TEST BORINGS 1 OF 4

OS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0741
PROJECT NUMBER & PHASE: 04000211311 CONTRACT NO.: 04-0A5341

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET 22 | OF 25

FILE =℄ $REQUEST

USERNAME =℄ $USER DATE PLOTTED =℄ $DATE TIME PLOTTED =℄ $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	12.80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL 9/10/12 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER G. PARIKH NO. 666 EXP. 12/31/13 GEOTECHNICAL STATE OF CALIFORNIA

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SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

Notes:
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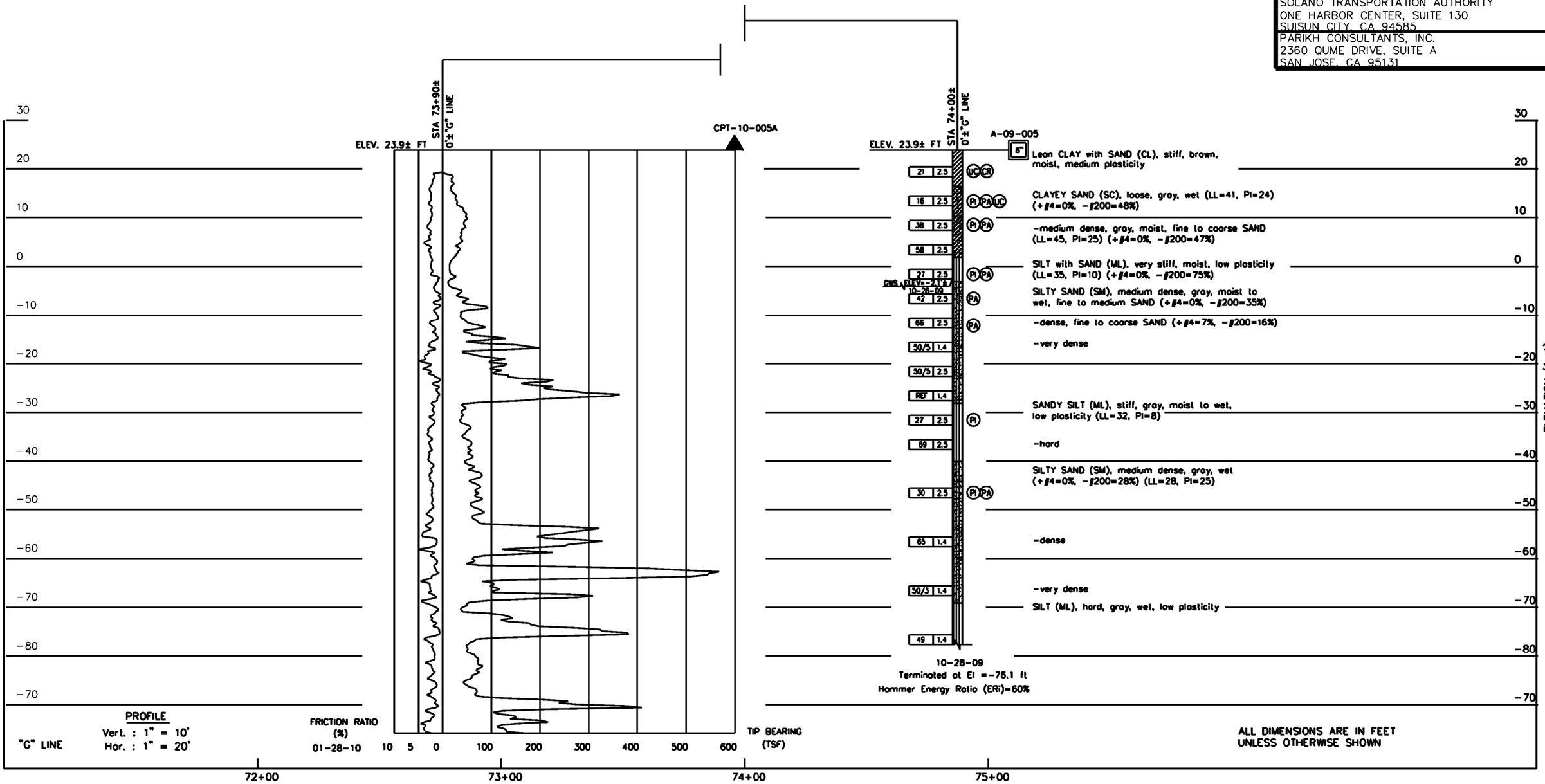
Hammer Assembly: A 140 lb hammer with a 30" drop (Semi-Automatic (wireline) Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (2010)

(SEE BORING/CPT LOCATIONS AND BENCH MARKS ON SHEET 1 OF 4)



ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DRAWN BY	L. DUDDU	L.S. BHANGOO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER	BRIDGE NO. 23-0246
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCTOBER 2009			POST MILES 12.8

GREEN VALLEY ROAD OVERCROSSING

LOG OF TEST BORINGS 2 OF 4

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0741
PROJECT NUMBER & PHASE: 04000211311 CONTRACT NO.: 04-0A5341

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 01/28/10 02/18/10 SHEET 23 OF 25

FILE = $REQUEST

USERNAME = $USER DATE PLOTTED = $DATE TIME PLOTTED = $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	12.80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL 9/10/12 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER G. PARIKH NO. 666 EXP. 12/31/13 GEOTECHNICAL STATE OF CALIFORNIA

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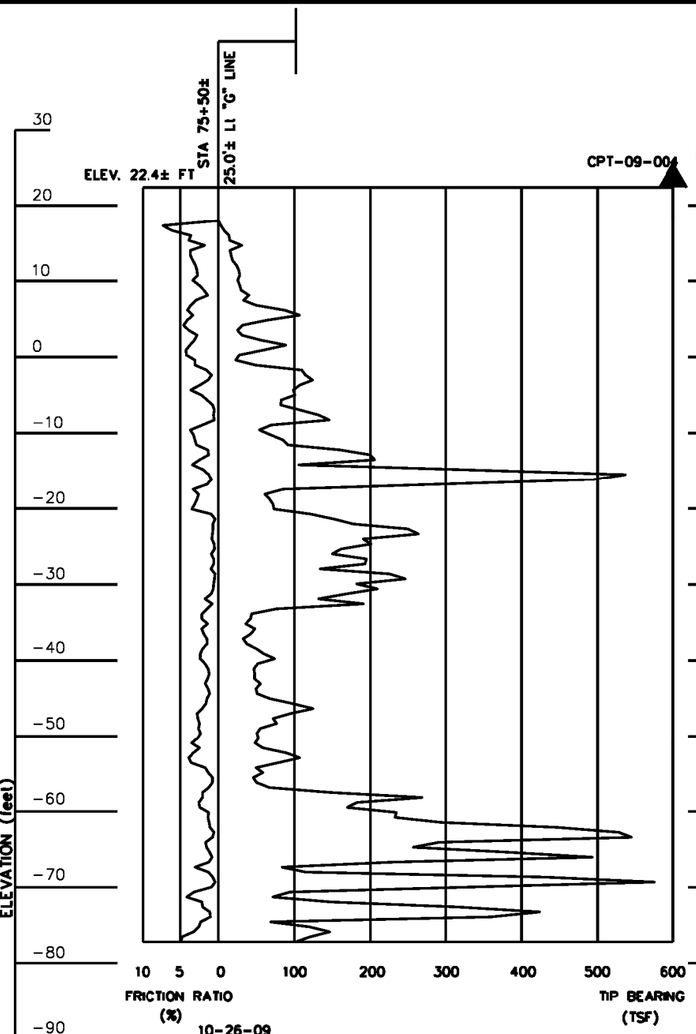
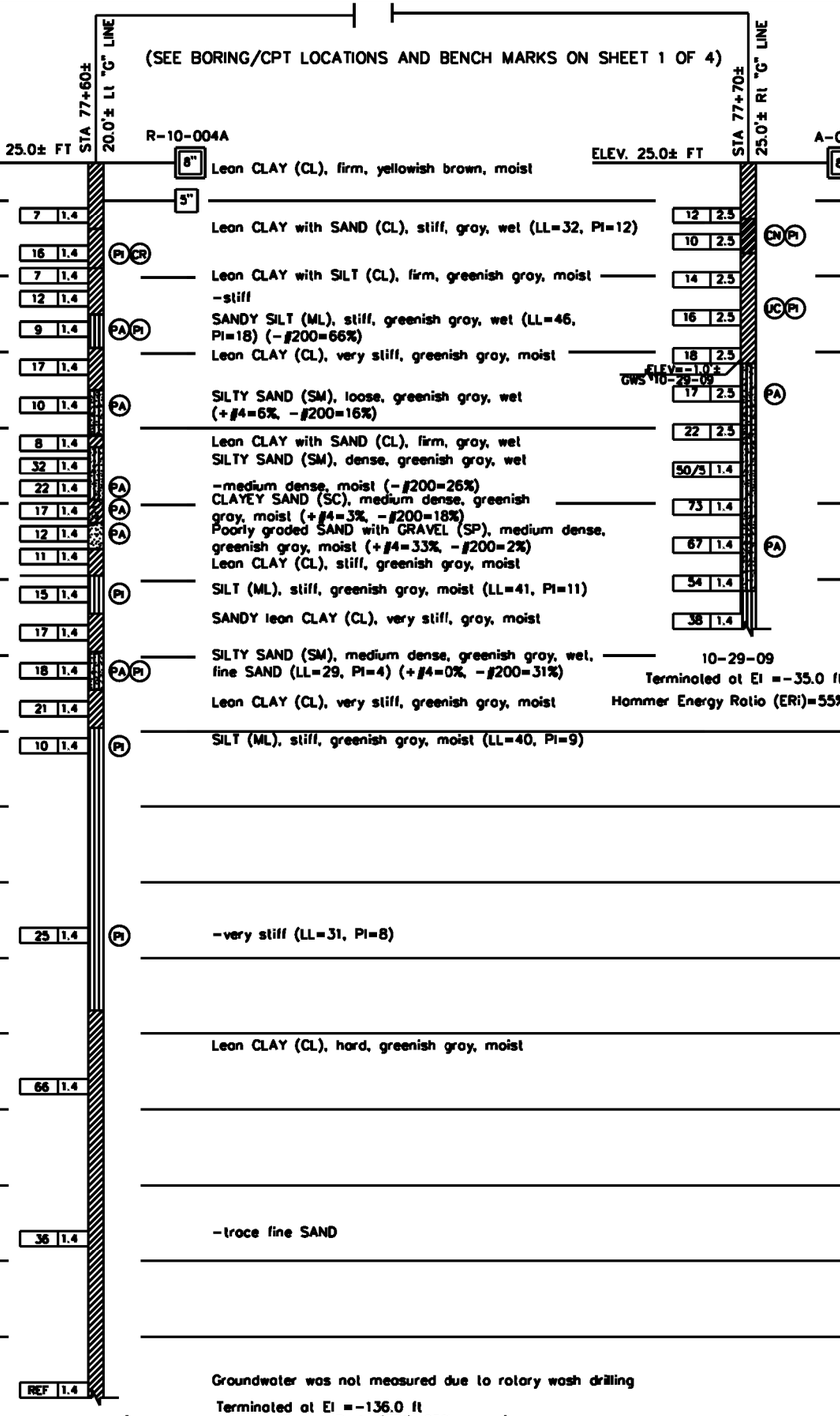
SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING/CPT LOCATIONS AND BENCH MARKS ON SHEET 1 OF 4)





Lean CLAY (CL), firm, yellowish brown, moist

Lean CLAY with SAND (CL), stiff, gray, wet (LL=32, PI=12)

Lean CLAY with SILT (CL), firm, greenish gray, moist

-stiff

SANDY SILT (ML), stiff, greenish gray, wet (LL=46, PI=18) (-#200=66%)

Lean CLAY (CL), very stiff, greenish gray, moist

SILTY SAND (SM), loose, greenish gray, wet (+#4=6%, -#200=16%)

Lean CLAY with SAND (CL), firm, gray, wet

SILTY SAND (SM), dense, greenish gray, wet

-medium dense, moist (-#200=26%)

CLAYEY SAND (SC), medium dense, greenish gray, moist (+#4=3%, -#200=18%)

Poorly graded SAND with GRAVEL (SP), medium dense, greenish gray, moist (+#4=33%, -#200=2%)

Lean CLAY (CL), stiff, greenish gray, moist

SILT (ML), stiff, greenish gray, moist (LL=41, PI=11)

SANDY lean CLAY (CL), very stiff, gray, moist

SILTY SAND (SM), medium dense, greenish gray, wet, fine SAND (LL=29, PI=4) (+#4=0%, -#200=31%)

Lean CLAY (CL), very stiff, greenish gray, moist

SILT (ML), stiff, greenish gray, moist (LL=40, PI=9)

-very stiff (LL=31, PI=8)

Lean CLAY (CL), hard, greenish gray, moist

-trace fine SAND

Groundwater was not measured due to rotary wash drilling

Terminated at El =-136.0 ft
Hammer Energy Ratio (ERi)=85%

05-19-10

Lean CLAY with SAND (CL), firm, brown, moist

Fat CLAY (CH), firm, brown, moist (LL=58, PI=40)

Lean CLAY with SAND (CL), stiff, gray, moist

-(LL=47, PI=26)

SILTY SAND (SM), loose, gray, wet (+#4=0%, -#200=49%)

-medium dense

-very dense

-fine to medium SAND (+#4=3%, -#200=27%)

SILT (ML), hard, gray, wet

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Semi-Automatic (wireline) Hammer for A-09-130 and Automatic Hammer for R-10-004A)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 20'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DRAWN BY	L. DUDDU	L.S. BHANGOO FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: NOVEMBER 2009 & MAY 2010

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG PROJECT ENGINEER

BRIDGE NO. 23-0246 POST MILES 12.8

GREEN VALLEY ROAD OVERCROSSING

LOG OF TEST BORINGS 3 OF 4

OS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0741
PROJECT NUMBER & PHASE: 04000211311 CONTRACT NO.: 04-0A5341

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET 24 OF 25

FILE = $REQUEST

USERNAME = $USER DATE PLOTTED = $DATE TIME PLOTTED = $TIME

I-080-2(11)43

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CAL.			160	239

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
X	Sol	80	B	10	10

BRIDGE ENGINEER — CIVIL ENGINEER—LICENSE 5565

DATE APPROVED January 18, 1960

DIVISION OF ENGINEERING SERVICES – GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILES – TOTAL PROJECT	Sheet No.	Total Sheets
04	Sol	12,80	2.3/2.8 12.0/13.1		

CERTIFIED ENGINEER — DATE 9/10/12

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

GREEN VALLEY ROAD OVERCROSSING

LOG OF TEST BORINGS 4 OF 4

NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: EA:04-0A5341

BRIDGE No. 23-0246

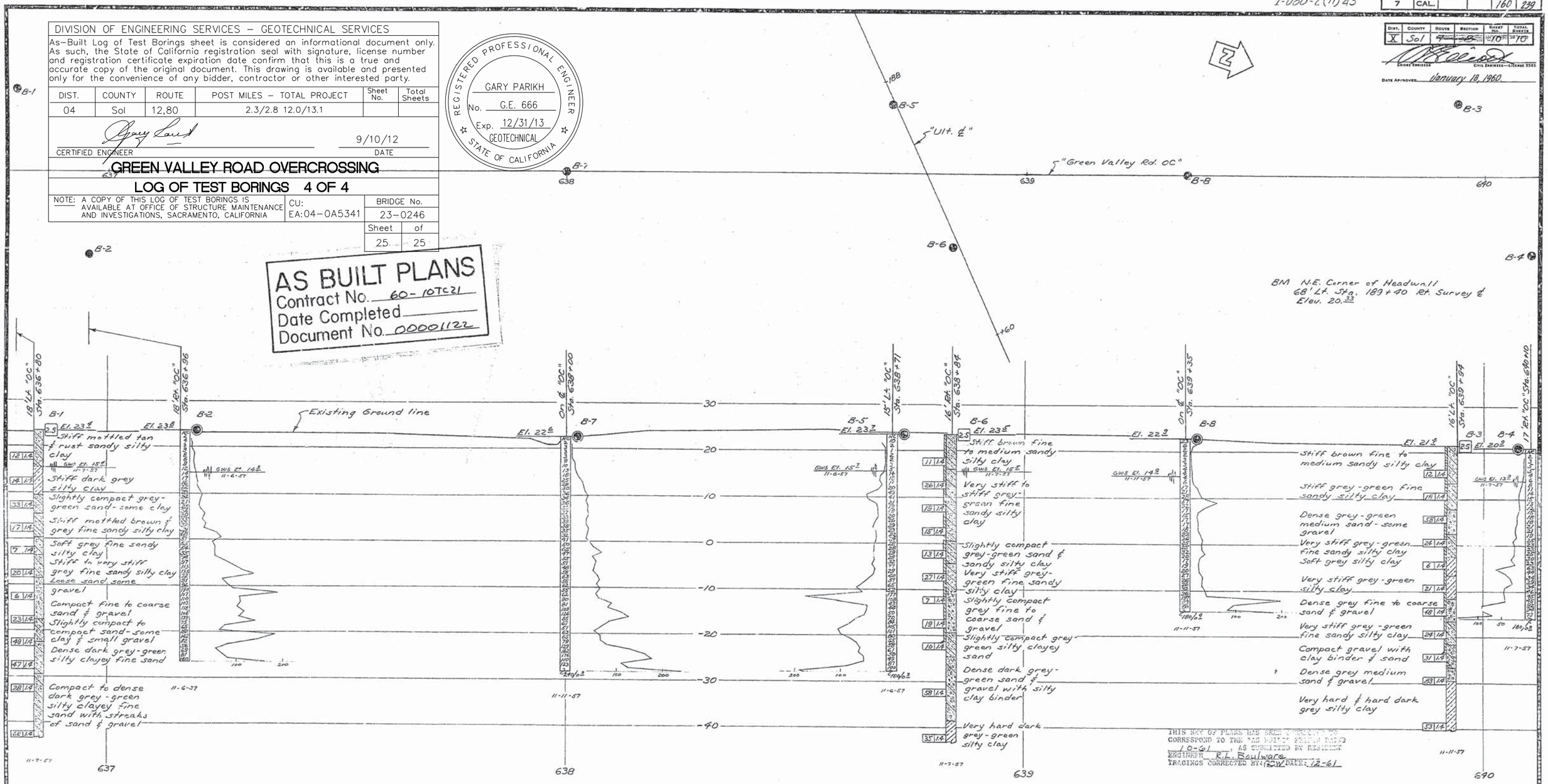
Sheet 25 of 25

AS BUILT PLANS
Contract No. 60-10TC21
Date Completed
Document No. 00001122

BRIDGE DEPARTMENT

FIELD STUDY	Wm. Strauchr
DRAWN	M. Aparicio 1-30-58
CHECKED	C. Hinck 2-3-58

Approved Recommended by — Engineering Geologist — Engineering Geology



THIS SET OF PLANS HAS BEEN CHANGED TO CORRESPOND TO THE "AS BUILT" PLANS DATED 10-61, AS SUBMITTED BY RESIDENT ENGINEER R.L. Boulware
TRACINGS CORRECTED BY: RCW DATE: 12-61

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

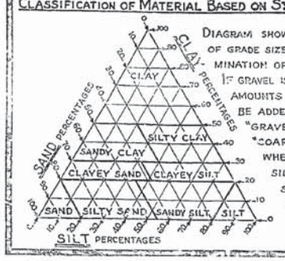


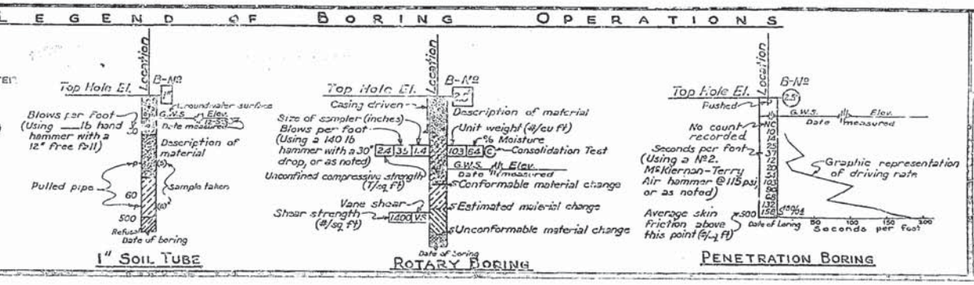
DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES. IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND/OR ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- 2½" CONE PENETROMETER
- SAMPLER BORING (LRV)
- ROTARY BORING (WE'I)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT



NOTES

Classification of earth materials as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

GREEN VALLEY ROAD OVERCROSSING

LOG OF TEST BORINGS

SCALE 1" = 10'	BRIDGE 23-138	E-23 FILE	DRAWING C-5801-10

PREL. DRAWING No. 1-5801 10 19

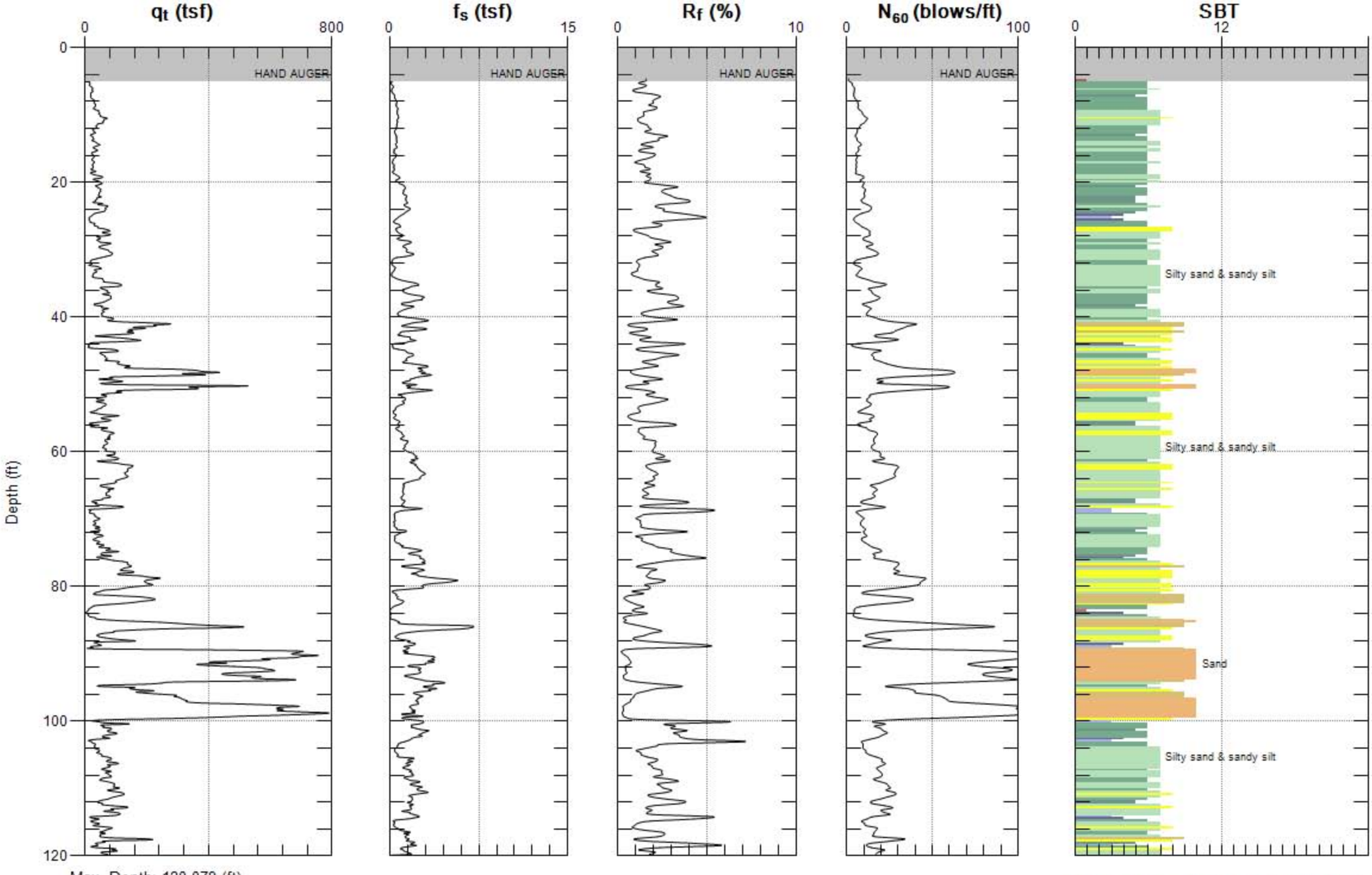
160

APPENDIX III

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-003A

Engineer: E.BHANGOO
Date: 2010-01-28 09:25



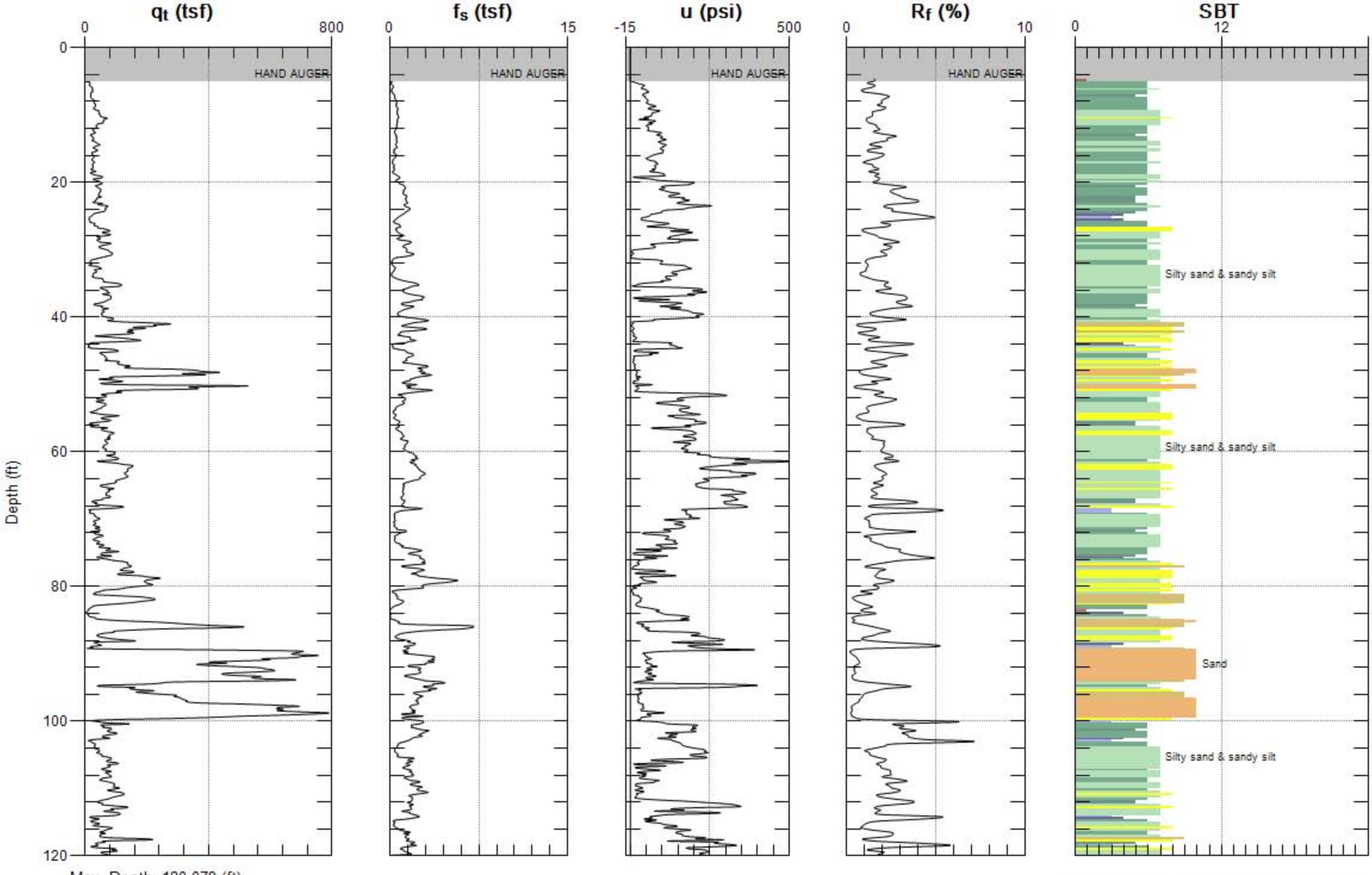
Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-003A

Engineer: E.BHANGOO
Date: 2010-01-28 09:25



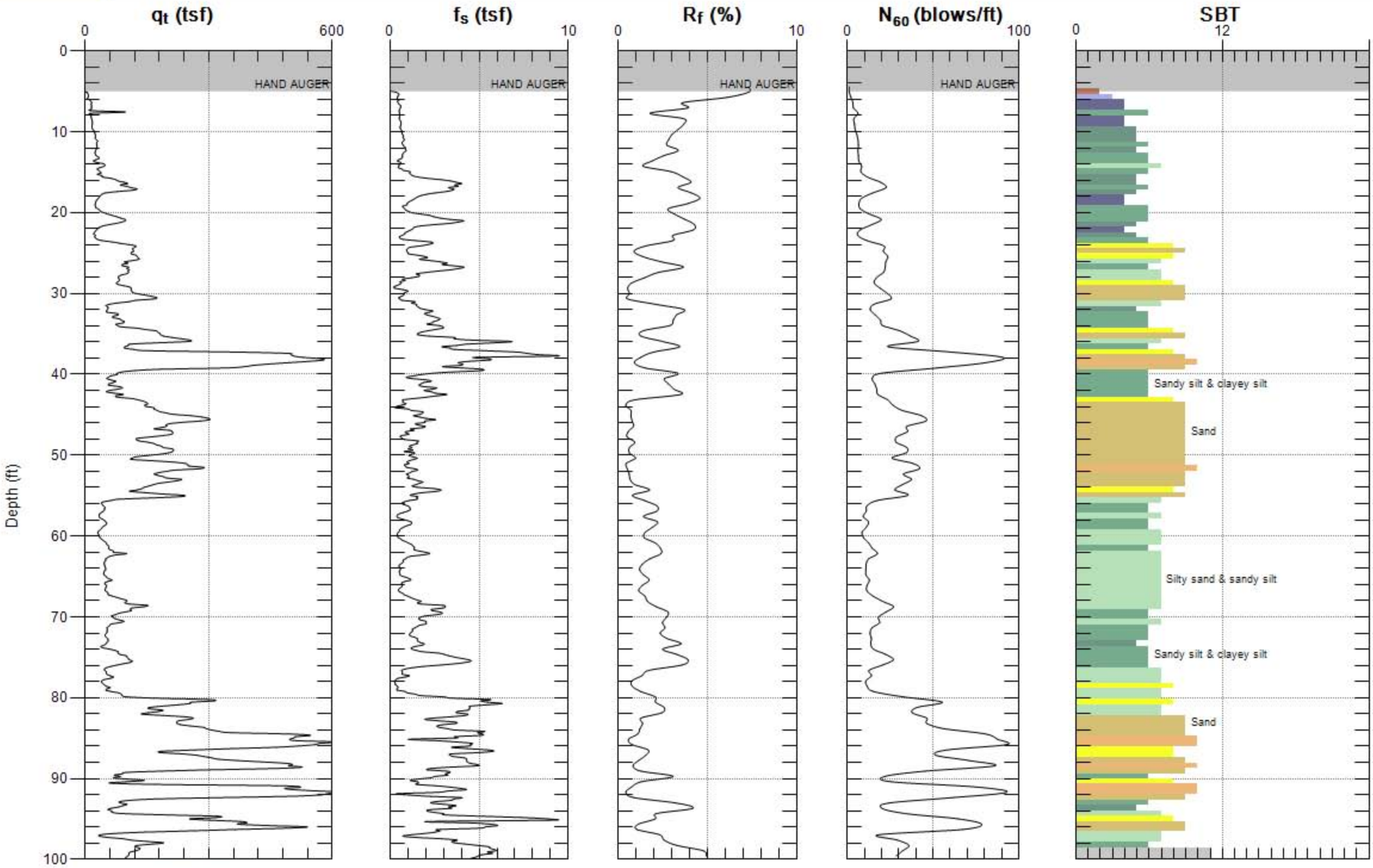
Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-04

Engineer: F.WANG
Date: 10/26/2009 03:46



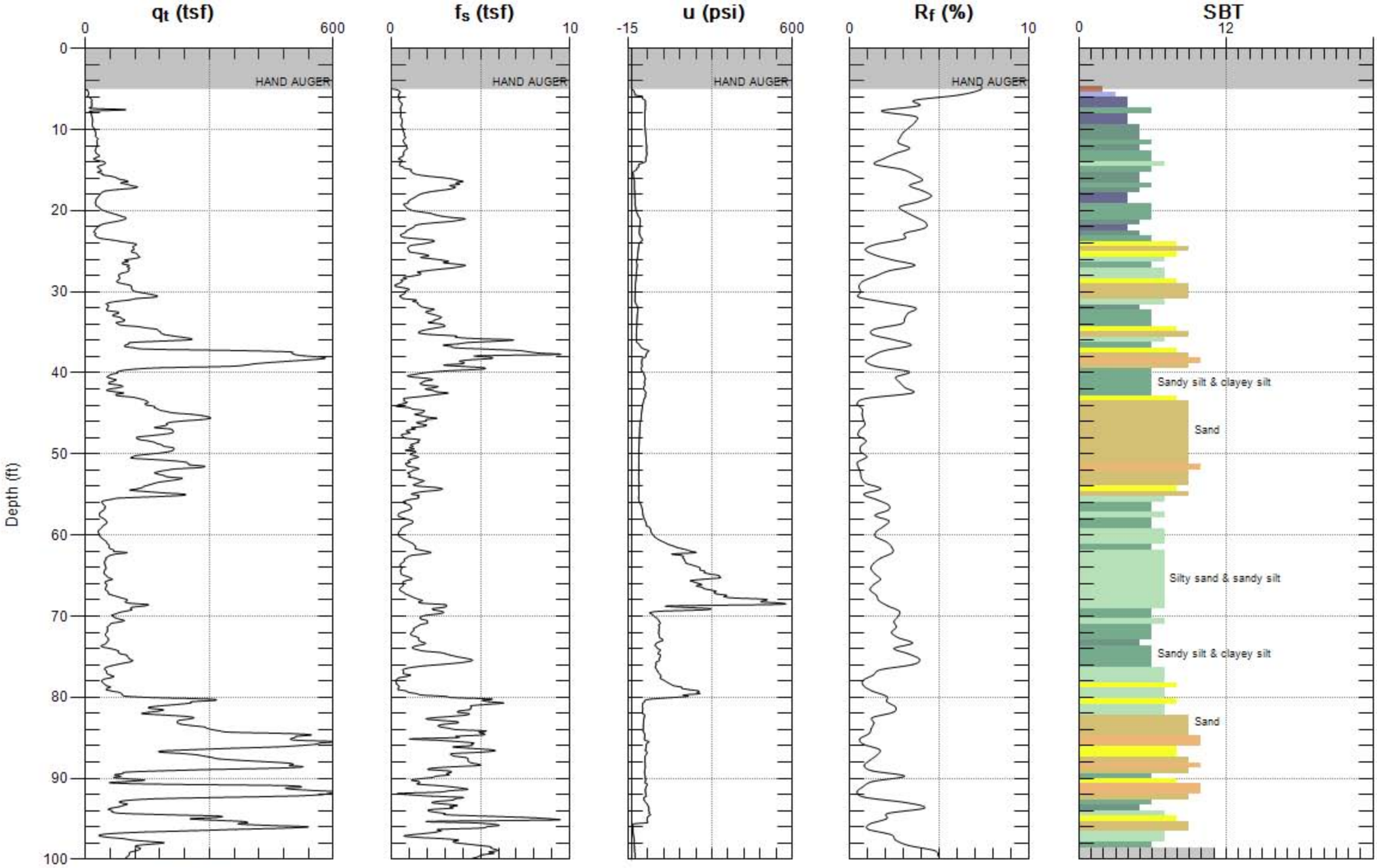
Max. Depth: 100.394 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-04

Engineer: F.WANG
Date: 10/26/2009 03:46



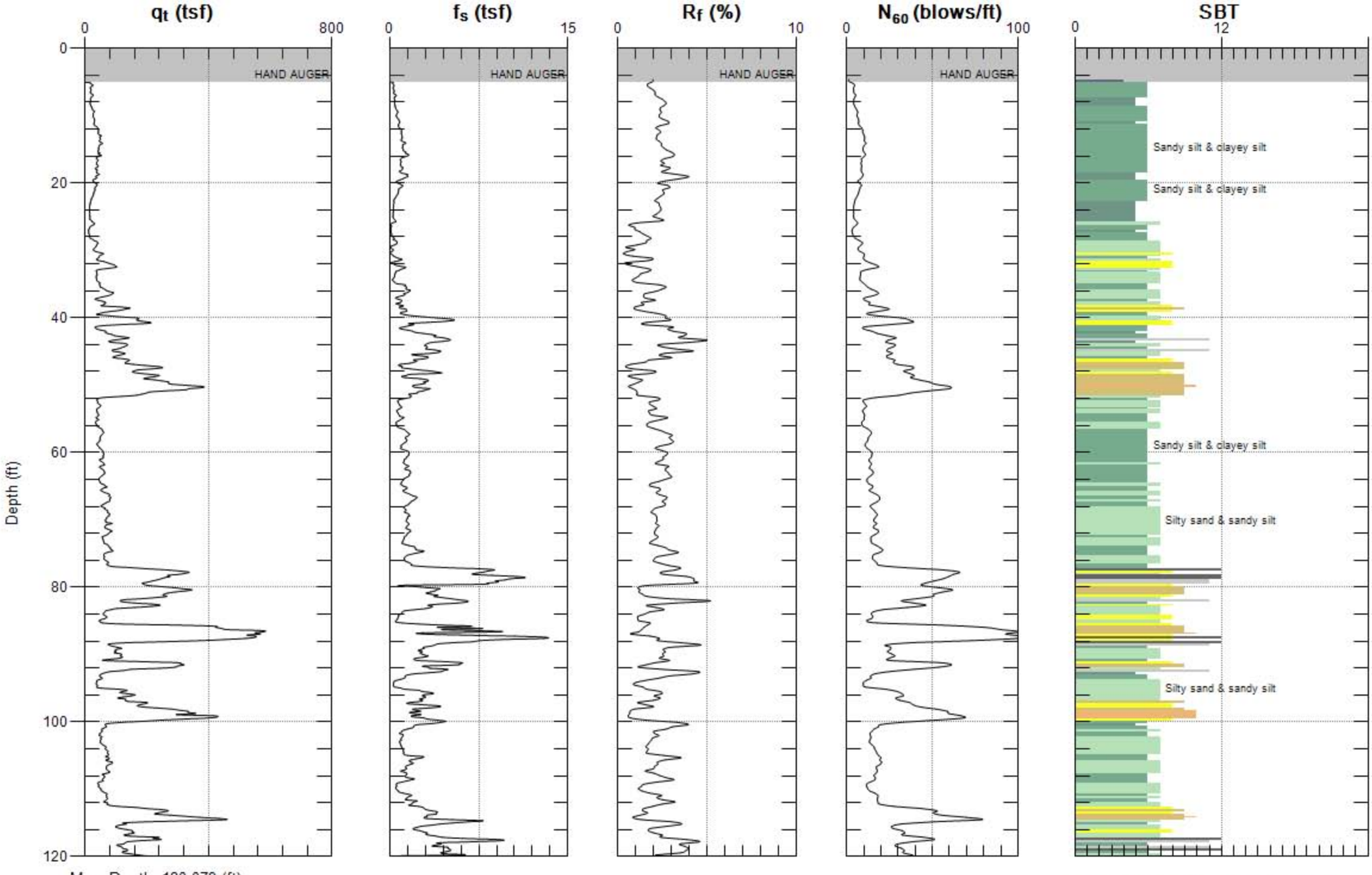
Max. Depth: 100.394 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-005A

Engineer: E.BHANGOO
Date: 2010-01-28 11:39



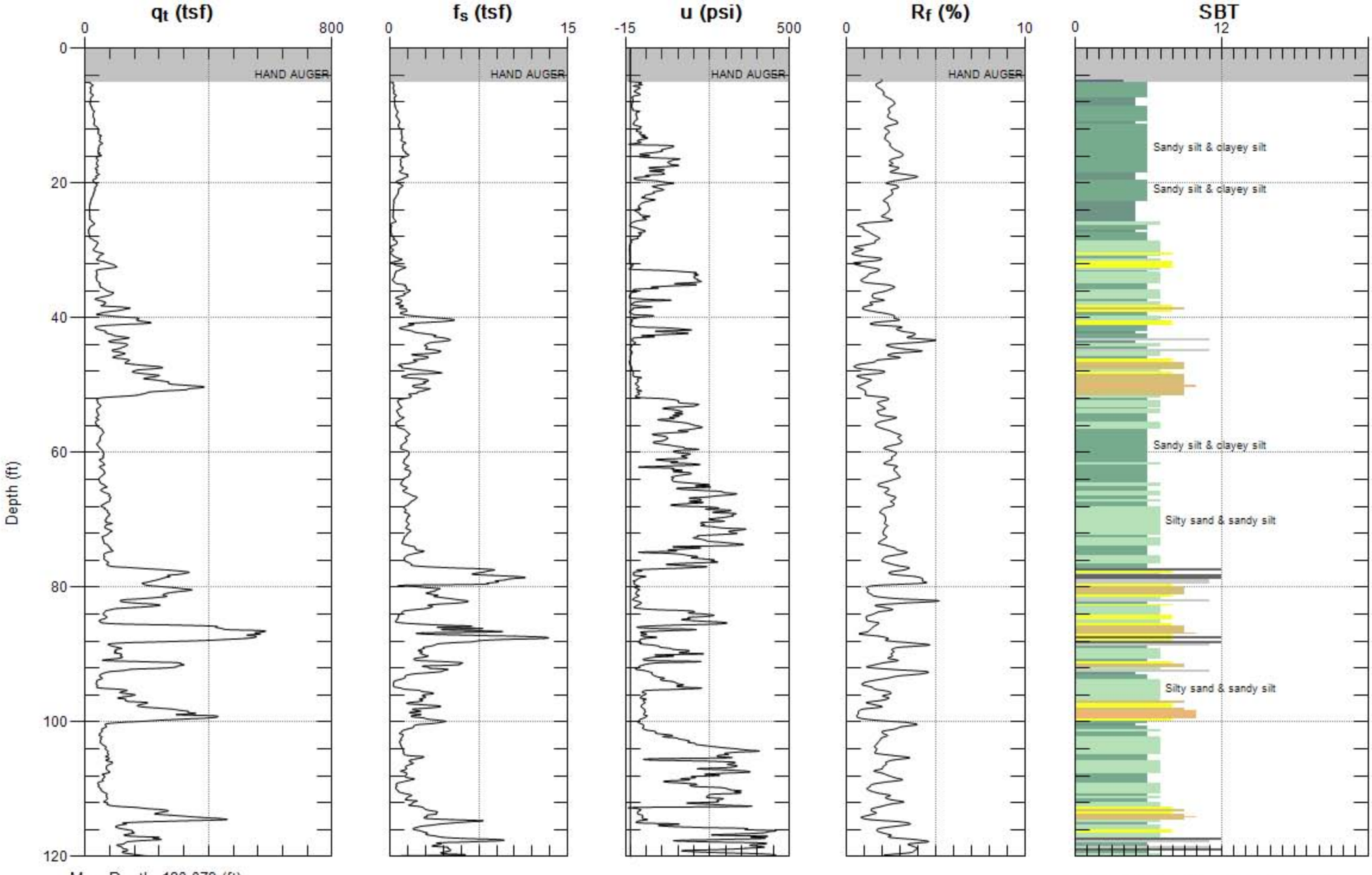
Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-005A

Engineer: E.BHANGOO
Date: 2010-01-28 11:39

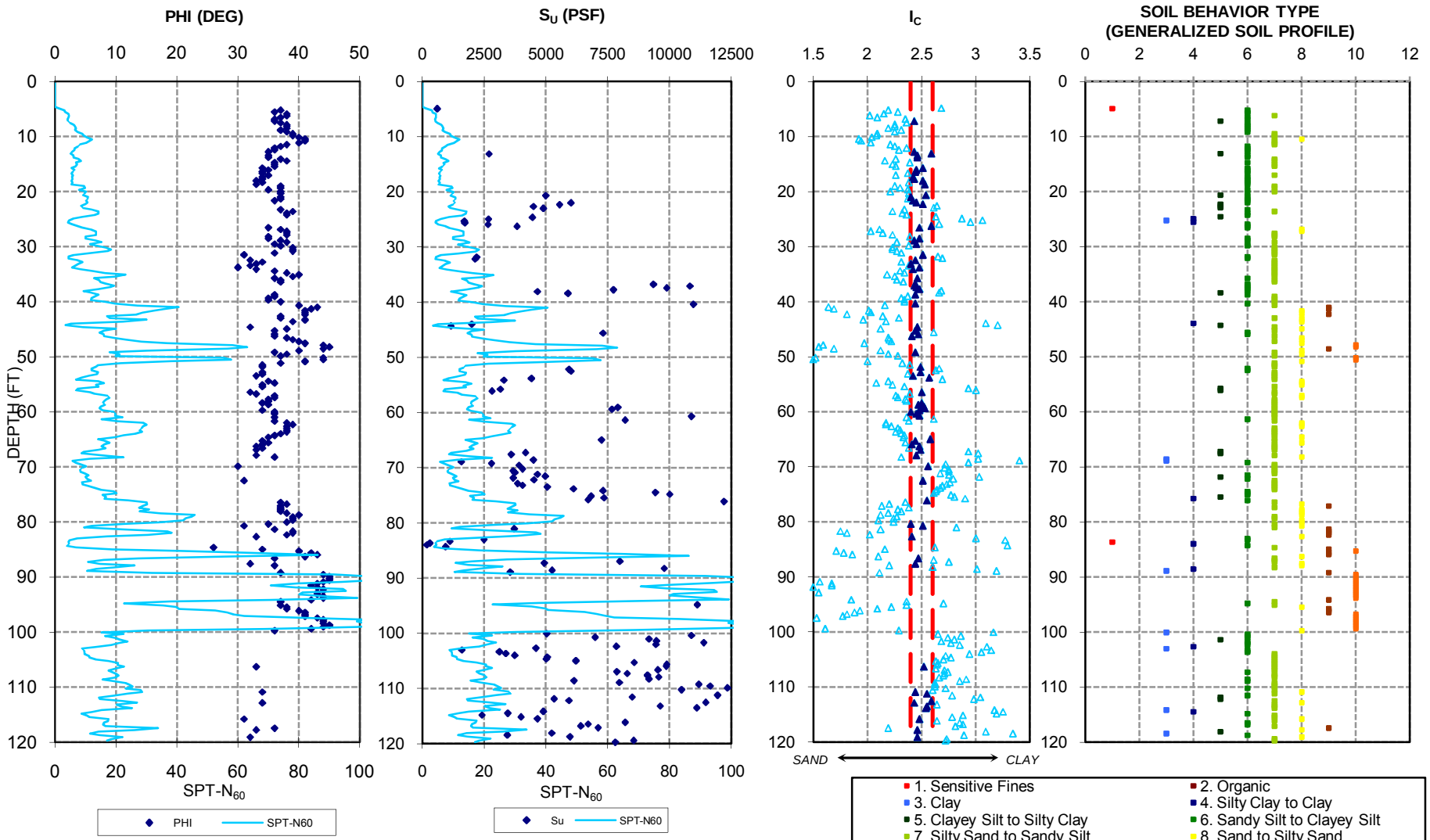


Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

CPT DATA CORRELATION

CPT-10-003A



Reference: CPT data and correlation provided by Gregg Drilling and Testing, Inc.

PARIKH

Practicing in the Geosciences

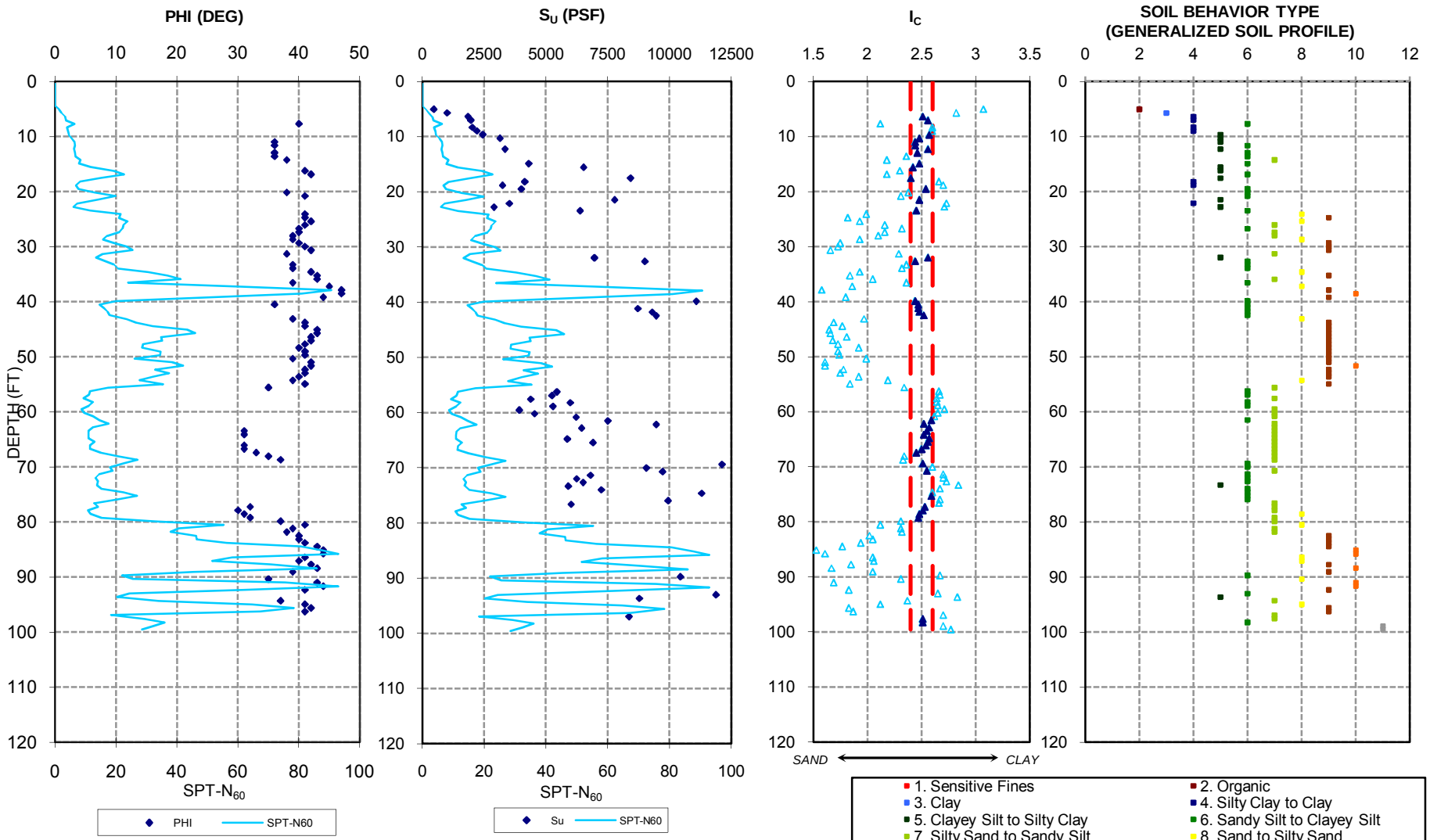
GREENVALLEY ROAD O.C.
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.: III-1

CPT DATA CORRELATION

CPT-09-004



Reference: CPT data and correlation provided by Gregg Drilling and Testing, Inc.

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Practicing in the Geosciences

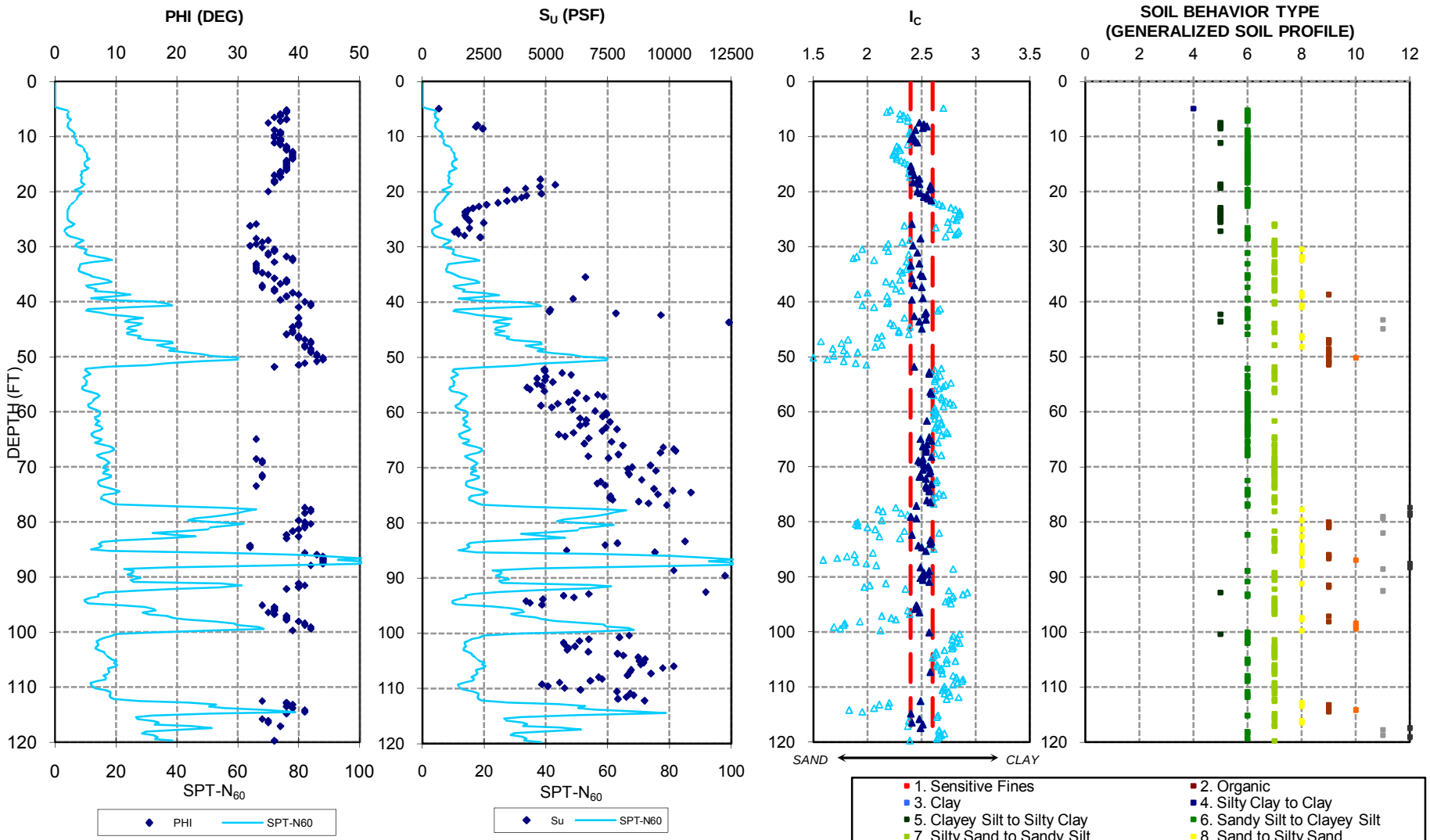
GREENVALLEY ROAD O.C.
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.: III-2

CPT DATA CORRELATION

CPT-10-005A



Reference: CPT data and correlation provided by Gregg Drilling and Testing, Inc.

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Practicing in the Geosciences

GREENVALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.: III-3

APPENDIX IV

APPENDIX IV
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System (ASTM Test Method D 2488, Visual-Manual Procedure). The classification has been verified with laboratory data as necessary. The classification tests are presented on "Log of Test Borings", Appendix II.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with California Test Method 226 (Moisture Content) and 212 (Unit Weight). This information was used to classify and correlate the soils. The results are presented on Plate IV-2A thru IV-2E.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed sample using unconfined compression machine. Unconfined compression test was performed in general accordance with California Test Method 221. The results are presented on Plate IV-2A thru IV-2E.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with California Test Method 204. The results of these tests are presented on Plate IV-3A and IV-3B, "Plasticity Chart".

Grain Size Classification

Grain size classification tests (California Test Method 202) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates IV-4A thru IV-4G, "Grain Size Distribution Curves".

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The test results are presented on Plates IV-5A thru IV-5C.

Consolidation Tests

Consolidation tests were performed on selected samples in accordance with California Test Method 219. The test resulrs are presented on the Plates IV-6A and IV-6F.

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-003	1	4.5	CL							2.0	98.9	22.9	
	2	9.5	CL				42	18	24		105.4	23.0	C. - See Plate No: IV-6A thru IV-6C
	3	14.5	SP-SC	23.8	66.4	9.8					-	36.6	
	4	19.5	SM								-	27.7	
	5	24.5	CL							1.0	86.2	35.0	
	6	29.5	SM	0.0	55.8	44.2	32	19	13	1.4	98.5	25.2	
	7	34.5	ML	0.0	49.9	50.1					96.6	27.0	
	8	39.5	SM	0.0	54.0	46.0	30	26	4		90.3	31.3	
	9	44.5	SM								-	15.6	
	10	49.5	SW-SM	16.7	72.4	10.9					-	16.8	
	11	54.5	SM	26.8	45.9	27.3					-	24.2	
	12	59.5	SM								-	18.0	
	13	69.5	ML								-	29.1	
	14	79.5	SM								-	21.0	
	15	89.5	SM								-	29.9	
	16	99.5	SM								-	18.0	

SUMMARY OF LABORATORY TEST RESULTS

GREEN VALLEY ROAD OVERCROSSING
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
Practicing in the Geosciences

Notes:
* Unified Soil Classification System
C. = Consolidation
D.S. = Direct Shear
G. = Gradation
P.I. = Plasticity Index
R. = R-Value
U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: IV-2A

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-003A	1	5.0	CL								-	-	
	2	10.0	CL								-	-	Corr. - See Plate No: IV-5A
	3	13.0	SM	0.9	80.1	19.0					-	27.5	
	4	16.0	SM								-	-	
	5	20.0	SM								-	-	
	6	25.0	ML	0.0	34.7	65.3	37	27	10		-	36.2	
	7	30.0	SM								-	-	
	8	35.0	SM	7.3	43.8	48.9	33	28	5		-	28.8	
	9	38.0	SM								-	-	
	10	41.0	SM								-	-	
	11	44.0	SM								-	-	
	12	47.0	SM								-	-	
	13	50.0	ML				49	29	20		-	42.6	
	14	53.0	ML	0.3	10.8	88.9					-	37.4	
	15	56.0	CL	0.0	13.5	86.5	41	23	18		-	25.8	
	16	59.0	CL								-	-	
	17	62.0	CL								-	-	
	18	65.0	ML	0.0	29.7	70.3	37	30	7		-	33.7	
	19	68.0	ML								-	-	
	20	71.0	ML								-	-	
	21	74.0	SM	0.0	56.8	43.2					-	33.0	
	22	77.0	SM								-	-	
	23	80.0	SM								-	-	

SUMMARY OF LABORATORY TEST RESULTS

GREEN VALLEY ROAD OVERCROSSING
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
Practicing in the Geosciences

Notes:
* Unified Soil Classification System
C. = Consolidation
D.S. = Direct Shear
G. = Gradation
P.I. = Plasticity Index
R. = R-Value
U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: IV-2B

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-004A	1	6.0	CL								-	20.9	
	2	11.0	CL				32	20	12		-	22.5	Corr. - See Plate No: IV-5B
	3	14.0	CL								-	32.1	
	4	17.0	CL								-	33.1	
	5	21.0	ML			66.2	46	28	18		-	32.4	
	6	26.0	CL								-	31.0	
	7	31.0	SM	5.9	77.7	16.4					-	29.6	
	8	36.0	CL								-	32.6	
	9	39.0	SM								-	16.9	
	10	42.0	SM			25.6					-	28.9	
	11	45.0	SC	3.4	78.2	18.4					-	31.9	
	12	48.0	SP	33.1	64.7	2.3					-	18.8	
	13	51.0	CL								-	37.8	
	14	56.0	ML				41	30	11		-	37.7	
	15	61.0	CL								-	30.6	
	16	66.0	SM	0.4	68.8	30.8	29	25	4		-	28.8	
	17	71.0	CL								-	34.5	
	18	76.0	ML				40	31	9		-	41.2	
	19	101.0	ML				31	23	8		-	22.2	
	20	121.0	CL								-	36.7	
	21	141.0	CL								-	28.2	
	22	161.0	CL								-	20.8	

SUMMARY OF LABORATORY TEST RESULTS

GREEN VALLEY ROAD OVERCROSSING
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
Practicing in the Geosciences

Notes:
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U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: IV-2C

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-005	1	4.5	CL							3.0	96.8	24.6	Corr. - See Plate No.: IV-5C
	2	9.5	SC	0.0	52.2	47.8	41	17	24	3.2	100.4	24.4	
	3	14.5	SM	0.0	72.2	27.8	28	23	5		99.8	22.2	
	4	19.5	SC								95.7	27.6	
	5	24.5	SC	0.0	56.5	43.5	45	20	25		93.2	29.7	
	6	29.5	SM	0.0	65.0	35.0					95.6	27.7	
	7	34.5	ML	0.1	25.1	74.8					-	15.4	
	8	39.5	SM								-	14.5	
	9	44.5	SM								93.1	29.7	
	10	49.5	SM								-	12.6	
	11	54.5	ML				32	24	8		-	31.1	
	12	59.5	ML								92.7	29.7	
	13	69.5	ML	6.8	77.4	15.9					89.3	29.5	
	14	79.5	ML								105.5	19.8	
	15	89.5	SM								-	16.0	
	16	99.5	ML								-	29.7	

SUMMARY OF LABORATORY TEST RESULTS

GREEN VALLEY ROAD OVERCROSSING
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
Practicing in the Geosciences

Notes:
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C. = Consolidation
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G. = Gradation
P.I. = Plasticity Index
R. = R-Value
U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: IV-2D

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-130	1	6.0	CL								104.1	22.5	
	2	9.5	CH				58	18	40		97.0	26.7	C. - See Plate No.: IV-6D thru IV-6F
	3	14.5	CL								105.0	21.6	
	4	19.5	CL				47	21	26	2.6	91.9	28.8	
	5	24.5	CL								91.2	31.1	
	6	29.5	SM	0.3	50.9	48.8					86.2	34.6	
	7	34.5	SM								90.7	29.2	
	8	39.5	SM								-	15.8	
	9	44.5	SM								-	10.9	
	10	49.5	SM	2.6	70.1	27.3					-	14.7	
	11	54.5	SM								-	17.1	
	12	59.5	ML								-	31.5	

SUMMARY OF LABORATORY TEST RESULTS

GREEN VALLEY ROAD OVERCROSSING
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
Practicing in the Geosciences

Notes:
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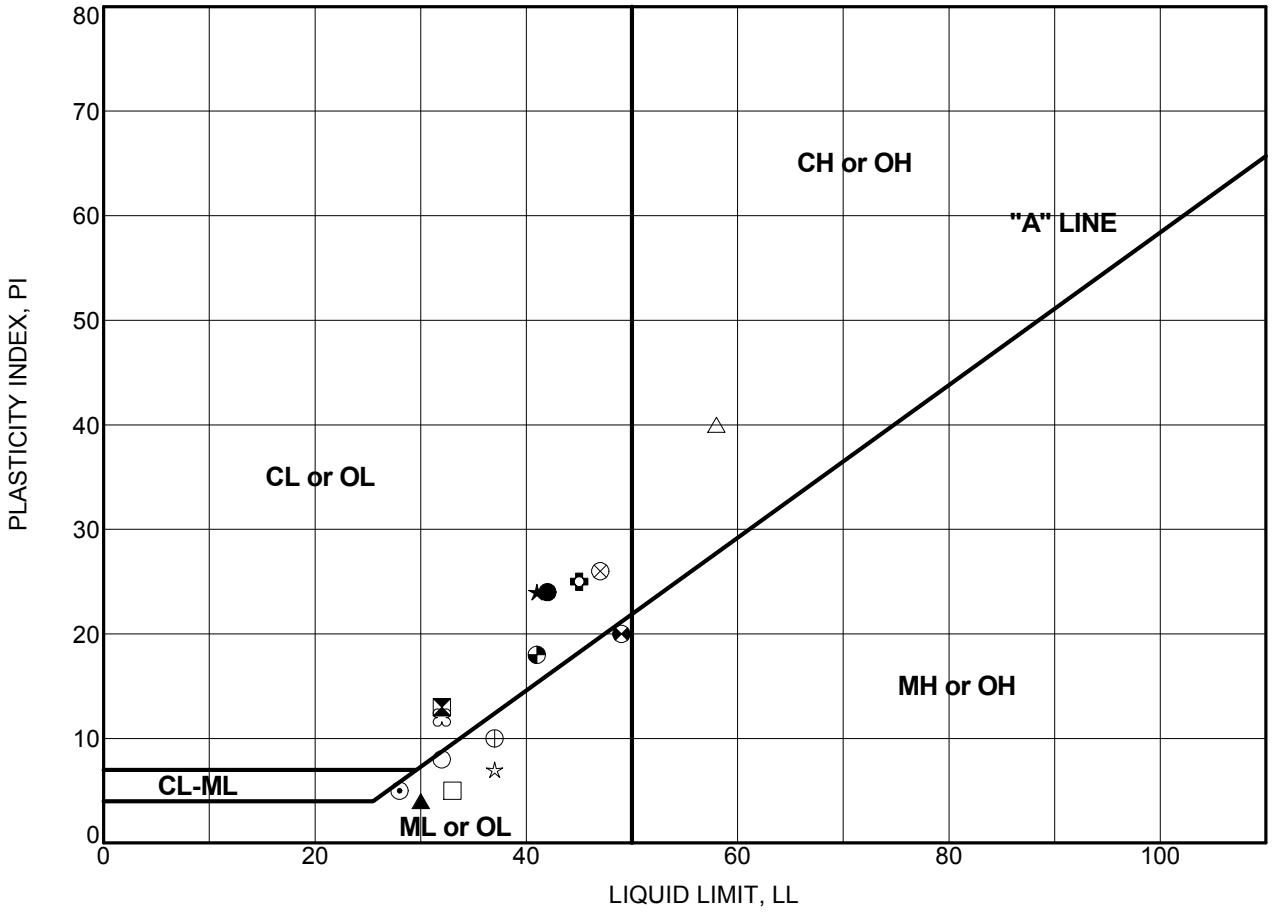
P.I. = Plasticity Index
R. = R-Value
U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: IV-2E



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-003	MC-2	9.5	●	23	42	18	24	LEAN CLAY WITH SAND (CL)
A-09-003	MC-6	29.5	⧗	25	32	19	13	SILTY SAND (SM)
A-09-003	MC-8	39.5	▲	31	30	26	4	SILTY SAND (SM)
A-09-005	MC-2	9.5	★	24	41	17	24	CLAYEY SAND (SC)
A-09-005	MC-3	14.5	⊙	22	28	23	5	SILTY SAND (SM)
A-09-005	MC-5	24.5	✿	30	45	20	25	CLAYEY SAND (SC)
A-09-005	MC-11	54.5	○	31	32	24	8	SANDY SILT (ML)
A-09-130	MC-2	9.5	△	27	58	18	40	FAT CLAY (CH)
A-09-130	MC-4	19.5	⊗	29	47	21	26	LEAN CLAY (CL)
R-10-003A	SPT-6	25.0	⊕	36	37	27	10	SANDY SILT (ML)
R-10-003A	SPT-8	35.0	□	29	33	28	5	SILTY SAND (SM)
R-10-003A	SPT-13	50.0	⊠	43	49	29	20	SILT (ML)
R-10-003A	SPT-15	56.0	◕	26	41	23	18	LEAN CLAY (CL)
R-10-003A	SPT-18	65.0	☆	34	37	30	7	SILT WITH SAND (ML)
R-10-004A	SPT-2	11.0	⌘	23	32	20	12	LEAN CLAY WITH SAND (CL)

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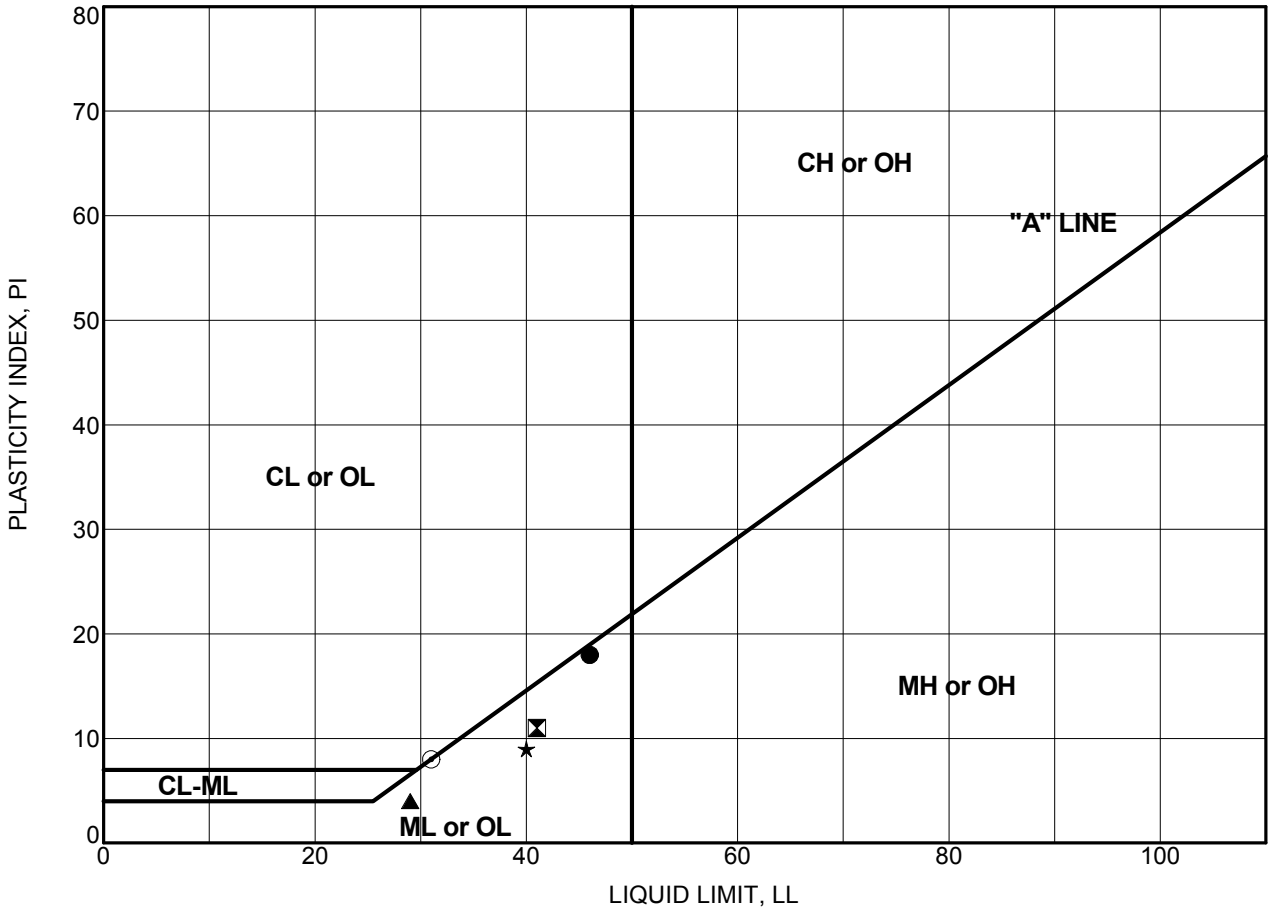
MATERIALS ENGINEERING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR | PLATE NO: IV-3A



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
R-10-004A	SPT-5	21.0	●	32	46	28	18	SANDY SILT (ML)
R-10-004A	SPT-14	56.0	⧗	38	41	30	11	SILT (ML)
R-10-004A	SPT-16	66.0	▲	29	29	25	4	SILTY SAND (SM)
R-10-004A	SPT-18	76.0	★	41	40	31	9	SILT (ML)
R-10-004A	SPT-19	101.0	⊙	22	31	23	8	SILT (ML)

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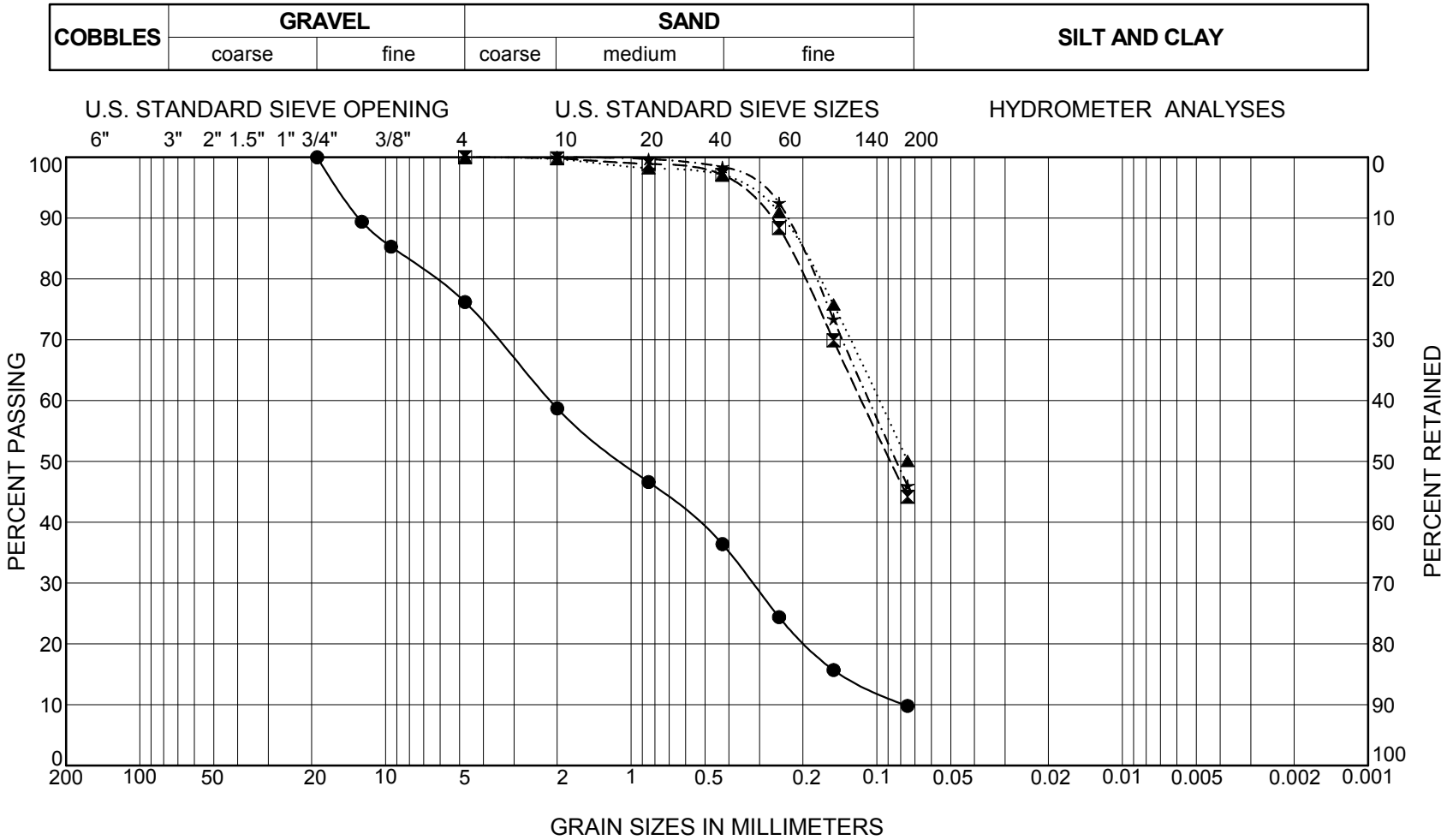
MATERIALS ENGINEERING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: IV-3B

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-003	MC-3	14.5	●			POORLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC)
A-09-003	MC-6	29.5	⧗	32	13	SILTY SAND (SM)
A-09-003	MC-7	34.5	▲			SANDY SILT (ML)
A-09-003	MC-8	39.5	★	30	4	SILTY SAND (SM)

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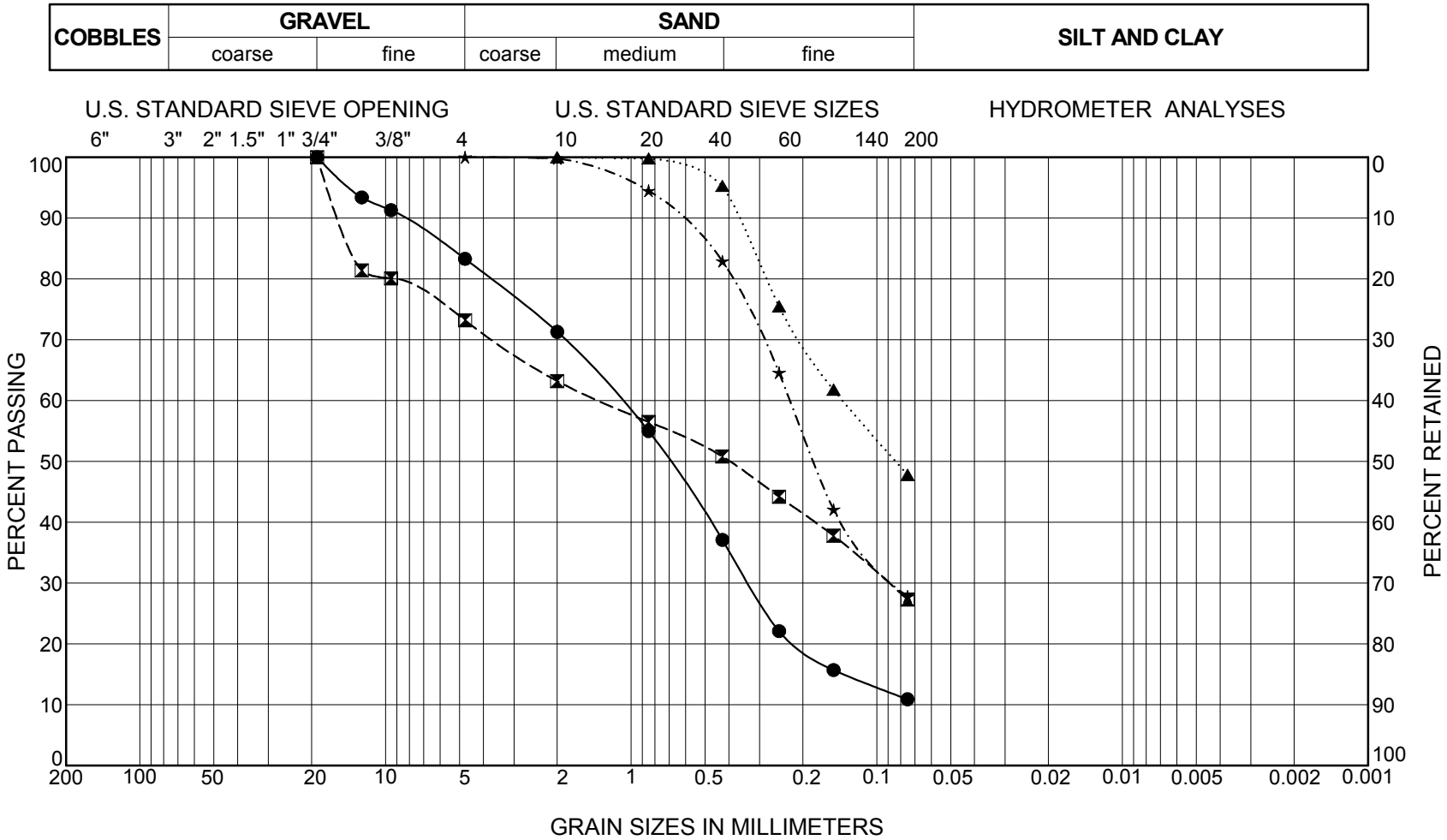
MATERIALS ENGINEERING

JOB NO: 2009-130-GDR

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

PLATE NO: IV-4A

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-003	MC-10	49.5	●			WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)
A-09-003	MC-11	54.5	⧓			SILTY SAND WITH GRAVEL (SM)
A-09-005	MC-2	9.5	▲	41	24	CLAYEY SAND (SC)
A-09-005	MC-3	14.5	★	28	5	SILTY SAND (SM)

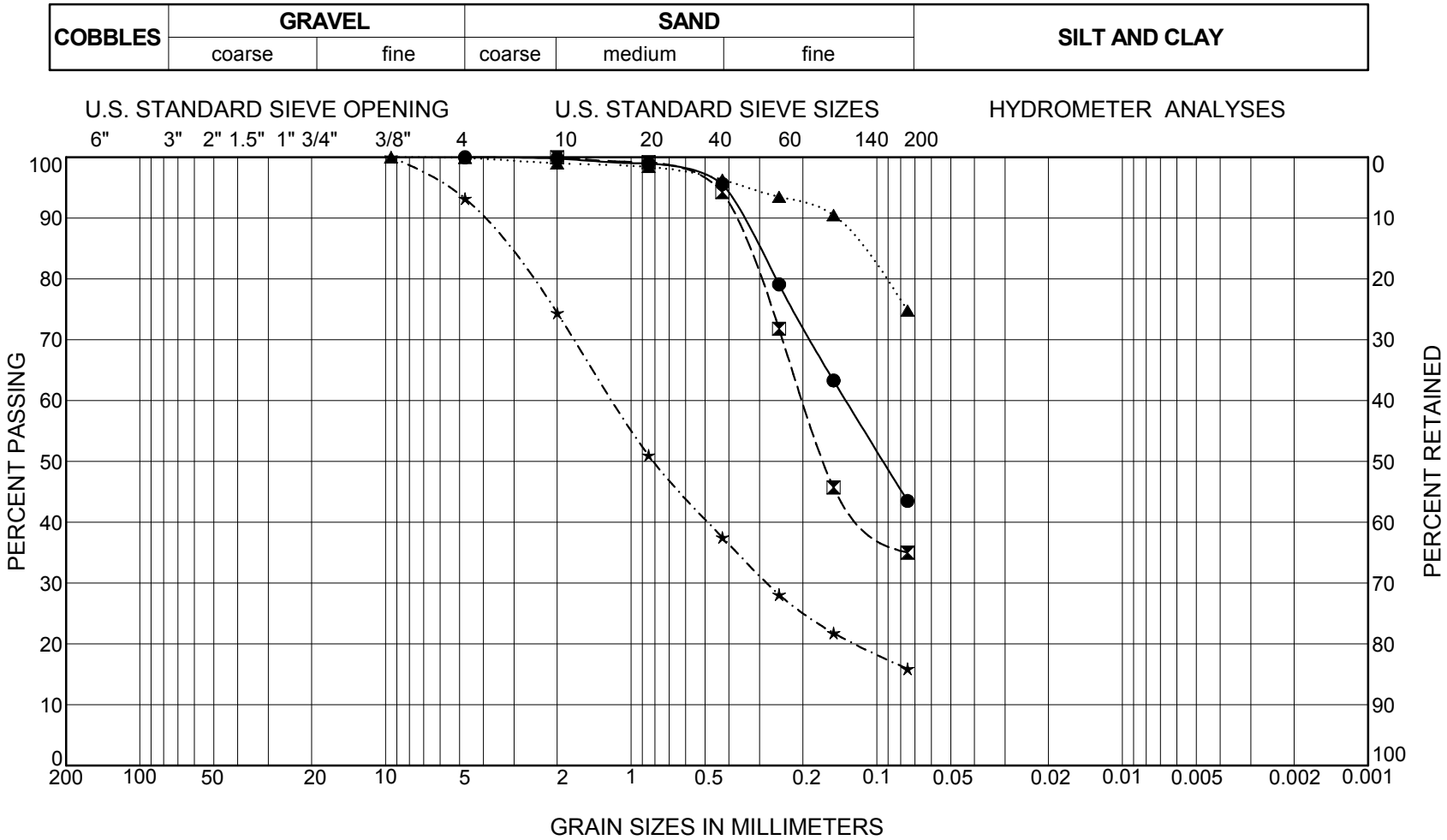
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: IV-4B

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-005	MC-5	24.5	●	45	25	CLAYEY SAND (SC)
A-09-005	MC-6	29.5	⊠			SILTY SAND (SM)
A-09-005	MC-7	34.5	▲			SILT WITH SAND (ML)
A-09-005	MC-13	69.5	★			SILTY SAND (SM)

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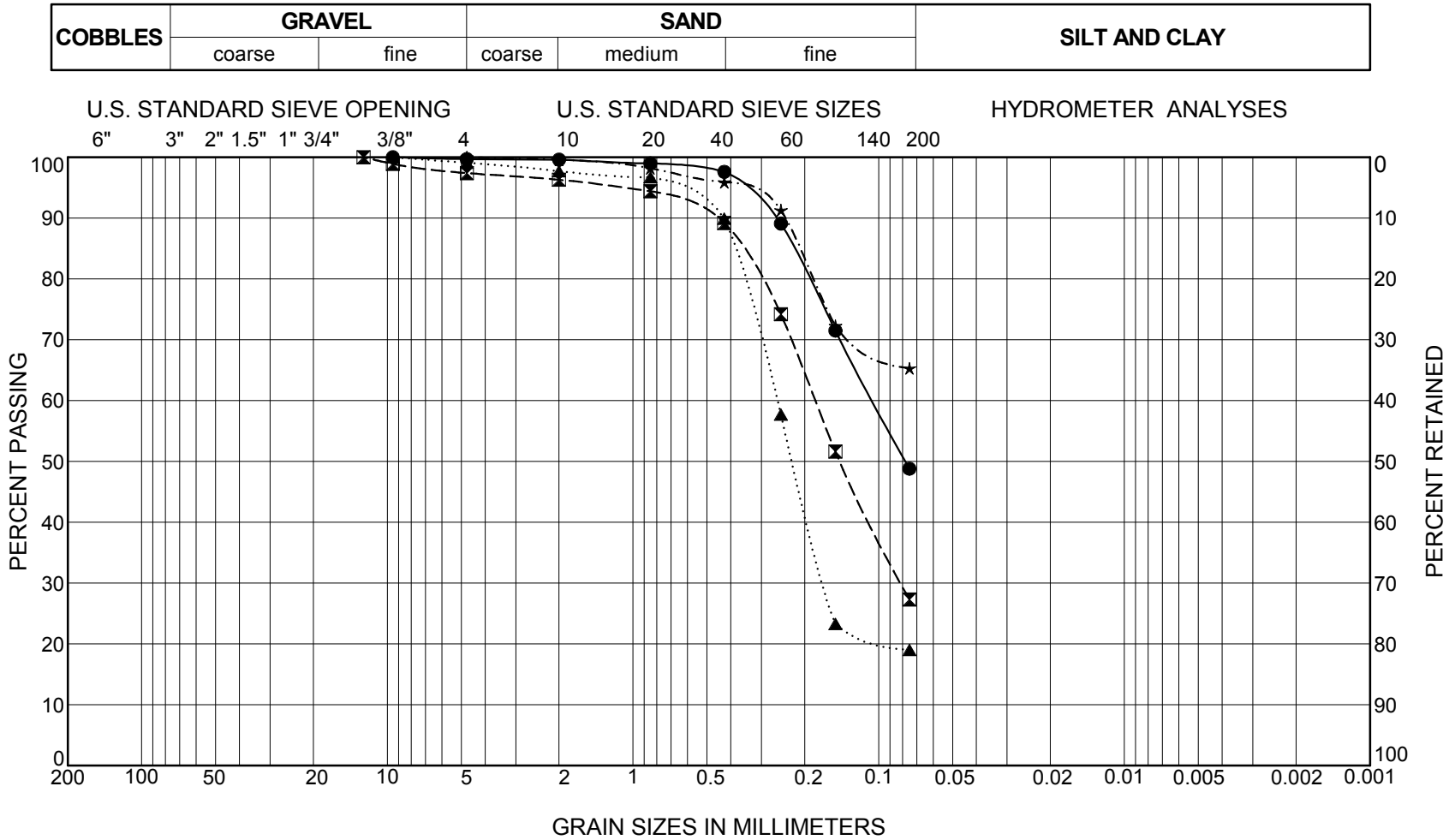
MATERIALS ENGINEERING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: IV-4C

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-130	MC-6	29.5	●			SILTY SAND (SM)
A-09-130	SPT-10	49.5	⊠			SILTY SAND (SM)
R-10-003A	SPT-3	13.0	▲			SILTY SAND (SM)
R-10-003A	SPT-6	25.0	★	37	10	SANDY SILT (ML)

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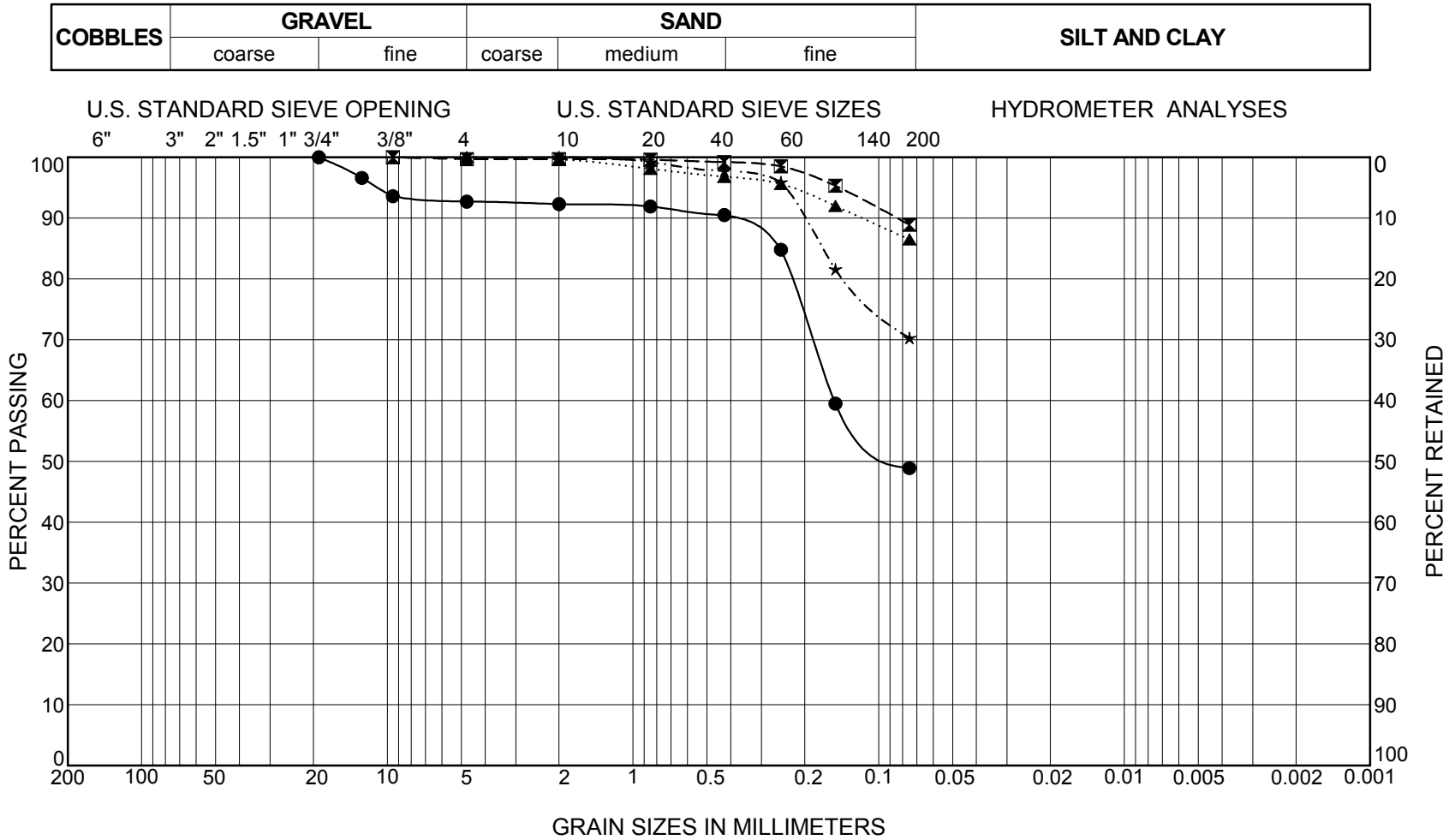
MATERIALS ENGINEERING

JOB NO: 2009-130-GDR

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

PLATE NO: IV-4D

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-003A	SPT-8	35.0	●	33	5	SILTY SAND (SM)
R-10-003A	SPT-14	53.0	⧓			SILT (ML)
R-10-003A	SPT-15	56.0	▲	41	18	LEAN CLAY (CL)
R-10-003A	SPT-18	65.0	★	37	7	SILT WITH SAND (ML)

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MATERIALS ENGINEERING

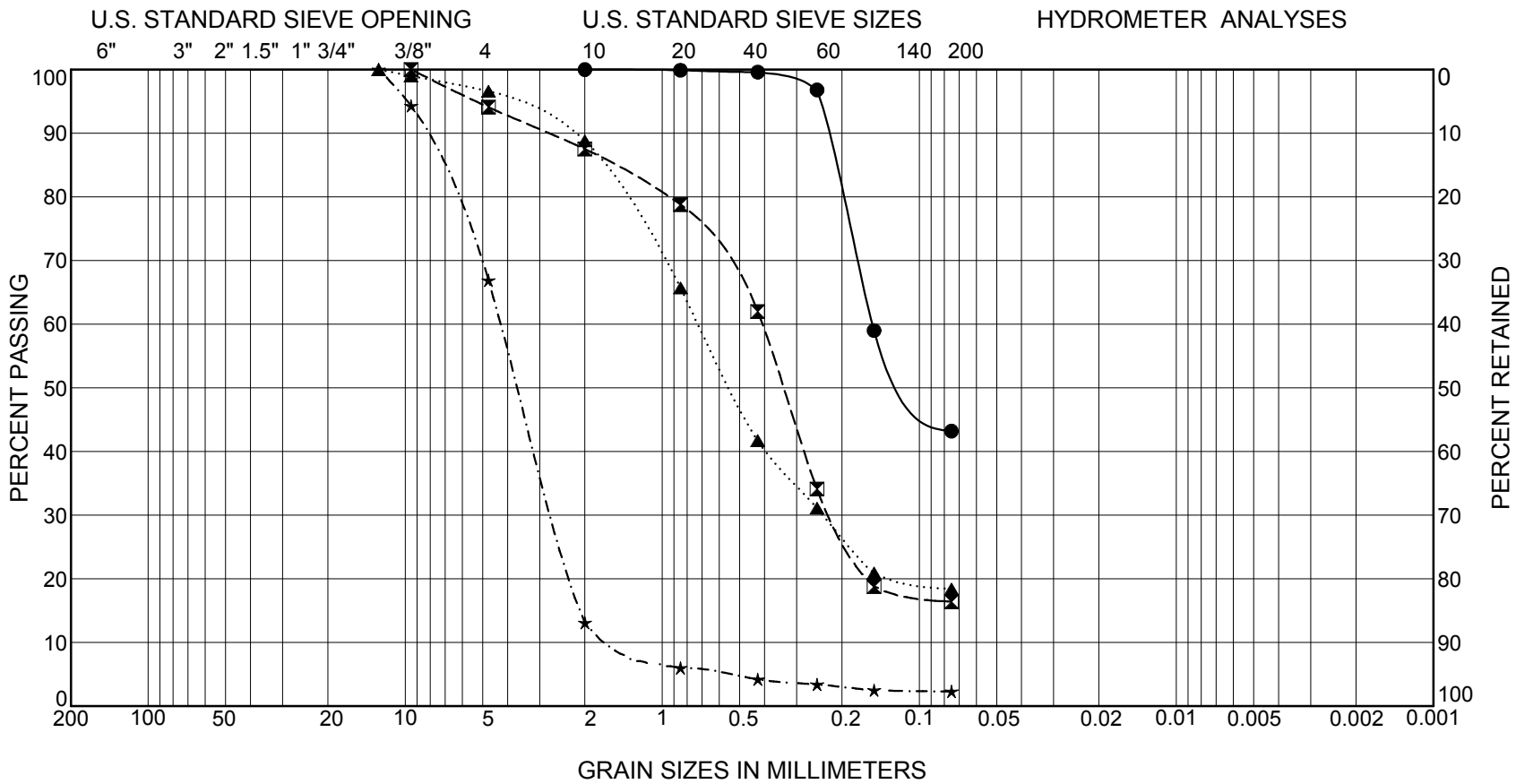
JOB NO: 2009-130-GDR

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

PLATE NO: IV-4E

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-003A	SPT-21	74.0	●			SILTY SAND (SM)
R-10-004A	SPT-7	31.0	⊠			SILTY SAND (SM)
R-10-004A	SPT-11	45.0	▲			CLAYEY SAND (SC)
R-10-004A	SPT-12	48.0	★			POORLY-GRADED SAND WITH GRAVEL (SP)

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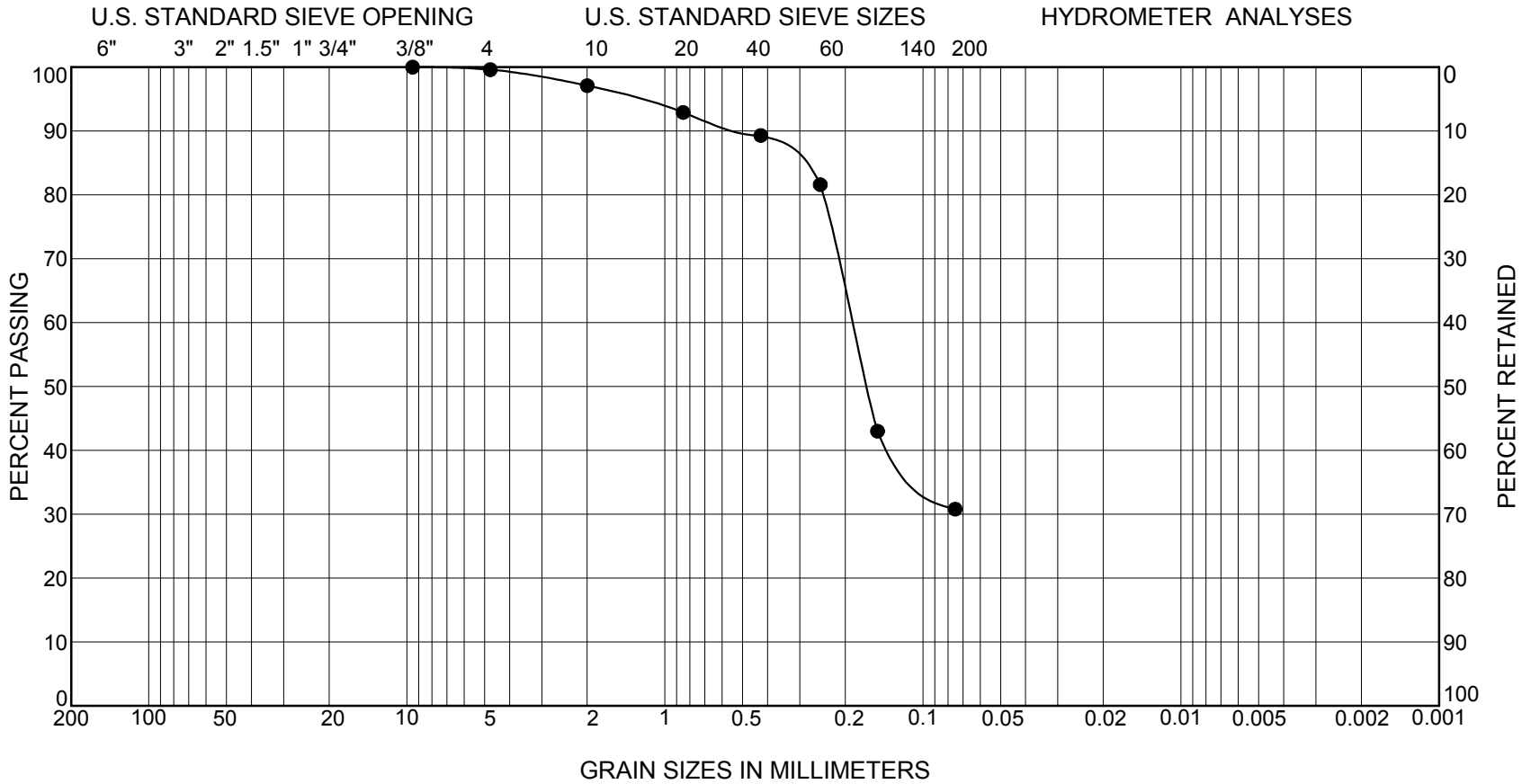
GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: IV-4F

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-004A	SPT-16	66.0	●	29	4	SILTY SAND (SM)

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GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: IV-4G

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 06/11/2010
Date Submitted 06/07/2010

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR/80-680-12 Site ID : R-10-003A #2 @ 10'.
Thank you for your business.

* For future reference to this analysis please use SUN # 58040-117809.

EVALUATION FOR SOIL CORROSION

Soil pH	7.90	
Minimum Resistivity	1.55 ohm-cm (x1000)	
Chloride	98.8 ppm	00.00988 %
Sulfate	50.1 ppm	00.00501 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 05/26/2010
Date Submitted 05/21/2010

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR/80-680-12 Site ID R-10-004A#2 @ 11'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57970-117674.

EVALUATION FOR SOIL CORROSION

Soil pH	8.37		
Minimum Resistivity	1.66 ohm-cm (x1000)		
Chloride	102.2 ppm	00.01022	%
Sulfate	64.1 ppm	00.00641	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID :A-09-005#1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115376.

EVALUATION FOR SOIL CORROSION

Soil pH	8.67		
Minimum Resistivity	0.19 ohm-cm (x1000)		
Chloride	2114.8 ppm	00.21148	%
Sulfate	142.3 ppm	00.01423	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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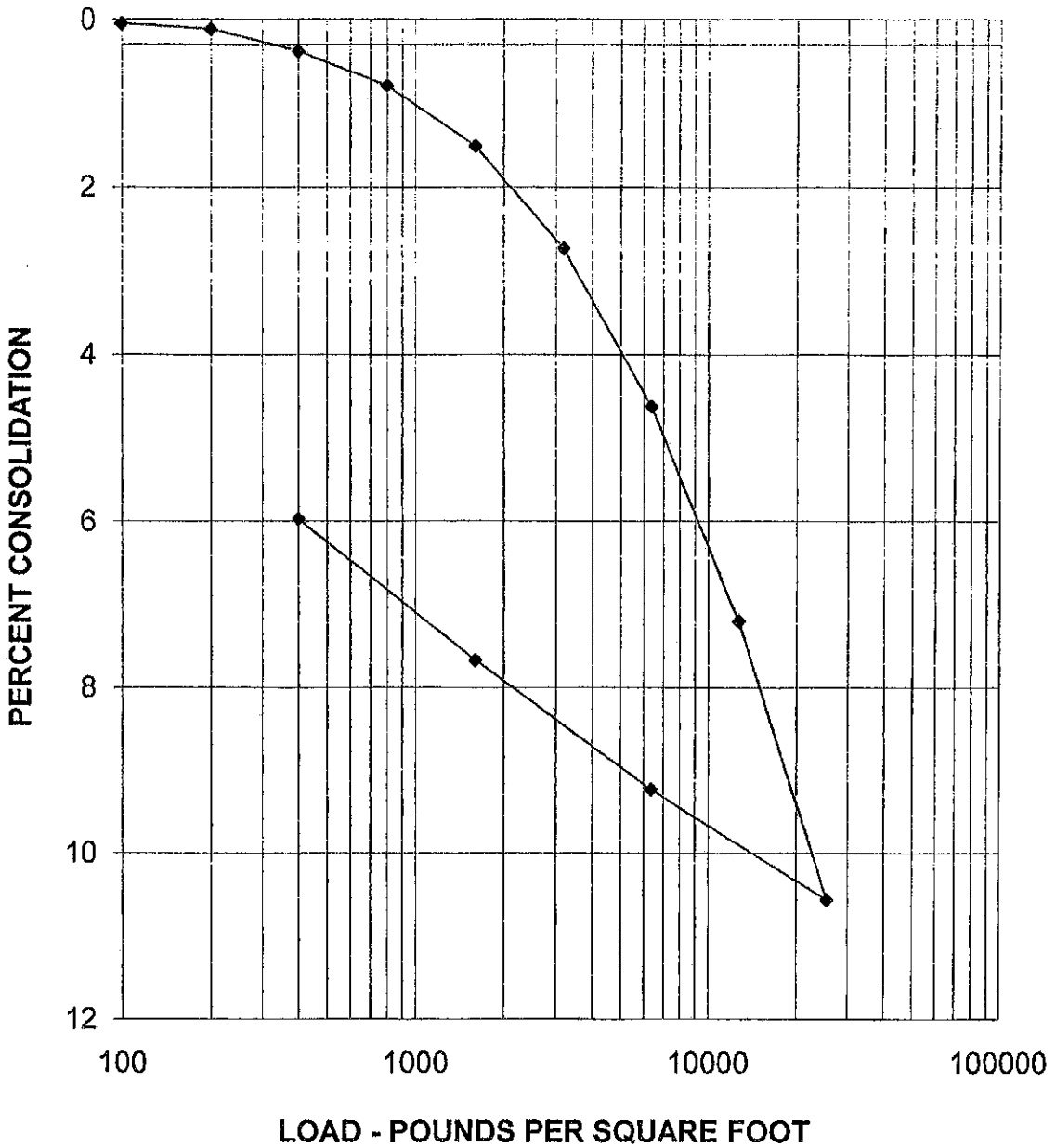
By

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	23.0	105.4	1.0000	2.416
FINAL	20.6	112.1	0.9403	2.416

BORING NO.	B003	SAMPLE NO.	2	ELEV. OR DEPTH	9.5'
DESCRIPTION	Lean clay, Reddish/grayish brown				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/18/2009	209130.GDR

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

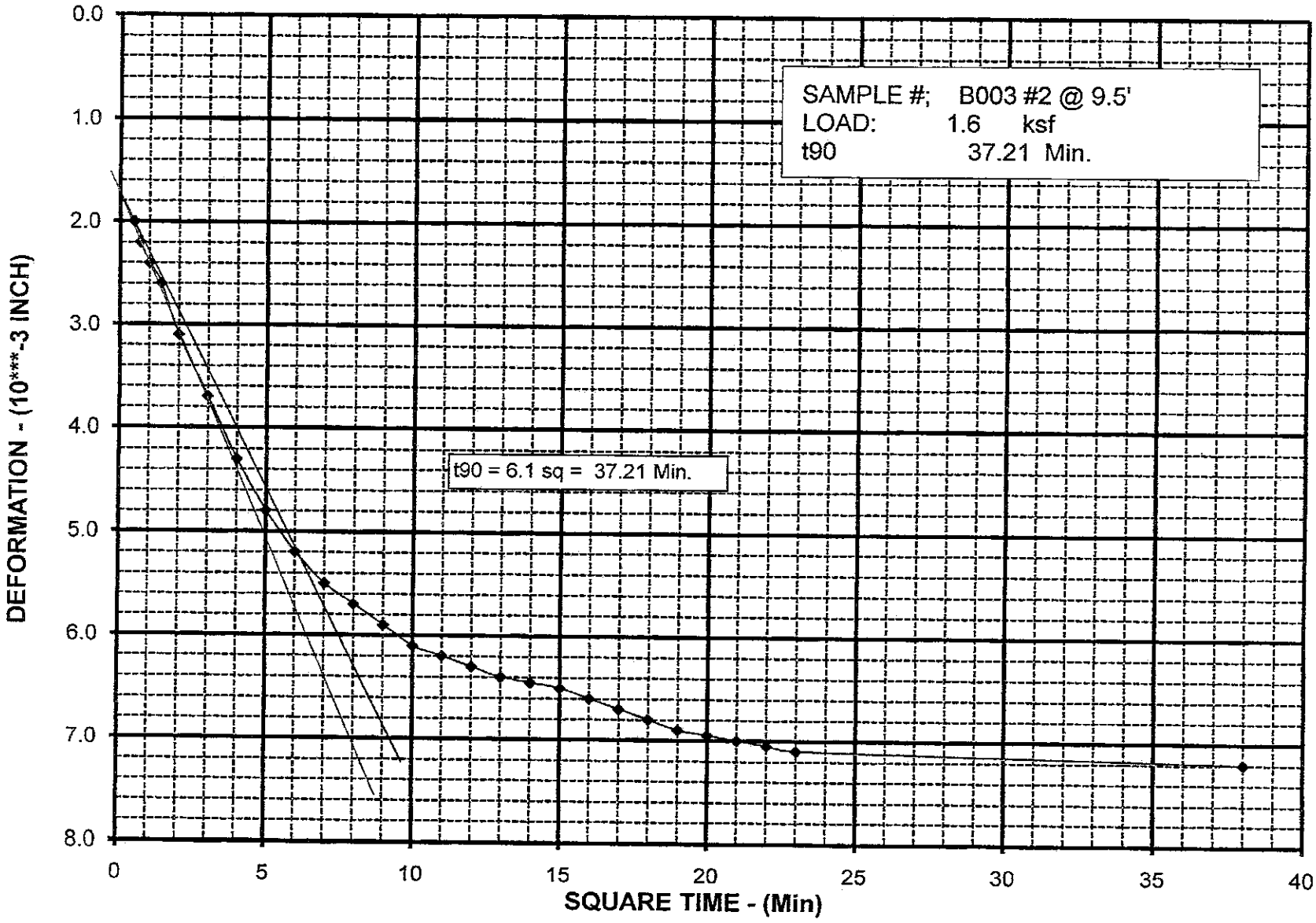


PLATE NO. IV-6B

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

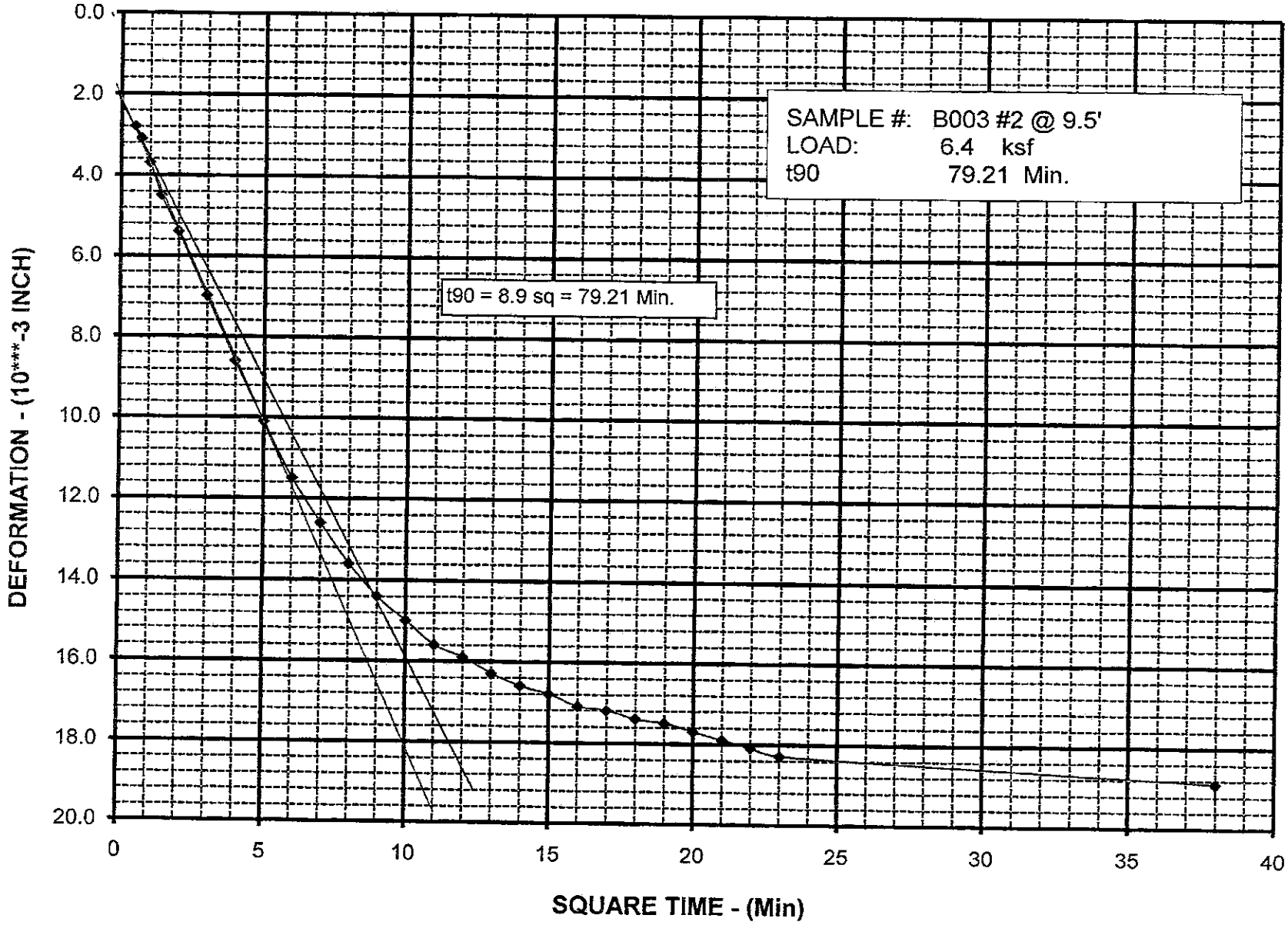
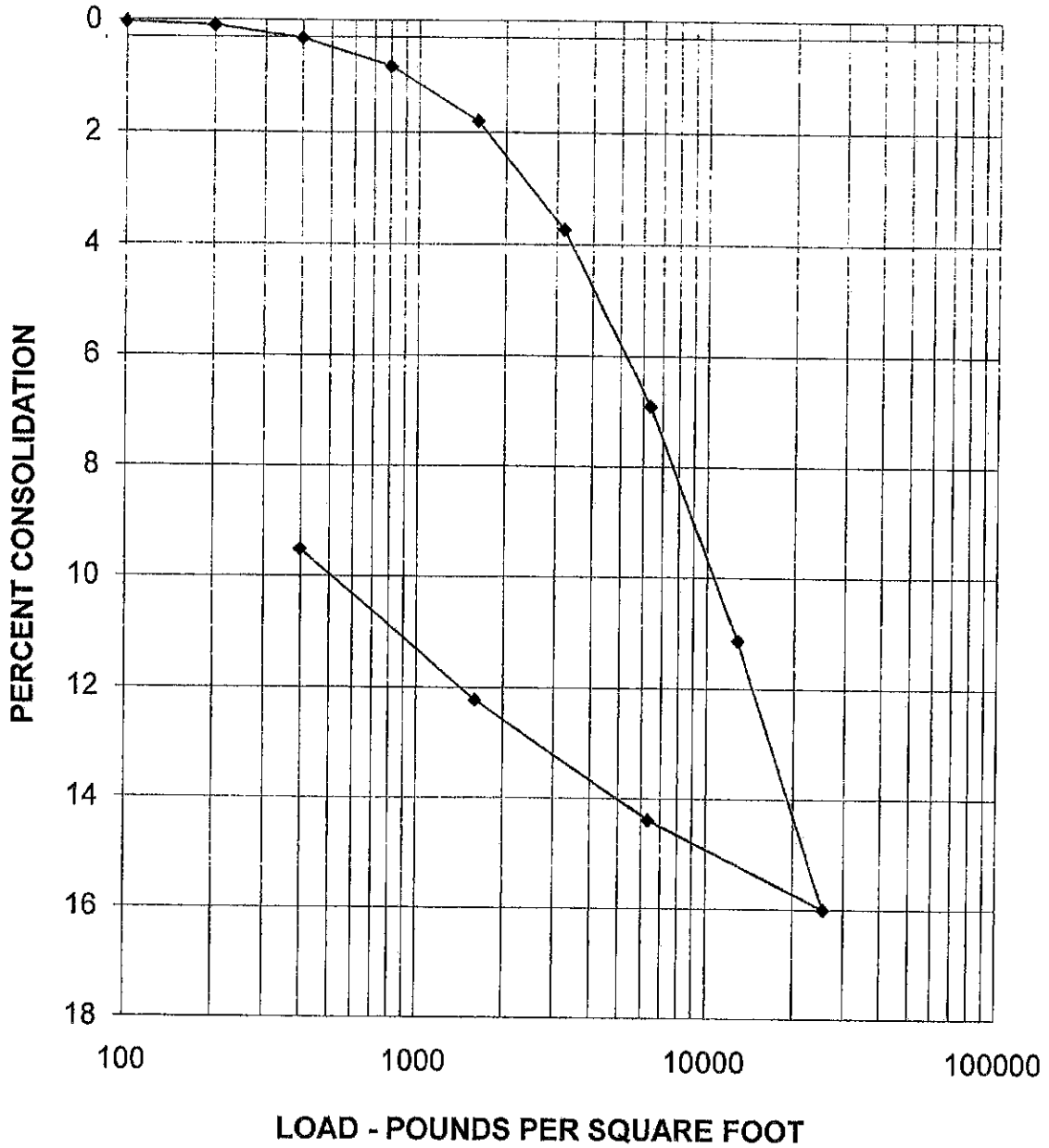


PLATE NO. IV-6C

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	26.7	97.0	1.0000	2.416
FINAL	23.2	107.1	0.9049	2.416

BORING NO.	B130	SAMPLE NO.	2	ELEV. OR DEPTH	9.5'
DESCRIPTION	Fat clay, dark gray				

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/18/2009	209130.GDR

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

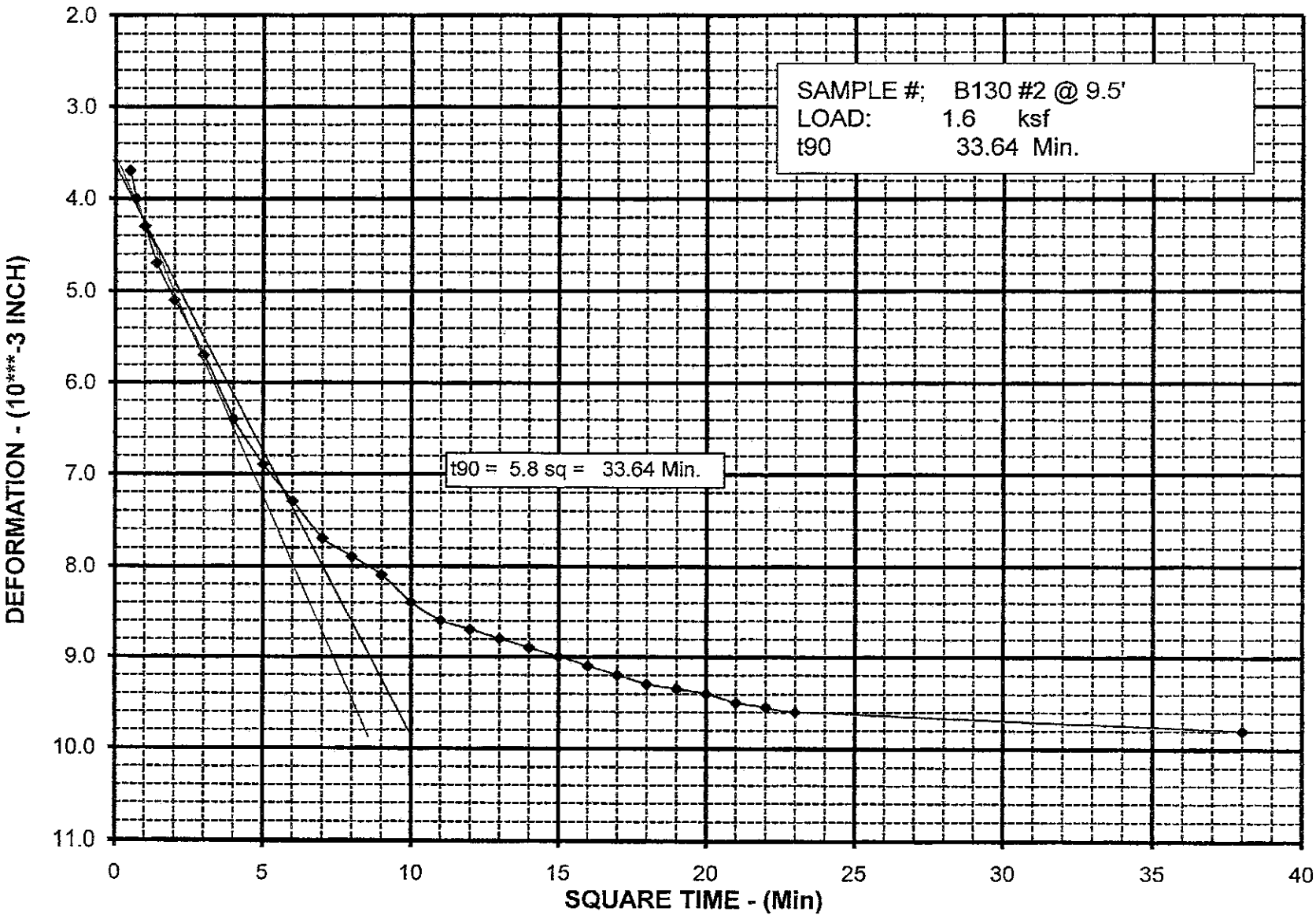


PLATE NO. IV-6E

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

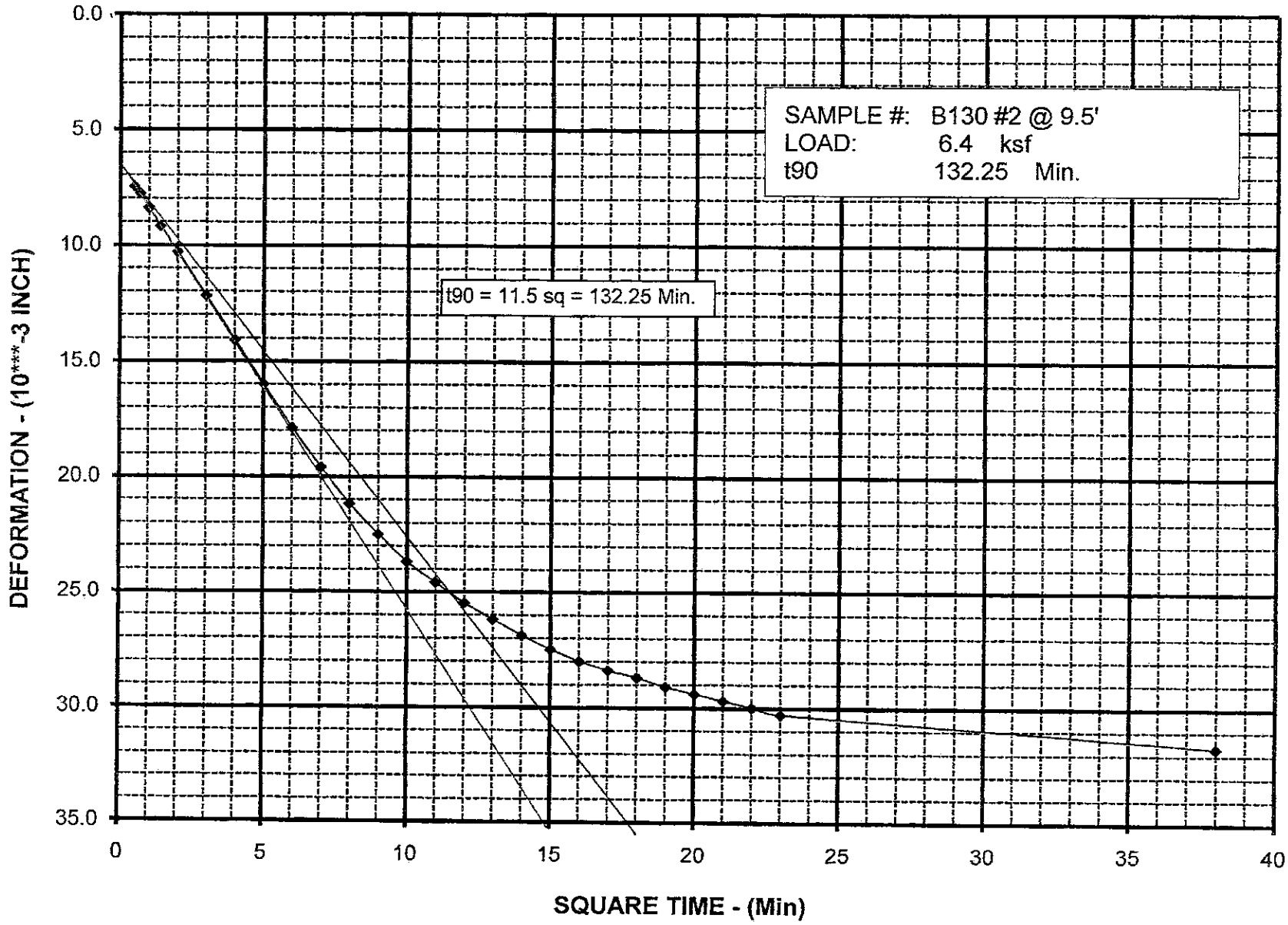
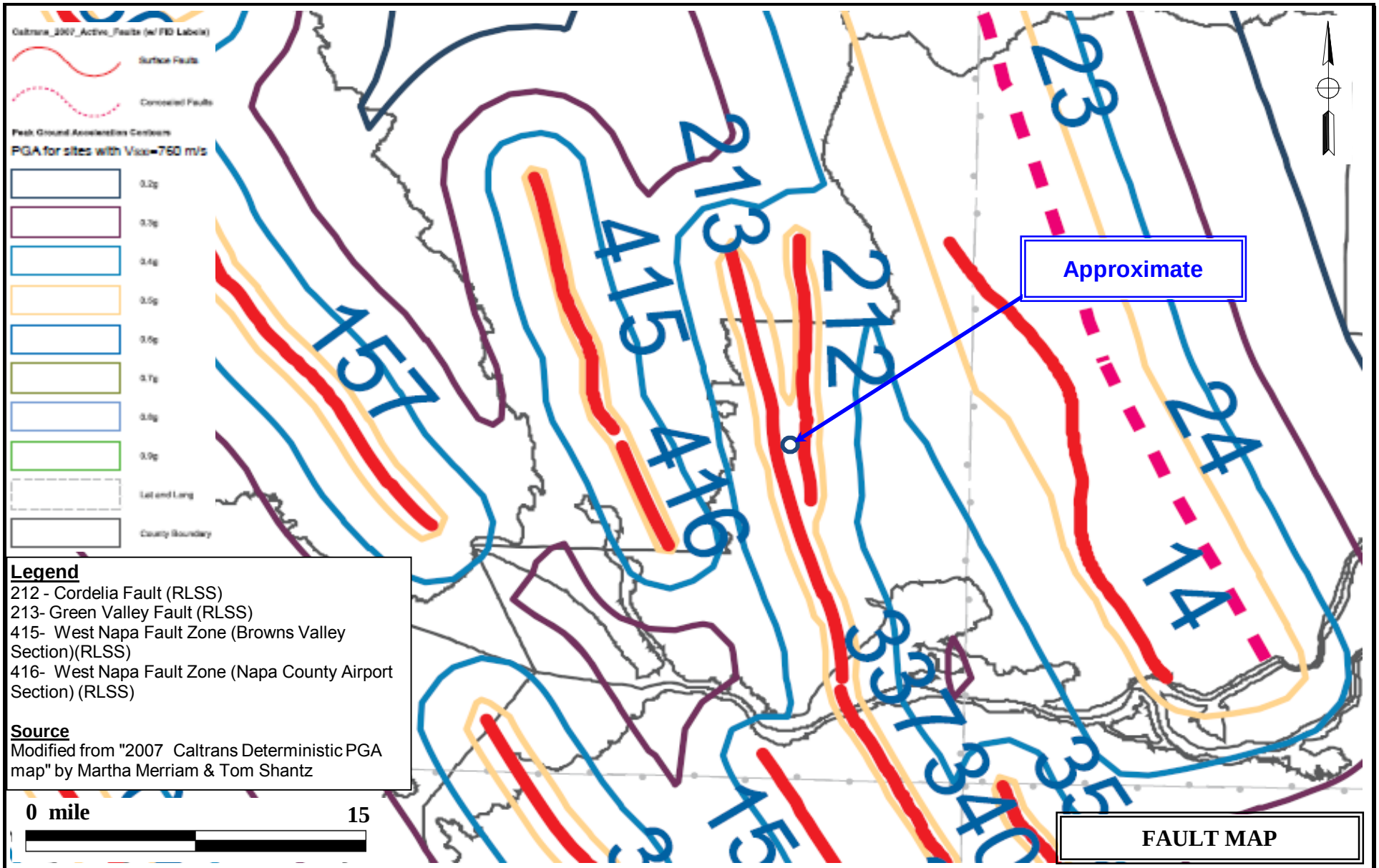


PLATE NO. IV-6F

APPENDIX V



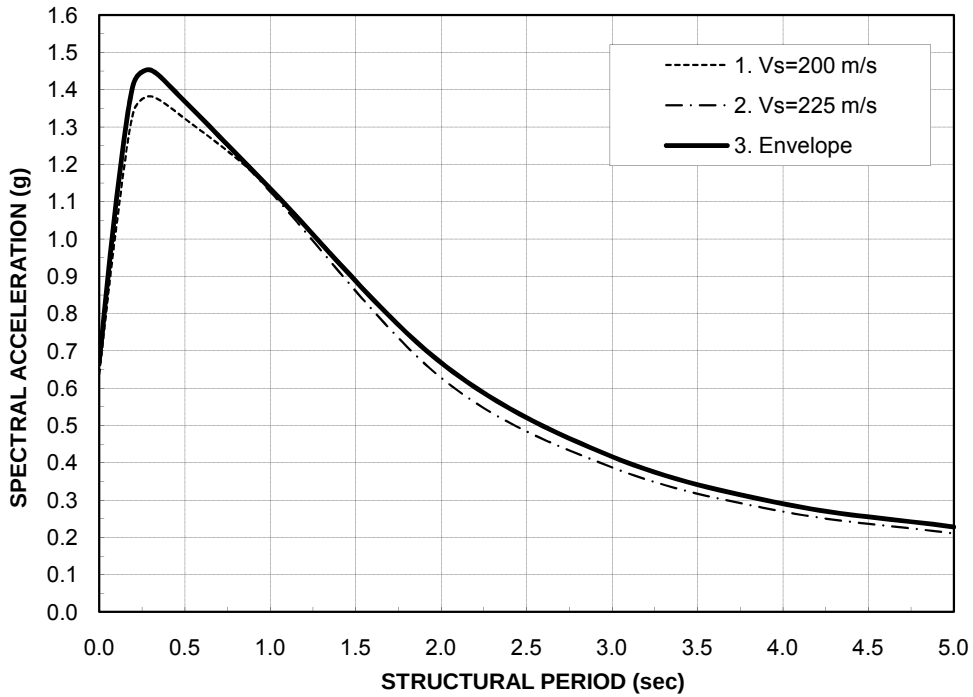
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.: V-1

ARS DESIGN CURVE
GREEN VALLEY ROAD OC
SOLANO COUNTY, CALIFORNIA



Period (sec)	Spectral Accel. (g)	
	1. Vs=200 m/s	2. Vs=225 m/s
0.000	0.638	0.669
0.100	1.031	1.101
0.200	1.340	1.416
0.300	1.383	1.453
0.500	1.323	1.369
1.000	1.136	1.127
2.000	0.668	0.628
3.000	0.417	0.388
4.000	0.291	0.269
5.000	0.228	0.211

Site Location: 38.21614885 N/122.1387434 W
Seismic design criteria is governed by USGS 2008 Deaggregation (beta)
1. Vs=200 m/s (liquefiable soils modeled as clay with residual strength per Seed & Harder (1990)
2. Vs=225 m/s (non-liquefied case)
3. Recommended Design Curve = Envelope of above two curves

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

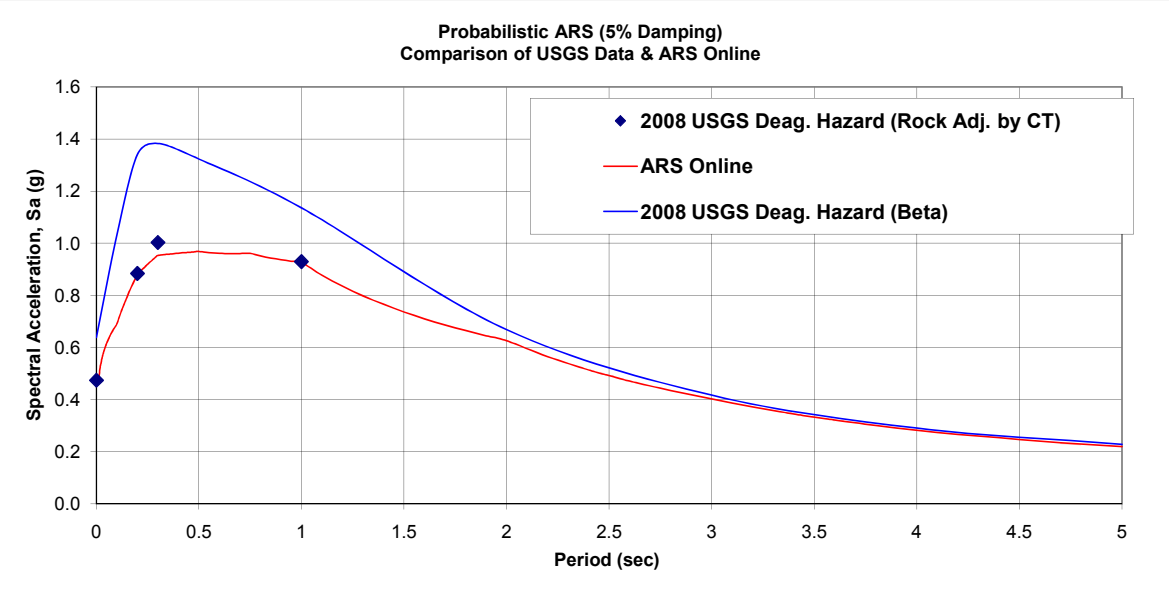
JOB NO.: 2009-130-GDR

PLATE NO.: V-2

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
38.2161	-122.1387
V_{S30} (m/s) =	200
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	8.4
$Z_{1.0}$ (m) =	0
$Z_{2.5}$ (km) =	0



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.472	1	1	0.472
0.02	0.529	1	1	0.529
0.022	0.537	1	1	0.537
0.025	0.549	1	1	0.549
0.029	0.562	1	1	0.562
0.03	0.565	1	1	0.565
0.032	0.571	1	1	0.571
0.035	0.58	1	1	0.58
0.036	0.583	1	1	0.583
0.04	0.593	1	1	0.593
0.042	0.597	1	1	0.597
0.044	0.602	1	1	0.602
0.045	0.604	1	1	0.604
0.046	0.606	1	1	0.606
0.048	0.611	1	1	0.611
0.05	0.615	1	1	0.615
0.055	0.624	1	1	0.624
0.06	0.633	1	1	0.633
0.065	0.642	1	1	0.642
0.067	0.645	1	1	0.645
0.07	0.65	1	1	0.65
0.075	0.657	1	1	0.657
0.08	0.664	1	1	0.664
0.085	0.671	1	1	0.671
0.09	0.677	1	1	0.677
0.095	0.683	1	1	0.683
0.1	0.689	1	1	0.689
0.11	0.712	1	1	0.712
0.12	0.734	1	1	0.734
0.13	0.755	1	1	0.755
0.133	0.761	1	1	0.761
0.14	0.775	1	1	0.775
0.15	0.794	1	1	0.794
0.16	0.813	1	1	0.813
0.17	0.83	1	1	0.83
0.18	0.847	1	1	0.847
0.19	0.863	1	1	0.863
0.2	0.879	1	1	0.879
0.22	0.896	1	1	0.896
0.24	0.911	1	1	0.911
0.25	0.919	1	1	0.919

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.697	1.000	0.681	1.000	0.474	0.472	0.4%
0.2	1.722	1.000	0.513	1.000	0.883	0.879	0.5%
0.3	1.446	1.000	0.693	1.000	1.002	0.953	4.9%
1	0.510	1.200	1.517	1.000	0.929	0.926	0.3%

Max % Difference = 4.9%

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

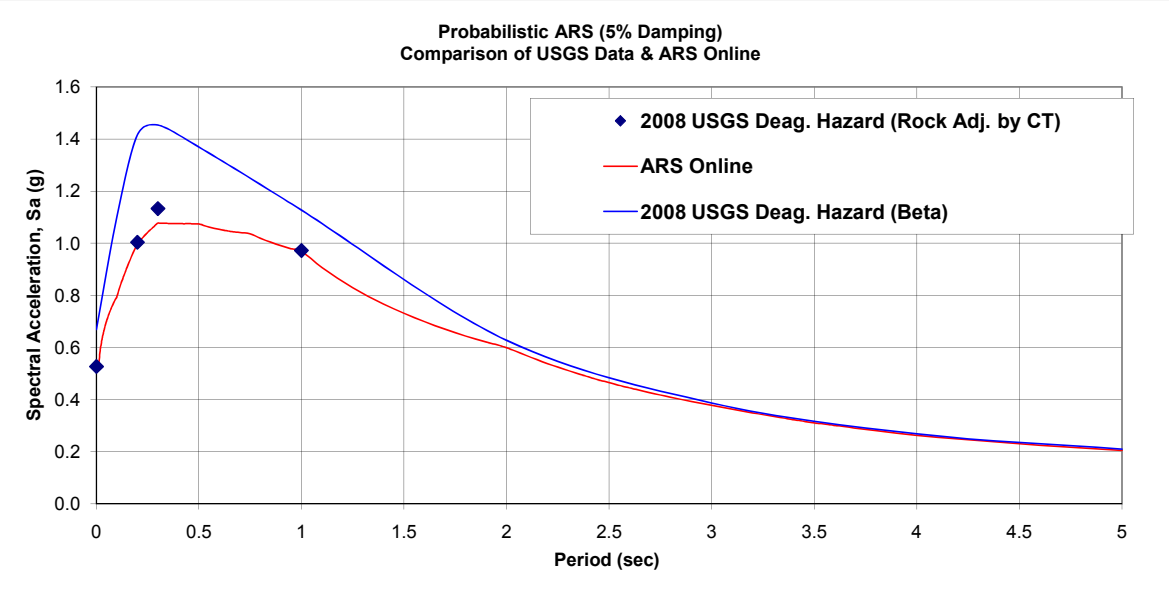
Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.6383	1.000	1.000	0.638	0.472	26.1%
0.1	1.0312	1.000	1.000	1.031	0.689	33.2%
0.2	1.3403	1.000	1.000	1.340	0.879	34.4%
0.3	1.3828	1.000	1.000	1.383	0.953	31.1%
0.5	1.323	1.000	1.000	1.323	0.968	26.8%
1	0.9463	1.200	1.000	1.136	0.926	18.5%
2	0.5568	1.200	1.000	0.668	0.626	6.3%
3	0.3473	1.200	1.000	0.417	0.403	3.3%
4	0.2421	1.200	1.000	0.291	0.282	2.9%
5	0.1901	1.200	1.000	0.228	0.22	3.6%

Max % Difference = 26.8%

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
38.2161	-122.1387
V_{S30} (m/s) =	225
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	8.4
$Z_{1.0}$ (m) =	0
$Z_{2.5}$ (km) =	0



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.525	1	1	0.525
0.02	0.594	1	1	0.594
0.022	0.605	1	1	0.605
0.025	0.619	1	1	0.619
0.029	0.636	1	1	0.636
0.03	0.639	1	1	0.639
0.032	0.647	1	1	0.647
0.035	0.657	1	1	0.657
0.036	0.661	1	1	0.661
0.04	0.673	1	1	0.673
0.042	0.679	1	1	0.679
0.044	0.685	1	1	0.685
0.045	0.688	1	1	0.688
0.046	0.691	1	1	0.691
0.048	0.696	1	1	0.696
0.05	0.701	1	1	0.701
0.055	0.713	1	1	0.713
0.06	0.725	1	1	0.725
0.065	0.735	1	1	0.735
0.067	0.739	1	1	0.739
0.07	0.745	1	1	0.745
0.075	0.754	1	1	0.754
0.08	0.763	1	1	0.763
0.085	0.772	1	1	0.772
0.09	0.78	1	1	0.78
0.095	0.787	1	1	0.787
0.1	0.794	1	1	0.794
0.11	0.82	1	1	0.82
0.12	0.844	1	1	0.844
0.13	0.866	1	1	0.866
0.133	0.873	1	1	0.873
0.14	0.887	1	1	0.887
0.15	0.908	1	1	0.908
0.16	0.927	1	1	0.927
0.17	0.946	1	1	0.946
0.18	0.964	1	1	0.964
0.19	0.981	1	1	0.981
0.2	0.998	1	1	0.998
0.22	1.016	1	1	1.016
0.24	1.033	1	1	1.033
0.25	1.041	1	1	1.041

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.697	1.000	0.756	1.000	0.527	0.525	0.3%
0.2	1.722	1.000	0.583	1.000	1.004	0.998	0.6%
0.3	1.446	1.000	0.784	1.000	1.133	1.077	4.9%
1	0.510	1.200	1.588	1.000	0.972	0.969	0.3%

Max % Difference = 4.9%

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.6693	1.000	1.000	0.669	0.525	21.6%
0.1	1.1011	1.000	1.000	1.101	0.794	27.9%
0.2	1.4155	1.000	1.000	1.416	0.998	29.5%
0.3	1.4532	1.000	1.000	1.453	1.077	25.9%
0.5	1.369	1.000	1.000	1.369	1.074	21.5%
1	0.9392	1.200	1.000	1.127	0.969	14.0%
2	0.5232	1.200	1.000	0.628	0.599	4.6%
3	0.3231	1.200	1.000	0.388	0.378	2.5%
4	0.2244	1.200	1.000	0.269	0.263	2.3%
5	0.1755	1.200	1.000	0.211	0.205	2.7%

Max % Difference = 21.5%

Liquefaction Analysis Results

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-003A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6	2	8	SPT	750	750	0.99		8.0	1.42	0.75	1.2	1.05	10.7	1.40	15.0				1.00	1	
2	11	2	8	SPT	1375	1313	0.98		8.0	1.42	0.80	1.2	1.05	11.4	1.19	13.5				1.00	1	
3	14	1	8	SPT	1750	1500	0.97	0.52	8.0	1.42	0.85	1.2	1.05	12.1	1.13	13.7	19%	18.1	0.19	1.00	1	(0.46)
4	17	1	11	SPT	2125	1688	0.96	0.55	11.0	1.42	0.85	1.2	1.05	16.7	1.08	18.0	35%	26.6	0.33	1.00	1	(0.73)
5	21	1	16	SPT	2625	1938	0.95	0.59	16.0	1.42	0.95	1.2	1.05	27.1	1.01	27.5	10%	29.0	0.41	1.00	1	(0.86)
6	26	1	12	SPT	3250	2250	0.94	0.62	12.0	1.42	0.95	1.2	1.05	20.3	0.95	19.3	65%	28.1	0.37	0.96	1	(0.72)
7	31	1	13	SPT	3875	2563	0.92	0.63	13.0	1.42	1.00	1.2	1.05	23.2	0.89	20.6	35%	30.0		0.92	1	NON-LIQ.
8	36	1	12	SPT	4500	2875	0.88	0.63	12.0	1.42	1.00	1.2	1.05	21.4	0.83	17.9	49%	26.4	0.32	0.90	1	(0.57)
9	39	1	12	SPT	4875	3063	0.86	0.62	12.0	1.42	1.00	1.2	1.05	21.4	0.81	17.3	40%	25.7	0.31	0.88	1	(0.54)
10	42	1	33	SPT	5250	3250	0.83	0.61	33.0	1.42	1.00	1.2	1.05	58.9	0.78	45.9		45.9		0.82	1	NON-LIQ.
11	45	1	13	SPT	5625	3438	0.80	0.60	13.0	1.42	1.00	1.2	1.05	23.2	0.75	17.5	30%	24.9	0.29	0.85	1	
12	48	1	39	SPT	6000	3625	0.77	0.58	39.0	1.42	1.00	1.2	1.05	69.6	0.73	50.8		50.8		0.79	1	NON-LIQ.
13	51	2	10	SPT	6375	3813	0.74		10.0	1.42	1.00	1.2	1.05	17.9	0.71	12.6				0.84	1	
14	54	2	8	SPT	6750	4000	0.71		8.0	1.42	1.00	1.2	1.05	14.3	0.69	9.8				0.84	1	
15	57	2	19	SPT	7125	4188	0.68		19.0	1.42	1.00	1.2	1.05	33.9	0.67	22.7				0.78	1	
16	60	1	28	SPT	7500	4375	0.66	0.51	28.0	1.42	1.00	1.2	1.05	50.0	0.65	32.5		32.5		0.74	1	NON-LIQ.
17	63	1	29	SPT	7875	4563	0.64	0.50	29.0	1.42	1.00	1.2	1.05	51.8	0.63	32.7		32.7		0.73	1	NON-LIQ.
18	66	1	25	SPT	8250	4750	0.62	0.49	25.0	1.42	1.00	1.2	1.05	44.6	0.62	27.5	20%	33.3		0.73	1	NON-LIQ.
19	69	1	8	SPT	8625	4938	0.60	0.47	8.0	1.42	1.00	1.2	1.05	14.3	0.60	8.6		8.6	0.10	0.81	1	(0.21)
20	72	1	28	SPT	9000	5125	0.58	0.46	28.0	1.42	1.00	1.2	1.05	50.0	0.58	29.2		29.2	0.42	0.71	1	(0.79)
21	75	1	23	SPT	9375	5313	0.57	0.46	23.0	1.42	1.00	1.2	1.05	41.1	0.57	23.4	43%	33.1		0.72	1	NON-LIQ.
22	78	1	43	SPT	9750	5500	0.56	0.45	43.0	1.42	1.00	1.2	1.05	76.8	0.56	42.7		42.7		0.67	1	NON-LIQ.
23	81	1	33	SPT	10125	5688	0.54	0.44	33.0	1.42	1.00	1.2	1.05	58.9	0.54	32.0		32.0		0.67	1	NON-LIQ.

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001)
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-004A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR $_{7.5}$)*											*F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6	2	7	SPT	750	750	0.99		7.0	1.42	0.75	1.2	1.05	9.4	1.40	13.1				1.00	1	
2	11	2	16	SPT	1375	1313	0.98		16.0	1.42	0.80	1.2	1.05	22.8	1.19	27.1				1.00	1	
3	14	2	7	SPT	1750	1500	0.97		7.0	1.42	0.85	1.2	1.05	10.6	1.13	12.0				1.00	1	
4	17	2	12	SPT	2125	1688	0.96		12.0	1.42	0.85	1.2	1.05	18.2	1.08	19.6				1.00	1	
5	21	2	9	SPT	2625	1938	0.95		9.0	1.42	0.95	1.2	1.05	15.3	1.01	15.5				1.00	1	
6	26	2	17	SPT	3250	2250	0.94		17.0	1.42	0.95	1.2	1.05	28.8	0.95	27.3				0.96	1	
7	31	1	10	SPT	3875	2563	0.92	0.63	10.0	1.42	1.00	1.2	1.05	17.9	0.89	15.8	16%	19.6	0.21	0.93	1	(0.38)
8	36	1	8	SPT	4500	2875	0.88	0.63	8.0	1.42	1.00	1.2	1.05	14.3	0.83	11.9	16%	15.3	0.16	0.91	1	(0.29)
9	39	1	32	SPT	4875	3063	0.86	0.62	32.0	1.42	1.00	1.2	1.05	57.1	0.81	46.0		46.0		0.84	1	NON-LIQ.
10	42	1	22	SPT	5250	3250	0.83	0.61	22.0	1.42	1.00	1.2	1.05	39.3	0.78	30.6		30.6		0.84	1	NON-LIQ.
11	45	1	17	SPT	5625	3438	0.80	0.60	17.0	1.42	1.00	1.2	1.05	30.3	0.75	22.9	18%	27.8	0.36	0.83	1	(0.62)
12	48	1	12	SPT	6000	3625	0.77	0.58	12.0	1.42	1.00	1.2	1.05	21.4	0.73	15.6	2%	15.6	0.17	0.84	1	(0.30)
13	51	2	11	SPT	6375	3813	0.74		11.0	1.42	1.00	1.2	1.05	19.6	0.71	13.9				0.84	1	
14	56	2	15	SPT	7000	4125	0.69		15.0	1.42	1.00	1.2	1.05	26.8	0.67	18.1				0.80	1	
15	61	1	17	SPT	7625	4438	0.65	0.51	17.0	1.42	1.00	1.2	1.05	30.3	0.64	19.5	30%	27.2	0.35	0.78	1	(0.65)
16	66	1	18	SPT	8250	4750	0.62	0.49	18.0	1.42	1.00	1.2	1.05	32.1	0.62	19.8	30%	27.5	0.35	0.76	1	(0.68)
17	71	2	21	SPT	8875	5063	0.59		21.0	1.42	1.00	1.2	1.05	37.5	0.59	22.1				0.74	1	
18	76	2	10	SPT	9500	5375	0.56		10.0	1.42	1.00	1.2	1.05	17.9	0.57	10.1				0.78	1	
19	101	2	25	SPT	12625	6938	0.50		25.0	1.42	1.00	1.2	1.05	44.6	0.47	21.0				0.67	1	
20	121	2	66	SPT	15125	8188	0.47		66.0	1.42	1.00	1.2	1.05	117.8	0.42	49.0				0.57	1	
21	141	2	36	SPT	17625	9438	0.45		36.0	1.42	1.00	1.2	1.05	64.3	0.37	23.9				0.59	1	
22	161	2	100	SPT	20125	10688	0.43		100.0	1.42	1.00	1.2	1.05	178.5	0.34	60.0				0.51	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001)
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-005***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	21	MC	562.5	563	0.99		13.7	0.92	1.00	1.0	1.05	13.1	1.49	19.5				1.00	1	
2	9.5	2	16	MC	1187.5	1188	0.98		10.4	0.92	1.00	1.0	1.05	10.0	1.23	12.3	48%			1.00	1	
3	14.5	2	38	MC	1812.5	1531	0.97		24.7	0.92	1.00	1.0	1.05	23.8	1.12	26.6	47%			1.00	1	
4	19.5	1	58	MC	2437.5	1844	0.96	0.58	37.7	0.92	1.00	1.0	1.05	36.3	1.04	37.6		37.6		1.00	1	NON-LIQ.
5	24.5	2	27	MC	3062.5	2156	0.94		17.6	0.92	1.00	1.0	1.05	16.9	0.97	16.3	75%			0.97	1	
6	29.5	1	42	MC	3687.5	2469	0.92	0.63	27.3	0.92	1.00	1.0	1.05	26.3	0.90	23.7	35%	33.5		0.92	1	NON-LIQ.
7	34.5	1	66	MC	4312.5	2781	0.89	0.63	42.9	0.92	1.00	1.0	1.05	41.3	0.85	35.1	16%	39.7		0.88	1	NON-LIQ.
8	39.5	1	100	SPT	4937.5	3094	0.86	0.62	100.0	0.92	1.00	1.2	1.05	115.5	0.80	92.5		92.5		0.84	1	NON-LIQ.
9	44.5	1	100	MC	5562.5	3406	0.81	0.60	65.0	0.92	1.00	1.0	1.05	62.6	0.76	47.4		47.4		0.81	1	NON-LIQ.
10	49.5	1	100	SPT	6187.5	3719	0.76	0.57	100.0	0.92	1.00	1.2	1.05	115.5	0.72	83.1		83.1		0.78	1	NON-LIQ.
11	54.5	1	27	MC	6812.5	4031	0.71	0.54	17.6	0.92	1.00	1.0	1.05	16.9	0.68	11.6		11.6	0.13	0.80	1	(0.23)
12	59.5	1	69	MC	7437.5	4344	0.66	0.52	44.9	0.92	1.00	1.0	1.05	43.2	0.65	28.2	15%	32.0		0.73	1	NON-LIQ.
13	69.5	1	30	MC	8687.5	4969	0.59	0.47	19.5	0.92	1.00	1.0	1.05	18.8	0.60	11.2	28%	17.3	0.18	0.74	1	(0.36)
14	79.5	1	65	SPT	9937.5	5594	0.55	0.44	65.0	0.92	1.00	1.2	1.05	75.1	0.55	41.3		41.3		0.66	1	NON-LIQ.
15	89.5	1	100	SPT	11188	6219	0.52	0.43	100.0	0.92	1.00	1.2	1.05	115.5	0.51	59.0		59.0		0.64	1	NON-LIQ.
16	99.5	2	49	SPT	12438	6844	0.50		49.0	0.92	1.00	1.2	1.05	56.6	0.48	26.9				0.61	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

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Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***		
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*	
CPT NO.	***CPT-09-004***	*FAULT M_w =* 6.9	*MSF =* 1.24 *a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***			***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
0.492																				
1.148																				
1.804																				
2.461																				
3.117																				
3.773																				
4.429																				
5.085	2	Organic	3.605	0.267	0.202		0.202	3.07	1.5692	0.99	0.450							1.00	1	
5.741	3	Clay	7.454	0.473	0.239		0.239	2.82	1.5288	0.99	0.450							1.00	1	
6.398	4	Silty Clay to Clay	13.445	0.508	0.276		0.276	2.51	1.4905	0.99	0.449	2.510	1.49	20.04	2.820	56.50	0.10	1.00	1	
7.054	4	Silty Clay to Clay	14.296	0.582	0.314		0.314	2.56	1.4531	0.99	0.448	2.560	1.45	20.77	3.091	64.20	0.10	1.00	1	
7.71	6	Sandy Silt to Clayey Silt	30.542	0.55	0.352		0.352	2.12	1.4175	0.98	0.448	2.120	1.42	43.29	1.492	64.60	0.11	1.00	1	
8.366	4	Silty Clay to Clay	14.846	0.565	0.389		0.389	2.6	1.3845	0.98	0.447							1.00	1	
9.022	4	Silty Clay to Clay	16.257	0.621	0.427		0.427	2.6	1.3522	0.98	0.446							1.00	1	
9.678	5	Clayey Silt to Silty Clay	18.048	0.629	0.464		0.464	2.57	1.3221	0.98	0.446	2.570	1.32	23.86	3.148	75.12	0.12	1.00	1	
10.335	5	Clayey Silt to Silty Clay	23.269	0.718	0.502	0.0001	0.502	2.48	1.2926	0.98	0.445	2.480	1.29	30.08	2.669	80.29	0.13	1.00	1	(0.36)
10.991	5	Clayey Silt to Silty Clay	26.359	0.76	0.54	0.0001	0.54	2.44	1.2644	0.98	0.445	2.440	1.26	33.33	2.483	82.76	0.13	1.00	1	(0.37)
11.647	6	Sandy Silt to Clayey Silt	27.441	0.765	0.577	0.0001	0.577	2.44	1.238	0.98	0.444	2.440	1.24	33.97	2.483	84.36	0.14	1.00	1	(0.38)
12.303	5	Clayey Silt to Silty Clay	24.868	0.857	0.615	0.0001	0.615	2.56	1.2121	0.97	0.443	2.560	1.21	30.14	3.091	93.16	0.16	1.00	1	(0.43)
12.959	6	Sandy Silt to Clayey Silt	27.424	0.712	0.652	0.014	0.638	2.46	1.197	0.97	0.452	2.460	1.20	32.83	2.574	84.50	0.14	1.00	1	(0.37)
13.615	6	Sandy Silt to Clayey Silt	29.402	0.565	0.69	0.035	0.655	2.36	1.186	0.97	0.466	2.360	1.19	34.87	2.156	75.19	0.12	1.00	1	(0.32)
14.272	7	Silty Sand to Sandy Silt	39.917	0.562	0.729	0.055	0.673	2.18	1.1746	0.97	0.478	2.180	1.17	46.89	1.619	75.92	0.12	1.00	1	(0.31)
14.928	6	Sandy Silt to Clayey Silt	32.843	0.974	0.766	0.076	0.691	2.48	1.1634	0.97	0.489	2.480	1.16	38.21	2.669	101.99	0.18	1.00	1	(0.45)
15.584	5	Clayey Silt to Silty Clay	49.605	1.796	0.804	0.096	0.708	2.42	1.153	0.97	0.500	2.420	1.15	57.20	2.396	137.04	0.32	1.00	1	(0.79)
16.24	5	Clayey Silt to Silty Clay	87.153	3.532	0.841	0.117	0.725	2.3	1.1429	0.97	0.510	2.300	1.14	99.60	1.949	194.10		1.00	1	
16.896	6	Sandy Silt to Clayey Silt	107.16	3.575	0.879	0.137	0.742	2.18	1.1329	0.96	0.520	2.180	1.13	121.40	1.619	196.57		1.00	1	
17.552	5	Clayey Silt to Silty Clay	63.957	2.608	0.917	0.158	0.759	2.4	1.123	0.96	0.529	2.400	1.12	71.83	2.312	166.09		1.00	1	
18.209	4	Silty Clay to Clay	31.845	1.456	0.954	0.178	0.776	2.66	1.1134	0.96	0.538							1.00	1	
18.865	4	Silty Clay to Clay	25.157	0.985	0.992	0.198	0.793	2.7	1.1039	0.96	0.546							1.00	1	
19.521	6	Sandy Silt to Clayey Silt	30.757	0.86	1.029	0.219	0.81	2.54	1.0945	0.96	0.554	2.540	1.09	33.66	2.979	100.29	0.17	1.00	1	(0.39)
20.177	6	Sandy Silt to Clayey Silt	55.789	1.756	1.067	0.239	0.828	2.38	1.0848	0.96	0.561	2.380	1.08	60.52	2.233	135.12	0.31	1.00	1	(0.68)
20.833	6	Sandy Silt to Clayey Silt	88.847	3.324	1.105	0.26	0.845	2.31	1.0758	0.95	0.568	2.310	1.08	95.58	1.981	189.37		1.00	1	
21.49	5	Clayey Silt to Silty Clay	59.014	2.525	1.142	0.28	0.862	2.48	1.0669	0.95	0.574	2.480	1.07	62.96	2.669	168.07		1.00	1	
22.146	4	Silty Clay to Clay	27.13	1.149	1.18	0.301	0.879	2.73	1.0582	0.95	0.581							1.00	1	
22.802	5	Clayey Silt to Silty Clay	22.617	0.704	1.217	0.321	0.896	2.71	1.0496	0.95	0.587							1.00	1	
23.458	6	Sandy Silt to Clayey Silt	48.539	1.491	1.255	0.342	0.913	2.45	1.0412	0.95	0.592	2.450	1.04	50.54	2.528	127.77	0.27	1.00	1	(0.57)
24.114	8	Sand to Silty Sand	109.54	1.675	1.295	0.362	0.932	1.99	1.0319	0.94	0.597	1.990	1.03	113.03	1.287	145.49	0.37	1.00	1	(0.76)
24.77	9	Sand	114.3	1.001	1.335	0.383	0.953	1.82	1.0218	0.94	0.601	1.820	1.02	116.79	1.122	130.99	0.29	1.00	1	(0.60)
25.427	8	Sand to Silty Sand	123.95	1.676	1.375	0.403	0.972	1.93	1.0129	0.94	0.605	1.930	1.01	125.55	1.218	152.98	0.41	1.00	1	(0.84)
26.083	7	Silty Sand to Sandy Silt	106.92	2.572	1.414	0.424	0.99	2.16	1.0046	0.94	0.609	2.160	1.00	107.41	1.574	169.09		1.00	1	
26.739	6	Sandy Silt to Clayey Silt	98.62	3.591	1.451	0.444	1.007	2.32	0.9968	0.94	0.613	2.320	1.00	98.31	2.015	198.05		1.00	1	
27.395	7	Silty Sand to Sandy Silt	100.51	2.24	1.49	0.465	1.025	2.16	0.9888	0.93	0.617	2.160	0.99	99.38	1.574	156.45	0.44	1.00	1	(0.87)
28.051	7	Silty Sand to Sandy Silt	82.692	1.213	1.529	0.485	1.043	2.1	0.9808	0.93	0.620	2.100	0.98	81.11	1.455	117.99	0.23	0.99	1	(0.46)
28.707	8	Sand to Silty Sand	82.023	0.604	1.568	0.506	1.063	1.93	0.9722	0.93	0.622	1.930	0.97	79.74	1.218	97.16	0.17	0.99	1	(0.32)
29.364	9	Sand	107.44	0.544	1.609	0.526	1.083	1.75	0.9636	0.92	0.624	1.750	0.96	103.53	1.072	110.95	0.21	0.98	1	(0.40)
30.02	9	Sand	131.64	0.822	1.65	0.547	1.103	1.73	0.9553	0.92	0.627	1.730	0.96	125.76	1.058	133.06	0.30	0.98	1	(0.58)
30.676	9	Sand	146.12	0.767	1.69	0.567	1.123	1.66	0.9471	0.92	0.628	1.660	0.95	138.38	1.010	139.82	0.33	0.98	1	(0.64)
31.332	7	Silty Sand to Sandy Silt	69.682	1.446	1.729	0.587	1.142	2.29	0.9394	0.91	0.629	2.290	0.94	65.46	1.917	125.48	0.26	0.97	1	(0.51)
31.988	5	Clayey Silt to Silty Clay	53.612	1.981	1.767	0.608	1.159	2.56	0.9326	0.91	0.631	2.560	0.93	50.00	3.091	154.52	0.42	0.97	1	(0.81)
32.644	6	Sandy Silt to Clayey Silt	68.934	2.252	1.804	0.628	1.176	2.44	0.9259	0.91	0.632	2.440	0.93	63.83	2.483	158.49	0.45	0.97	1	(0.85)
33.301	6	Sandy Silt to Clayey Silt	84.687	2.604	1.842	0.649	1.193	2.36	0.9193	0.90	0.634	2.360	0.92	77.86	2.156	167.89		0.97	1	
33.957	6	Sandy Silt to Clayey Silt	91.489	2.635	1.879	0.669	1.21	2.32	0.9129	0.90	0.634	2.320	0.91	83.52	2.015	168.25		0.96	1	
34.613	8	Sand to Silty Sand	159.98	2.197	1.919	0.69	1.229	1.93	0.9057	0.89	0.635	1.930	0.91	144.90	1.218	176.55		0.96	1	
35.269	9	Sand	199.59	2.527	1.96	0.71	1.25	1.84	0.898	0.89	0.634	1.840	0.90	179.23	1.137	203.79		0.96	1	
35.925	7	Silty Sand to Sandy Silt	205.63	5.046	1.998	0.731	1.268	2.05	0.8914	0.88	0.634	2.050	0.89	183.30	1.371	251.31		0.95	1	
36.581	6	Sandy Silt to Clayey Silt	104.84	3.603	2.036	0.751	1.285	2.36	0.8853	0.88	0.634	2.360	0.89	92.81	2.156	200.15		0.95	1	
37.238	8	Sand to Silty Sand	324.08	6.408	2.076	0.772	1.304	1.86	0.8786	0.87	0.633	1.860	0.88	284.74	1.153	328.40		0.95	1	
37.894	9	Sand	536.42	6.72	2.116	0.792	1.324	1.58	0.8716	0.87	0.632	1.580	0.87	467.56	1.000	467.56		0.95	1	
38.55	10	Gravelly Sand to Sand	494.2	4.382	2.158	0.813	1.346	1.48	0.8641	0.86	0.630	1.480	0.86	427.04	1.000	427.04		0.94	1	
39.206	9	Sand	287.43	4.24	2.199	0.833	1.366	1.8	0.8574	0.86	0.628	1.800	0.86	246.43	1.107	272.72		0.94	1	
39.862	6	Sandy Silt to Clayey Silt	84.704	2.835	2.237	0.854	1.383	2.44	0.8517	0.85	0.627	2.440	0.85	72.14	2.483	179.14		0.94	1	
40.518	6	Sandy Silt to Clayey Silt	60.567	1.575	2.274	0.874	1.4	2.47	0.8462	0.85	0.626	2.470	0.85	51.25	2.621	134.34	0.31	0.93	1	(0.56)
41.175	6	Sandy Silt to Clayey Silt	66.984	1.891	2.312	0.895	1.417	2.47	0.8407	0.84	0.624	2.470	0.84	56.31	2.621	147.61	0.38	0.93	1	(0.70)
41.831	6	Sandy Silt to Clayey Silt	71.406	2.225	2.349	0.915	1.434	2.48	0.8352	0.83	0.622	2.480	0.84	59.64	2.669	159.20	0.46	0.93	1	(0.84)
42.487	6	Sandy Silt to Clayey Silt	72.658	2.556	2.387	0.935	1.451	2.52	0.8299	0.83	0.620	2.520	0.83	60.30	2.872	173.15		0.93	1	
43.143	8	Sand to Silty Sand	120.57	1.14	2.427	0.956	1.471	1.97	0.8237	0.82	0.617	1.970	0.82	99.31	1.263	125.40	0.26	0.93	1	(0.49)
43.799	9	Sand	151.3	0.616	2.467	0.976	1.491	1.69	0.8175	0.82	0.614	1.690	0.82	123.70	1.031	127.54	0.27	0.92	1	(0.51)
44.455	9	Sand	177.11	1.252	2.508	0.997	1.511	1.77	0.8115	0.81	0.611	1.770	0.81	143.72	1.085	155.99	0.43	0.92	1	(0.81)
45.112	9	Sand	249.86	1.715	2.549	1.017	1.531	1.65	0.8056	0.80	0.608	1.650	0.81	201.27	1.003	201.95		0.92	1	
45.768	9	Sand	263.92	1.999	2.59	1.038	1.552	1.66	0.7994	0.80	0.604	1.660	0.80	210.99	1.010	213.18		0.92	1	
46.424	9	Sand	189.86	1.607	2.63	1.058	1.572	1.81	0.7937	0.79	0.601	1.810	0.79	150.68	1.114	167.86		0.91	1	
47.08	9	Sand	200.72	1.086	2.671	1.079	1.592	1.68	0.788	0.78	0.597	1.680	0.79	158.16	1.024	162.00		0.91	1	
47.736	9	Sand	161.27	0.778	2.712	1.099	1.612	1.73	0.7824	0.78	0.594	1.730	0.78	126.17	1.058	133.50	0.30	0.91	1	(0.57)
48.392	9	Sand	149.2	1.357	2.752	1.12	1.633	1.92	0.7766	0.77	0.590	1.920	0.78	115.86	1.208	139.99	0.34	0.91	1	(0.64)
49.049	9	Sand	194.55	1.193	2.793	1.14	1.653	1.73	0.7711	0.76	0.586	1.730	0.77	150.02	1.058	158.73	0.45	0.90	1	(0.86)
49.705	9	Sand	192.55	1.163	2.834	1.161	1.673	1.74	0.7658	0.76	0.582	1.740	0.77	147.44	1.065	157.00	0.44	0.90	1	(0.84)
50.361	9	Sand	132.92	1.265	2.875	1.181	1.693	1.99	0.7605	0.75	0.579	1.990	0.76	101.08	1.287	130.11	0.28	0.90	1	(0.55)
51.017	9	Sand	224.68	0.969	2.915	1.202	1.714	1.61	0.755	0.74	0.574	1.610	0.75	169.62	1.000	169.62		0.90	1	
51.673	10	Gravelly Sand to Sand	245.95	1.214	2.957	1.222	1.735	1.61	0.7496	0.74	0.571	1.610	0.75	184.36	1.000	184.36		0.90	1	
52.329	9	Sand	181.15	1.096	2.998	1.243	1.755	1.78	0.7445	0.73	0.567	1.780	0.74	134.86	1.092	147.32	0.38	0.89	1	(0.74)
52.986	9	Sand	209.29	1.372	3.039	1.263	1.776	1.75	0.7392	0.72	0.563	1.750	0.74	154.72	1.072	165.80		0.89	1	
53.642	9	Sand	168.36	1.557	3.079	1.284	1.796	1.92	0.7343	0.72	0.559	1.920	0.73	123.63	1.208	149.38	0.39	0.89	1	(0.77)
54.298	8	Sand to Silty Sand	131.06	2.287	3.119	1.304	1.815	2.19	0.7297	0.71	0.555	2.190	0.73	95.63	1.643	157.08	0.44	0.89	1	(0.87)
54.954	9	Sand	191.29	1.497	3.16	1.324	1.835	1.84	0.7249	0.70	0.551	1.840	0.72	138.66	1.137	157.67	0.44	0.89	1	(0.88)
55.61	7	Silty Sand to Sandy Silt	76.479	1.123	3.198	1.345	1.853	2.34	0.7206	0.70	0.548	2.340	0.72	55.11	2.084	114.84	0.22	0.88	1	(0.44)

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***				
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*			
CPT NO.	***CPT-09-004***	*FAULT M_w =*	6.9	*MSF =* 1.24	*a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***		***CRR $_{7.5}$***						***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
56.266	6	Sandy Silt to Clayey Silt	43.545	0.945	3.236	1.365	1.871	2.66	0.7164	0.69	0.544							0.88	1	
56.923	6	Sandy Silt to Clayey Silt	41.941	0.914	3.274	1.386	1.888	2.67	0.7124	0.69	0.541							0.88	1	
57.579	7	Silty Sand to Sandy Silt	35.49	0.507	3.312	1.406	1.906	2.64	0.7083	0.68	0.537							0.88	1	
58.235	6	Sandy Silt to Clayey Silt	47.524	1.051	3.35	1.427	1.923	2.64	0.7045	0.67	0.534							0.88	1	
58.891	6	Sandy Silt to Clayey Silt	42.139	0.82	3.387	1.447	1.94	2.65	0.7006	0.67	0.531							0.88	1	
59.547	7	Silty Sand to Sandy Silt	31.732	0.488	3.426	1.468	1.958	2.71	0.6966	0.66	0.528							0.87	1	
60.203	7	Silty Sand to Sandy Silt	36.216	0.538	3.465	1.488	1.976	2.65	0.6927	0.66	0.525							0.87	1	
60.86	7	Silty Sand to Sandy Silt	48.409	1.03	3.503	1.509	1.995	2.62	0.6886	0.65	0.521							0.87	1	
61.516	6	Sandy Silt to Clayey Silt	57.342	1.406	3.541	1.529	2.012	2.59	0.6849	0.65	0.518	2.590	0.68	39.28	3.266	128.27	0.28	0.87	1	(0.57)
62.172	7	Silty Sand to Sandy Silt	71.581	1.773	3.58	1.55	2.03	2.52	0.6811	0.64	0.515	2.520	0.68	48.75	2.872	140.01	0.34	0.87	1	(0.70)
62.828	7	Silty Sand to Sandy Silt	49.191	0.904	3.618	1.57	2.048	2.57	0.6773	0.64	0.512	2.570	0.68	33.32	3.148	104.89	0.19	0.87	1	(0.39)
63.484	7	Silty Sand to Sandy Silt	43.874	0.624	3.657	1.591	2.066	2.55	0.6736	0.63	0.509	2.550	0.67	29.55	3.034	89.67	0.15	0.86	1	(0.31)
64.14	7	Silty Sand to Sandy Silt	44.277	0.564	3.695	1.611	2.084	2.52	0.6699	0.63	0.507	2.520	0.67	29.66	2.872	85.18	0.14	0.86	1	(0.29)
64.797	7	Silty Sand to Sandy Silt	43.432	0.669	3.734	1.632	2.103	2.57	0.6661	0.62	0.504	2.570	0.67	28.93	3.148	91.07	0.15	0.86	1	(0.32)
65.453	7	Silty Sand to Sandy Silt	51.583	0.954	3.773	1.652	2.121	2.56	0.6625	0.62	0.501	2.560	0.66	34.17	3.091	105.61	0.19	0.86	1	(0.40)
66.109	7	Silty Sand to Sandy Silt	46.096	0.662	3.811	1.672	2.139	2.54	0.6589	0.61	0.498	2.540	0.66	30.37	2.979	90.48	0.15	0.86	1	(0.32)
66.765	7	Silty Sand to Sandy Silt	46.889	0.575	3.85	1.693	2.157	2.5	0.6553	0.61	0.496	2.500	0.66	30.73	2.768	85.07	0.14	0.86	1	(0.29)
67.421	7	Silty Sand to Sandy Silt	63.124	1.006	3.889	1.713	2.175	2.45	0.6519	0.61	0.494	2.450	0.65	41.15	2.528	104.03	0.18	0.86	1	(0.40)
68.077	7	Silty Sand to Sandy Silt	91.115	1.584	3.927	1.734	2.193	2.34	0.6484	0.60	0.491	2.340	0.65	59.08	2.084	123.11	0.25	0.85	1	(0.55)
68.734	7	Silty Sand to Sandy Silt	119.93	2.632	3.966	1.754	2.212	2.33	0.6448	0.60	0.489	2.330	0.64	77.33	2.049	158.42	0.45	0.85	1	(0.97)
69.39	6	Sandy Silt to Clayey Silt	92.515	2.63	4.003	1.775	2.229	2.51	0.6416	0.60	0.486	2.510	0.64	59.36	2.820	167.36		0.85	1	
70.046	6	Sandy Silt to Clayey Silt	70.828	1.931	4.041	1.795	2.246	2.6	0.6384	0.59	0.484							0.85	1	
70.702	7	Silty Sand to Sandy Silt	75.453	1.894	4.08	1.816	2.264	2.55	0.6351	0.59	0.482	2.550	0.64	47.92	3.034	145.40	0.37	0.85	1	(0.80)
71.358	6	Sandy Silt to Clayey Silt	53.703	1.435	4.117	1.836	2.281	2.7	0.632	0.58	0.480							0.85	1	
72.014	6	Sandy Silt to Clayey Silt	49.452	1.185	4.155	1.857	2.298	2.7	0.6289	0.58	0.478							0.85	1	
72.671	6	Sandy Silt to Clayey Silt	51.379	1.436	4.193	1.877	2.315	2.73	0.6259	0.58	0.477							0.85	1	
73.327	5	Clayey Silt to Silty Clay	47.031	1.694	4.23	1.898	2.332	2.84	0.6229	0.58	0.475							0.84	1	
73.983	6	Sandy Silt to Clayey Silt	57.15	1.447	4.268	1.918	2.35	2.67	0.6197	0.57	0.473							0.84	1	
74.639	6	Sandy Silt to Clayey Silt	87.629	2.908	4.305	1.939	2.367	2.6	0.6168	0.57	0.471							0.84	1	
75.295	6	Sandy Silt to Clayey Silt	105.94	4.17	4.343	1.959	2.384	2.59	0.6138	0.57	0.469	2.590	0.61	65.03	3.266	212.40		0.84	1	
75.951	6	Sandy Silt to Clayey Silt	77.567	2.803	4.38	1.98	2.401	2.67	0.6109	0.56	0.468							0.84	1	
76.608	7	Silty Sand to Sandy Silt	48.153	0.846	4.419	2	2.419	2.66	0.6079	0.56	0.466							0.84	1	
77.264	7	Silty Sand to Sandy Silt	57.28	0.771	4.458	2.021	2.437	2.53	0.6049	0.56	0.465	2.530	0.60	34.65	2.925	101.34	0.18	0.84	1	(0.39)
77.92	7	Silty Sand to Sandy Silt	44.271	0.34	4.496	2.041	2.455	2.51	0.6019	0.56	0.463	2.510	0.60	26.65	2.820	75.13	0.12	0.84	1	(0.27)
78.576	8	Sand to Silty Sand	48.256	0.389	4.536	2.061	2.475	2.48	0.5986	0.55	0.461	2.480	0.60	28.89	2.669	77.11	0.12	0.83	1	(0.27)
79.232	7	Silty Sand to Sandy Silt	63.935	0.832	4.575	2.082	2.493	2.47	0.5957	0.55	0.460	2.470	0.60	38.09	2.621	99.84	0.17	0.83	1	(0.39)
79.888	7	Silty Sand to Sandy Silt	146.12	3.055	4.613	2.102	2.511	2.31	0.5928	0.55	0.459	2.310	0.59	86.62	1.981	171.62		0.83	1	
80.545	8	Sand to Silty Sand	268.99	5.589	4.653	2.123	2.53	2.12	0.5898	0.55	0.457	2.120	0.59	158.65	1.492	236.73		0.83	1	
81.201	7	Silty Sand to Sandy Silt	181.99	4.656	4.692	2.143	2.548	2.31	0.587	0.54	0.456	2.310	0.59	106.82	1.981	211.64		0.83	1	
81.857	7	Silty Sand to Sandy Silt	168.86	4.102	4.73	2.164	2.566	2.32	0.5842	0.54	0.455	2.320	0.58	98.65	2.015	198.73		0.83	1	
82.513	9	Sand	233.51	2.952	4.771	2.184	2.587	2.02	0.5809	0.54	0.453	2.020	0.58	135.65	1.327	180.01		0.83	1	
83.169	9	Sand	231.86	3.132	4.812	2.205	2.607	2.05	0.5779	0.54	0.452	2.050	0.58	133.99	1.371	183.70		0.83	1	
83.825	9	Sand	293.76	3.531	4.852	2.225	2.627	1.94	0.5749	0.54	0.450	1.940	0.57	168.87	1.229	207.54		0.82	1	
84.482	9	Sand	446.19	4.83	4.893	2.246	2.647	1.77	0.5719	0.53	0.449	1.770	0.57	255.16	1.085	276.94		0.82	1	
85.138	10	Gravelly Sand to Sand	527.21	2.954	4.935	2.266	2.669	1.53	0.5686	0.53	0.448	1.530	0.57	299.78	1.000	299.78		0.82	1	
85.794	10	Gravelly Sand to Sand	543.96	4.156	4.977	2.287	2.69	1.61	0.5656	0.53	0.446	1.610	0.57	307.64	1.000	307.64		0.82	1	
86.45	8	Sand to Silty Sand	290.8	4.83	5.016	2.307	2.709	2.05	0.5628	0.53	0.445	2.050	0.56	163.66	1.371	224.39		0.82	1	
87.106	8	Sand to Silty Sand	256.14	3.919	5.056	2.328	2.729	2.06	0.5599	0.53	0.444	2.060	0.56	143.42	1.387	198.88		0.82	1	
87.762	9	Sand	382.02	4.316	5.097	2.348	2.749	1.85	0.5571	0.52	0.443	1.850	0.56	212.83	1.145	243.70		0.82	1	
88.419	10	Gravelly Sand to Sand	492.96	3.989	5.139	2.369	2.77	1.67	0.5542	0.52	0.442	1.670	0.55	273.18	1.017	277.93		0.82	1	
89.075	9	Sand	226.82	2.82	5.179	2.389	2.79	2.05	0.5514	0.52	0.440	2.050	0.55	125.06	1.371	171.47		0.81	1	
89.731	6	Sandy Silt to Clayey Silt	82.799	2.557	5.217	2.41	2.807	2.67	0.549	0.52	0.440							0.81	1	
90.387	8	Sand to Silty Sand	114.54	1.478	5.257	2.43	2.827	2.31	0.5463	0.52	0.439	2.310	0.55	62.58	1.981	123.98	0.26	0.81	1	(0.59)
91.043	10	Gravelly Sand to Sand	429.77	3.125	5.298	2.45	2.848	1.69	0.5435	0.52	0.437	1.690	0.54	233.57	1.031	240.83		0.81	1	
91.699	10	Gravelly Sand to Sand	574.51	2.349	5.34	2.471	2.869	1.44	0.5407	0.52	0.436	1.440	0.54	310.62	1.000	310.62		0.81	1	
92.356	9	Sand	331.9	2.885	5.381	2.491	2.889	1.83	0.538	0.51	0.435	1.830	0.54	178.57	1.129	201.64		0.81	1	
93.012	6	Sandy Silt to Clayey Silt	93.74	3.016	5.418	2.512	2.907	2.65	0.5357	0.51	0.435							0.81	1	
93.668	5	Clayey Silt to Silty Clay	70.397	2.963	5.456	2.532	2.924	2.83	0.5335	0.51	0.434							0.81	1	
94.324	7	Silty Sand to Sandy Silt	147.79	3.166	5.495	2.553	2.942	2.37	0.5311	0.51	0.433	2.370	0.53	78.50	2.194	172.23		0.81	1	
94.98	8	Sand to Silty Sand	314.31	6.489	5.534	2.573	2.961	2.12	0.5287	0.51	0.432	2.120	0.53	166.18	1.492	247.97		0.80	1	
95.636	9	Sand	423.97	4.715	5.575	2.594	2.981	1.83	0.5262	0.51	0.431	1.830	0.53	223.09	1.129	251.91		0.80	1	
96.293	9	Sand	359.4	3.688	5.616	2.614	3.002	1.87	0.5236	0.51	0.430	1.870	0.52	188.17	1.162	218.62		0.80	1	
96.949	7	Silty Sand to Sandy Silt	68.293	1.582	5.654	2.635	3.02	2.7	0.5213	0.50	0.430							0.80	1	
97.605	7	Silty Sand to Sandy Silt	119.67	3.053	5.693	2.655	3.038	2.51	0.5191	0.50	0.429	2.510	0.52	62.12	2.820	175.16		0.80	1	
98.261	6	Sandy Silt to Clayey Silt	146.77	4.774	5.731	2.676	3.055	2.51	0.517	0.50	0.428	2.510	0.52	75.88	2.820	213.96		0.80	1	
98.917	11	Sitff Fine-Grained	120.63	5.718	5.774	2.696	3.077	2.7	0.5144	0.50	0.427							0.80	1	
99.573	11	Sitff Fine-Grained	102.28	5.029	5.816	2.717	3.1	2.77	0.5116	0.50	0.426							0.80	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***		
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*	
CPT NO.	***CPT-10-003A***	*FAULT M_w =* 6.9	*MSF =* 1.24 *a_{max} (g)=* 0.7

		CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***				***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
0.328																				
0.656																				
0.984																				
1.312																				
1.64																				
1.969																				
2.297																				
2.625																				
2.953																				
3.281																				
3.609																				
3.937																				
4.265																				
4.593																				
4.921	1	Sensitive Fines	4.701	0.074	0.274		0.274	2.68	1.4925	0.99	0.451							1.00	1	
5.249	6	Sandy Silt to Clayey Silt	14.484	0.17	0.293		0.293	2.19	1.4735	0.99	0.450	2.190	1.47	21.34	1.643	35.06	0.08	1.00	1	
5.577	6	Sandy Silt to Clayey Silt	15.198	0.249	0.312		0.312	2.28	1.455	0.99	0.450	2.280	1.46	22.11	1.886	41.71	0.08	1.00	1	
5.906	6	Sandy Silt to Clayey Silt	20.994	0.298	0.331		0.331	2.15	1.437	0.99	0.450	2.150	1.44	30.17	1.553	46.84	0.09	1.00	1	
6.234	7	Silty Sand to Sandy Silt	22.792	0.205	0.35		0.35	2.02	1.4194	0.99	0.449	2.020	1.42	32.35	1.327	42.93	0.09	1.00	1	
6.562	6	Sandy Silt to Clayey Silt	21.388	0.215	0.369		0.369	2.09	1.4022	0.99	0.449	2.090	1.40	29.99	1.437	43.09	0.09	1.00	1	
6.89	6	Sandy Silt to Clayey Silt	17.831	0.355	0.387		0.387	2.35	1.3863	0.99	0.449	2.350	1.39	24.72	2.120	52.39	0.09	1.00	1	
7.218	5	Clayey Silt to Silty Clay	17.889	0.44	0.406		0.406	2.43	1.3699	0.99	0.448	2.430	1.37	24.51	2.439	59.77	0.10	1.00	1	
7.546	6	Sandy Silt to Clayey Silt	21.436	0.479	0.425		0.425	2.36	1.3538	0.98	0.448	2.360	1.35	29.02	2.156	62.58	0.10	1.00	1	
7.874	6	Sandy Silt to Clayey Silt	28.415	0.569	0.444		0.444	2.25	1.3382	0.98	0.448	2.250	1.34	38.02	1.798	68.38	0.11	1.00	1	
8.202	6	Sandy Silt to Clayey Silt	29.886	0.606	0.463		0.463	2.25	1.3229	0.98	0.447	2.250	1.32	39.54	1.798	71.10	0.11	1.00	1	
8.53	6	Sandy Silt to Clayey Silt	32.482	0.578	0.481		0.481	2.19	1.3087	0.98	0.447	2.190	1.31	42.51	1.643	69.83	0.11	1.00	1	
8.858	6	Sandy Silt to Clayey Silt	29.184	0.655	0.5		0.5	2.31	1.2941	0.98	0.447	2.310	1.29	37.77	1.981	74.83	0.12	1.00	1	
9.186	6	Sandy Silt to Clayey Silt	33.337	0.691	0.519		0.519	2.25	1.2798	0.98	0.446	2.250	1.28	42.67	1.798	76.72	0.12	1.00	1	
9.514	7	Silty Sand to Sandy Silt	43.546	0.652	0.538		0.538	2.09	1.2658	0.98	0.446	2.090	1.27	55.12	1.437	79.21	0.13	1.00	1	
9.843	7	Silty Sand to Sandy Silt	45.872	0.681	0.558		0.558	2.08	1.2514	0.98	0.446	2.080	1.25	57.41	1.420	81.50	0.13	1.00	1	
10.171	7	Silty Sand to Sandy Silt	51.775	0.74	0.577	0.005	0.572	2.04	1.2415	0.98	0.449	2.040	1.24	64.28	1.356	87.16	0.14	1.00	1	(0.39)
10.499	8	Sand to Silty Sand	63.32	0.723	0.597	0.015	0.581	1.92	1.2353	0.98	0.457	1.920	1.24	78.22	1.208	94.51	0.16	1.00	1	(0.43)
10.827	7	Silty Sand to Sandy Silt	59.004	0.662	0.616	0.026	0.59	1.94	1.2291	0.98	0.464	1.940	1.23	72.52	1.229	89.12	0.15	1.00	1	(0.39)
11.155	7	Silty Sand to Sandy Silt	51.236	0.663	0.635	0.036	0.599	2.03	1.2229	0.98	0.471	2.030	1.22	62.66	1.341	84.04	0.14	1.00	1	(0.36)
11.483	7	Silty Sand to Sandy Silt	37.672	0.632	0.655	0.046	0.609	2.21	1.2161	0.98	0.478	2.210	1.22	45.81	1.692	77.50	0.12	1.00	1	(0.32)
11.811	6	Sandy Silt to Clayey Silt	34.548	0.599	0.674	0.056	0.617	2.25	1.2108	0.98	0.485	2.250	1.21	41.83	1.798	75.22	0.12	1.00	1	(0.31)
12.139	6	Sandy Silt to Clayey Silt	27.694	0.53	0.692	0.067	0.626	2.36	1.2048	0.97	0.490	2.360	1.20	33.37	2.156	71.95	0.11	1.00	1	(0.29)
12.467	6	Sandy Silt to Clayey Silt	28.637	0.447	0.711	0.077	0.634	2.29	1.1996	0.97	0.497	2.290	1.20	34.35	1.917	65.85	0.11	1.00	1	(0.27)
12.795	6	Sandy Silt to Clayey Silt	23.83	0.501	0.73	0.087	0.643	2.43	1.1937	0.97	0.503	2.430	1.19	28.45	2.439	69.38	0.11	1.00	1	(0.27)
13.123	5	Clayey Silt to Silty Clay	19.668	0.582	0.749	0.097	0.651	2.59	1.1885	0.97	0.509	2.590	1.19	23.38	3.266	76.35	0.12	1.00	1	(0.30)
13.451	6	Sandy Silt to Clayey Silt	24.868	0.6	0.768	0.108	0.66	2.46	1.1828	0.97	0.515	2.460	1.18	29.41	2.574	75.72	0.12	1.00	1	(0.29)
13.78	6	Sandy Silt to Clayey Silt	25.493	0.608	0.786	0.118	0.668	2.46	1.1777	0.97	0.520	2.460	1.18	30.02	2.574	77.29	0.12	1.00	1	(0.29)
14.108	7	Silty Sand to Sandy Silt	35.222	0.589	0.806	0.128	0.678	2.26	1.1715	0.97	0.525	2.260	1.17	41.26	1.827	75.38	0.12	1.00	1	(0.28)
14.436	7	Silty Sand to Sandy Silt	40.528	0.548	0.825	0.138	0.687	2.16	1.1659	0.97	0.530	2.160	1.17	47.25	1.574	74.38	0.12	1.00	1	(0.28)
14.764	6	Sandy Silt to Clayey Silt	29.357	0.605	0.844	0.149	0.695	2.39	1.1609	0.97	0.535	2.390	1.16	34.08	2.272	77.43	0.12	1.00	1	(0.28)
15.092	7	Silty Sand to Sandy Silt	33.501	0.45	0.863	0.159	0.704	2.23	1.1555	0.97	0.540	2.230	1.16	38.71	1.743	67.49	0.11	1.00	1	(0.25)
15.42	7	Silty Sand to Sandy Silt	30.069	0.384	0.882	0.169	0.713	2.26	1.15	0.97	0.545	2.260	1.15	34.58	1.827	63.17	0.10	1.00	1	(0.24)
15.748	6	Sandy Silt to Clayey Silt	22.071	0.476	0.901	0.179	0.722	2.51	1.1446	0.97	0.549	2.510	1.14	25.26	2.820	71.23	0.11	1.00	1	(0.26)
16.076	6	Sandy Silt to Clayey Silt	26.858	0.559	0.92	0.189	0.731	2.45	1.1393	0.97	0.553	2.450	1.14	30.60	2.528	77.36	0.12	1.00	1	(0.28)
16.404	6	Sandy Silt to Clayey Silt	24.57	0.433	0.939	0.2	0.739	2.44	1.1346	0.97	0.558	2.440	1.13	27.88	2.483	69.22	0.11	1.00	1	(0.25)
16.732	6	Sandy Silt to Clayey Silt	23.686	0.298	0.958	0.21	0.748	2.37	1.1294	0.96	0.562	2.370	1.13	26.75	2.194	58.69	0.10	1.00	1	(0.22)
17.06	7	Silty Sand to Sandy Silt	26.973	0.264	0.977	0.22	0.757	2.26	1.1242	0.96	0.566	2.260	1.12	30.32	1.827	55.39	0.10	1.00	1	(0.21)
17.388	6	Sandy Silt to Clayey Silt	23.59	0.359	0.996	0.23	0.765	2.42	1.1196	0.96	0.571	2.420	1.12	26.41	2.396	63.28	0.10	1.00	1	(0.22)
17.717	6	Sandy Silt to Clayey Silt	24.042	0.38	1.015	0.241	0.774	2.43	1.1145	0.96	0.574	2.430	1.11	26.79	2.439	65.35	0.11	1.00	1	(0.23)
18.045	6	Sandy Silt to Clayey Silt	21.773	0.408	1.033	0.251	0.782	2.51	1.11	0.96	0.578	2.510	1.11	24.17	2.820	68.14	0.11	1.00	1	(0.23)
18.373	6	Sandy Silt to Clayey Silt	24.936	0.322	1.052	0.261	0.791	2.38	1.105	0.96	0.581	2.380	1.10	27.55	2.233	61.52	0.10	1.00	1	(0.22)
18.701	6	Sandy Silt to Clayey Silt	21.437	0.412	1.071	0.271	0.8	2.53	1.1	0.96	0.585	2.530	1.10	23.58	2.925	68.97	0.11	1.00	1	(0.23)
19.029	7	Silty Sand to Sandy Silt	43.402	0.705	1.09	0.282	0.809	2.25	1.0951	0.96	0.588	2.250	1.10	47.53	1.798	85.47	0.14	1.00	1	(0.29)
19.357	7	Silty Sand to Sandy Silt	43.998	0.813	1.11	0.292	0.818	2.3	1.0902	0.96	0.592	2.300	1.09	47.97	1.949	93.47	0.16	1.00	1	(0.33)
19.685	6	Sandy Silt to Clayey Silt	34.26	0.624	1.128	0.302	0.826	2.37	1.0859	0.96	0.595	2.370	1.09	37.20	2.194	81.62	0.13	1.00	1	(0.27)
20.013	7	Silty Sand to Sandy Silt	47.478	0.745	1.148	0.312	0.835	2.21	1.0811	0.96	0.599	2.210	1.08	51.33	1.692	86.83	0.14	1.00	1	(0.29)
20.341	6	Sandy Silt to Clayey Silt	42.249	1.058	1.166	0.323	0.844	2.38	1.0763	0.96	0.601	2.380	1.08	45.47	2.233	101.52	0.18	1.00	1	(0.37)
20.669	5	Clayey Silt to Silty Clay	37.096	1.291	1.185	0.333	0.852	2.54	1.0721	0.96	0.604	2.540	1.07	39.77	2.979	118.48	0.23	1.00	1	(0.48)
20.997	6	Sandy Silt to Clayey Silt	46.449	1.275	1.204	0.343	0.861	2.4	1.0674	0.95	0.607	2.400	1.07	49.58	2.312	114.65	0.22	1.00	1	(0.45)
21.325	6	Sandy Silt to Clayey Silt	46.795	1.184	1.223	0.353	0.87	2.37	1.0628	0.95	0.610	2.370	1.06	49.73	2.194	109.12	0.20	1.00	1	(0.41)
21.654	6	Sandy Silt to Clayey Silt	42.95	1.186	1.242	0.364	0.878	2.42	1.0587	0.95	0.613	2.420	1.06	45.47	2.396	108.94	0.20	1.00	1	(0.40)
21.982	6	Sandy Silt to Clayey Silt	44.536	1.377	1.26	0.374	0.887	2.45	1.0541	0.95	0.615	2.450	1.05	46.95	2.528	118.69	0.24	1.00	1	(0.47)
22.31	5	Clayey Silt to Silty Clay	40.816	1.394	1.279	0.384	0.895	2.51	1.0501	0.95	0.618	2.510	1.05	42.86	2.820	120.85	0.24	1.00	1	(0.49)
22.638	5	Clayey Silt to Silty Clay	32.587	1.388	1.298	0.394	0.904	2.64	1.0456	0.95	0.620							1.00	1	
22.966	5	Clayey Silt to Silty Clay	35.798	1.473	1.317	0.404	0.912	2.61	1.0417	0.95	0.623							1.00	1	
23.294	6	Sandy Silt to Clayey Silt	53.178	1.33	1.336	0.415	0.921	2.34	1.0372	0.95	0.625	2.340	1.04	55.16	2.084	114.94	0.22	1.00	1	(0.44)
23.622	7	Silty Sand to Sandy Silt	66.348	1.452	1.355	0.425	0.93	2.23	1.0329	0.95	0.627	2.230	1.03	68.53	1.743	119.48	0.24	1.00	1	(0.47)
23.95	6	Sandy Silt to Clayey Silt	63.521	1.696	1.374	0.435	0.939	2.32	1.0285	0.95	0.629	2.320	1.03	65.33	2.015	131.62	0.29	1.00	1	(0.57)
24.278	6	Sandy Silt to Clayey Silt	56.591	1.5	1.393	0.445	0.947	2.36	1.0247	0.94	0.632	2.360	1.02	57.99	2.156	125.05	0.26	1.00	1	(0.51)
24.606	5	Clayey Silt to Silty Clay	33.722	1.234	1.411	0.456	0.956	2.63	1.0204	0.94	0.633							1.00	1	
24.934	4	Silty Clay to Clay	20.61	0.949	1.43	0.466	0.964	2.87	1.0166	0.94	0.636							1.00	1	
25.262	3	Clay	13.66	0.697	1.448	0.476	0.972	3.06	1.0129	0.94	0.638							1.00	1	
25.591	4	Silty Clay to Clay	13.679	0.465	1.467	0.486	0.981	2.95	1.0087	0.94	0.639							1.00	1	
25.919	6	Sandy Silt to Clayey Silt	20.091	0.415	1.486	0.497	0.989	2.66	1.005	0.94	0.642							1.00	1	
26.247	6	Sandy Silt to Clayey Silt	28.877	0.742	1.505	0.507	0.998	2.59	1.0009	0.94	0.643	2.590	1.00	28.90	3.266	94.40	0.16	1.00	1	(0.30)
26.575	6	Sandy Silt to Clayey Silt	36.48	0.832	1.524	0.517	1.007	2.48	0.9968	0.94	0.644	2.480	1.00	36.36	2.669	97.07	0.17	1.00	1	(0.32)
26.903	8	Sand to Silty Sand	57.177	0.591	1.543	0.527	1.016	2.11	0.9928	0.93	0.646	2.110	0.99	56.76	1.473	83.62	0.13	1.00	1	(0.26)
27.231	8	Sand to Silty Sand	67.511	0.632	1.563	0.538	1.026	2.03	0.9883	0.93	0.647	2.030	0.99	66.72	1.341	89.49	0.15	0.99	1	(0.28)
27.559	7	Silty Sand to Sandy Silt	64.531	0.849	1.583	0.548	1.035	2.14	0.9843	0.93	0.649	2.140	0.98	63.52	1.532	97.31	0.17	0.99	1	(0.31)
27.887	7	Silty Sand to Sandy Silt	62.099	1.069	1.602	0.558	1.044	2.23	0.9804	0.93	0.650	2.230	0.98	60.88	1.743	106.14	0.19	0.99	1	(0.36)

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***				
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*			
CPT NO.	***CPT-10-003A***	*FAULT M_w =*	6.9	*MSF =* 1.24	*a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
28.215	7	Silty Sand to Sandy Silt	43.078	0.831	1.621	0.568	1.053	2.39	0.9765	0.93	0.651	2.390	0.98	42.06	2.272	95.57	0.16	0.99	1	(0.30)
28.543	6	Sandy Silt to Clayey Silt	40.896	1.062	1.64	0.578	1.062	2.48	0.9726	0.93	0.652	2.480	0.97	39.78	2.669	106.17	0.19	0.99	1	(0.36)
28.871	6	Sandy Silt to Clayey Silt	57.074	1.738	1.659	0.589	1.07	2.43	0.9692	0.93	0.653	2.430	0.97	55.31	2.439	134.91	0.31	0.99	1	(0.58)
29.199	7	Silty Sand to Sandy Silt	69.654	1.47	1.678	0.599	1.079	2.27	0.9653	0.92	0.654	2.270	0.97	67.24	1.856	124.80	0.26	0.98	1	(0.49)
29.528	6	Sandy Silt to Clayey Silt	48.391	1.232	1.697	0.609	1.088	2.45	0.9615	0.92	0.655	2.450	0.96	46.53	2.528	117.64	0.23	0.98	1	(0.43)
29.856	6	Sandy Silt to Clayey Silt	58.859	1.422	1.716	0.619	1.096	2.38	0.9582	0.92	0.656	2.380	0.96	56.40	2.233	125.91	0.27	0.98	1	(0.49)
30.184	7	Silty Sand to Sandy Silt	76.797	1.469	1.735	0.63	1.105	2.23	0.9544	0.92	0.657	2.230	0.95	73.30	1.743	127.79	0.27	0.98	1	(0.51)
30.512	7	Silty Sand to Sandy Silt	85.4	1.813	1.754	0.64	1.114	2.23	0.9507	0.92	0.658	2.230	0.95	81.19	1.743	141.56	0.34	0.97	1	(0.63)
30.84	7	Silty Sand to Sandy Silt	78.296	1.737	1.774	0.65	1.124	2.27	0.9466	0.92	0.658	2.270	0.95	74.12	1.856	137.57	0.32	0.97	1	(0.59)
31.168	7	Silty Sand to Sandy Silt	52.082	0.787	1.793	0.66	1.133	2.31	0.943	0.91	0.658	2.310	0.94	49.11	1.981	97.30	0.17	0.98	1	(0.30)
31.496	7	Silty Sand to Sandy Silt	24.878	0.29	1.812	0.671	1.142	2.51	0.9394	0.91	0.659	2.510	0.94	23.37	2.820	65.89	0.11	0.97	1	(0.19)
31.824	6	Sandy Silt to Clayey Silt	16.851	0.191	1.831	0.681	1.15	2.65	0.9362	0.91	0.660							0.97	1	
32.152	6	Sandy Silt to Clayey Silt	16.13	0.213	1.85	0.691	1.159	2.69	0.9326	0.91	0.660							0.97	1	
32.48	7	Silty Sand to Sandy Silt	30.242	0.391	1.869	0.701	1.168	2.44	0.9291	0.91	0.660	2.440	0.93	28.10	2.483	69.77	0.11	0.97	1	(0.20)
32.808	7	Silty Sand to Sandy Silt	40.412	0.467	1.889	0.712	1.177	2.31	0.9255	0.90	0.661	2.310	0.93	37.40	1.981	74.10	0.12	0.97	1	(0.21)
33.136	7	Silty Sand to Sandy Silt	32.17	0.366	1.908	0.722	1.186	2.4	0.922	0.90	0.661	2.400	0.92	29.66	2.312	68.59	0.11	0.97	1	(0.20)
33.465	7	Silty Sand to Sandy Silt	28.559	0.231	1.927	0.732	1.195	2.38	0.9186	0.90	0.661	2.380	0.92	26.23	2.233	58.57	0.10	0.96	1	(0.18)
33.793	7	Silty Sand to Sandy Silt	23.164	0.203	1.947	0.742	1.204	2.48	0.9151	0.90	0.661	2.480	0.92	21.20	2.669	56.59	0.10	0.96	1	(0.17)
34.121	7	Silty Sand to Sandy Silt	33.969	0.416	1.966	0.752	1.213	2.42	0.9117	0.90	0.661	2.420	0.91	30.97	2.396	74.20	0.12	0.96	1	(0.21)
34.449	7	Silty Sand to Sandy Silt	56.187	0.891	1.985	0.763	1.222	2.3	0.9083	0.89	0.661	2.300	0.91	51.04	1.949	99.46	0.17	0.96	1	(0.31)
34.777	7	Silty Sand to Sandy Silt	72.135	1.691	2.004	0.773	1.232	2.34	0.9046	0.89	0.660	2.340	0.90	65.25	2.084	135.97	0.31	0.96	1	(0.56)
35.105	7	Silty Sand to Sandy Silt	109.26	2.338	2.024	0.783	1.241	2.18	0.9013	0.89	0.660	2.180	0.90	98.47	1.619	159.44	0.46	0.95	1	(0.81)
35.433	7	Silty Sand to Sandy Silt	91.428	1.991	2.043	0.793	1.25	2.25	0.898	0.89	0.660	2.250	0.90	82.10	1.798	147.63	0.38	0.95	1	(0.67)
35.761	6	Sandy Silt to Clayey Silt	53.495	1.398	2.062	0.804	1.258	2.46	0.895	0.89	0.660	2.460	0.90	47.88	2.574	123.26	0.25	0.96	1	(0.46)
36.089	7	Silty Sand to Sandy Silt	65.761	1.139	2.081	0.814	1.267	2.27	0.8918	0.88	0.660	2.270	0.89	58.64	1.856	108.85	0.20	0.95	1	(0.36)
36.417	7	Silty Sand to Sandy Silt	65.944	1.415	2.101	0.824	1.276	2.33	0.8885	0.88	0.660	2.330	0.89	58.59	2.049	120.04	0.24	0.95	1	(0.43)
36.745	6	Sandy Silt to Clayey Silt	69.895	2.231	2.119	0.834	1.285	2.44	0.8853	0.88	0.659	2.440	0.89	61.88	2.483	153.65	0.42	0.95	1	(0.75)
37.073	6	Sandy Silt to Clayey Silt	82.641	2.805	2.138	0.845	1.294	2.43	0.8821	0.88	0.658	2.430	0.88	72.90	2.439	177.80		0.95	1	
37.402	6	Sandy Silt to Clayey Silt	75.614	2.519	2.157	0.855	1.302	2.45	0.8793	0.87	0.658	2.450	0.88	66.49	2.528	168.09		0.95	1	
37.73	6	Sandy Silt to Clayey Silt	58.907	1.674	2.176	0.865	1.311	2.48	0.8761	0.87	0.657	2.480	0.88	51.61	2.669	137.77	0.32	0.95	1	(0.58)
38.058	6	Sandy Silt to Clayey Silt	35.029	1.124	2.195	0.875	1.319	2.68	0.8734	0.87	0.657							0.95	1	
38.386	5	Clayey Silt to Silty Clay	44.546	1.704	2.213	0.886	1.328	2.66	0.8703	0.86	0.656							0.94	1	
38.714	6	Sandy Silt to Clayey Silt	60.167	1.557	2.232	0.896	1.336	2.44	0.8675	0.86	0.655	2.440	0.87	52.20	2.483	129.61	0.28	0.94	1	(0.50)
39.042	7	Silty Sand to Sandy Silt	56.687	1.048	2.251	0.906	1.345	2.37	0.8644	0.86	0.654	2.370	0.86	49.00	2.194	107.51	0.20	0.94	1	(0.35)
39.37	7	Silty Sand to Sandy Silt	53.572	0.754	2.271	0.916	1.355	2.31	0.8611	0.86	0.653	2.310	0.86	46.13	1.981	91.39	0.15	0.94	1	(0.27)
39.698	7	Silty Sand to Sandy Silt	51.919	0.776	2.29	0.927	1.364	2.34	0.858	0.85	0.652	2.340	0.86	44.55	2.084	92.83	0.15	0.94	1	(0.28)
40.026	7	Silty Sand to Sandy Silt	71.019	1.523	2.309	0.937	1.373	2.34	0.855	0.85	0.651	2.340	0.86	60.72	2.084	126.53	0.27	0.94	1	(0.48)
40.354	6	Sandy Silt to Clayey Silt	83.208	2.818	2.328	0.947	1.381	2.44	0.8524	0.85	0.650	2.440	0.85	70.93	2.483	176.12		0.94	1	
40.682	7	Silty Sand to Sandy Silt	129.46	2.678	2.348	0.957	1.39	2.16	0.8494	0.84	0.649	2.160	0.85	109.96	1.574	173.11		0.91	1	
41.011	9	Sand	234.62	1.636	2.368	0.967	1.4	1.64	0.8462	0.84	0.648	1.640	0.85	198.52	1.000	198.52		0.88	1	
41.339	9	Sand	202.38	1.378	2.388	0.978	1.411	1.69	0.8426	0.84	0.646	1.690	0.84	170.52	1.031	175.82		0.89	1	
41.667	8	Sand to Silty Sand	164.33	2.627	2.408	0.988	1.42	2.01	0.8397	0.84	0.645	2.010	0.84	137.99	1.313	181.22		0.90	1	
41.995	8	Sand to Silty Sand	144.5	2.109	2.428	0.998	1.43	2.03	0.8365	0.83	0.643	2.030	0.84	120.87	1.341	162.12		0.90	1	
42.323	9	Sand	144.61	0.956	2.448	1.008	1.44	1.81	0.8333	0.83	0.642	1.810	0.83	120.51	1.114	134.24	0.30	0.90	1	(0.53)
42.651	8	Sand to Silty Sand	82.363	0.895	2.468	1.019	1.45	2.14	0.8302	0.83	0.640	2.140	0.83	68.38	1.532	104.75	0.19	0.92	1	(0.33)
42.979	7	Silty Sand to Sandy Silt	81.498	1.514	2.487	1.029	1.459	2.29	0.8274	0.82	0.639	2.290	0.83	67.43	1.917	129.27	0.28	0.93	1	(0.50)
43.307	8	Sand to Silty Sand	155.43	1.913	2.507	1.039	1.468	1.96	0.8246	0.82	0.637	1.960	0.82	128.17	1.251	160.35		0.89	1	
43.635	8	Sand to Silty Sand	105.96	1.727	2.527	1.049	1.478	2.17	0.8215	0.82	0.636	2.170	0.82	87.05	1.596	138.96	0.33	0.91	1	(0.58)
43.963	4	Silty Clay to Clay	15.813	0.658	2.546	1.06	1.486	3.09	0.8191	0.81	0.635							0.92	1	
44.291	5	Clayey Silt to Silty Clay	9.295	0.276	2.565	1.07	1.495	3.2	0.8163	0.81	0.633							0.92	1	
44.619	7	Silty Sand to Sandy Silt	37.999	0.456	2.584	1.08	1.504	2.46	0.8136	0.81	0.631	2.460	0.81	30.92	2.574	79.59	0.13	0.92	1	(0.23)
44.948	8	Sand to Silty Sand	97.263	1.141	2.604	1.09	1.514	2.12	0.8106	0.80	0.629	2.120	0.81	78.84	1.492	117.65	0.23	0.91	1	(0.41)
45.276	7	Silty Sand to Sandy Silt	67.434	1.62	2.623	1.101	1.523	2.44	0.8079	0.80	0.628	2.440	0.81	54.48	2.483	135.29	0.31	0.92	1	(0.56)
45.604	6	Sandy Silt to Clayey Silt	56.927	1.966	2.642	1.111	1.531	2.61	0.8056	0.80	0.626							0.92	1	
45.932	6	Sandy Silt to Clayey Silt	66.05	1.666	2.661	1.121	1.54	2.47	0.8029	0.79	0.624	2.470	0.80	53.03	2.621	139.02	0.33	0.92	1	(0.60)
46.26	7	Silty Sand to Sandy Silt	68.847	1.445	2.68	1.131	1.549	2.41	0.8003	0.79	0.623	2.410	0.80	55.10	2.354	129.68	0.28	0.92	1	(0.52)
46.588	8	Sand to Silty Sand	93.667	1.285	2.7	1.141	1.559	2.19	0.7974	0.79	0.621	2.190	0.80	74.69	1.643	122.69	0.25	0.91	1	(0.46)
46.916	8	Sand to Silty Sand	109.24	1.884	2.72	1.152	1.568	2.2	0.7948	0.78	0.619	2.200	0.79	86.82	1.667	144.72	0.36	0.90	1	(0.65)
47.244	7	Silty Sand to Sandy Silt	131.5	2.981	2.739	1.162	1.577	2.22	0.7922	0.78	0.617	2.220	0.79	104.18	1.717	178.90		0.89	1	
47.572	8	Sand to Silty Sand	188.32	2.747	2.759	1.172	1.587	1.97	0.7894	0.78	0.615	1.970	0.79	148.65	1.263	187.71		0.86	1	
47.9	10	Gravelly Sand to Sand	342.71	2.643	2.78	1.182	1.597	1.59	0.7866	0.77	0.613	1.590	0.79	269.56	1.000	269.56		0.83	1	
48.228	10	Gravelly Sand to Sand	376.54	2.735	2.801	1.193	1.608	1.55	0.7835	0.77	0.611	1.550	0.78	295.01	1.000	295.01		0.83	1	
48.556	9	Sand	321.47	3.133	2.821	1.203	1.618	1.69	0.7807	0.77	0.609	1.690	0.78	250.97	1.031	258.77		0.82	1	
48.885	8	Sand to Silty Sand	146.28	2.572	2.841	1.213	1.628	2.12	0.7779	0.76	0.607	2.120	0.78	113.79	1.492	169.80		0.88	1	
49.213	7	Silty Sand to Sandy Silt	75.48	1.88	2.86	1.223	1.637	2.44	0.7755	0.76	0.605	2.440	0.78	58.53	2.483	145.34	0.37	0.91	1	(0.68)
49.541	8	Sand to Silty Sand	100	1.42	2.88	1.234	1.647	2.19	0.7727	0.76	0.603	2.190	0.77	77.28	1.643	126.94	0.27	0.90	1	(0.50)
49.869	7	Silty Sand to Sandy Silt	90.284	1.561	2.899	1.244	1.656	2.28	0.7703	0.75	0.601	2.280	0.77	69.55	1.886	131.18	0.29	0.90	1	(0.54)
50.197	10	Gravelly Sand to Sand	333.84	1.835	2.92	1.254	1.666	1.52	0.7676	0.75	0.599	1.520	0.77	256.27	1.000	256.27		0.82	1	
50.525	10	Gravelly Sand to Sand	349.99	1.928	2.941	1.264	1.677	1.5	0.7647	0.75	0.596	1.500	0.76	267.64	1.000	267.64		0.81	1	
50.853	8	Sand to Silty Sand	193.35	2.967	2.961	1.275	1.687	2	0.762	0.74	0.594	2.000	0.76	147.34	1.300	191.54		0.85	1	
51.181	7	Silty Sand to Sandy Silt	95.571	2.01	2.98	1.285	1.696	2.32	0.7597	0.74	0.592	2.320	0.76	72.60	2.015	146.26	0.37	0.89	1	(0.69)
51.509	7	Silty Sand to Sandy Silt	60.301	1.008	3	1.295	1.705	2.39	0.7573	0.74	0.590	2.390	0.76	45.67	2.272	103.76	0.18	0.90	1	(0.35)
51.837	7	Silty Sand to Sandy Silt	55.293	1.137	3.019	1.305	1.714	2.49	0.755	0.73	0.588	2.490	0.75	41.74	2.718	113.48	0.22	0.90	1	(0.41)
52.165	6	Sandy Silt to Clayey Silt	45.267	1.319	3.038	1.315	1.722	2.66	0.7529	0.73	0.587							0.90	1	
52.493	6	Sandy Silt to Clayey Silt	46.276	1.199	3.057	1.326	1.731	2.63	0.7506	0.73	0.585							0.90	1	
52.822	7	Silty Sand to Sandy Silt	58.254	1.165	3.076	1.336	1.74	2.49	0.7483	0.72	0.583	2.490	0.75	43.59	2.718	118.50	0.23	0.90	1	(0.45)
53.15	7	Silty Sand to Sandy Silt	60.1	0.81	3.095	1.346	1.749	2.37	0.746	0.72	0.581	2.370	0.75	44.84	2.194	98.37	0.17	0.89	1	(0.32)
53.478	7	Silty Sand to Sandy Silt	47.372	0.553	3.115	1.356	1.758	2.42	0.7437	0.72	0.579	2.420	0.74	35.23	2.396	84.41	0.14	0.89	1	(0.26)
53.806	7	Silty Sand to Sandy Silt	33.981	0.435	3.134	1.367	1.767	2.57	0.7415	0.71	0.577	2.570	0.74	25.20	3.148	79.32	0.13	0.89	1	(0.24)
54.134	7	Silty Sand to Sandy Silt	25.349	0.336	3.153	1.377	1.776	2.69	0.7392	0.71	0.575							0.89	1	
54.462	8	Sand to Silty Sand	66.425	0.482	3.173	1.387	1.786	2.19	0.7368	0.71	0.573	2.190	0.74	48.94	1.643	80.39	0.13	0.89	1	(0.25)
54.79	8	Sand to Silty Sand	79.027	0.448	3.193	1.397	1.796	2.08	0.7343	0.71	0.571	2.080	0.73	58.03	1.420	82.38	0.13	0.89	1	(0.25)
55.118	8	Sand to Silty Sand	61.926	0.477	3.213	1.408	1.805	2.23	0.7321	0.70	0.569	2.230	0.73	45.34	1.743	79.04	0.13	0.89	1	(0.24)
55.446	7	Silty Sand to Sandy Silt	62.445	0.789	3.232	1.418	1.814	2.34	0.7299	0.70	0.567	2.340	0.73	45.58	2.084	94.98	0.16	0.89	1	(0.31)
55.774	5	Clayey Silt to Silty Clay	23.787	0.78	3.251	1.428	1.823	2.93	0.7278	0.70	0.565							0.89	1	
56.102	5	Clayey Silt to Silty Clay	21.687	0.768	3.27	1.438	1.831	3	0.7258	0.69	0.563							0.89	1	
56.43	7	Silty Sand to Sandy Silt	46.67	0.659	3.289	1.449	1.84	2.5	0.7237	0.69	0.561	2.500	0.72	33.77	2.768	93.50	0.16	0.89	1	(0.30)
56.759	7	Silty Sand to Sandy Silt	55.716	0.671	3.308	1.459	1.849	2.39	0.7215	0.69	0.559	2.390	0.72	40.20	2.272	91.34	0.15	0.88	1	(0.30)
57.087	8	Sand to Silty Sand	78.873	0.942	3.328	1.469	1.859	2.26	0.7192	0.68	0.557	2.260	0.72	56.72	1.827	103.62	0.18	0.88	1	(0.36)

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***		
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*	
CPT NO.	***CPT-10-003A***	*FAULT M_w =* 6.9	*MSF =* 1.24 *a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
57.415	8	Sand to Silty Sand	81.257	1.115	3.348	1.479	1.869	2.28	0.7168	0.68	0.555	2.280	0.72	58.25	1.886	109.87	0.20	0.88	1	(0.40)
57.743	7	Silty Sand to Sandy Silt	74.057	1.141	3.367	1.489	1.878	2.35	0.7147	0.68	0.553	2.350	0.71	52.93	2.120	112.20	0.21	0.88	1	(0.42)
58.071	7	Silty Sand to Sandy Silt	69.962	1.038	3.387	1.5	1.887	2.36	0.7127	0.68	0.552	2.360	0.71	49.86	2.156	107.52	0.20	0.88	1	(0.39)
58.399	7	Silty Sand to Sandy Silt	64.31	1.409	3.406	1.51	1.896	2.5	0.7106	0.67	0.550	2.500	0.71	45.70	2.768	126.51	0.27	0.88	1	(0.53)
58.727	7	Silty Sand to Sandy Silt	68.184	1.454	3.425	1.52	1.905	2.47	0.7085	0.67	0.548	2.470	0.71	48.31	2.621	126.64	0.27	0.88	1	(0.53)
59.055	7	Silty Sand to Sandy Silt	60.301	1.323	3.445	1.53	1.914	2.52	0.7065	0.67	0.546	2.520	0.71	42.60	2.872	122.34	0.25	0.88	1	(0.50)
59.383	7	Silty Sand to Sandy Silt	58.705	1.248	3.464	1.541	1.923	2.53	0.7045	0.66	0.544	2.530	0.70	41.35	2.925	120.95	0.24	0.88	1	(0.49)
59.711	7	Silty Sand to Sandy Silt	64.435	1.296	3.483	1.551	1.932	2.48	0.7024	0.66	0.543	2.480	0.70	45.26	2.669	120.82	0.24	0.88	1	(0.49)
60.039	7	Silty Sand to Sandy Silt	82.718	1.684	3.502	1.561	1.941	2.4	0.7004	0.66	0.541	2.400	0.70	57.94	2.312	133.97	0.30	0.88	1	(0.61)
60.367	7	Silty Sand to Sandy Silt	83.256	2.067	3.522	1.571	1.95	2.45	0.6984	0.66	0.539	2.450	0.70	58.15	2.528	147.01	0.38	0.87	1	(0.75)
60.696	7	Silty Sand to Sandy Silt	81.459	2.212	3.541	1.582	1.96	2.48	0.6962	0.65	0.537	2.480	0.70	56.71	2.669	151.38	0.40	0.87	1	(0.81)
61.024	7	Silty Sand to Sandy Silt	96.82	2.143	3.56	1.592	1.969	2.36	0.6942	0.65	0.536	2.360	0.69	67.21	2.156	144.94	0.36	0.87	1	(0.73)
61.352	6	Sandy Silt to Clayey Silt	58.984	1.909	3.579	1.602	1.977	2.61	0.6925	0.65	0.534							0.87	1	
61.68	7	Silty Sand to Sandy Silt	88.851	1.939	3.599	1.612	1.986	2.38	0.6905	0.65	0.533	2.380	0.69	61.35	2.233	136.98	0.32	0.87	1	(0.65)
62.008	8	Sand to Silty Sand	137.74	2.233	3.618	1.623	1.996	2.17	0.6884	0.64	0.531	2.170	0.69	94.82	1.596	151.36	0.40	0.84	1	(0.79)
62.336	8	Sand to Silty Sand	143.12	2.382	3.638	1.633	2.005	2.17	0.6864	0.64	0.529	2.170	0.69	98.24	1.596	156.83	0.44	0.84	1	(0.86)
62.664	8	Sand to Silty Sand	134.49	2.535	3.658	1.643	2.015	2.22	0.6843	0.64	0.527	2.220	0.68	92.03	1.717	158.04	0.45	0.84	1	(0.88)
62.992	7	Silty Sand to Sandy Silt	128.62	2.799	3.677	1.653	2.024	2.28	0.6824	0.64	0.526	2.280	0.68	87.77	1.886	165.54		0.85	1	
63.32	7	Silty Sand to Sandy Silt	124.99	2.907	3.697	1.664	2.033	2.3	0.6805	0.63	0.524	2.300	0.68	85.05	1.949	165.74		0.85	1	
63.648	7	Silty Sand to Sandy Silt	130.45	2.663	3.716	1.674	2.042	2.26	0.6786	0.63	0.523	2.260	0.68	88.52	1.827	161.71		0.84	1	
63.976	7	Silty Sand to Sandy Silt	117.39	2.495	3.735	1.684	2.051	2.31	0.6767	0.63	0.521	2.310	0.68	79.44	1.981	157.39	0.44	0.85	1	(0.89)
64.304	7	Silty Sand to Sandy Silt	99.195	1.936	3.755	1.694	2.06	2.34	0.6748	0.63	0.520	2.340	0.67	66.94	2.084	139.49	0.33	0.86	1	(0.68)
64.633	8	Sand to Silty Sand	86.227	1.352	3.775	1.704	2.07	2.33	0.6728	0.62	0.518	2.330	0.67	58.01	2.049	118.85	0.24	0.86	1	(0.49)
64.961	7	Silty Sand to Sandy Silt	55.206	1.196	3.794	1.715	2.079	2.58	0.6709	0.62	0.517	2.580	0.67	37.04	3.206	118.77	0.24	0.86	1	(0.49)
65.289	7	Silty Sand to Sandy Silt	68.338	1.179	3.813	1.725	2.088	2.44	0.6691	0.62	0.515	2.440	0.67	45.72	2.483	113.54	0.22	0.86	1	(0.45)
65.617	8	Sand to Silty Sand	78.354	1.143	3.833	1.735	2.098	2.35	0.6671	0.62	0.514	2.350	0.67	52.27	2.120	110.79	0.21	0.86	1	(0.43)
65.945	7	Silty Sand to Sandy Silt	69.135	1.134	3.852	1.745	2.107	2.41	0.6653	0.62	0.512	2.410	0.67	45.99	2.354	108.25	0.20	0.86	1	(0.41)
66.273	7	Silty Sand to Sandy Silt	63.3	1.171	3.872	1.756	2.116	2.48	0.6634	0.61	0.511	2.480	0.66	42.00	2.669	112.10	0.21	0.86	1	(0.44)
66.601	7	Silty Sand to Sandy Silt	71.683	1.066	3.891	1.766	2.125	2.38	0.6617	0.61	0.510	2.380	0.66	47.43	2.233	105.89	0.19	0.86	1	(0.40)
66.929	7	Silty Sand to Sandy Silt	59.023	1.025	3.91	1.776	2.134	2.49	0.6599	0.61	0.508	2.490	0.66	38.95	2.718	105.87	0.19	0.86	1	(0.40)
67.257	5	Clayey Silt to Silty Clay	30.684	1.211	3.929	1.786	2.143	2.93	0.6581	0.61	0.507							0.86	1	
67.585	5	Clayey Silt to Silty Clay	26.627	1.189	3.948	1.797	2.151	3.02	0.6565	0.61	0.506							0.86	1	
67.913	7	Silty Sand to Sandy Silt	64.627	1.052	3.967	1.807	2.16	2.45	0.6548	0.60	0.504	2.450	0.65	42.32	2.528	106.98	0.19	0.86	1	(0.41)
68.241	8	Sand to Silty Sand	100.78	1.737	3.987	1.817	2.17	2.31	0.6528	0.60	0.503	2.310	0.65	65.79	1.981	130.35	0.29	0.85	1	(0.60)
68.57	3	Clay	34.921	1.958	4.005	1.827	2.178	3.02	0.6513	0.60	0.502							0.86	1	
68.898	3	Clay	13.319	0.752	4.024	1.838	2.186	3.4	0.6497	0.60	0.501							0.86	1	
69.226	6	Sandy Silt to Clayey Silt	22.436	0.44	4.042	1.848	2.195	2.93	0.648	0.60	0.499							0.85	1	
69.554	7	Silty Sand to Sandy Silt	30.713	0.427	4.062	1.858	2.204	2.72	0.6463	0.59	0.498							0.85	1	
69.882	7	Silty Sand to Sandy Silt	40.412	0.434	4.081	1.868	2.213	2.56	0.6446	0.59	0.497	2.560	0.64	26.05	3.091	80.51	0.13	0.85	1	(0.27)
70.21	7	Silty Sand to Sandy Silt	32.539	0.432	4.1	1.878	2.222	2.71	0.6429	0.59	0.496							0.85	1	
70.538	7	Silty Sand to Sandy Silt	29.463	0.397	4.12	1.889	2.231	2.75	0.6412	0.59	0.495							0.85	1	
70.866	7	Silty Sand to Sandy Silt	29.896	0.418	4.139	1.899	2.24	2.75	0.6395	0.59	0.494							0.85	1	
71.194	7	Silty Sand to Sandy Silt	36.711	0.511	4.158	1.909	2.249	2.67	0.6379	0.59	0.493							0.85	1	
71.522	6	Sandy Silt to Clayey Silt	39.682	0.867	4.177	1.919	2.258	2.75	0.6362	0.58	0.491							0.85	1	
71.85	5	Clayey Silt to Silty Clay	30.453	1.237	4.196	1.93	2.266	3.03	0.6347	0.58	0.491							0.85	1	
72.178	6	Sandy Silt to Clayey Silt	37.24	0.792	4.215	1.94	2.275	2.79	0.6331	0.58	0.490							0.85	1	
72.507	7	Silty Sand to Sandy Silt	48.401	0.501	4.234	1.95	2.284	2.51	0.6315	0.58	0.488	2.510	0.63	30.56	2.820	86.17	0.14	0.85	1	(0.30)
72.835	7	Silty Sand to Sandy Silt	31.559	0.453	4.253	1.96	2.293	2.76	0.6298	0.58	0.487							0.85	1	
73.163	7	Silty Sand to Sandy Silt	32.876	0.459	4.273	1.971	2.302	2.73	0.6282	0.58	0.486							0.85	1	
73.491	7	Silty Sand to Sandy Silt	40.249	0.665	4.292	1.981	2.311	2.69	0.6266	0.57	0.485							0.85	1	
73.819	7	Silty Sand to Sandy Silt	48.602	0.995	4.311	1.991	2.32	2.67	0.625	0.57	0.484							0.85	1	
74.147	7	Silty Sand to Sandy Silt	57.667	1.324	4.331	2.001	2.329	2.64	0.6234	0.57	0.483							0.84	1	
74.475	6	Sandy Silt to Clayey Silt	73.913	2.249	4.349	2.012	2.338	2.63	0.6218	0.57	0.482							0.84	1	
74.803	6	Sandy Silt to Clayey Silt	78.614	2.335	4.368	2.022	2.346	2.61	0.6204	0.57	0.482							0.84	1	
75.131	6	Sandy Silt to Clayey Silt	55.504	1.841	4.387	2.032	2.355	2.77	0.6188	0.57	0.481							0.84	1	
75.459	5	Clayey Silt to Silty Clay	58.763	2.4	4.406	2.042	2.364	2.8	0.6173	0.57	0.480							0.84	1	
75.787	4	Silty Clay to Clay	53.928	2.681	4.425	2.052	2.372	2.9	0.6159	0.56	0.479							0.84	1	
76.115	6	Sandy Silt to Clayey Silt	95.523	2.923	4.443	2.063	2.381	2.55	0.6144	0.56	0.478	2.550	0.61	58.68	3.034	178.06		0.84	1	
76.444	7	Silty Sand to Sandy Silt	132.27	2.906	4.463	2.073	2.39	2.35	0.6128	0.56	0.477	2.350	0.61	81.06	2.120	171.81		0.83	1	
76.772	8	Sand to Silty Sand	141.73	2.022	4.483	2.083	2.399	2.2	0.6113	0.56	0.476	2.200	0.61	86.64	1.667	144.41	0.36	0.82	1	(0.76)
77.1	9	Sand	139.77	1.471	4.503	2.093	2.409	2.13	0.6096	0.56	0.475	2.130	0.61	85.20	1.512	128.80	0.28	0.82	1	(0.59)
77.428	7	Silty Sand to Sandy Silt	119.95	2.592	4.522	2.104	2.419	2.38	0.6079	0.56	0.474	2.380	0.61	72.92	2.233	162.79		0.83	1	
77.756	8	Sand to Silty Sand	139.86	2.549	4.542	2.114	2.428	2.28	0.6064	0.56	0.474	2.280	0.61	84.81	1.886	159.96	0.46	0.82	1	(0.98)
78.084	8	Sand to Silty Sand	124.26	2.164	4.562	2.124	2.438	2.31	0.6047	0.56	0.473	2.310	0.60	75.14	1.981	148.87	0.39	0.83	1	(0.84)
78.412	8	Sand to Silty Sand	163.39	2.625	4.582	2.134	2.447	2.19	0.6032	0.55	0.472	2.190	0.60	98.56	1.643	161.90		0.80	1	
78.74	8	Sand to Silty Sand	221.69	3.96	4.602	2.145	2.457	2.12	0.6016	0.55	0.471	2.120	0.60	133.37	1.492	199.00		0.77	1	
79.068	7	Silty Sand to Sandy Silt	203.55	5.371	4.621	2.155	2.466	2.27	0.6001	0.55	0.470	2.270	0.60	122.15	1.856	226.73		0.78	1	
79.396	7	Silty Sand to Sandy Silt	197.08	4.586	4.64	2.165	2.475	2.24	0.5986	0.55	0.469	2.240	0.60	117.98	1.770	208.88		0.78	1	
79.724	8	Sand to Silty Sand	205.67	3.101	4.66	2.175	2.485	2.1	0.597	0.55	0.469	2.100	0.60	122.79	1.455	178.62		0.78	1	
80.052	8	Sand to Silty Sand	157.26	2.79	4.68	2.186	2.494	2.24	0.5956	0.55	0.468	2.240	0.60	93.66	1.770	165.82		0.80	1	
80.381	7	Silty Sand to Sandy Silt	98.964	1.681	4.699	2.196	2.503	2.4	0.5941	0.55	0.467	2.400	0.59	58.80	2.312	135.96	0.31	0.83	1	(0.69)
80.709	8	Sand to Silty Sand	48.929	0.387	4.719	2.206	2.513	2.51	0.5925	0.55	0.466	2.510	0.59	28.99	2.820	81.74	0.13	0.83	1	(0.29)
81.037	7	Silty Sand to Sandy Silt	32.558	0.466	4.738	2.216	2.522	2.82	0.5911	0.54	0.466							0.83	1	
81.365	9	Sand	106.19	0.628	4.759	2.227	2.532	2.12	0.5895	0.54	0.465	2.120	0.59	62.60	1.492	93.41	0.16	0.83	1	(0.34)
81.693	9	Sand	204.49	0.691	4.779	2.237	2.542	1.75	0.5879	0.54	0.464	1.750	0.59	120.23	1.072	128.83	0.28	0.76	1	(0.57)
82.021	9	Sand	209.01	0.984	4.799	2.247	2.553	1.81	0.5862	0.54	0.463	1.810	0.59	122.52	1.114	136.49	0.32	0.76	1	(0.64)
82.349	9	Sand	153.9	1.109	4.82	2.257	2.563	2.02	0.5846	0.54	0.462	2.020	0.58	89.98	1.327	119.40	0.24	0.80	1	(0.51)
82.677	8	Sand to Silty Sand	73.365	0.771	4.84	2.267	2.572	2.41	0.5832	0.54	0.462	2.410	0.58	42.79	2.354	100.71	0.18	0.83	1	(0.39)
83.005	6	Sandy Silt to Clayey Silt	23.157	0.343	4.858	2.278	2.581	3	0.5819	0.54	0.461							0.83	1	
83.333	6	Sandy Silt to Clayey Silt	12.218	0.126	4.877	2.288	2.589	3.27	0.5806	0.54	0.461							0.83	1	
83.661	1	Sensitive Fines	5.844	0.06	4.896	2.298	2.597	3.9	0.5794	0.54	0.460							0.83	1	
83.99	4	Silty Clay to Clay	4.826	0.103	4.914	2.308	2.606	4.06	0.578	0.54	0.459							0.83	1	
84.318	6	Sandy Silt to Clayey Silt	9.831	0.08	4.933	2.319	2.615	3.29	0.5767	0.53	0.459							0.83	1	
84.646	7	Silty Sand to Sandy Silt	26.8	0.088	4.952	2.329	2.624	2.62	0.5753	0.53	0.458							0.82	1	
84.974	9	Sand	89.092	0.423	4.973	2.339	2.634	2.16	0.5738	0.53	0.457	2.160	0.57	51.12	1.574	80.48	0.13	0.82	1	(0.29)
85.302	10	Gravelly Sand to Sand	230.49	0.775	4.994	2.349	2.644	1.71	0.5723	0.53	0.457	1.710	0.57	131.91	1.045	137.80	0.32	0.74	1	(0.65)
85.63	9	Sand	356.56	3.091	5.014	2.36	2.655	1.78	0.5707	0.53	0.456	1.780	0.57	203.48	1.092	222.27		0.69	1	
85.958	9	Sand	462.13	6.781	5.034	2.37	2.665	1.86	0.5692	0.53	0.455	1.860	0.57	263.05	1.153	303.39		0.68	1	
86.286	8	Sand to Silty Sand	286.61	5.71	5.054	2.38	2.674	2.1	0.5679	0.53	0.455	2.100	0.57	162.76	1.455	236.78		0.73	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***		
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*	
CPT NO.	***CPT-10-003A***	*FAULT M_w =* 6.9	*MSF =* 1.24 *a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
86.614	7	Silty Sand to Sandy Silt	114.24	2.839	5.074	2.39	2.683	2.47	0.5666	0.53	0.454	2.470	0.57	64.72	2.621	169.66		0.82	1	
86.942	7	Silty Sand to Sandy Silt	62.089	1.182	5.093	2.401	2.692	2.61	0.5653	0.53	0.454							0.82	1	
87.27	7	Silty Sand to Sandy Silt	39.163	0.628	5.112	2.411	2.701	2.75	0.564	0.53	0.453							0.82	1	
87.598	8	Sand to Silty Sand	62.474	0.594	5.132	2.421	2.711	2.44	0.5625	0.53	0.452	2.440	0.56	35.14	2.483	87.26	0.14	0.82	1	(0.32)
87.927	8	Sand to Silty Sand	122.12	1.255	5.152	2.431	2.721	2.2	0.5611	0.52	0.452	2.200	0.56	68.52	1.667	114.21	0.22	0.81	1	(0.49)
88.255	7	Silty Sand to Sandy Silt	75.826	1.796	5.171	2.441	2.73	2.6	0.5598	0.52	0.451							0.82	1	
88.583	4	Silty Clay to Clay	41.45	2.044	5.19	2.452	2.738	3.01	0.5587	0.52	0.451							0.82	1	
88.911	3	Clay	28.97	1.588	5.208	2.462	2.746	3.19	0.5575	0.52	0.450							0.82	1	
89.239	9	Sand	155	1.533	5.229	2.472	2.757	2.11	0.556	0.52	0.450	2.110	0.56	86.17	1.473	126.95	0.27	0.79	1	(0.59)
89.567	10	Gravelly Sand to Sand	594.52	1.379	5.25	2.482	2.767	1.28	0.5546	0.52	0.449	1.280	0.55	329.70	1.000	329.70		0.67	1	
89.895	10	Gravelly Sand to Sand	681	1.607	5.27	2.493	2.778	1.24	0.553	0.52	0.448	1.240	0.55	376.62	1.000	376.62		0.66	1	
90.223	10	Gravelly Sand to Sand	708.62	2.849	5.291	2.503	2.788	1.35	0.5517	0.52	0.448	1.350	0.55	390.91	1.000	390.91		0.66	1	
90.551	10	Gravelly Sand to Sand	650.31	3.685	5.312	2.513	2.799	1.48	0.5501	0.52	0.447	1.480	0.55	357.76	1.000	357.76		0.66	1	
90.879	10	Gravelly Sand to Sand	558.87	3.536	5.333	2.523	2.81	1.56	0.5486	0.52	0.447	1.560	0.55	306.61	1.000	306.61		0.66	1	
91.207	10	Gravelly Sand to Sand	455.54	3.344	5.354	2.534	2.82	1.67	0.5473	0.52	0.446	1.670	0.55	249.30	1.017	253.63		0.66	1	
91.535	10	Gravelly Sand to Sand	405.36	2.587	5.375	2.544	2.831	1.67	0.5458	0.52	0.445	1.670	0.55	221.24	1.017	225.08		0.66	1	
91.864	10	Gravelly Sand to Sand	479.78	1.946	5.396	2.554	2.842	1.5	0.5443	0.51	0.445	1.500	0.54	261.14	1.000	261.14		0.66	1	
92.192	10	Gravelly Sand to Sand	581.93	2.518	5.417	2.564	2.852	1.45	0.5429	0.51	0.444	1.450	0.54	315.96	1.000	315.96		0.66	1	
92.52	10	Gravelly Sand to Sand	588.46	2.539	5.438	2.575	2.863	1.44	0.5415	0.51	0.444	1.440	0.54	318.63	1.000	318.63		0.66	1	
92.848	10	Gravelly Sand to Sand	485.67	2.418	5.458	2.585	2.874	1.55	0.54	0.51	0.443	1.550	0.54	262.27	1.000	262.27		0.66	1	
93.176	10	Gravelly Sand to Sand	495.76	1.59	5.479	2.595	2.884	1.44	0.5387	0.51	0.443	1.440	0.54	267.06	1.000	267.06		0.65	1	
93.504	10	Gravelly Sand to Sand	559.76	1.785	5.5	2.605	2.895	1.39	0.5372	0.51	0.442	1.390	0.54	300.72	1.000	300.72		0.65	1	
93.832	10	Gravelly Sand to Sand	613.86	2.646	5.521	2.615	2.906	1.43	0.5358	0.51	0.441	1.430	0.54	328.90	1.000	328.90		0.65	1	
94.16	9	Sand	378.39	4	5.541	2.626	2.916	1.85	0.5345	0.51	0.441	1.850	0.53	202.25	1.145	231.59		0.67	1	
94.488	7	Silty Sand to Sandy Silt	164.78	3.993	5.561	2.636	2.925	2.36	0.5333	0.51	0.441	2.360	0.53	87.88	2.156	189.51		0.78	1	
94.816	6	Sandy Silt to Clayey Silt	84.208	3.206	5.58	2.646	2.933	2.7	0.5323	0.51	0.440							0.81	1	
95.144	7	Silty Sand to Sandy Silt	154.71	3.445	5.599	2.656	2.942	2.36	0.5311	0.51	0.440	2.360	0.53	82.17	2.156	177.20		0.79	1	
95.472	8	Sand to Silty Sand	184.83	3.052	5.619	2.667	2.952	2.22	0.5299	0.51	0.439	2.220	0.53	97.93	1.717	168.17		0.77	1	
95.801	9	Sand	200.05	2.225	5.639	2.677	2.962	2.09	0.5286	0.51	0.439	2.090	0.53	105.75	1.437	151.95	0.41	0.75	1	(0.86)
96.129	9	Sand	274.4	2.522	5.659	2.687	2.972	1.93	0.5273	0.51	0.438	1.930	0.53	144.70	1.218	176.31		0.71	1	
96.457	9	Sand	301.06	2.578	5.68	2.697	2.982	1.88	0.5261	0.51	0.438	1.880	0.53	158.37	1.171	185.39		0.70	1	
96.785	10	Gravelly Sand to Sand	320.12	2.32	5.701	2.708	2.993	1.81	0.5247	0.50	0.437	1.810	0.52	167.96	1.114	187.11		0.69	1	
97.113	10	Gravelly Sand to Sand	343.55	2.333	5.722	2.718	3.004	1.77	0.5233	0.50	0.437	1.770	0.52	179.79	1.085	195.13		0.67	1	
97.441	10	Gravelly Sand to Sand	499.15	2.254	5.742	2.728	3.014	1.53	0.5221	0.50	0.436	1.530	0.52	260.59	1.000	260.59		0.64	1	
97.769	10	Gravelly Sand to Sand	646.07	1.792	5.763	2.738	3.025	1.32	0.5207	0.50	0.436	1.320	0.52	336.41	1.000	336.41		0.64	1	
98.097	10	Gravelly Sand to Sand	631.05	1.824	5.784	2.749	3.036	1.34	0.5194	0.50	0.435	1.340	0.52	327.74	1.000	327.74		0.64	1	
98.425	10	Gravelly Sand to Sand	651.81	1.984	5.805	2.759	3.046	1.34	0.5181	0.50	0.435	1.340	0.52	337.72	1.000	337.72		0.64	1	
98.753	10	Gravelly Sand to Sand	741.01	1.704	5.826	2.769	3.057	1.24	0.5168	0.50	0.434	1.240	0.52	382.95	1.000	382.95		0.64	1	
99.081	10	Gravelly Sand to Sand	630.48	1.757	5.847	2.779	3.068	1.34	0.5155	0.50	0.434	1.340	0.52	324.99	1.000	324.99		0.64	1	
99.409	10	Gravelly Sand to Sand	403.15	1.738	5.868	2.789	3.078	1.61	0.5143	0.50	0.433	1.610	0.51	207.33	1.000	207.33		0.64	1	
99.738	8	Sand to Silty Sand	136.64	1.814	5.888	2.8	3.088	2.29	0.5131	0.50	0.433	2.290	0.51	70.11	1.917	134.40	0.31	0.79	1	(0.69)
100.07	3	Clay	42.736	2.747	5.906	2.81	3.096	3.16	0.5121	0.50	0.433							0.80	1	
100.39	6	Sandy Silt to Clayey Silt	85.66	2.384	5.925	2.82	3.104	2.65	0.5112	0.50	0.432							0.80	1	
100.72	6	Sandy Silt to Clayey Silt	55.504	1.871	5.943	2.83	3.113	2.86	0.5101	0.50	0.432							0.80	1	
101.05	6	Sandy Silt to Clayey Silt	72	2.213	5.962	2.841	3.122	2.74	0.509	0.50	0.432							0.80	1	
101.38	5	Clayey Silt to Silty Clay	74.298	2.985	5.981	2.851	3.13	2.8	0.5081	0.50	0.431							0.80	1	
101.71	6	Sandy Silt to Clayey Silt	89.236	2.852	6	2.861	3.139	2.68	0.507	0.50	0.431							0.80	1	
102.03	6	Sandy Silt to Clayey Silt	75.124	2.629	6.019	2.871	3.147	2.77	0.5061	0.49	0.431							0.80	1	
102.36	6	Sandy Silt to Clayey Silt	63.31	2.279	6.037	2.882	3.156	2.85	0.5051	0.49	0.430							0.79	1	
102.69	4	Silty Clay to Clay	38.893	1.754	6.056	2.892	3.164	3.1	0.5041	0.49	0.430							0.79	1	
103.02	3	Clay	16.034	1.287	6.075	2.902	3.172	3.66	0.5032	0.49	0.430							0.79	1	
103.35	6	Sandy Silt to Clayey Silt	27.127	0.812	6.093	2.912	3.181	3.14	0.5022	0.49	0.429							0.79	1	
103.68	6	Sandy Silt to Clayey Silt	28.906	0.677	6.112	2.923	3.19	3.05	0.5011	0.49	0.429							0.79	1	
104	7	Silty Sand to Sandy Silt	31.28	0.537	6.131	2.933	3.199	2.94	0.5001	0.49	0.429							0.79	1	
104.33	7	Silty Sand to Sandy Silt	40.816	0.451	6.151	2.943	3.208	2.72	0.4991	0.49	0.428							0.79	1	
104.66	7	Silty Sand to Sandy Silt	40.508	0.556	6.17	2.953	3.217	2.77	0.4981	0.49	0.428							0.79	1	
104.99	7	Silty Sand to Sandy Silt	49.833	0.688	6.189	2.964	3.226	2.7	0.4971	0.49	0.428							0.79	1	
105.32	7	Silty Sand to Sandy Silt	67.376	1.182	6.209	2.974	3.235	2.63	0.4961	0.49	0.428							0.79	1	
105.64	7	Silty Sand to Sandy Silt	78.489	1.772	6.228	2.984	3.244	2.65	0.495	0.49	0.427							0.79	1	
105.97	7	Silty Sand to Sandy Silt	78.642	1.683	6.247	2.994	3.253	2.64	0.494	0.49	0.427							0.79	1	
106.3	7	Silty Sand to Sandy Silt	91.822	1.557	6.267	3.004	3.262	2.52	0.4931	0.49	0.427	2.520	0.49	45.27	2.872	130.01	0.28	0.79	1	(0.65)
106.63	7	Silty Sand to Sandy Silt	77.047	1.479	6.286	3.015	3.271	2.63	0.4921	0.49	0.426							0.79	1	
106.96	7	Silty Sand to Sandy Silt	64.906	1.287	6.305	3.025	3.28	2.71	0.4911	0.49	0.426							0.79	1	
107.28	6	Sandy Silt to Clayey Silt	67.674	1.672	6.324	3.035	3.289	2.74	0.4901	0.49	0.426							0.79	1	
107.61	7	Silty Sand to Sandy Silt	74.211	1.816	6.343	3.045	3.298	2.71	0.4891	0.49	0.425							0.79	1	
107.94	7	Silty Sand to Sandy Silt	77.566	1.938	6.363	3.056	3.307	2.7	0.4881	0.49	0.425							0.79	1	
108.27	7	Silty Sand to Sandy Silt	74.653	1.507	6.382	3.066	3.316	2.66	0.4872	0.48	0.425							0.79	1	
108.6	6	Sandy Silt to Clayey Silt	51.65	1.524	6.401	3.076	3.325	2.91	0.4862	0.48	0.424							0.79	1	
108.92	6	Sandy Silt to Clayey Silt	65.156	2.23	6.42	3.086	3.333	2.85	0.4853	0.48	0.424							0.79	1	
109.25	7	Silty Sand to Sandy Silt	89.947	2.025	6.439	3.097	3.342	2.62	0.4844	0.48	0.424							0.79	1	
109.58	7	Silty Sand to Sandy Silt	93.533	2.234	6.458	3.107	3.352	2.62	0.4833	0.48	0.423							0.79	1	
109.91	7	Silty Sand to Sandy Silt	98.752	2.512	6.478	3.117	3.361	2.62	0.4824	0.48	0.423							0.78	1	
110.24	6	Sandy Silt to Clayey Silt	84.776	2.556	6.496	3.127	3.369	2.72	0.4815	0.48	0.423							0.78	1	
110.56	7	Silty Sand to Sandy Silt	109.61	2.941	6.516	3.138	3.378	2.6	0.4806	0.48	0.423							0.78	1	
110.89	8	Sand to Silty Sand	120.3	2.088	6.536	3.148	3.388	2.44	0.4795	0.48	0.422	2.440	0.48	57.68	2.483	143.23	0.35	0.78	1	(0.81)
111.22	7	Silty Sand to Sandy Silt	96.003	1.799	6.555	3.158	3.397	2.55	0.4786	0.48	0.422	2.550	0.48	45.94	3.034	139.41	0.33	0.78	1	(0.76)
111.55	6	Sandy Silt to Clayey Silt	69.501	1.911	6.574	3.168	3.405	2.78	0.4777	0.48	0.422							0.78	1	
111.88	5	Clayey Silt to Silty Clay	44.113	1.745	6.593	3.178	3.414	3.04	0.4768	0.48	0.422							0.78	1	
112.21	5	Clayey Silt to Silty Clay	47.055	1.759	6.611	3.189	3.423	2.98	0.4759	0.48	0.421							0.78	1	
112.53	7	Silty Sand to Sandy Silt	87.967	1.836	6.631	3.199	3.432	2.59	0.475	0.48	0.421	2.590	0.47	41.78	3.266	136.46	0.32	0.78	1	(0.73)
112.86	8	Sand to Silty Sand	113.79	1.814	6.65	3.209	3.441	2.43	0.474	0.48	0.421	2.430	0.47	53.94	2.439	131.56	0.29	0.78	1	(0.67)
113.19	7	Silty Sand to Sandy Silt	77.191	1.5	6.67	3.219	3.45	2.64	0.4731	0.48	0.420							0.78	1	
113.52	7	Silty Sand to Sandy Silt	87.256	1.486	6.689	3.23	3.459	2.55	0.4722	0.48	0.420	2.550	0.47	41.20	3.034	125.02	0.26	0.78	1	(0.60)
113.85	7	Silty Sand to Sandy Silt	101.47	2.041	6.708	3.24	3.469	2.54	0.4712	0.48	0.420	2.540	0.47	47.81	2.979	142.43	0.35	0.78	1	(0.80)
114.17	3	Clay	42.484	2.306	6.727	3.25	3.477	3.17	0.4704	0.48	0.419							0.78	1	
114.5	4	Silty Clay to Clay	31.711	1.387	6.745	3.26	3.485	3.25	0.4696	0.48	0.419							0.78	1	
114.83	6	Sandy Silt to Clayey Silt	23.965	0.444	6.764	3.271	3.494	3.19	0.4687	0.48	0.419							0.78	1	
115.16	7	Silty Sand to Sandy Silt	35.49	0.406	6.784	3.281	3.503	2.88	0.4678	0.48	0.419							0.78	1	
115.49	7	Silty Sand to Sandy Silt	39.931	0.388	6.803	3.291	3.512	2.78	0.4669	0.47	0.418							0.78	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***					
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*				
CPT NO.	***CPT-10-003A***	*FAULT M_w =*	6.9	*MSF =*	1.24	*a_{max} (g)=* 0.7

		CPT RESULT INPUT							***CSR***				***CRR 7.5***				***F.S.=(CRR 7.5/CSR)*MSF*K σ*K α***		
Depth (ft)	Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
115.81	8 Sand to Silty Sand	72.961	0.606	6.823	3.301	3.521	2.48	0.466	0.47	0.418	2.480	0.47	34.00	2.669	90.76	0.15	0.78	1	(0.34)
116.14	7 Silty Sand to Sandy Silt	66.117	0.971	6.842	3.312	3.531	2.64	0.465	0.47	0.418							0.78	1	
116.47	6 Sandy Silt to Clayey Silt	55.082	1.411	6.861	3.322	3.539	2.85	0.4642	0.47	0.418							0.78	1	
116.8	6 Sandy Silt to Clayey Silt	52.765	1.424	6.88	3.332	3.548	2.88	0.4634	0.47	0.417							0.78	1	
117.13	7 Silty Sand to Sandy Silt	57.513	1.366	6.899	3.342	3.557	2.81	0.4625	0.47	0.417							0.78	1	
117.45	9 Sand	159.33	1.516	6.919	3.352	3.567	2.19	0.4615	0.47	0.417	2.190	0.46	73.53	1.643	120.79	0.24	0.76	1	(0.55)
117.78	8 Sand to Silty Sand	108.89	1.697	6.939	3.363	3.576	2.46	0.4606	0.47	0.416	2.460	0.46	50.16	2.574	129.12	0.28	0.78	1	(0.65)
118.11	5 Clayey Silt to Silty Clay	42.229	1.935	6.958	3.373	3.585	3.09	0.4598	0.47	0.416							0.77	1	
118.44	3 Clay	28.348	1.889	6.976	3.383	3.593	3.34	0.459	0.47	0.416							0.77	1	
118.77	6 Sandy Silt to Clayey Silt	48.765	1.209	6.995	3.393	3.602	2.89	0.4581	0.47	0.416							0.77	1	
119.09	8 Sand to Silty Sand	92.6	1.1	7.015	3.404	3.611	2.46	0.4573	0.47	0.415	2.460	0.46	42.34	2.574	109.01	0.20	0.77	1	(0.46)
119.42	7 Silty Sand to Sandy Silt	67.818	1.48	7.034	3.414	3.62	2.73	0.4564	0.47	0.415							0.77	1	
119.75	7 Silty Sand to Sandy Silt	62.368	1.156	7.054	3.424	3.629	2.72	0.4556	0.47	0.415							0.77	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***		
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*	
CPT NO.	***CPT-10-005A***	*FAULT M_w =* 6.9	*MSF =* 1.24 *a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***				***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
0.328																				
0.656																				
0.984																				
1.312																				
1.64																				
1.969																				
2.297																				
2.625																				
2.953																				
3.281																				
3.609																				
3.937																				
4.265																				
4.593																				
4.921	4	Silty Clay to Clay	5.141	0.104	0.282		0.282	2.7	1.4845	0.99	0.451							1.00	1	
5.249	6	Sandy Silt to Clayey Silt	18.927	0.326	0.301		0.301	2.21	1.4657	0.99	0.450	2.210	1.47	27.74	1.692	46.93	0.09	1.00	1	
5.577	6	Sandy Silt to Clayey Silt	21.645	0.363	0.32		0.32	2.18	1.4474	0.99	0.450	2.180	1.45	31.33	1.619	50.73	0.09	1.00	1	
5.906	6	Sandy Silt to Clayey Silt	17.469	0.323	0.338		0.338	2.3	1.4304	0.99	0.450	2.300	1.43	24.99	1.949	48.70	0.09	1.00	1	
6.234	6	Sandy Silt to Clayey Silt	18.534	0.375	0.357		0.357	2.33	1.413	0.99	0.449	2.330	1.41	26.19	2.049	53.65	0.09	1.00	1	
6.562	6	Sandy Silt to Clayey Silt	17.846	0.378	0.376		0.376	2.37	1.3959	0.99	0.449	2.370	1.40	24.91	2.194	54.66	0.10	1.00	1	
6.89	6	Sandy Silt to Clayey Silt	23.2	0.489	0.395		0.395	2.3	1.3793	0.99	0.449	2.300	1.38	32.00	1.949	62.36	0.10	1.00	1	
7.218	6	Sandy Silt to Clayey Silt	21.17	0.475	0.414		0.414	2.37	1.3631	0.99	0.448	2.370	1.36	28.86	2.194	63.31	0.10	1.00	1	
7.546	5	Clayey Silt to Silty Clay	17.453	0.433	0.432		0.432	2.48	1.348	0.98	0.448	2.480	1.35	23.53	2.669	62.80	0.10	1.00	1	
7.874	5	Clayey Silt to Silty Clay	17.06	0.452	0.451		0.451	2.52	1.3325	0.98	0.448	2.520	1.33	22.73	2.872	65.28	0.11	1.00	1	
8.202	5	Clayey Silt to Silty Clay	16.536	0.447	0.47		0.47	2.55	1.3174	0.98	0.447	2.550	1.32	21.78	3.034	66.10	0.11	1.00	1	
8.53	5	Clayey Silt to Silty Clay	18.73	0.479	0.489		0.489	2.51	1.3025	0.98	0.447	2.510	1.30	24.40	2.820	68.79	0.11	1.00	1	
8.858	6	Sandy Silt to Clayey Silt	21.939	0.519	0.508		0.508	2.44	1.2881	0.98	0.447	2.440	1.29	28.26	2.483	70.17	0.11	1.00	1	
9.186	6	Sandy Silt to Clayey Silt	26.147	0.622	0.526		0.526	2.39	1.2746	0.98	0.446	2.390	1.27	33.33	2.272	75.72	0.12	1.00	1	
9.514	6	Sandy Silt to Clayey Silt	28.013	0.685	0.545		0.545	2.39	1.2607	0.98	0.446	2.390	1.26	35.32	2.272	80.24	0.13	1.00	1	
9.843	6	Sandy Silt to Clayey Silt	25.836	0.606	0.564		0.564	2.42	1.2472	0.98	0.446	2.420	1.25	32.22	2.396	77.20	0.12	1.00	1	
10.171	6	Sandy Silt to Clayey Silt	26.605	0.619	0.583	0.005	0.577	2.41	1.238	0.98	0.450	2.410	1.24	32.94	2.354	77.52	0.12	1.00	1	(0.34)
10.499	6	Sandy Silt to Clayey Silt	29.568	0.744	0.602	0.015	0.586	2.4	1.2318	0.98	0.457	2.400	1.23	36.42	2.312	84.22	0.14	1.00	1	(0.37)
10.827	6	Sandy Silt to Clayey Silt	29.798	0.84	0.62	0.026	0.595	2.44	1.2256	0.98	0.463	2.440	1.23	36.52	2.483	90.69	0.15	1.00	1	(0.40)
11.155	5	Clayey Silt to Silty Clay	28.733	0.814	0.639	0.036	0.603	2.46	1.2202	0.98	0.471	2.460	1.22	35.06	2.574	90.25	0.15	1.00	1	(0.39)
11.483	6	Sandy Silt to Clayey Silt	32.254	0.764	0.658	0.046	0.612	2.37	1.2141	0.98	0.477	2.370	1.21	39.16	2.194	85.92	0.14	1.00	1	(0.36)
11.811	6	Sandy Silt to Clayey Silt	40.194	0.86	0.677	0.056	0.62	2.27	1.2088	0.98	0.485	2.270	1.21	48.59	1.856	90.18	0.15	1.00	1	(0.38)
12.139	6	Sandy Silt to Clayey Silt	42.487	0.988	0.695	0.067	0.629	2.29	1.2028	0.97	0.490	2.290	1.20	51.11	1.917	97.97	0.17	1.00	1	(0.42)
12.467	6	Sandy Silt to Clayey Silt	42.012	1.008	0.714	0.077	0.637	2.3	1.1976	0.97	0.497	2.300	1.20	50.31	1.949	98.05	0.17	1.00	1	(0.42)
12.795	6	Sandy Silt to Clayey Silt	45.794	1.026	0.733	0.087	0.646	2.26	1.1918	0.97	0.502	2.260	1.19	54.58	1.827	99.70	0.17	1.00	1	(0.42)
13.123	6	Sandy Silt to Clayey Silt	48.626	1.068	0.752	0.097	0.655	2.24	1.186	0.97	0.508	2.240	1.19	57.67	1.770	102.10	0.18	1.00	1	(0.44)
13.451	6	Sandy Silt to Clayey Silt	47.775	1.03	0.771	0.108	0.663	2.24	1.1809	0.97	0.514	2.240	1.18	56.42	1.770	99.89	0.17	1.00	1	(0.42)
13.78	6	Sandy Silt to Clayey Silt	47.581	1.101	0.789	0.118	0.672	2.27	1.1752	0.97	0.519	2.270	1.18	55.92	1.856	103.79	0.18	1.00	1	(0.44)
14.108	6	Sandy Silt to Clayey Silt	51.642	1.261	0.808	0.128	0.68	2.27	1.1702	0.97	0.525	2.270	1.17	60.43	1.856	112.17	0.21	1.00	1	(0.50)
14.436	6	Sandy Silt to Clayey Silt	45.27	1.126	0.827	0.138	0.689	2.31	1.1646	0.97	0.530	2.310	1.16	52.72	1.981	104.46	0.19	1.00	1	(0.43)
14.764	6	Sandy Silt to Clayey Silt	42.355	1.126	0.846	0.149	0.697	2.34	1.1597	0.97	0.535	2.340	1.16	49.12	2.084	102.35	0.18	1.00	1	(0.42)
15.092	6	Sandy Silt to Clayey Silt	41.848	1.178	0.865	0.159	0.706	2.37	1.1542	0.97	0.540	2.370	1.15	48.30	2.194	105.98	0.19	1.00	1	(0.44)
15.42	6	Sandy Silt to Clayey Silt	43.01	1.323	0.883	0.169	0.714	2.4	1.1494	0.97	0.544	2.400	1.15	49.44	2.312	114.32	0.22	1.00	1	(0.50)
15.748	6	Sandy Silt to Clayey Silt	47.414	1.515	0.902	0.179	0.723	2.39	1.144	0.97	0.549	2.390	1.14	54.24	2.272	123.24	0.25	1.00	1	(0.57)
16.076	6	Sandy Silt to Clayey Silt	43.272	1.344	0.921	0.189	0.732	2.41	1.1387	0.97	0.553	2.410	1.14	49.27	2.354	115.97	0.23	1.00	1	(0.50)
16.404	6	Sandy Silt to Clayey Silt	36.658	0.989	0.94	0.2	0.74	2.41	1.134	0.97	0.558	2.410	1.13	41.57	2.354	97.84	0.17	1.00	1	(0.37)
16.732	6	Sandy Silt to Clayey Silt	38.18	0.959	0.959	0.21	0.749	2.38	1.1288	0.96	0.562	2.380	1.13	43.10	2.233	96.22	0.16	1.00	1	(0.36)
17.06	6	Sandy Silt to Clayey Silt	35.201	0.958	0.977	0.22	0.757	2.43	1.1242	0.96	0.566	2.430	1.12	39.57	2.439	96.52	0.16	1.00	1	(0.36)
17.388	6	Sandy Silt to Clayey Silt	38.213	0.961	0.996	0.23	0.766	2.39	1.119	0.96	0.570	2.390	1.12	42.76	2.272	97.15	0.17	1.00	1	(0.36)
17.717	6	Sandy Silt to Clayey Silt	35.675	1.073	1.015	0.241	0.774	2.48	1.1145	0.96	0.574	2.480	1.11	39.76	2.669	106.13	0.19	1.00	1	(0.41)
18.045	6	Sandy Silt to Clayey Silt	35.724	1.002	1.034	0.251	0.783	2.46	1.1094	0.96	0.578	2.460	1.11	39.63	2.574	102.03	0.18	1.00	1	(0.38)
18.373	6	Sandy Silt to Clayey Silt	36.871	0.934	1.053	0.261	0.791	2.42	1.105	0.96	0.582	2.420	1.10	40.74	2.396	97.61	0.17	1.00	1	(0.35)
18.701	5	Clayey Silt to Silty Clay	40.129	1.349	1.071	0.271	0.8	2.48	1.1	0.96	0.585	2.480	1.10	44.14	2.669	117.83	0.23	1.00	1	(0.49)
19.029	5	Clayey Silt to Silty Clay	36.218	1.456	1.09	0.282	0.809	2.58	1.0951	0.96	0.588	2.580	1.10	39.66	3.206	127.17	0.27	1.00	1	(0.57)
19.357	5	Clayey Silt to Silty Clay	32.156	1.122	1.109	0.292	0.817	2.59	1.0907	0.96	0.592	2.590	1.09	35.07	3.266	114.55	0.22	1.00	1	(0.46)
19.685	6	Sandy Silt to Clayey Silt	25.738	0.71	1.128	0.302	0.826	2.58	1.0859	0.96	0.595	2.580	1.09	27.95	3.206	89.62	0.15	1.00	1	(0.31)
20.013	6	Sandy Silt to Clayey Silt	31.664	0.738	1.147	0.312	0.834	2.46	1.0816	0.96	0.599	2.460	1.08	34.25	2.574	88.16	0.14	1.00	1	(0.30)
20.341	6	Sandy Silt to Clayey Silt	35.97	1.033	1.165	0.323	0.843	2.49	1.0768	0.96	0.601	2.490	1.08	38.73	2.718	105.29	0.19	1.00	1	(0.39)
20.669	6	Sandy Silt to Clayey Silt	31.631	0.948	1.184	0.333	0.851	2.55	1.0726	0.96	0.605	2.550	1.07	33.93	3.034	102.95	0.18	1.00	1	(0.37)
20.997	6	Sandy Silt to Clayey Silt	30.011	0.784	1.203	0.343	0.86	2.52	1.068	0.95	0.607	2.520	1.07	32.05	2.872	92.04	0.15	1.00	1	(0.31)
21.325	6	Sandy Silt to Clayey Silt	28.111	0.749	1.222	0.353	0.869	2.56	1.0633	0.95	0.610	2.560	1.06	29.89	3.091	92.38	0.15	1.00	1	(0.31)
21.654	6	Sandy Silt to Clayey Silt	26.016	0.685	1.241	0.364	0.877	2.59	1.0592	0.95	0.613	2.590	1.06	27.56	3.266	90.00	0.15	1.00	1	(0.30)
21.982	6	Sandy Silt to Clayey Silt	23.56	0.569	1.259	0.374	0.886	2.62	1.0547	0.95	0.615							1.00	1	
22.31	6	Sandy Silt to Clayey Silt	20.04	0.458	1.278	0.384	0.894	2.66	1.0506	0.95	0.618							1.00	1	
22.638	6	Sandy Silt to Clayey Silt	17.535	0.38	1.297	0.394	0.903	2.69	1.0461	0.95	0.621							1.00	1	
22.966	5	Clayey Silt to Silty Clay	16.012	0.377	1.316	0.404	0.911	2.77	1.0422	0.95	0.623							1.00	1	
23.294	5	Clayey Silt to Silty Clay	14.67	0.349	1.335	0.415	0.92	2.81	1.0377	0.95	0.626							1.00	1	
23.622	5	Clayey Silt to Silty Clay	13.835	0.339	1.353	0.425	0.928	2.85	1.0338	0.95	0.628							1.00	1	
23.95	5	Clayey Silt to Silty Clay	14.08	0.346	1.372	0.435	0.937	2.85	1.0295	0.95	0.630							1.00	1	
24.278	5	Clayey Silt to Silty Clay	14.015	0.331	1.391	0.445	0.946	2.85	1.0252	0.94	0.632							1.00	1	
24.606	5	Clayey Silt to Silty Clay	14.145	0.315	1.41	0.456	0.954	2.83	1.0214	0.94	0.634							1.00	1	
24.934	5	Clayey Silt to Silty Clay	14.588	0.298	1.429	0.466	0.963	2.79	1.0171	0.94	0.636							1.00	1	
25.262	5	Clayey Silt to Silty Clay	15.112	0.364	1.447	0.476	0.971	2.82	1.0134	0.94	0.638							1.00	1	
25.591	5	Clayey Silt to Silty Clay	19.647	0.501	1.466	0.486	0.98	2.74	1.0092	0.94	0.640							1.00	1	
25.919	7	Silty Sand to Sandy Silt	27.571	0.295	1.485	0.497	0.989	2.41	1.005	0.94	0.641	2.410	1.01	27.71	2.354	65.22	0.11	1.00	1	(0.20)
26.247	7	Silty Sand to Sandy Silt	24.559	0.147	1.505	0.507	0.998	2.34	1.0009	0.94	0.643	2.340	1.00	24.58	2.084	51.22	0.09	1.00	1	(0.18)
26.575	6	Sandy Silt to Clayey Silt	15.521	0.147	1.524	0.517	1.007	2.63	0.9968	0.94	0.644							1.00	1	
26.903	6	Sandy Silt to Clayey Silt	11.608	0.115	1.542	0.527	1.015	2.76	0.9932	0.93	0.646							1.00	1	
27.231	5	Clayey Silt to Silty Clay	10.74	0.137	1.561	0.538	1.024	2.84	0.9892	0.93	0.647							1.00	1	
27.559	6	Sandy Silt to Clayey Silt	12.099	0.175	1.58	0.548	1.032	2.83	0.9857	0.93	0.649							0.99	1	
27.887	6	Sandy Silt to Clayey Silt	13.999	0.239	1.599	0.558	1.041	2.81	0.9817	0.93	0.650							0.99	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***				
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*			
CPT NO.	***CPT-10-005A***	*FAULT M_w =* 6.9	*MSF =* 1.24	*a_{max} (g)=* 0.7	

			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
28.215	6	Sandy Silt to Clayey Silt	18.845	0.353	1.618	0.568	1.049	2.72	0.9782	0.93	0.652							0.99	1	
28.543	6	Sandy Silt to Clayey Silt	30.895	0.498	1.636	0.578	1.058	2.49	0.9743	0.93	0.653	2.490	0.97	30.10	2.718	81.83	0.13	0.99	1	(0.25)
28.871	7	Silty Sand to Sandy Silt	40.031	0.625	1.656	0.589	1.067	2.39	0.9704	0.93	0.654	2.390	0.97	38.85	2.272	88.26	0.14	0.99	1	(0.27)
29.199	7	Silty Sand to Sandy Silt	37.624	0.393	1.675	0.599	1.076	2.32	0.9666	0.92	0.655	2.320	0.97	36.37	2.015	73.27	0.12	0.99	1	(0.22)
29.528	7	Silty Sand to Sandy Silt	32.843	0.14	1.694	0.609	1.085	2.19	0.9628	0.92	0.656	2.190	0.96	31.62	1.643	51.94	0.09	0.98	1	(0.17)
29.856	7	Silty Sand to Sandy Silt	28.013	0.262	1.714	0.619	1.094	2.42	0.959	0.92	0.657	2.420	0.96	26.87	2.396	64.37	0.10	0.98	1	(0.19)
30.184	7	Silty Sand to Sandy Silt	37.771	0.19	1.733	0.63	1.103	2.17	0.9553	0.92	0.657	2.170	0.96	36.08	1.596	57.60	0.10	0.98	1	(0.18)
30.512	8	Sand to Silty Sand	53.456	0.167	1.753	0.64	1.113	1.95	0.9511	0.92	0.658	1.950	0.95	50.84	1.240	63.04	0.10	0.98	1	(0.19)
30.84	7	Silty Sand to Sandy Silt	47.431	0.388	1.772	0.65	1.122	2.19	0.9475	0.92	0.658	2.190	0.95	44.94	1.643	73.82	0.12	0.98	1	(0.22)
31.168	6	Sandy Silt to Clayey Silt	40.8	0.78	1.791	0.66	1.131	2.46	0.9438	0.91	0.659	2.460	0.94	38.51	2.574	99.13	0.17	0.98	1	(0.31)
31.496	7	Silty Sand to Sandy Silt	46.858	0.794	1.81	0.671	1.14	2.38	0.9402	0.91	0.659	2.380	0.94	44.05	2.233	98.36	0.17	0.97	1	(0.31)
31.824	8	Sand to Silty Sand	71.727	0.312	1.83	0.681	1.149	1.9	0.9366	0.91	0.660	1.900	0.94	67.18	1.189	79.86	0.13	0.97	1	(0.23)
32.152	8	Sand to Silty Sand	91.342	0.538	1.85	0.691	1.159	1.87	0.9326	0.91	0.660	1.870	0.93	85.19	1.162	98.97	0.17	0.97	1	(0.31)
32.48	8	Sand to Silty Sand	92.57	1.14	1.87	0.701	1.168	2.06	0.9291	0.91	0.661	2.060	0.93	86.00	1.387	119.26	0.24	0.96	1	(0.43)
32.808	7	Silty Sand to Sandy Silt	53.98	0.996	1.889	0.712	1.178	2.36	0.9251	0.90	0.660	2.360	0.93	49.94	2.156	107.69	0.20	0.97	1	(0.36)
33.136	6	Sandy Silt to Clayey Silt	34.791	0.627	1.908	0.722	1.186	2.48	0.922	0.90	0.661	2.480	0.92	32.08	2.669	85.63	0.14	0.97	1	(0.25)
33.465	7	Silty Sand to Sandy Silt	35.299	0.485	1.927	0.732	1.195	2.4	0.9186	0.90	0.661	2.400	0.92	32.42	2.312	74.98	0.12	0.96	1	(0.22)
33.793	7	Silty Sand to Sandy Silt	34.284	0.436	1.947	0.742	1.204	2.39	0.9151	0.90	0.661	2.390	0.92	31.37	2.272	71.28	0.11	0.96	1	(0.20)
34.121	7	Silty Sand to Sandy Silt	33.711	0.353	1.966	0.752	1.213	2.36	0.9117	0.90	0.661	2.360	0.91	30.74	2.156	66.28	0.11	0.96	1	(0.19)
34.449	7	Silty Sand to Sandy Silt	35.561	0.308	1.985	0.763	1.222	2.3	0.9083	0.89	0.661	2.300	0.91	32.30	1.949	62.95	0.10	0.96	1	(0.19)
34.777	7	Silty Sand to Sandy Silt	42.159	0.495	2.004	0.773	1.232	2.32	0.9046	0.89	0.660	2.320	0.90	38.14	2.015	76.83	0.12	0.96	1	(0.22)
35.105	6	Sandy Silt to Clayey Silt	44.943	1.08	2.023	0.783	1.24	2.49	0.9016	0.89	0.661	2.490	0.90	40.52	2.718	110.16	0.20	0.96	1	(0.37)
35.433	6	Sandy Silt to Clayey Silt	50.149	1.379	2.042	0.793	1.249	2.51	0.8983	0.89	0.660	2.510	0.90	45.05	2.820	127.02	0.27	0.96	1	(0.49)
35.761	6	Sandy Silt to Clayey Silt	61.986	1.523	2.061	0.804	1.257	2.41	0.8954	0.89	0.660	2.410	0.90	55.50	2.354	130.63	0.29	0.96	1	(0.51)
36.089	7	Silty Sand to Sandy Silt	78.194	1.642	2.08	0.814	1.266	2.3	0.8921	0.88	0.660	2.300	0.89	69.76	1.949	135.94	0.31	0.95	1	(0.56)
36.417	7	Silty Sand to Sandy Silt	88.067	1.34	2.1	0.824	1.275	2.17	0.8889	0.88	0.660	2.170	0.89	78.28	1.596	124.97	0.26	0.95	1	(0.46)
36.745	7	Silty Sand to Sandy Silt	70.418	1.006	2.119	0.834	1.284	2.23	0.8857	0.88	0.659	2.230	0.89	62.37	1.743	108.73	0.20	0.95	1	(0.36)
37.073	7	Silty Sand to Sandy Silt	42.65	0.656	2.138	0.845	1.294	2.43	0.8821	0.88	0.658	2.430	0.88	37.62	2.439	91.76	0.15	0.95	1	(0.27)
37.402	6	Sandy Silt to Clayey Silt	43.518	0.929	2.157	0.855	1.302	2.5	0.8793	0.87	0.658	2.500	0.88	38.27	2.768	105.93	0.19	0.95	1	(0.34)
37.73	7	Silty Sand to Sandy Silt	62.411	0.827	2.176	0.865	1.311	2.26	0.8761	0.87	0.657	2.260	0.88	54.68	1.827	99.89	0.17	0.95	1	(0.31)
38.058	7	Silty Sand to Sandy Silt	58.826	0.85	2.196	0.875	1.32	2.31	0.873	0.87	0.657	2.310	0.87	51.36	1.981	101.75	0.18	0.95	1	(0.32)
38.386	8	Sand to Silty Sand	102.56	0.974	2.215	0.886	1.33	2	0.8696	0.86	0.655	2.000	0.87	89.18	1.300	115.93	0.22	0.93	1	(0.40)
38.714	9	Sand	130	1.223	2.236	0.896	1.34	1.91	0.8661	0.86	0.655	1.910	0.87	112.60	1.198	134.94	0.31	0.92	1	(0.54)
39.042	8	Sand to Silty Sand	87.609	1.28	2.256	0.906	1.35	2.18	0.8627	0.86	0.653	2.180	0.86	75.58	1.619	122.38	0.25	0.94	1	(0.44)
39.37	6	Sandy Silt to Clayey Silt	47.988	1.067	2.274	0.916	1.358	2.51	0.86	0.86	0.653	2.510	0.86	41.27	2.820	116.37	0.23	0.94	1	(0.40)
39.698	6	Sandy Silt to Clayey Silt	74.871	2.019	2.293	0.927	1.367	2.41	0.857	0.85	0.652	2.410	0.86	64.17	2.354	151.03	0.40	0.94	1	(0.71)
40.026	7	Silty Sand to Sandy Silt	151.44	4.025	2.313	0.937	1.376	2.19	0.854	0.85	0.651	2.190	0.85	129.34	1.643	212.46		0.91	1	
40.354	7	Silty Sand to Sandy Silt	174.63	5.106	2.332	0.947	1.385	2.18	0.8511	0.85	0.650	2.180	0.85	148.62	1.619	240.64		0.90	1	
40.682	8	Sand to Silty Sand	199.27	3.184	2.352	0.957	1.394	1.95	0.8481	0.84	0.649	1.950	0.85	169.00	1.240	209.54		0.89	1	
41.011	8	Sand to Silty Sand	124.82	1.782	2.372	0.967	1.404	2.06	0.8449	0.84	0.647	2.060	0.84	105.46	1.387	146.24	0.37	0.91	1	(0.65)
41.339	6	Sandy Silt to Clayey Silt	40.522	1.259	2.39	0.978	1.413	2.67	0.8419	0.84	0.646							0.93	1	
41.667	6	Sandy Silt to Clayey Silt	38.753	1.143	2.409	0.988	1.421	2.65	0.8394	0.84	0.645							0.93	1	
41.995	6	Sandy Silt to Clayey Silt	59.186	1.892	2.428	0.998	1.43	2.54	0.8365	0.83	0.643	2.540	0.84	49.51	2.979	147.49	0.38	0.93	1	(0.68)
42.323	5	Clayey Silt to Silty Clay	72.824	2.854	2.447	1.008	1.438	2.53	0.834	0.83	0.642	2.530	0.83	60.73	2.925	177.63		0.93	1	
42.651	6	Sandy Silt to Clayey Silt	99.806	3.741	2.466	1.019	1.447	2.43	0.8311	0.83	0.641	2.430	0.83	82.95	2.439	202.32		0.93	1	
42.979	6	Sandy Silt to Clayey Silt	128.07	4.413	2.484	1.029	1.455	2.34	0.8286	0.82	0.640	2.340	0.83	106.12	2.084	221.12		0.91	1	
43.307	11	Sitff Fine-Grained	98.398	4.896	2.506	1.039	1.467	2.54	0.8249	0.82	0.638	2.540	0.82	81.17	2.979	241.80		0.93	1	
43.635	5	Clayey Silt to Silty Clay	95.467	3.835	2.525	1.049	1.475	2.48	0.8224	0.82	0.636	2.480	0.82	78.51	2.669	209.58		0.93	1	
43.963	7	Silty Sand to Sandy Silt	132.4	3.088	2.544	1.06	1.484	2.21	0.8197	0.81	0.635	2.210	0.82	108.53	1.692	183.59		0.90	1	
44.291	7	Silty Sand to Sandy Silt	126.05	3.091	2.563	1.07	1.493	2.24	0.8169	0.81	0.633	2.240	0.82	102.98	1.770	182.32		0.90	1	
44.619	6	Sandy Silt to Clayey Silt	104.37	3.341	2.582	1.08	1.502	2.39	0.8142	0.81	0.632	2.390	0.81	84.98	2.272	193.08		0.91	1	
44.948	11	Sitff Fine-Grained	96.924	4.085	2.603	1.09	1.513	2.5	0.8109	0.80	0.629	2.500	0.81	78.60	2.768	217.59		0.92	1	
45.276	7	Silty Sand to Sandy Silt	120.84	3.21	2.623	1.101	1.522	2.29	0.8082	0.80	0.628	2.290	0.81	97.67	1.917	187.24		0.90	1	
45.604	7	Silty Sand to Sandy Silt	106.9	2.481	2.642	1.111	1.531	2.29	0.8056	0.80	0.626	2.290	0.81	86.11	1.917	165.08		0.90	1	
45.932	6	Sandy Silt to Clayey Silt	103.18	3.093	2.661	1.121	1.54	2.38	0.8029	0.79	0.624	2.380	0.80	82.84	2.233	184.96		0.91	1	
46.26	8	Sand to Silty Sand	135.56	2.4	2.681	1.131	1.549	2.13	0.8003	0.79	0.623	2.130	0.80	108.49	1.512	164.01		0.89	1	
46.588	8	Sand to Silty Sand	133.63	2.028	2.7	1.141	1.559	2.09	0.7974	0.79	0.621	2.090	0.80	106.56	1.437	153.11	0.41	0.89	1	(0.73)
46.916	9	Sand	160.07	1.134	2.721	1.152	1.569	1.82	0.7945	0.78	0.619	1.820	0.79	127.18	1.122	142.63	0.35	0.88	1	(0.61)
47.244	9	Sand	227.35	0.959	2.741	1.162	1.579	1.57	0.7917	0.78	0.617	1.570	0.79	179.98	1.000	179.98		0.85	1	
47.572	9	Sand	214.25	1.731	2.762	1.172	1.589	1.76	0.7888	0.78	0.615	1.760	0.79	169.00	1.078	182.26		0.85	1	
47.9	7	Silty Sand to Sandy Silt	161.2	3.313	2.781	1.182	1.598	2.13	0.7863	0.77	0.613	2.130	0.79	126.75	1.512	191.61		0.87	1	
48.228	8	Sand to Silty Sand	179.1	3.377	2.801	1.193	1.608	2.07	0.7835	0.77	0.611	2.070	0.78	140.32	1.403	196.86		0.87	1	
48.556	9	Sand	225.63	1.424	2.821	1.203	1.618	1.68	0.7807	0.77	0.609	1.680	0.78	176.15	1.024	180.42		0.85	1	
48.885	9	Sand	206.29	1.662	2.841	1.213	1.628	1.78	0.7779	0.76	0.607	1.780	0.78	160.48	1.092	175.30		0.85	1	
49.213	9	Sand	221.68	3.014	2.862	1.223	1.638	1.91	0.7752	0.76	0.605	1.910	0.78	171.85	1.198	205.94		0.85	1	
49.541	9	Sand	263.51	3.056	2.882	1.234	1.649	1.81	0.7722	0.76	0.602	1.810	0.77	203.48	1.114	226.68		0.83	1	
49.869	9	Sand	293.64	2.574	2.903	1.244	1.659	1.69	0.7695	0.75	0.600	1.690	0.77	225.96	1.031	232.98		0.82	1	
50.197	10	Gravelly Sand to Sand	363.89	2.105	2.923	1.254	1.669	1.5	0.7668	0.75	0.598	1.500	0.77	279.04	1.000	279.04		0.81	1	
50.525	9	Sand	347.47	2.926	2.944	1.264	1.68	1.63	0.7639	0.75	0.596	1.630	0.76	265.43	1.000	265.43		0.81	1	
50.853	9	Sand	264.51	2.761	2.964	1.275	1.69	1.78	0.7612	0.74	0.594	1.780	0.76	201.36	1.092	219.95		0.82	1	
51.181	9	Sand	196.19	2.113	2.985	1.285	1.7	1.89	0.7586	0.74	0.592	1.890	0.76	148.83	1.180	175.56		0.85	1	
51.509	9	Sand	154.7	1.736	3.005	1.295	1.71	1.99	0.756	0.74	0.590	1.990	0.76	116.96	1.287	150.54	0.40	0.86	1	(0.72)
51.837	7	Silty Sand to Sandy Silt	73.07	1.605	3.024	1.305	1.719	2.43	0.7537	0.73	0.588	2.430	0.75	55.07	2.439	134.32	0.31	0.90	1	(0.58)
52.165	6	Sandy Silt to Clayey Silt	38.23	0.928	3.043	1.315	1.728	2.68	0.7514	0.73	0.586							0.90	1	
52.493	7	Silty Sand to Sandy Silt	38.017	0.718	3.062	1.326	1.737	2.62	0.7491	0.73	0.584							0.90	1	
52.822	7	Silty Sand to Sandy Silt	42.683	0.811	3.082	1.336	1.746	2.57	0.7468	0.72	0.582	2.570	0.75	31.87	3.148	100.34	0.17	0.89	1	(0.33)
53.15	7	Silty Sand to Sandy Silt	45.777	0.957	3.101	1.346	1.755	2.57	0.7445	0.72	0.580	2.570	0.74	34.08	3.148	107.29	0.19	0.89	1	(0.37)
53.478	6	Sandy Silt to Clayey Silt	38.868	0.871	3.12	1.356	1.763	2.67	0.7425	0.72	0.578							0.89	1	
53.806	7	Silty Sand to Sandy Silt	35.807	0.658	3.139	1.367	1.772	2.64	0.7402	0.71	0.576							0.89	1	
54.134	7	Silty Sand to Sandy Silt	38.148	0.711	3.158	1.377	1.782	2.62	0.7378	0.71	0.574							0.89	1	
54.462	6	Sandy Silt to Clayey Silt	40.538	0.826	3.177	1.387	1.79	2.62	0.7358	0.71	0.572							0.89	1	
54.79	6	Sandy Silt to Clayey Silt	36.052	1.059	3.196	1.397	1.799	2.77	0.7336	0.71	0.570							0.89	1	
55.118	6	Sandy Silt to Clayey Silt	37.837	0.946	3.215	1.408	1.807	2.72	0.7316	0.70	0.568							0.89	1	
55.446	6	Sandy Silt to Clayey Silt	33.007	0.649	3.234	1.418	1.816	2.7	0.7294	0.70	0.566							0.89	1	
55.774	7	Silty Sand to Sandy Silt	33.22	0.581	3.253	1.428	1.825	2.66	0.7273	0.70	0.565							0.89	1	
56.102	7	Silty Sand to Sandy Silt	37.215	0.664	3.272	1.438	1.834	2.62	0.7251	0.69	0.563							0.89	1	
56.43	7	Silty Sand to Sandy Silt	47.251	0.998	3.292	1.449	1.843	2.58	0.723	0.69	0.561	2.580	0.72	34.16	3.206	109.54	0.20	0.88	1	(0.39)
56.759	6	Sandy Silt to Clayey Silt	53.996	1.355	3.31	1.459	1.852	2.59	0.7208	0.69	0.559	2.590	0.72	38.92	3.266	127.12	0.27	0.88	1	(0.53)
57.087	6	Sandy Silt to Clayey Silt	56.55	1.567	3.329	1.469	1.86	2.61	0.719	0.68	0.557							0.88	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***				
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*			
CPT NO.	***CPT-10-005A***	*FAULT M_w =*	6.9	*MSF =* 1.24	*a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
57.415	6	Sandy Silt to Clayey Silt	51.917	1.617	3.348	1.479	1.869	2.68	0.7168	0.68	0.555							0.88	1	
57.743	6	Sandy Silt to Clayey Silt	47.349	1.404	3.367	1.489	1.877	2.69	0.715	0.68	0.554							0.88	1	
58.071	6	Sandy Silt to Clayey Silt	46.22	1.419	3.386	1.5	1.886	2.72	0.7129	0.68	0.552							0.88	1	
58.399	6	Sandy Silt to Clayey Silt	43.272	1.378	3.404	1.51	1.894	2.76	0.7111	0.67	0.550							0.88	1	
58.727	6	Sandy Silt to Clayey Silt	38.098	1.144	3.423	1.52	1.903	2.79	0.709	0.67	0.548							0.88	1	
59.055	6	Sandy Silt to Clayey Silt	40.653	0.998	3.442	1.53	1.911	2.7	0.7072	0.67	0.547							0.88	1	
59.383	6	Sandy Silt to Clayey Silt	46.448	1.022	3.461	1.541	1.92	2.62	0.7051	0.66	0.545							0.88	1	
59.711	6	Sandy Silt to Clayey Silt	53.603	1.38	3.48	1.551	1.929	2.61	0.7031	0.66	0.543							0.88	1	
60.039	6	Sandy Silt to Clayey Silt	56.976	1.642	3.498	1.561	1.937	2.63	0.7013	0.66	0.541							0.88	1	
60.367	6	Sandy Silt to Clayey Silt	56.894	1.61	3.517	1.571	1.946	2.62	0.6993	0.66	0.540							0.88	1	
60.696	6	Sandy Silt to Clayey Silt	55.912	1.47	3.536	1.582	1.954	2.61	0.6975	0.65	0.538							0.87	1	
61.024	6	Sandy Silt to Clayey Silt	49.625	1.299	3.555	1.592	1.963	2.66	0.6955	0.65	0.536							0.87	1	
61.352	6	Sandy Silt to Clayey Silt	51.622	1.202	3.574	1.602	1.971	2.62	0.6938	0.65	0.535							0.87	1	
61.68	7	Silty Sand to Sandy Silt	58.024	1.277	3.593	1.612	1.98	2.55	0.6918	0.65	0.533	2.550	0.69	40.14	3.034	121.80	0.25	0.87	1	(0.50)
62.008	6	Sandy Silt to Clayey Silt	51.474	1.5	3.612	1.623	1.989	2.68	0.6899	0.64	0.532							0.87	1	
62.336	6	Sandy Silt to Clayey Silt	50.083	1.372	3.63	1.633	1.998	2.68	0.6879	0.64	0.530							0.87	1	
62.664	6	Sandy Silt to Clayey Silt	57.435	1.584	3.649	1.643	2.006	2.63	0.6862	0.64	0.529							0.87	1	
62.992	6	Sandy Silt to Clayey Silt	60.267	1.753	3.668	1.653	2.015	2.62	0.6843	0.64	0.527							0.87	1	
63.32	6	Sandy Silt to Clayey Silt	55.862	1.68	3.687	1.664	2.023	2.66	0.6826	0.63	0.526							0.87	1	
63.648	6	Sandy Silt to Clayey Silt	47.578	1.487	3.706	1.674	2.032	2.73	0.6807	0.63	0.524							0.87	1	
63.976	6	Sandy Silt to Clayey Silt	43.158	1.198	3.724	1.684	2.04	2.74	0.679	0.63	0.523							0.87	1	
64.304	6	Sandy Silt to Clayey Silt	44.942	1.068	3.743	1.694	2.049	2.68	0.6771	0.63	0.521							0.87	1	
64.633	7	Silty Sand to Sandy Silt	51.229	0.986	3.763	1.704	2.058	2.57	0.6753	0.62	0.520	2.570	0.68	34.59	3.148	108.90	0.20	0.87	1	(0.41)
64.961	7	Silty Sand to Sandy Silt	62.674	1.182	3.782	1.715	2.067	2.49	0.6734	0.62	0.518	2.490	0.67	42.20	2.718	114.73	0.22	0.86	1	(0.46)
65.289	6	Sandy Silt to Clayey Silt	58.499	1.416	3.801	1.725	2.076	2.59	0.6716	0.62	0.517	2.590	0.67	39.29	3.266	128.31	0.28	0.86	1	(0.57)
65.617	6	Sandy Silt to Clayey Silt	49.772	1.237	3.819	1.735	2.084	2.65	0.6699	0.62	0.515							0.86	1	
65.945	7	Silty Sand to Sandy Silt	60.316	1.383	3.839	1.745	2.093	2.55	0.6681	0.62	0.514	2.550	0.67	40.30	3.034	122.27	0.25	0.86	1	(0.52)
66.273	7	Silty Sand to Sandy Silt	72.644	1.796	3.858	1.756	2.102	2.51	0.6663	0.61	0.513	2.510	0.67	48.40	2.820	136.46	0.32	0.86	1	(0.66)
66.601	6	Sandy Silt to Clayey Silt	76.819	2.188	3.877	1.766	2.111	2.54	0.6645	0.61	0.511	2.540	0.66	51.04	2.979	152.05	0.41	0.86	1	(0.85)
66.929	6	Sandy Silt to Clayey Silt	77.818	2.156	3.896	1.776	2.12	2.54	0.6627	0.61	0.510	2.540	0.66	51.57	2.979	153.61	0.42	0.86	1	(0.87)
67.257	7	Silty Sand to Sandy Silt	73.119	1.879	3.915	1.786	2.129	2.54	0.6609	0.61	0.508	2.540	0.66	48.32	2.979	143.95	0.36	0.86	1	(0.75)
67.585	6	Sandy Silt to Clayey Silt	60.889	1.675	3.934	1.797	2.137	2.62	0.6593	0.61	0.507							0.86	1	
67.913	6	Sandy Silt to Clayey Silt	51.819	1.402	3.953	1.807	2.146	2.68	0.6575	0.60	0.506							0.86	1	
68.241	7	Silty Sand to Sandy Silt	56.943	1.281	3.972	1.817	2.155	2.59	0.6557	0.60	0.505	2.590	0.66	37.34	3.266	121.95	0.25	0.86	1	(0.52)
68.57	7	Silty Sand to Sandy Silt	65.244	1.355	3.991	1.827	2.164	2.51	0.654	0.60	0.503	2.510	0.65	42.67	2.820	120.30	0.24	0.86	1	(0.51)
68.898	7	Silty Sand to Sandy Silt	70.712	1.391	4.011	1.838	2.173	2.47	0.6522	0.60	0.502	2.470	0.65	46.12	2.621	120.90	0.24	0.86	1	(0.52)
69.226	7	Silty Sand to Sandy Silt	73.66	1.64	4.03	1.848	2.182	2.49	0.6505	0.60	0.501	2.490	0.65	47.92	2.718	130.25	0.29	0.86	1	(0.60)
69.554	7	Silty Sand to Sandy Silt	69.01	1.586	4.049	1.858	2.191	2.52	0.6488	0.59	0.500	2.520	0.65	44.77	2.872	128.57	0.28	0.85	1	(0.59)
69.882	7	Silty Sand to Sandy Silt	64.065	1.482	4.068	1.868	2.2	2.56	0.6471	0.59	0.499	2.560	0.65	41.45	3.091	128.12	0.28	0.85	1	(0.58)
70.21	7	Silty Sand to Sandy Silt	62.706	1.452	4.088	1.878	2.209	2.57	0.6454	0.59	0.497	2.570	0.65	40.47	3.148	127.39	0.27	0.85	1	(0.58)
70.538	7	Silty Sand to Sandy Silt	71.763	1.584	4.107	1.889	2.218	2.51	0.6437	0.59	0.496	2.510	0.64	46.19	2.820	130.23	0.29	0.85	1	(0.61)
70.866	7	Silty Sand to Sandy Silt	63.23	1.524	4.126	1.899	2.228	2.58	0.6418	0.59	0.495	2.580	0.64	40.58	3.206	130.12	0.28	0.85	1	(0.61)
71.194	7	Silty Sand to Sandy Silt	62.591	1.445	4.146	1.909	2.237	2.57	0.6401	0.59	0.494	2.570	0.64	40.06	3.148	126.12	0.27	0.85	1	(0.57)
71.522	7	Silty Sand to Sandy Silt	75.657	1.68	4.165	1.919	2.246	2.49	0.6384	0.58	0.493	2.490	0.64	48.30	2.718	131.30	0.29	0.85	1	(0.62)
71.85	7	Silty Sand to Sandy Silt	76.377	1.649	4.184	1.93	2.255	2.48	0.6368	0.58	0.492	2.480	0.64	48.63	2.669	129.82	0.28	0.85	1	(0.61)
72.178	7	Silty Sand to Sandy Silt	66.75	1.467	4.204	1.94	2.264	2.54	0.6351	0.58	0.491	2.540	0.64	42.39	2.979	126.29	0.27	0.85	1	(0.57)
72.507	6	Sandy Silt to Clayey Silt	55.322	1.312	4.223	1.95	2.272	2.64	0.6336	0.58	0.490							0.85	1	
72.835	7	Silty Sand to Sandy Silt	54.258	1.212	4.242	1.96	2.281	2.63	0.632	0.58	0.489							0.85	1	
73.163	7	Silty Sand to Sandy Silt	56.059	1.126	4.261	1.971	2.291	2.59	0.6302	0.58	0.487	2.590	0.63	35.33	3.266	115.38	0.22	0.85	1	(0.48)
73.491	7	Silty Sand to Sandy Silt	60.201	1.153	4.28	1.981	2.3	2.54	0.6286	0.57	0.486	2.540	0.63	37.84	2.979	112.73	0.21	0.85	1	(0.46)
73.819	7	Silty Sand to Sandy Silt	70.729	1.677	4.3	1.991	2.309	2.55	0.627	0.57	0.485	2.550	0.63	44.34	3.034	134.55	0.31	0.85	1	(0.66)
74.147	6	Sandy Silt to Clayey Silt	77.867	2.152	4.319	2.001	2.317	2.57	0.6255	0.57	0.485	2.570	0.63	48.71	3.148	153.33	0.42	0.85	1	(0.90)
74.475	6	Sandy Silt to Clayey Silt	83.908	2.461	4.337	2.012	2.326	2.57	0.6239	0.57	0.484	2.570	0.62	52.35	3.148	164.81		0.84	1	
74.803	6	Sandy Silt to Clayey Silt	74.511	2.569	4.356	2.022	2.334	2.66	0.6225	0.57	0.483							0.84	1	
75.131	6	Sandy Silt to Clayey Silt	59.284	1.788	4.375	2.032	2.343	2.7	0.6209	0.57	0.482							0.84	1	
75.459	7	Silty Sand to Sandy Silt	58.646	1.363	4.394	2.042	2.352	2.63	0.6194	0.57	0.481							0.84	1	
75.787	7	Silty Sand to Sandy Silt	58.924	1.269	4.414	2.052	2.361	2.6	0.6178	0.56	0.480							0.84	1	
76.115	7	Silty Sand to Sandy Silt	66.325	1.396	4.433	2.063	2.37	2.55	0.6162	0.56	0.479	2.550	0.62	40.87	3.034	124.02	0.26	0.84	1	(0.56)
76.444	7	Silty Sand to Sandy Silt	70.434	1.716	4.452	2.073	2.379	2.58	0.6147	0.56	0.478	2.580	0.61	43.30	3.206	138.83	0.33	0.84	1	(0.72)
76.772	6	Sandy Silt to Clayey Silt	76.197	2.23	4.471	2.083	2.388	2.61	0.6132	0.56	0.477							0.84	1	
77.1	6	Sandy Silt to Clayey Silt	145.35	5.156	4.49	2.093	2.396	2.45	0.6118	0.56	0.477	2.450	0.61	88.93	2.528	224.82		0.84	1	
77.428	12	Sand to Clayey Sand	255.75	8.238	4.51	2.104	2.406	2.26	0.6101	0.56	0.476	2.260	0.61	156.03	1.827	285.04		0.76	1	
77.756	8	Sand to Silty Sand	322.14	7.812	4.53	2.114	2.416	2.1	0.6084	0.56	0.475	2.100	0.61	195.99	1.455	285.12		0.73	1	
78.084	7	Silty Sand to Sandy Silt	298.8	7.633	4.549	2.124	2.425	2.14	0.6069	0.56	0.474	2.140	0.61	181.34	1.532	277.80		0.74	1	
78.412	12	Sand to Clayey Sand	266.48	10.238	4.569	2.134	2.434	2.31	0.6054	0.55	0.473	2.310	0.61	161.32	1.981	319.62		0.76	1	
78.74	12	Sand to Clayey Sand	246.08	10.445	4.589	2.145	2.444	2.37	0.6037	0.55	0.472	2.370	0.60	148.56	2.194	325.96		0.84	1	
79.068	11	Sitff Fine-Grained	218.74	9.262	4.61	2.155	2.455	2.4	0.6019	0.55	0.471	2.400	0.60	131.66	2.312	304.45		0.84	1	
79.396	11	Sitff Fine-Grained	193.37	8.355	4.631	2.165	2.466	2.45	0.6001	0.55	0.470	2.450	0.60	116.05	2.528	293.39		0.83	1	
79.724	8	Sand to Silty Sand	210.84	3.593	4.651	2.175	2.476	2.13	0.5985	0.55	0.469	2.130	0.60	126.18	1.512	190.76		0.77	1	
80.052	9	Sand	280.44	3.136	4.672	2.186	2.486	1.91	0.5969	0.55	0.469	1.910	0.60	167.38	1.198	200.59		0.74	1	
80.381	9	Sand	327.99	4.009	4.692	2.196	2.496	1.89	0.5952	0.55	0.468	1.890	0.60	195.23	1.180	230.29		0.72	1	
80.709	9	Sand	294.67	3.451	4.712	2.206	2.506	1.91	0.5936	0.55	0.467	1.910	0.59	174.93	1.198	209.63		0.73	1	
81.037	9	Sand	258.18	3.551	4.733	2.216	2.516	2	0.592	0.54	0.466	2.000	0.59	152.85	1.300	198.70		0.74	1	
81.365	8	Sand to Silty Sand	248.73	4.067	4.752	2.227	2.526	2.07	0.5904	0.54	0.465	2.070	0.59	146.86	1.403	206.03		0.75	1	
81.693	7	Silty Sand to Sandy Silt	181	5.109	4.772	2.237	2.535	2.34	0.589	0.54	0.465	2.340	0.59	106.61	2.084	222.15		0.79	1	
82.021	11	Sitff Fine-Grained	121.55	6.294	4.793	2.247	2.546	2.66	0.5873	0.54	0.464							0.83	1	
82.349	6	Sandy Silt to Clayey Silt	167.21	5.469	4.812	2.257	2.555	2.41	0.5859	0.54	0.463	2.410	0.59	97.97	2.354	230.58		0.80	1	
82.677	8	Sand to Silty Sand	225.22	3.666	4.832	2.267	2.564	2.11	0.5845	0.54	0.462	2.110	0.58	131.64	1.473	193.92		0.76	1	
83.005	7	Silty Sand to Sandy Silt	158.62	3.379	4.851	2.278	2.573	2.3	0.5831	0.54	0.462	2.300	0.58	92.49	1.949	180.23		0.80	1	
83.333	7	Silty Sand to Sandy Silt	83.205	2.174	4.87	2.288	2.583	2.58	0.5815	0.54	0.461	2.580	0.58	48.39	3.206	155.15	0.43	0.83	1	(0.95)
83.661	7	Silty Sand to Sandy Silt	61.397	1.145	4.89	2.298	2.592	2.59	0.5802	0.54	0.460	2.590	0.58	35.62	3.266	116.34	0.23	0.83	1	(0.50)
83.99	7	Silty Sand to Sandy Silt	57.123	0.907	4.909	2.308	2.601	2.58	0.5788	0.54	0.460	2.580	0.58	33.06	3.206	106.01	0.19	0.83	1	(0.42)
84.318	8	Sand to Silty Sand	63.738	0.751	4.929	2.319	2.61	2.47	0.5774	0.53	0.459	2.470	0.58	36.80	2.621	96.47	0.16	0.83	1	(0.36)
84.646	8	Sand to Silty Sand	59.382	0.689	4.949	2.329	2.62	2.5	0.5759	0.53	0.458	2.500	0.58	34.20	2.768	94.68	0.16	0.82	1	(0.35)
84.974	7	Silty Sand to Sandy Silt	45.793	0.573	4.968	2.339	2.629	2.61	0.5746	0.53	0.458							0.82	1	
85.302	7	Silty Sand to Sandy Silt	71.531	1.354	4.987	2.349	2.638	2.54	0.5732	0.53	0.457	2.540	0.57	41.00	2.979	122.15	0.25	0.82	1	(0.56)
85.63	8	Sand to Silty Sand	279.95	4.623	5.007	2.36	2.648	2.05	0.5717	0.53	0.456	2.050	0.57	160.06	1.371	219.44		0.73	1	
85.958	9	Sand	428.99	6.245	5.028	2.37	2.658	1.88	0.5702	0.53	0.456	1.880	0.57	244.63	1.171	286.36		0.68	1	
86.286	9	Sand	490.66	6.529	5.048	2.38	2.668	1.81	0.5688	0.53	0.455	1.810	0.57	279.07	1.114	310.89		0.68	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***		
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*	
CPT NO.	***CPT-10-005A***	*FAULT M_w =* 6.9	*MSF =* 1.24 *a_{max} (g)=* 0.7

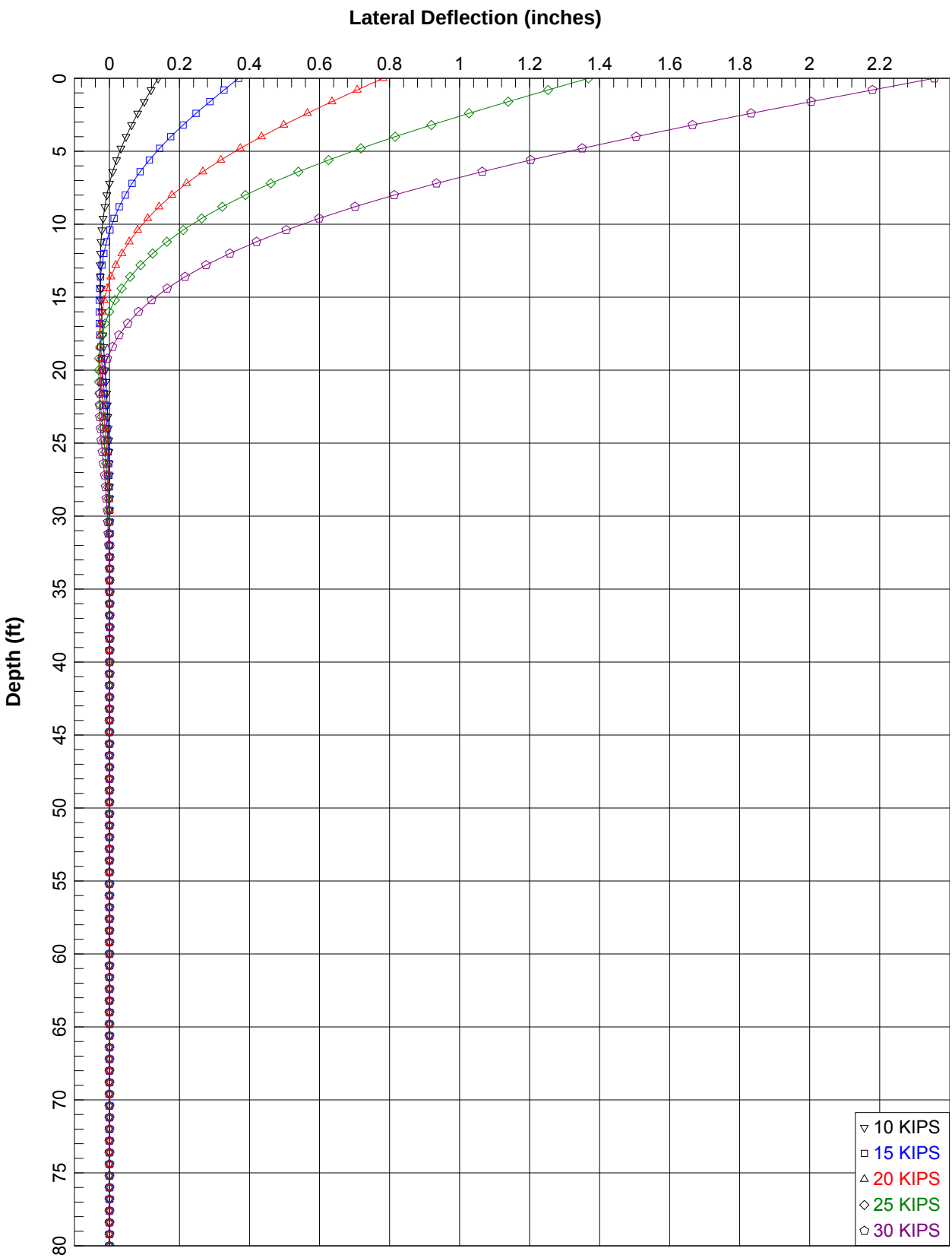
			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***				***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
86.614	9	Sand	566.53	6.533	5.068	2.39	2.678	1.72	0.5673	0.53	0.455	1.720	0.57	321.40	1.051	337.89		0.67	1	
86.942	10	Gravelly Sand to Sand	546.84	3.892	5.089	2.401	2.689	1.59	0.5657	0.53	0.454	1.590	0.57	309.35	1.000	309.35		0.67	1	
87.27	8	Sand to Silty Sand	541.75	9.861	5.109	2.411	2.698	1.89	0.5644	0.53	0.453	1.890	0.56	305.76	1.180	360.66		0.67	1	
87.598	12	Sand to Clayey Sand	507.58	11.809	5.129	2.421	2.708	1.99	0.5629	0.53	0.453	1.990	0.56	285.74	1.287	367.79		0.67	1	
87.927	8	Sand to Silty Sand	358.39	7.997	5.149	2.431	2.718	2.08	0.5615	0.52	0.452	2.080	0.56	201.24	1.420	285.69		0.69	1	
88.255	12	Sand to Clayey Sand	152.07	5.415	5.169	2.441	2.727	2.49	0.5602	0.52	0.452	2.490	0.56	85.19	2.718	231.58		0.82	1	
88.583	11	Sitff Fine-Grained	80.634	3.781	5.19	2.452	2.738	2.79	0.5587	0.52	0.451							0.82	1	
88.911	6	Sandy Silt to Clayey Silt	102.1	3.075	5.209	2.462	2.747	2.57	0.5574	0.52	0.450	2.570	0.56	56.91	3.148	179.14		0.82	1	
89.239	7	Silty Sand to Sandy Silt	103.23	2.665	5.228	2.472	2.756	2.52	0.5561	0.52	0.450	2.520	0.56	57.41	2.872	164.85		0.82	1	
89.567	7	Silty Sand to Sandy Silt	94.796	2.581	5.247	2.482	2.765	2.56	0.5549	0.52	0.449	2.560	0.55	52.60	3.091	162.56		0.82	1	
89.895	7	Silty Sand to Sandy Silt	107.26	2.729	5.267	2.493	2.774	2.51	0.5536	0.52	0.449	2.510	0.55	59.38	2.820	167.41		0.82	1	
90.223	7	Silty Sand to Sandy Silt	116.13	3.005	5.286	2.503	2.783	2.49	0.5523	0.52	0.448	2.490	0.55	64.14	2.718	174.37		0.81	1	
90.551	7	Silty Sand to Sandy Silt	101.46	2.371	5.305	2.513	2.792	2.51	0.5511	0.52	0.448	2.510	0.55	55.91	2.820	157.65	0.44	0.81	1	(1.00)
90.879	6	Sandy Silt to Clayey Silt	102.69	3.003	5.324	2.523	2.801	2.57	0.5499	0.52	0.447	2.570	0.55	56.46	3.148	177.75		0.81	1	
91.207	8	Sand to Silty Sand	259.27	5.494	5.344	2.534	2.81	2.17	0.5486	0.52	0.447	2.170	0.55	142.24	1.596	227.08		0.73	1	
91.535	9	Sand	308.93	4.813	5.364	2.544	2.821	2.02	0.5471	0.52	0.446	2.020	0.55	169.02	1.327	224.30		0.71	1	
91.864	9	Sand	276.76	3.19	5.385	2.554	2.831	1.97	0.5458	0.51	0.446	1.970	0.55	151.05	1.263	190.73		0.72	1	
92.192	7	Silty Sand to Sandy Silt	172.21	4.283	5.404	2.564	2.84	2.35	0.5446	0.51	0.445	2.350	0.54	93.78	2.120	198.77		0.78	1	
92.52	11	Sitff Fine-Grained	90.752	4.095	5.426	2.575	2.851	2.75	0.5431	0.51	0.445							0.81	1	
92.848	5	Clayey Silt to Silty Clay	55.044	2.352	5.444	2.585	2.86	2.92	0.5419	0.51	0.444							0.81	1	
93.176	6	Sandy Silt to Clayey Silt	47.235	1.397	5.463	2.595	2.868	2.88	0.5408	0.51	0.444							0.81	1	
93.504	6	Sandy Silt to Clayey Silt	50.1	1.176	5.482	2.605	2.877	2.79	0.5396	0.51	0.443							0.81	1	
93.832	7	Silty Sand to Sandy Silt	40.505	0.64	5.501	2.615	2.886	2.78	0.5384	0.51	0.443							0.81	1	
94.16	7	Silty Sand to Sandy Silt	35.053	0.366	5.521	2.626	2.895	2.75	0.5372	0.51	0.442							0.81	1	
94.488	7	Silty Sand to Sandy Silt	35.954	0.337	5.54	2.636	2.904	2.72	0.5361	0.51	0.442							0.81	1	
94.816	7	Silty Sand to Sandy Silt	39.343	0.588	5.559	2.646	2.913	2.77	0.5349	0.51	0.442							0.81	1	
95.144	7	Silty Sand to Sandy Silt	95.664	1.567	5.579	2.656	2.922	2.45	0.5337	0.51	0.441	2.450	0.53	51.06	2.528	129.09	0.28	0.81	1	(0.63)
95.472	7	Silty Sand to Sandy Silt	122.96	2.894	5.598	2.667	2.931	2.46	0.5326	0.51	0.441	2.460	0.53	65.48	2.574	168.57		0.81	1	
95.801	7	Silty Sand to Sandy Silt	136.1	3.362	5.617	2.677	2.94	2.44	0.5314	0.51	0.440	2.440	0.53	72.33	2.483	179.59		0.80	1	
96.129	7	Silty Sand to Sandy Silt	143.78	2.916	5.636	2.687	2.949	2.37	0.5302	0.51	0.440	2.370	0.53	76.24	2.194	167.28		0.80	1	
96.457	7	Silty Sand to Sandy Silt	118.95	2.818	5.656	2.697	2.958	2.48	0.5291	0.51	0.440	2.480	0.53	62.93	2.669	167.99		0.81	1	
96.785	7	Silty Sand to Sandy Silt	133.14	2.653	5.675	2.708	2.968	2.39	0.5278	0.50	0.439	2.390	0.53	70.28	2.272	159.67	0.46	0.80	1	(1.04)
97.113	9	Sand	177.58	1.969	5.695	2.718	2.978	2.13	0.5266	0.50	0.438	2.130	0.53	93.51	1.512	141.36	0.34	0.77	1	(0.74)
97.441	8	Sand to Silty Sand	180.28	2.8	5.715	2.728	2.987	2.22	0.5254	0.50	0.438	2.220	0.53	94.72	1.717	162.66		0.77	1	
97.769	8	Sand to Silty Sand	195.65	3.891	5.735	2.738	2.997	2.26	0.5242	0.50	0.438	2.260	0.52	102.56	1.827	187.35		0.76	1	
98.097	9	Sand	272.55	2.505	5.756	2.749	3.007	1.93	0.5229	0.50	0.437	1.930	0.52	142.53	1.218	173.66		0.71	1	
98.425	10	Gravelly Sand to Sand	323.24	2.173	5.776	2.759	3.018	1.79	0.5216	0.50	0.437	1.790	0.52	168.59	1.099	185.36		0.68	1	
98.753	10	Gravelly Sand to Sand	328.17	2.171	5.797	2.769	3.028	1.78	0.5203	0.50	0.436	1.780	0.52	170.76	1.092	186.53		0.68	1	
99.081	10	Gravelly Sand to Sand	378.79	2.169	5.818	2.779	3.039	1.69	0.519	0.50	0.436	1.690	0.52	196.59	1.031	202.70		0.66	1	
99.409	10	Gravelly Sand to Sand	382.33	2.68	5.839	2.789	3.05	1.75	0.5176	0.50	0.435	1.750	0.52	197.91	1.072	212.08		0.65	1	
99.738	8	Sand to Silty Sand	249.92	3.999	5.859	2.8	3.059	2.12	0.5166	0.50	0.435	2.120	0.52	129.10	1.492	192.64		0.72	1	
100.07	6	Sandy Silt to Clayey Silt	126.87	4.216	5.878	2.81	3.068	2.57	0.5155	0.50	0.435	2.570	0.52	65.40	3.148	205.87		0.80	1	
100.39	5	Clayey Silt to Silty Clay	68.256	2.704	5.896	2.82	3.076	2.85	0.5145	0.50	0.434							0.80	1	
100.72	6	Sandy Silt to Clayey Silt	65.211	2.008	5.915	2.83	3.085	2.79	0.5134	0.50	0.434							0.80	1	
101.05	6	Sandy Silt to Clayey Silt	55.814	1.537	5.934	2.841	3.093	2.83	0.5125	0.50	0.434							0.80	1	
101.38	7	Silty Sand to Sandy Silt	52.621	1.091	5.953	2.851	3.102	2.78	0.5114	0.50	0.433							0.80	1	
101.71	6	Sandy Silt to Clayey Silt	47.48	0.994	5.972	2.861	3.111	2.82	0.5103	0.50	0.433							0.80	1	
102.03	6	Sandy Silt to Clayey Silt	47.529	1.128	5.991	2.871	3.12	2.85	0.5093	0.49	0.432							0.80	1	
102.36	7	Silty Sand to Sandy Silt	50.427	1.023	6.01	2.882	3.129	2.78	0.5082	0.49	0.432							0.80	1	
102.69	7	Silty Sand to Sandy Silt	48.004	0.944	6.03	2.892	3.138	2.79	0.5071	0.49	0.432							0.80	1	
103.02	7	Silty Sand to Sandy Silt	47.284	0.874	6.049	2.902	3.147	2.78	0.5061	0.49	0.431							0.80	1	
103.35	7	Silty Sand to Sandy Silt	53.407	0.944	6.068	2.912	3.156	2.71	0.5051	0.49	0.431							0.79	1	
103.68	7	Silty Sand to Sandy Silt	61.528	1.015	6.088	2.923	3.165	2.63	0.504	0.49	0.431							0.79	1	
104	7	Silty Sand to Sandy Silt	62.346	1.132	6.107	2.933	3.174	2.64	0.503	0.49	0.430							0.79	1	
104.33	7	Silty Sand to Sandy Silt	66.456	1.172	6.126	2.943	3.183	2.61	0.5019	0.49	0.430							0.79	1	
104.66	7	Silty Sand to Sandy Silt	69.255	1.21	6.146	2.953	3.192	2.6	0.5009	0.49	0.430							0.79	1	
104.99	6	Sandy Silt to Clayey Silt	67.929	1.863	6.164	2.964	3.201	2.73	0.4999	0.49	0.429							0.79	1	
105.32	6	Sandy Silt to Clayey Silt	70.303	2.594	6.183	2.974	3.209	2.81	0.499	0.49	0.429							0.79	1	
105.64	6	Sandy Silt to Clayey Silt	70.663	1.899	6.202	2.984	3.218	2.73	0.498	0.49	0.429							0.79	1	
105.97	7	Silty Sand to Sandy Silt	78.277	1.824	6.221	2.994	3.227	2.64	0.497	0.49	0.429							0.79	1	
106.3	7	Silty Sand to Sandy Silt	74.593	1.76	6.241	3.004	3.236	2.65	0.4959	0.49	0.428							0.79	1	
106.63	7	Silty Sand to Sandy Silt	65.048	1.414	6.26	3.015	3.245	2.68	0.4949	0.49	0.428							0.79	1	
106.96	7	Silty Sand to Sandy Silt	65.522	1.372	6.279	3.025	3.254	2.68	0.4939	0.49	0.428							0.79	1	
107.28	7	Silty Sand to Sandy Silt	70.729	1.155	6.299	3.035	3.263	2.58	0.4929	0.49	0.427	2.580	0.49	34.87	3.206	111.79	0.21	0.79	1	(0.48)
107.61	7	Silty Sand to Sandy Silt	64.262	1.381	6.318	3.045	3.272	2.69	0.4919	0.49	0.427							0.79	1	
107.94	6	Sandy Silt to Clayey Silt	56.501	1.384	6.337	3.056	3.281	2.79	0.491	0.49	0.427							0.79	1	
108.27	6	Sandy Silt to Clayey Silt	58.236	1.635	6.355	3.066	3.29	2.82	0.49	0.48	0.426							0.79	1	
108.6	6	Sandy Silt to Clayey Silt	55.208	1.792	6.374	3.076	3.298	2.88	0.4891	0.48	0.426							0.79	1	
108.92	6	Sandy Silt to Clayey Silt	46.235	1.056	6.393	3.086	3.307	2.87	0.4881	0.48	0.426							0.79	1	
109.25	7	Silty Sand to Sandy Silt	39.997	0.615	6.412	3.097	3.316	2.83	0.4872	0.48	0.425							0.79	1	
109.58	7	Silty Sand to Sandy Silt	41.324	0.58	6.432	3.107	3.325	2.79	0.4862	0.48	0.425							0.79	1	
109.91	7	Silty Sand to Sandy Silt	45.319	0.568	6.451	3.117	3.334	2.71	0.4852	0.48	0.425							0.79	1	
110.24	7	Silty Sand to Sandy Silt	49.788	0.724	6.47	3.127	3.343	2.7	0.4843	0.48	0.425							0.79	1	
110.56	7	Silty Sand to Sandy Silt	61.135	1.158	6.49	3.138	3.352	2.69	0.4833	0.48	0.424							0.79	1	
110.89	6	Sandy Silt to Clayey Silt	66.112	1.698	6.508	3.148	3.361	2.75	0.4824	0.48	0.424							0.78	1	
111.22	7	Silty Sand to Sandy Silt	67.045	1.534	6.528	3.158	3.37	2.71	0.4814	0.48	0.424							0.78	1	
111.55	6	Sandy Silt to Clayey Silt	64.507	1.707	6.547	3.168	3.378	2.76	0.4806	0.48	0.423							0.78	1	
111.88	6	Sandy Silt to Clayey Silt	62.494	2.107	6.565	3.178	3.387	2.84	0.4796	0.48	0.423							0.78	1	
112.21	7	Silty Sand to Sandy Silt	70.614	1.81	6.585	3.189	3.396	2.73	0.4787	0.48	0.423							0.78	1	
112.53	7	Silty Sand to Sandy Silt	114.3	2.296	6.604	3.199	3.405	2.49	0.4777	0.48	0.423	2.490	0.48	54.60	2.718	148.43	0.38	0.78	1	(0.88)
112.86	8	Sand to Silty Sand	204.28	2.941	6.624	3.209	3.415	2.2	0.4767	0.48	0.422	2.200	0.48	97.38	1.667	162.31		0.74	1	
113.19	9	Sand	257.11	3.554	6.644	3.219	3.425	2.11	0.4757	0.48	0.422	2.110	0.48	122.30	1.473	180.17		0.71	1	
113.52	8	Sand to Silty Sand	237.86	3.96	6.664	3.23	3.434	2.19	0.4748	0.48	0.422	2.190	0.47	112.92	1.643	185.49		0.72	1	
113.85	9	Sand	275.71	3.416	6.684	3.24	3.445	2.06	0.4736	0.48	0.421	2.060	0.47	130.58	1.387	181.08		0.69	1	
114.17	10	Gravelly Sand to Sand	377.92	3.089	6.705	3.25	3.455	1.83	0.4726	0.48	0.421	1.830	0.47	178.61	1.129	201.68		0.64	1	
114.5	9	Sand	408.59	5.421	6.726	3.26	3.465	1.95	0.4716	0.48	0.420	1.950	0.47	192.69	1.240	238.91		0.64	1	
114.83	7	Silty Sand to Sandy Silt	219.31	6.607	6.745	3.271	3.474	2.4	0.4707	0.48	0.420	2.400	0.47	103.23	2.312	238.70		0.74	1	
115.16	6	Sandy Silt to Clayey Silt	121.61	4.376	6.764	3.281	3.483	2.65	0.4698	0.48	0.420							0.78	1	
115.49	7	Silty Sand to Sandy Silt	101.84	2.838	6.783	3.291	3.492	2.64	0.4689	0.47	0.420							0.78	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

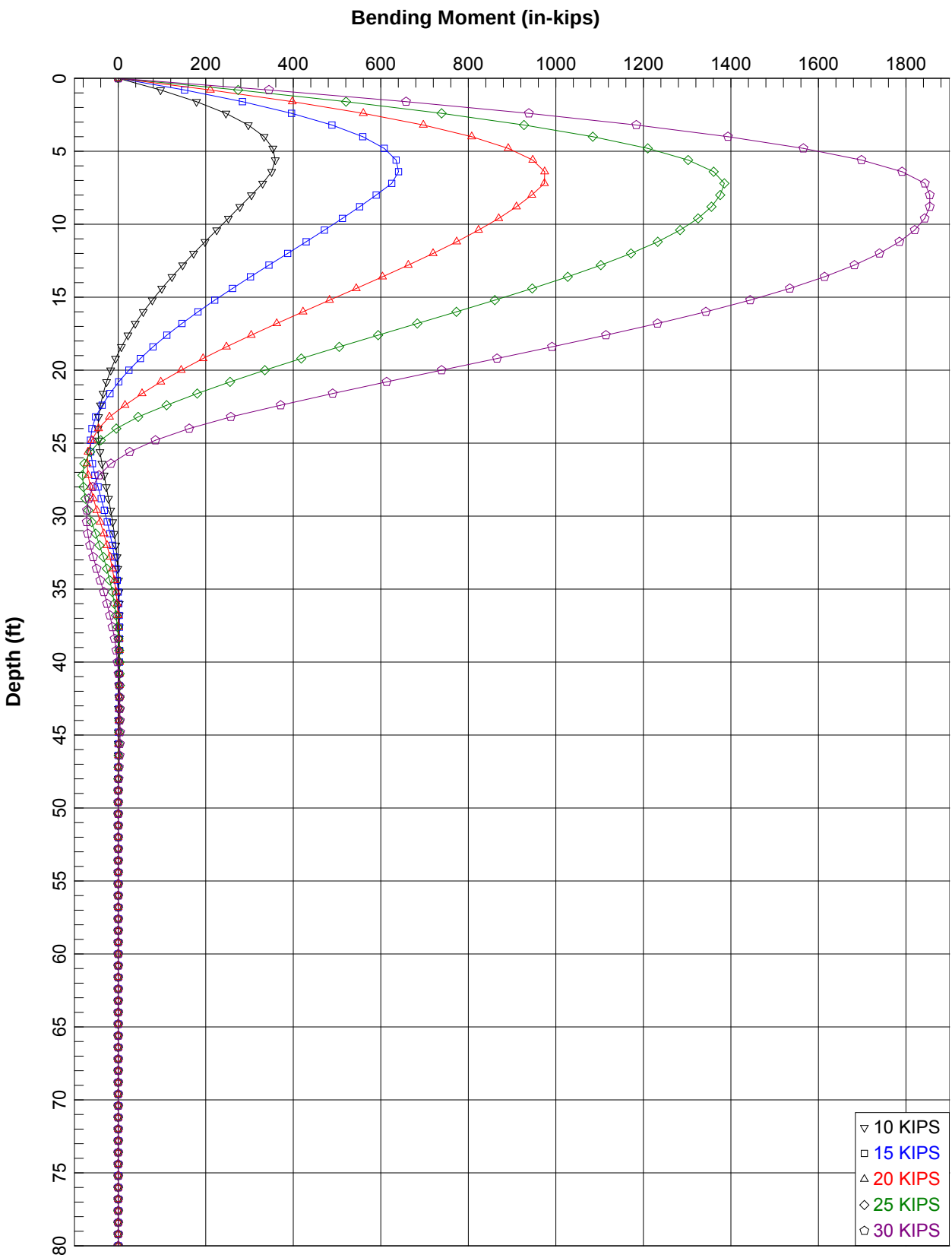
PROJECT NAME	***80-680-12 INTERCHAGNE***						
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*					
CPT NO.	***CPT-10-005A***	*FAULT M_w =*	6.9	*MSF =*	1.24	*a_{max} (g)=*	0.7

			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
115.81	7	Silty Sand to Sandy Silt	112.09	2.134	6.802	3.301	3.501	2.48	0.468	0.47	0.419	2.480	0.47	52.45	2.669	140.02	0.34	0.78	1	(0.77)
116.14	8	Sand to Silty Sand	140.72	2.487	6.822	3.312	3.511	2.38	0.467	0.47	0.419	2.380	0.47	65.72	2.233	146.72	0.37	0.78	1	(0.86)
116.47	8	Sand to Silty Sand	145.29	3.018	6.842	3.322	3.52	2.41	0.4661	0.47	0.419	2.410	0.47	67.72	2.354	159.39	0.46	0.78	1	(1.05)
116.8	7	Silty Sand to Sandy Silt	133.29	3.422	6.861	3.332	3.529	2.51	0.4652	0.47	0.418	2.510	0.47	62.01	2.820	174.83		0.78	1	
117.13	7	Silty Sand to Sandy Silt	195.86	4.851	6.881	3.342	3.538	2.37	0.4643	0.47	0.418	2.370	0.46	90.95	2.194	199.54		0.74	1	
117.45	12	Sand to Clayey Sand	212.32	8.241	6.901	3.352	3.548	2.49	0.4634	0.47	0.418	2.490	0.46	98.38	2.718	267.43		0.78	1	
117.78	11	Sitff Fine-Grained	146.78	6.893	6.922	3.363	3.559	2.66	0.4623	0.47	0.417							0.78	1	
118.11	6	Sandy Silt to Clayey Silt	113.04	4.119	6.941	3.373	3.568	2.66	0.4614	0.47	0.417							0.78	1	
118.44	6	Sandy Silt to Clayey Silt	105.44	4.117	6.96	3.383	3.576	2.71	0.4606	0.47	0.417							0.78	1	
118.77	11	Sitff Fine-Grained	120.19	4.95	6.981	3.393	3.588	2.68	0.4595	0.47	0.416							0.77	1	
119.09	12	Sand to Clayey Sand	128.07	4.988	7.001	3.404	3.597	2.66	0.4586	0.47	0.416							0.77	1	
119.42	6	Sandy Silt to Clayey Silt	126.44	4.593	7.02	3.414	3.606	2.64	0.4578	0.47	0.416							0.77	1	
119.75	7	Silty Sand to Sandy Silt	166.47	3.653	7.039	3.424	3.615	2.39	0.4569	0.47	0.416	2.390	0.46	76.06	2.272	172.82		0.76	1	

L-PILE Analysis Results



GREEN VALLEY ROAD OC, ABUT 1, CLASS 200 ALT. "W" (16" DIA.)



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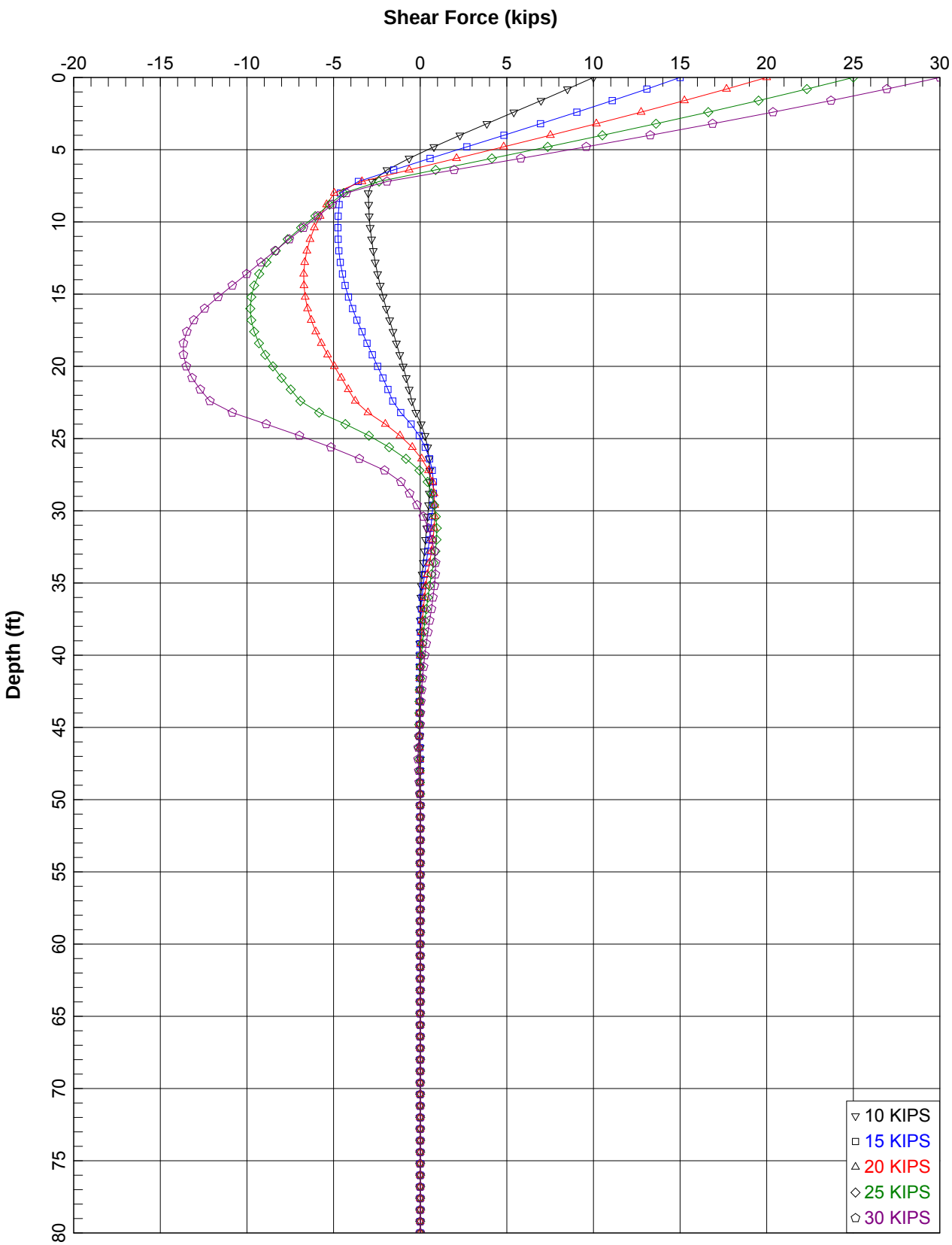

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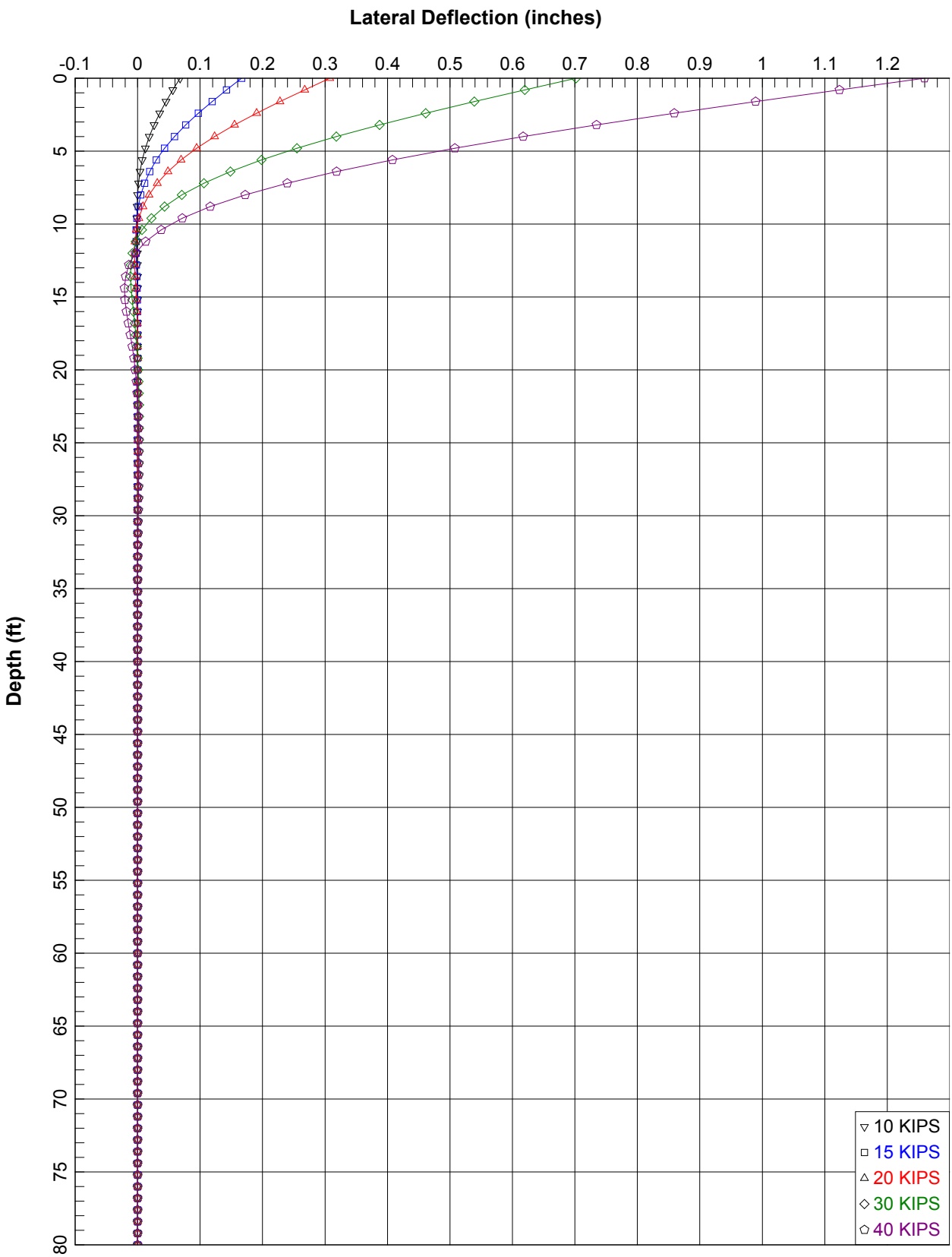

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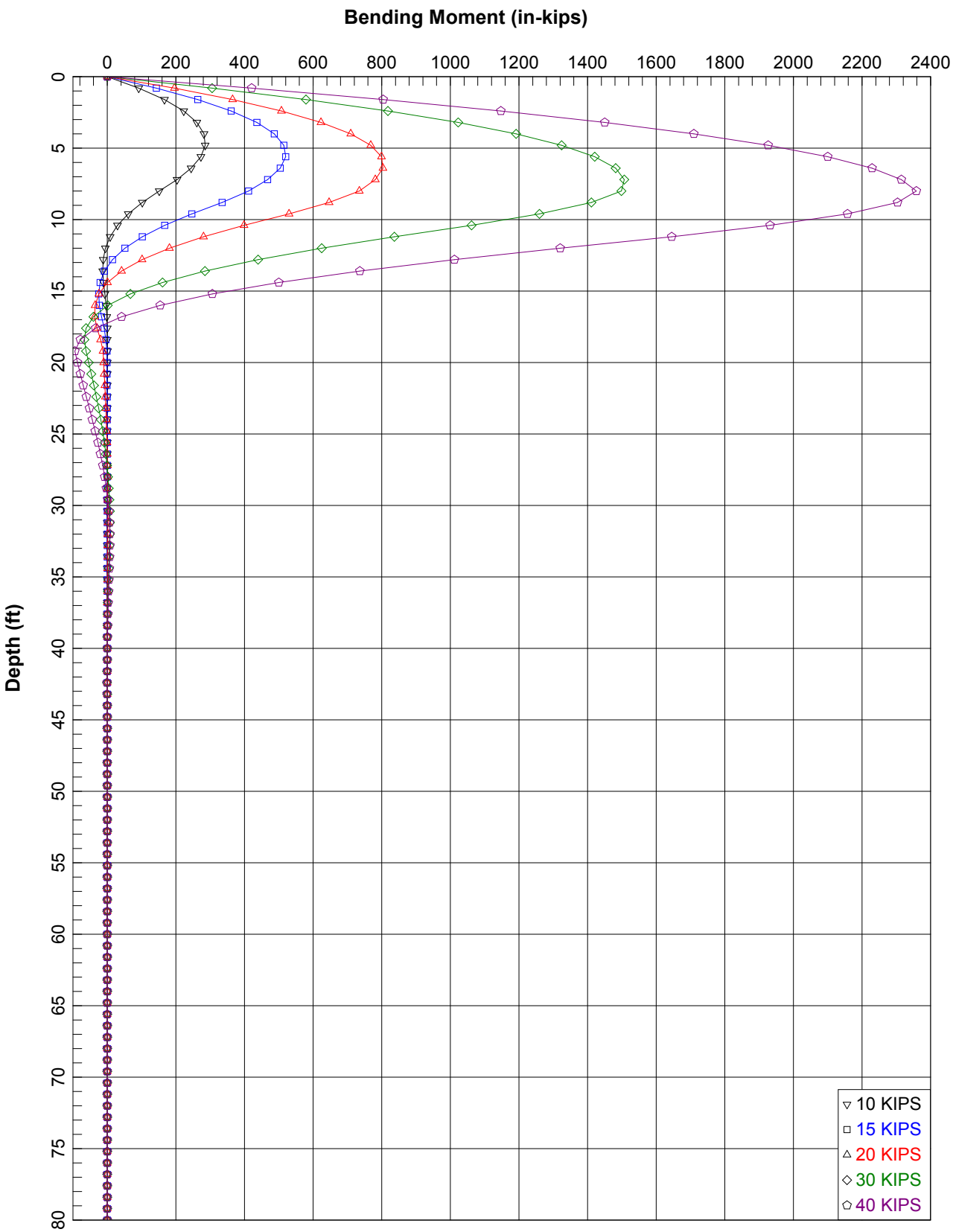

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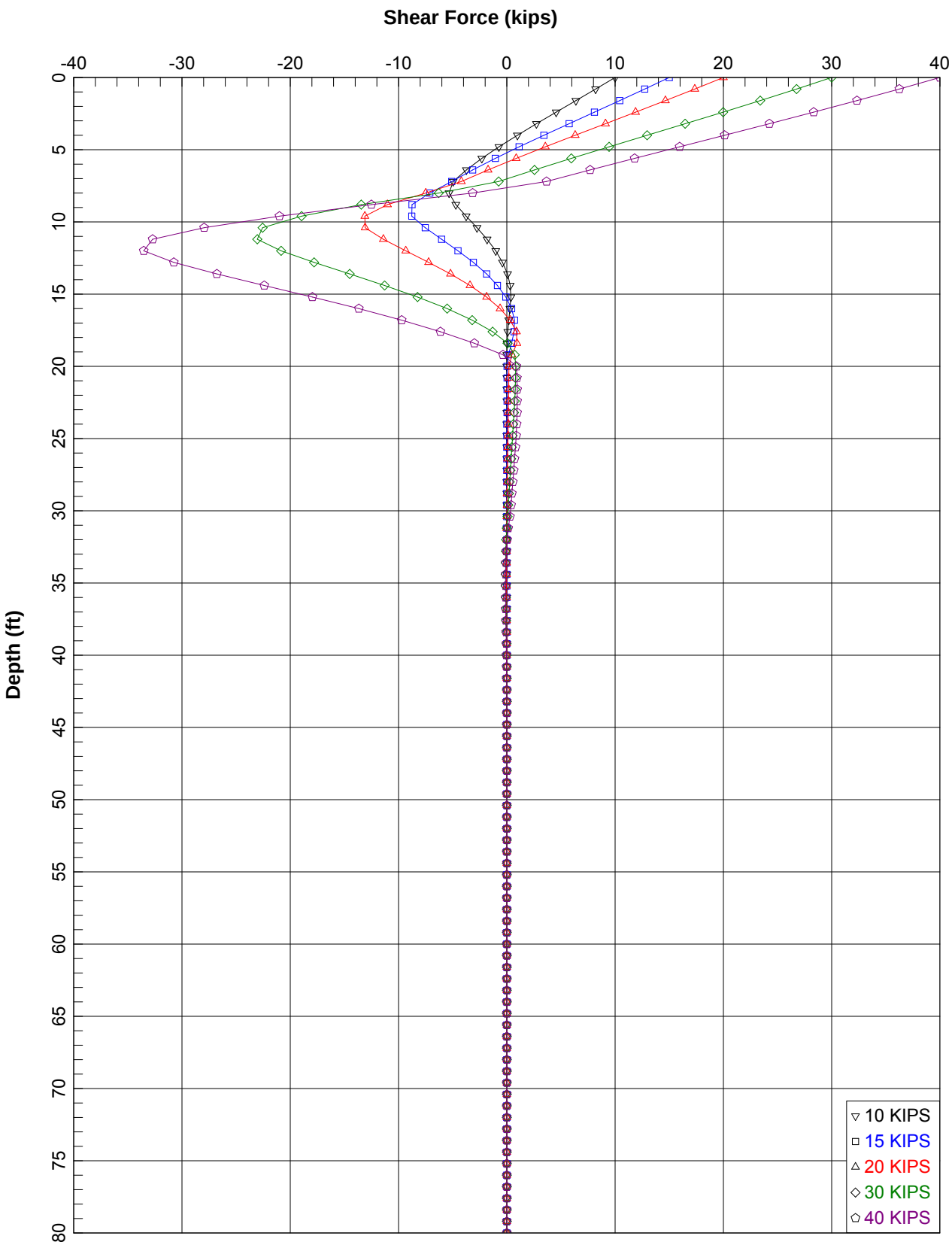

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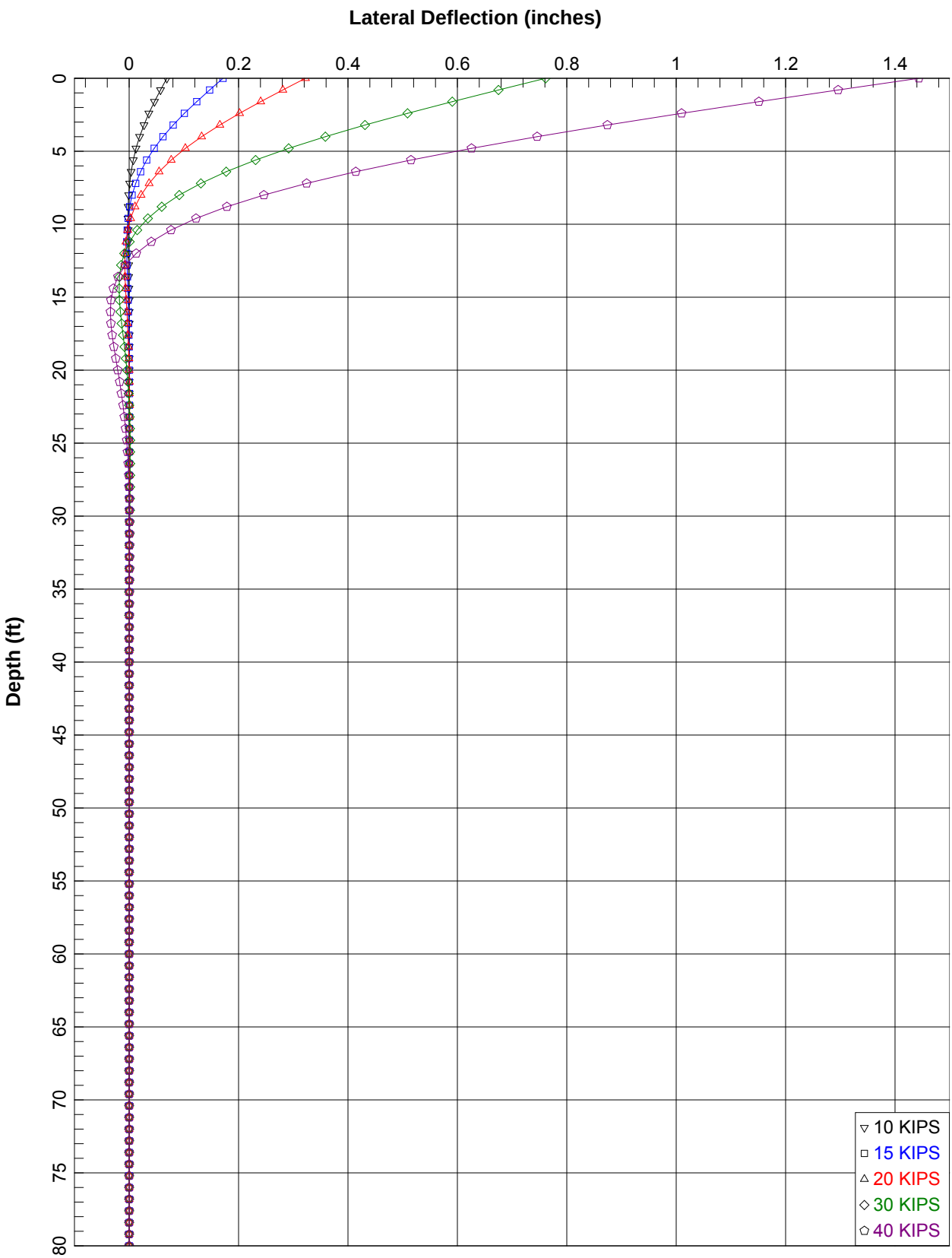

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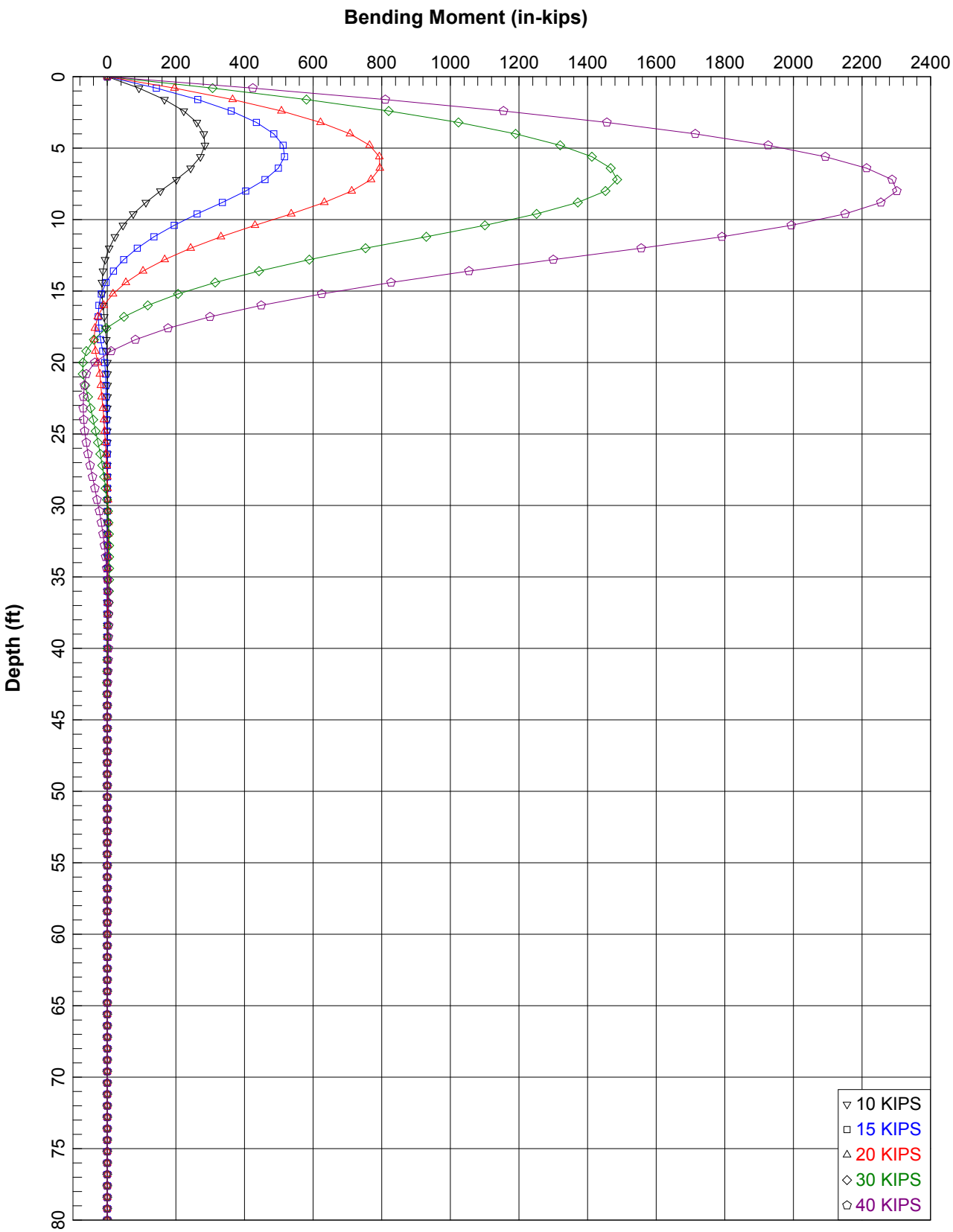

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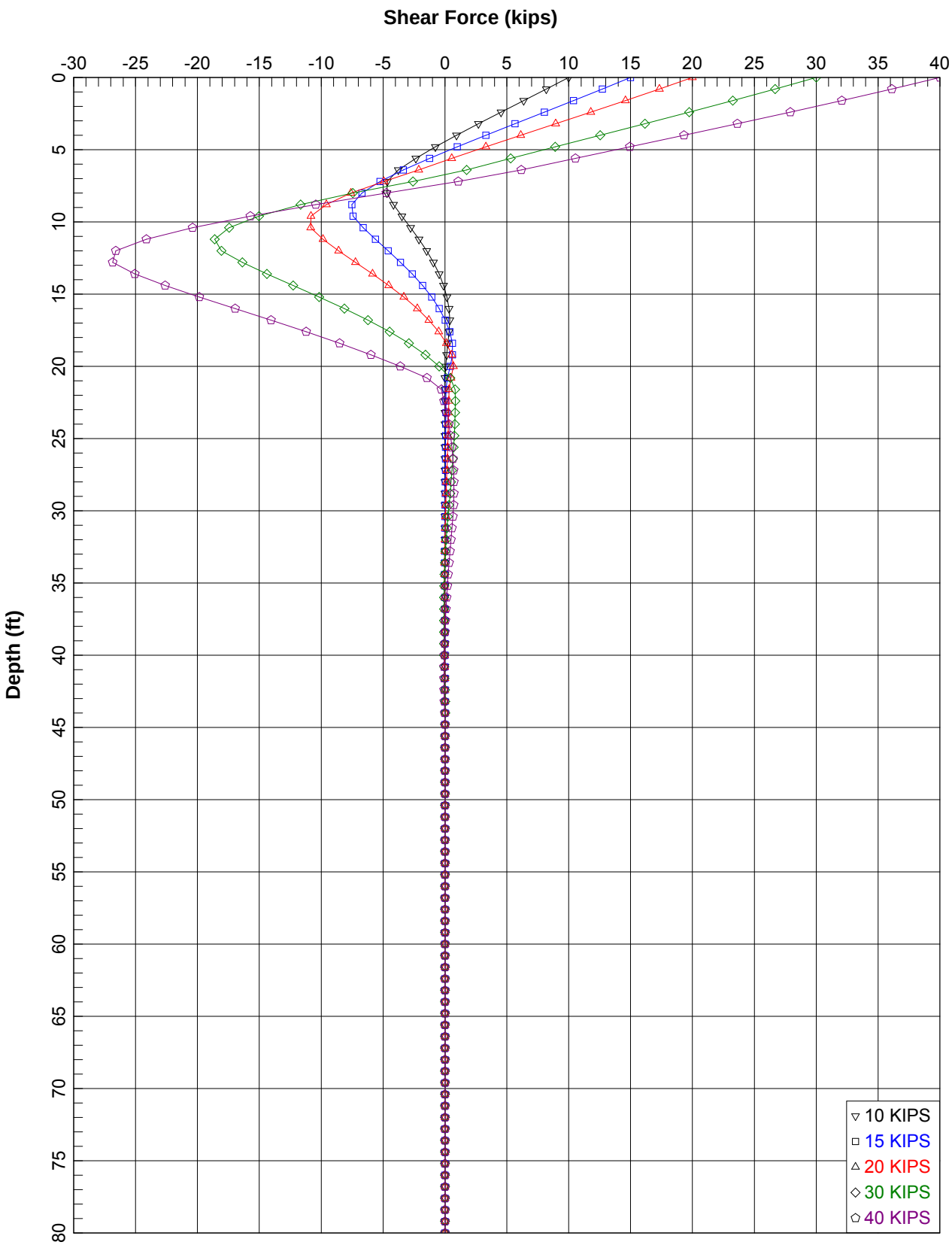
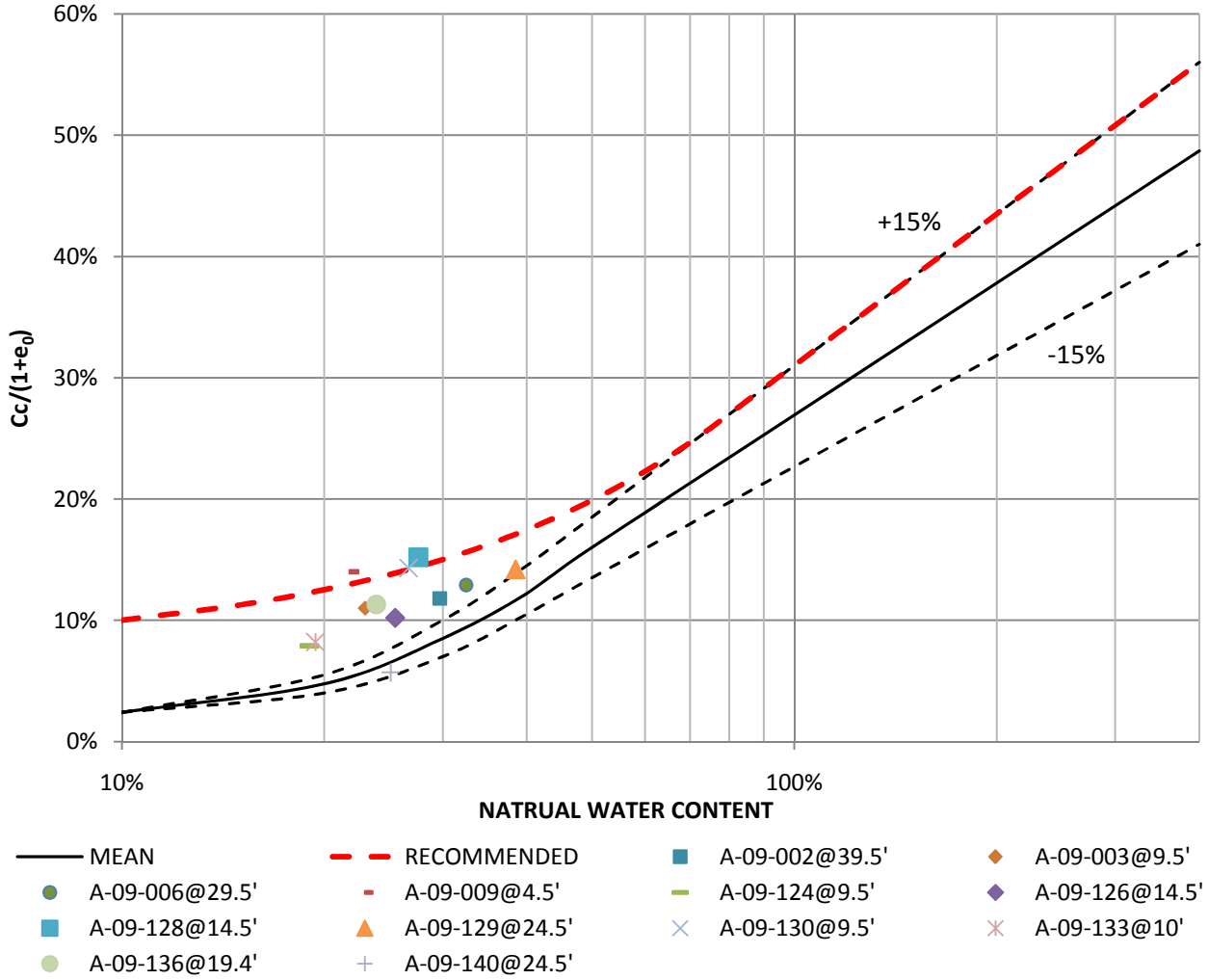


GREEN VALLEY ROAD OC, ABUT 3, CLASS 200 ALT. "W" (16" DIA.)

Settlement Analysis Results

Modified Compression Index v.s. Natural Moisture Content



Boring	Sample No.	Depth	Moisture Content	Cc/(1+e0)	Cr/(1+e0)	Cr/Cc
A-09-002	8	39.5	29.7%	11.8%	1.6%	13.6%
A-09-003	2	9.5	23.0%	11.0%	2.6%	23.6%
A-09-006	6	29.5	32.5%	12.9%	1.7%	13.2%
A-09-009	1	4.5	21.8%	14.0%	4.1%	29.3%
A-09-124	3	9.5	19.0%	7.9%	1.4%	17.7%
A-09-126	3	14.5	25.5%	10.2%	3.2%	31.4%
A-09-128	4	14.5	27.6%	15.2%	3.0%	19.7%
A-09-129	6	24.5	38.5%	14.2%	2.5%	17.6%
A-09-130	2	9.5	26.7%	14.3%	3.0%	21.0%
A-09-133	3	10.0	19.4%	8.2%	1.8%	22.0%
A-09-136	5	19.4	23.9%	11.3%	2.3%	20.4%
A-09-140	5	24.5	25.1%	5.7%	1.0%	17.5%

PARIKH
Practicing in the Geosciences

I-80/680/12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR | PLATE NO.:

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***2009-130-GDR***
BORING NO. ***R-10-004*** *(GREEN VALLEY ROAD OC, NORTH EMBANKMENT)*

Embankment H (ft)= 30 *Contact Pressure (psf)=* 3750 *Contact Area, B (ft)=* 150 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 10 *Contact Area, L (ft)=*
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	8	7	SPT	7	125.0	125.0	24.4%	500	3652.6	3653	0.0272	0.1361	2.258	0.728	2.985
2	8	12	23	SPT	23	125.0	62.6	20.4%	1125	3515.6	11574	0.0252	0.1262	0.745		0.745
2	12	14	9	SPT	9	125.0	62.6	20.0%	1313	3450.9	4487	0.0250	0.1252	0.321	0.078	0.399
2	14	17	19	SPT	19	125.0	62.6	25.0%	1470	3398.8	9499	0.0275	0.1376	0.515		0.515
1	17	22	13	SPT	13	125.0	62.6	21.7%	1720	3318.6						
2	22	30	27	SPT	27	125.0	62.6	30.1%	2127	3196.0	13365	0.0301	0.1503	1.150		1.150
1	30	33	16	SPT	16	125.0	62.6	26.7%	2471	3099.2						
1	33	36	14	SPT	14	125.0	62.6	29.7%	2659	3048.8						
1	36	40	67	SPT	67	125.0	62.6	34.8%	2878	2992.0						
1	40	43.5	43	SPT	43	125.0	62.6	28.8%	3113	2933.5						
1	43.5	46.5	32	SPT	32	125.0	62.6	31.6%	3316	2884.6						
1	46.5	50	22	SPT	22	125.0	62.6	27.2%	3520	2837.3						
2	50	53	20	SPT	20	125.0	62.6	24.2%	3723	2791.6	9905	0.0271	0.1356	0.237		0.237
2	53	58.5	28	SPT	28	125.0	62.6	14.7%	3989	2733.9	14035	0.0224	0.1119	0.335		0.335
2	58.5	63	32	SPT	32	125.0	62.6	14.6%	4302	2669.0	16211	0.0223	0.1116	0.253		0.253
2	63	68	35	SPT	35	125.0	62.6	32.3%	4600	2610.2	17302	0.0311	0.1557	0.365		0.365
2	68	73	41	SPT	41	125.0	62.6	27.5%	4913	2551.0	20699	0.0288	0.1438	0.314		0.314
2	73	80	18	SPT	18	125.0	62.6	29.9%	5288	2483.4	8960	0.0300	0.1498	0.421		0.421
1	80	90	85	SPT	85	125.0	62.6	32.3%	5820	2393.6						
1	90	100	85	SPT	85	125.0	62.6	34.8%	6446	2295.9						
													Estimated Settlement (in)=	*6.9*	*0.8*	***7.7***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-130*** *(GREEN VALLEY ROAD OC, NORTH EMBANKMENT)*

Embankment H (ft)=	20	*Contact Pressure (psf)=*	2500	*Contact Area, B (ft)=*	150	*Cr/Cc=*	20%
Unit Weight (pcf)=	125	*GW Level (ft)=*	10	*Contact Area, L (ft)=*	60		
				Plane Strain? (Y/N)=	Y		

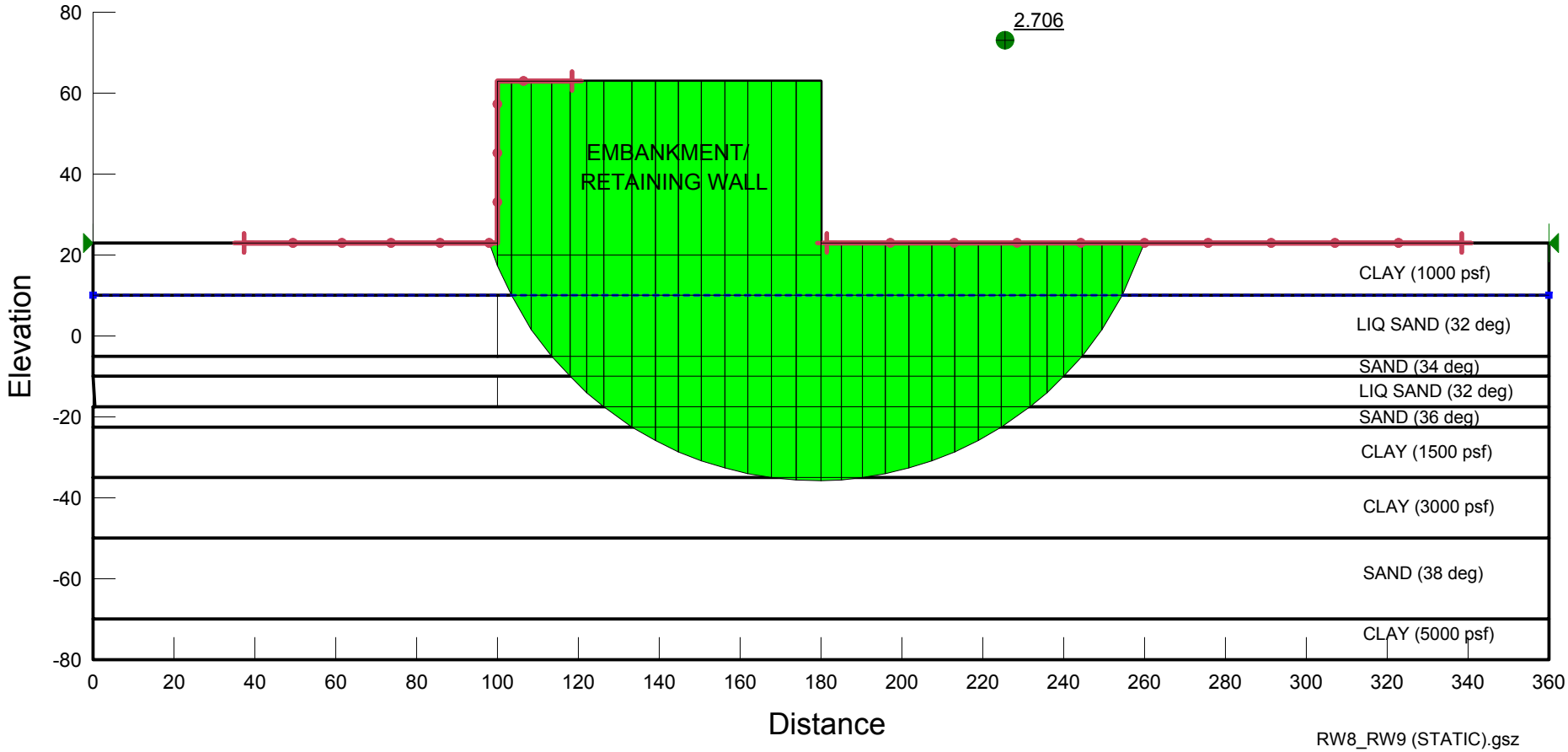
GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	7	7	SPT	7	125.0	125.0	22.5%	438	2443.0	3575	0.0263	0.1314	1.807		1.807
2	7	12	6	SPT	6	125.0	62.6	26.7%	1032	2351.1	2979	0.0284	0.1419	0.784	0.469	1.254
2	12	17	8	SPT	8	125.0	62.6	21.6%	1345	2279.6	4171	0.0258	0.1292	0.667		0.667
2	17	22	10	SPT	10	125.0	62.6	28.8%	1658	2212.4	4767	0.0294	0.1471	0.650		0.650
2	22	26.5	11	SPT	11	125.0	62.6	31.1%	1955	2152.1	5363	0.0305	0.1527	0.532		0.532
1	26.5	31.5	10	SPT	10	125.0	62.6	34.6%	2252	2095.0						
1	31.5	36.5	13	SPT	13	125.0	62.6	29.2%	2565	2038.0						
1	36.5	41.5	92	SPT	92	125.0	62.6	15.8%	2878	1984.1						
1	41.5	46.5	67	SPT	67	125.0	62.6	10.9%	3191	1933.0						
1	46.5	51.5	61	SPT	61	125.0	62.6	14.7%	3504	1884.4						
1	51.5	56.5	50	SPT	50	125.0	62.6	17.1%	3817	1838.2						
2	56.5	64	35	SPT	35	125.0	62.6	31.5%	4208	1783.6	17417	0.0307	0.1537	0.425		0.425
													Estimated Settlement (in)=	*4.9*	*0.5*	***5.3***

Slope Stability Analysis Results

GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9

(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUCTION)



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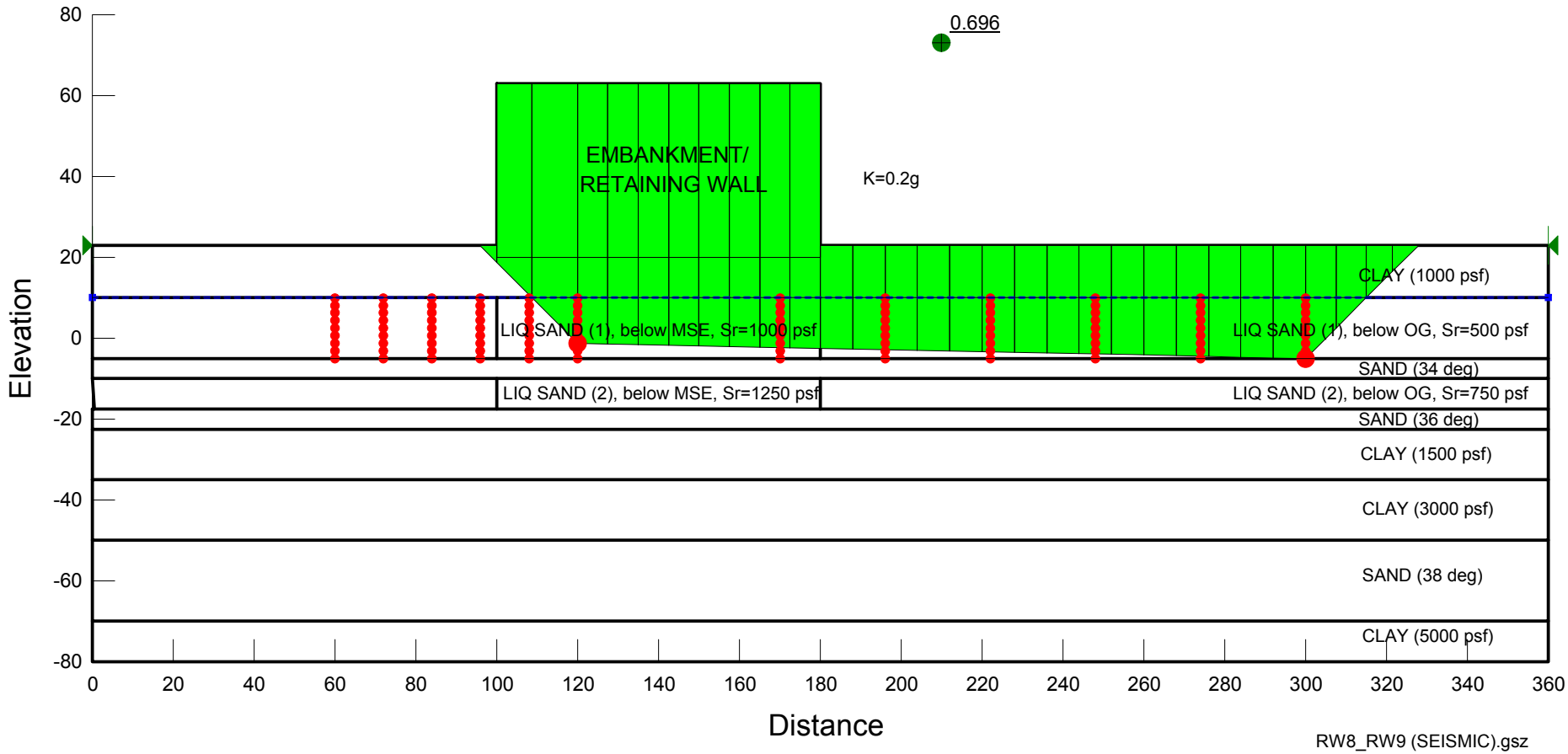
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTH)



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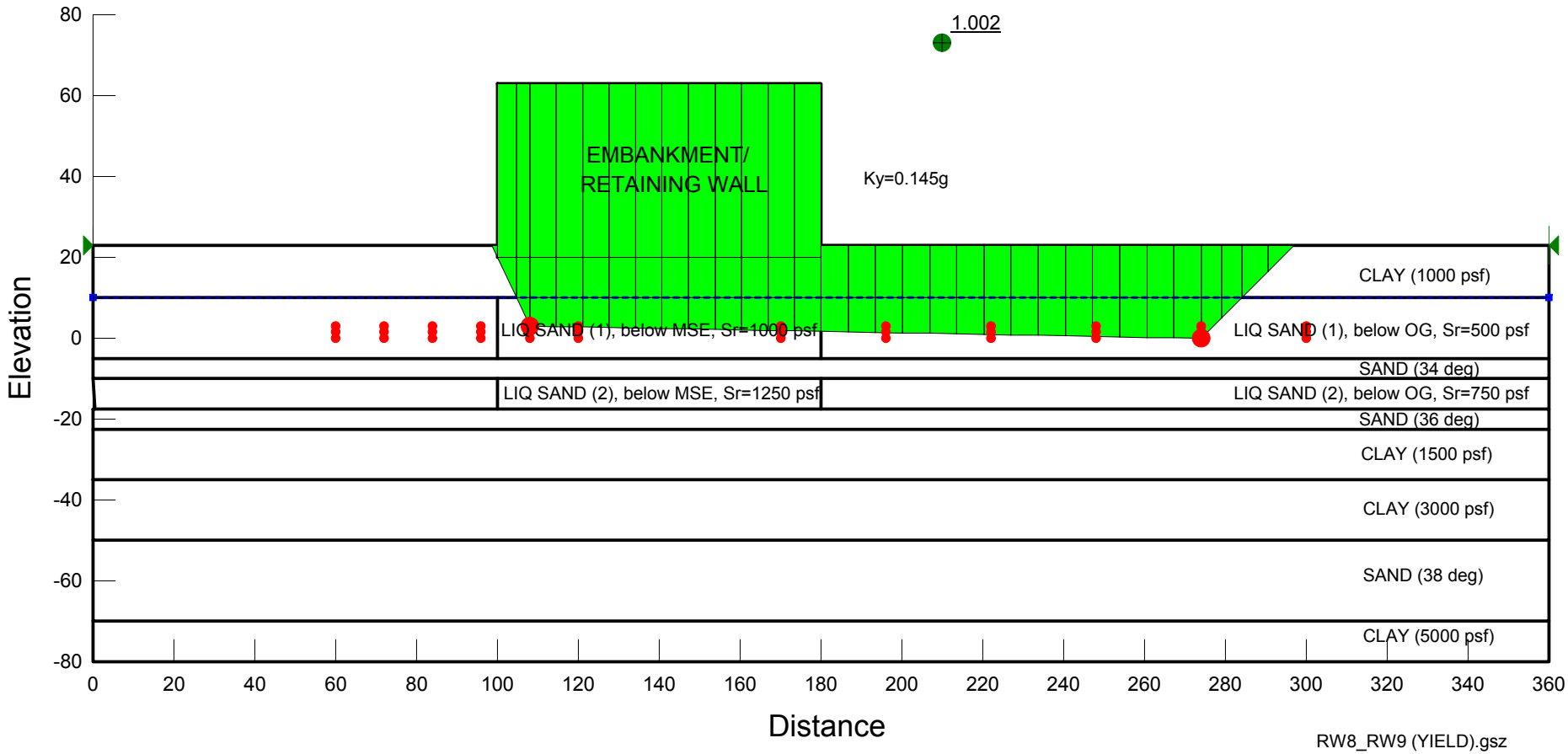
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9



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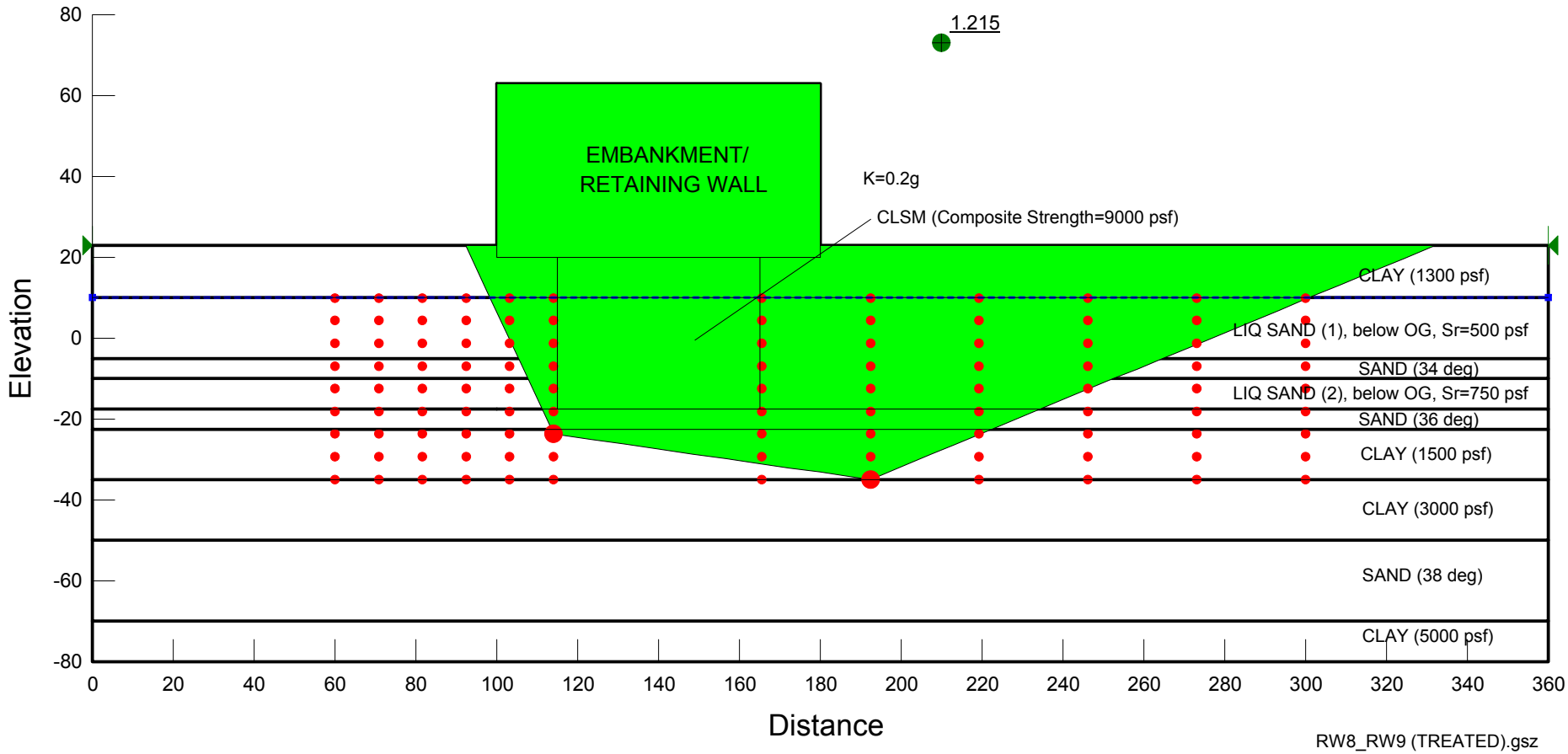
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTH+CLSM COLUMNS)



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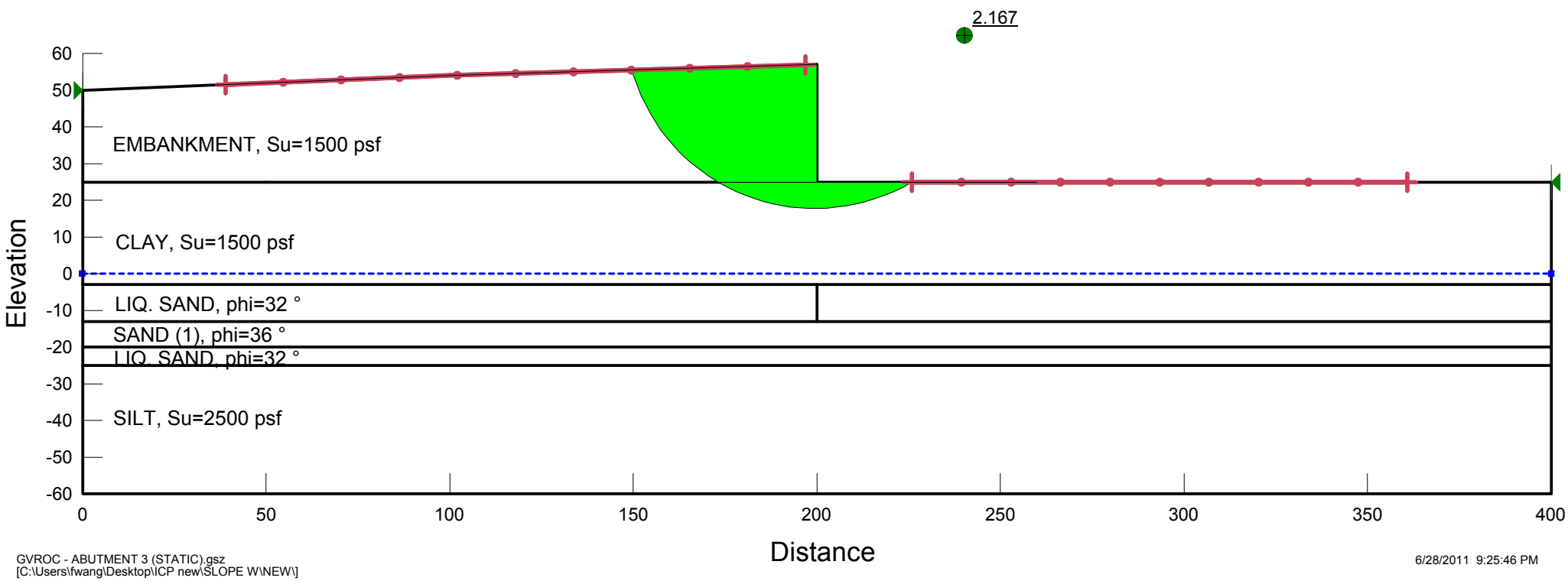
I-80/680/12 INTERCHANGE PROJECT
GREEN VALLEY ROAD OVERCROSSING
ABUTMENT 3 (NORTH)

(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUCTION)



GVROC - ABUTMENT 3 (STATIC).gsz
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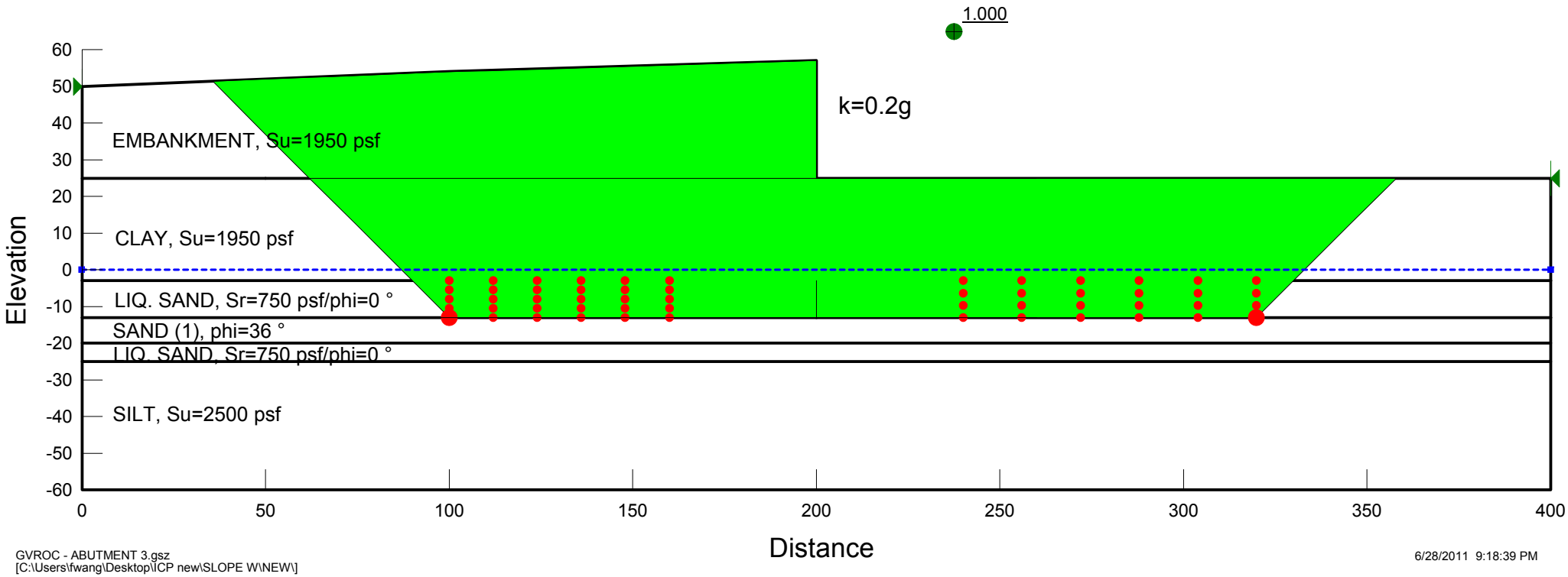
I-80/680/12 INTERCHANGE PROJECT
GREEN VALLEY ROAD OVERCROSSING
ABUTMENT 3 (NORTH)

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTHS)



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Ground Improvement (by Acacia CE)

Acacia CE
Consultants & Engineers

GROUND IMPROVEMENT CONSTRUCTION DOCUMENTS

65% DESIGN DEVELOPMENT
NOT FOR CONSTRUCTION

I-80/I-680/SR-12 ICP
Retaining Walls 8 & 9
Solano County, CA

Submitted to:

Y. David Wang, Ph.D., PE
Parikh Consultants, Inc.
2360 Qume Drive, Suite A
San Jose, CA 95131

Prepared by:
William M. Kenney, GE

Acacia CE

July 11, 2011
REVISED September 28, 2011

Project Number: AC 157

3025 Venture Road, Placerville, CA 95667 tel 530.748.1336 fax 530.621.4837 www.acaciace.com

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Mr. Y. David Wang
Parikh Consultants, Inc.
2360 Qume Drive, Suite A
San Jose, CA 95131

Subject: I-80/I-680/SR-12 ICP
"G" Line Retaining Walls 8 & 9
Solano County, CA

GROUND IMPROVEMENT CONSTRUCTION DOCUMENTS
65% DESIGN DEVELOPMENT

Dear Mr. Wang:

Acacia CE is pleased to present the following Ground Improvement Design Development and Construction Documents for subsurface improvements in the Retaining Wall 8 & 9 are of the "G" line for the I-8-/I-680/SR-12 ICP in Solano County California.

Generally, liquefaction mitigation and performance criteria vary according to the acceptable level of risk and required levels of performance for each structure type. The ground improvement described herein, once implemented, will provide liquefaction mitigation in the improved ground areas such that acceptable performance in the Wall 8 & 9 "soil raft" (i.e., stability and deformation levels) is achieved.

The calculations included in this submittal are for 24 inch diameter controlled low strength material (CLSM) ground improvement columns (GIC) using a 750 psi CLSM backfill material. Final design will include documentation for Deep Soil Mix (DSM) GIC providing substantially similar engineering properties using lower strength material (soil-cement ~200 psi) and a larger diameter column (higher area replacement ratio).

This Transmittal is based on 65% Design Development information and should be used for review of the ground improvement methods proposed. This submittal should not be considered as basis for the bidding or construction phase of this project.

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This 65% Design Development package includes the following Attachments:

ATTACHMENT A – Plan Sheets
ATTACHMENT B – Calculations
ATTACHMENT C – Load Test Requirements
ATTACHMENT D – Special Provisions CLSM GIC
ATTACHMENT E – Special Provisions DSM GIC

We are pleased to serve you on this project. If you have any questions regarding the contents of this Transmittal, please contact me at (530) 748-1336 ext. 15.

Sincerely,

9/28/11

Acacia CE Inc.

REGISTERED PROFESSIONAL ENGINEER
WILLIAM M. KENNEY
No. GE 2760
Exp. 3/31/13
GEOTECHNICAL
STATE OF CALIFORNIA

William M. Kenney, GE
Principal Engineer

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ATTACHMENT A
Plan Sheets

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Dist.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12.80	2.5/2.8 12.0/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2760 Exp. 12/31/12 CIVIL STATE OF CALIFORNIA

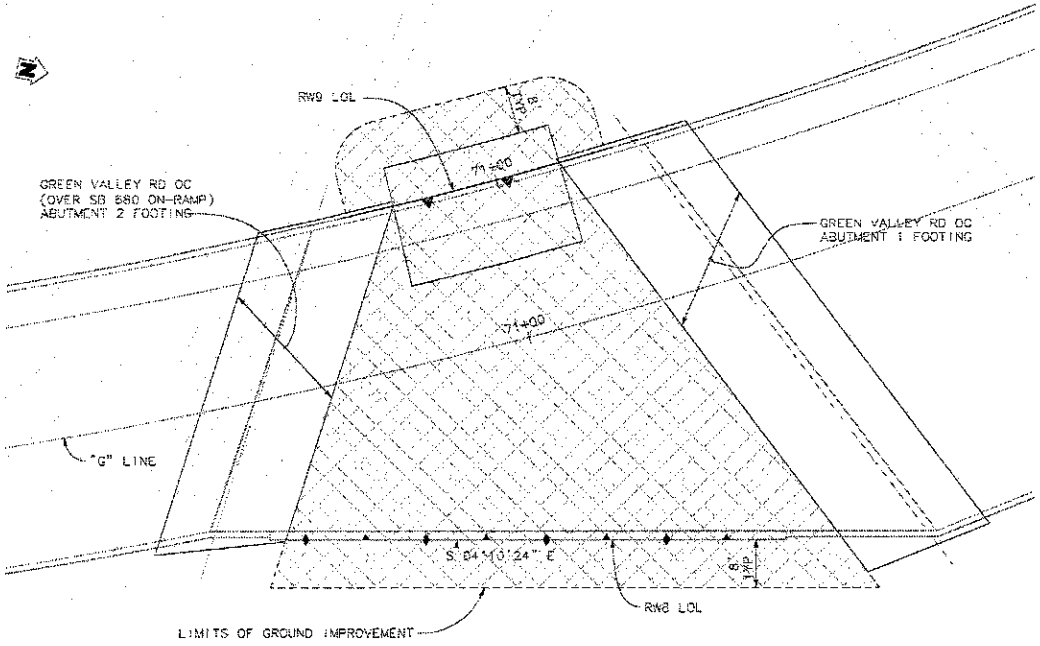
ACACIA CE
3025 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

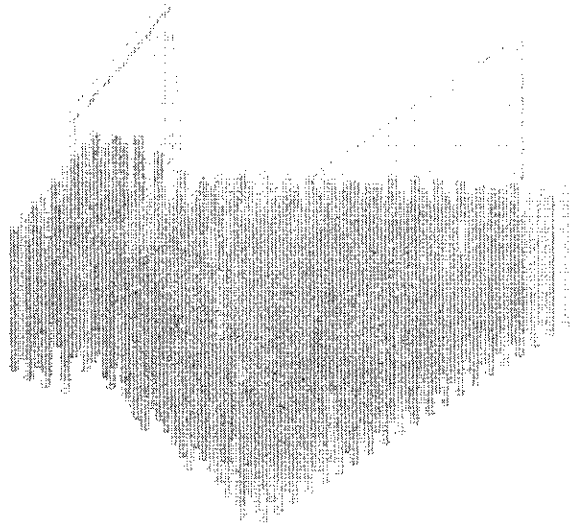
65% SUBMITTAL
07/11/11

LEGEND

GROUND IMPROVEMENT



PLAN
1" = 10'



CONCEPTUAL ISOMETRIC VIEW
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL

CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM M KENNEY

CALCULATED-DESIGNED BY: S. B. WARREN
CHECKED BY: W. M. KENNEY

REVISED BY
DATE REVISED

USERNAME => $USER | RELATIVE BORDER SCALE 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 0000000001

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	G-DET No.	TOTAL SHEETS
04	Sol	12,80	2.5/2.6 12.0/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2760 Exp. 3/31/13 CIVIL STATE OF CALIFORNIA

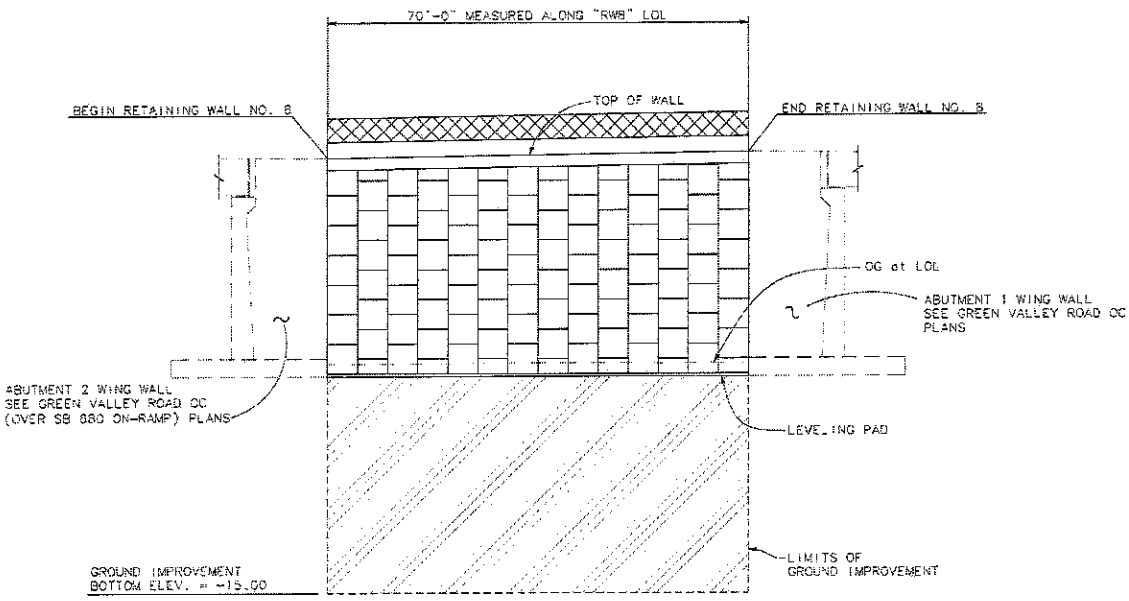
ACACIA CE
3525 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

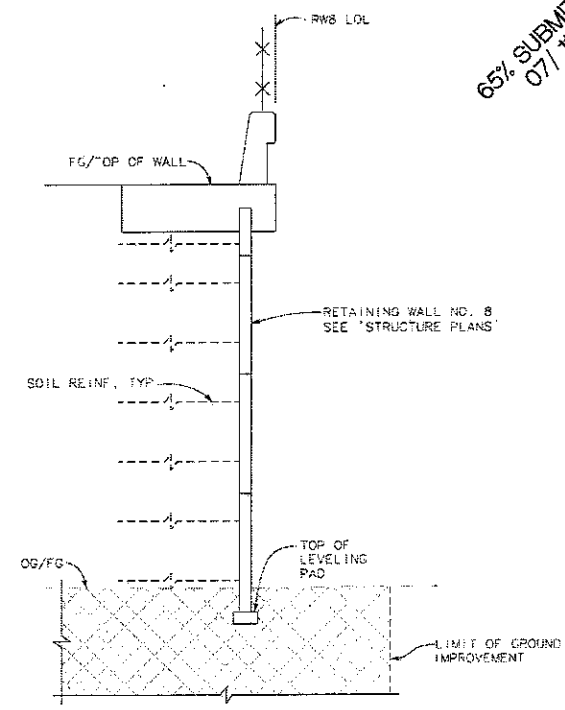
LEGEND

GROUND IMPROVEMENT

65% SUBMITTAL
07/11/11



ELEVATION
1" = 10'



TYPICAL SECTION - RETAINING WALL NO. 8
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL
CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM M. KENNEY
CALCULATED-DESIGNED BY: S. D. WARREN
CHECKED BY: W. M. KENNEY
REVISED BY
DATE REVISED

USERNAME =A$USER
RELATIVE BORDER SCALE 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0000000000
DATE PLOTTED = 11-JUL-2011

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.5/2.8 12.3/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2780 Exp. 3/31/13 GEOTECHNICAL STATE OF CALIFORNIA

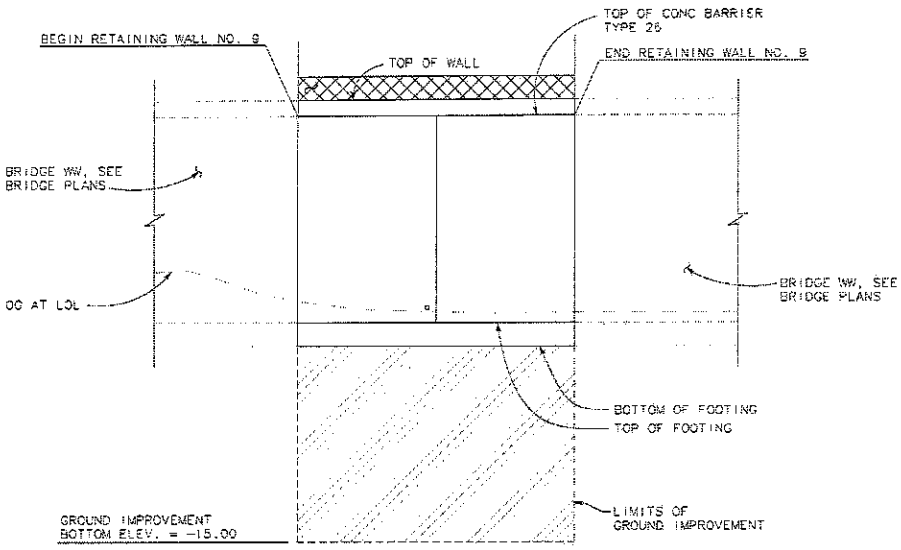
ACACIA CE
3025 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

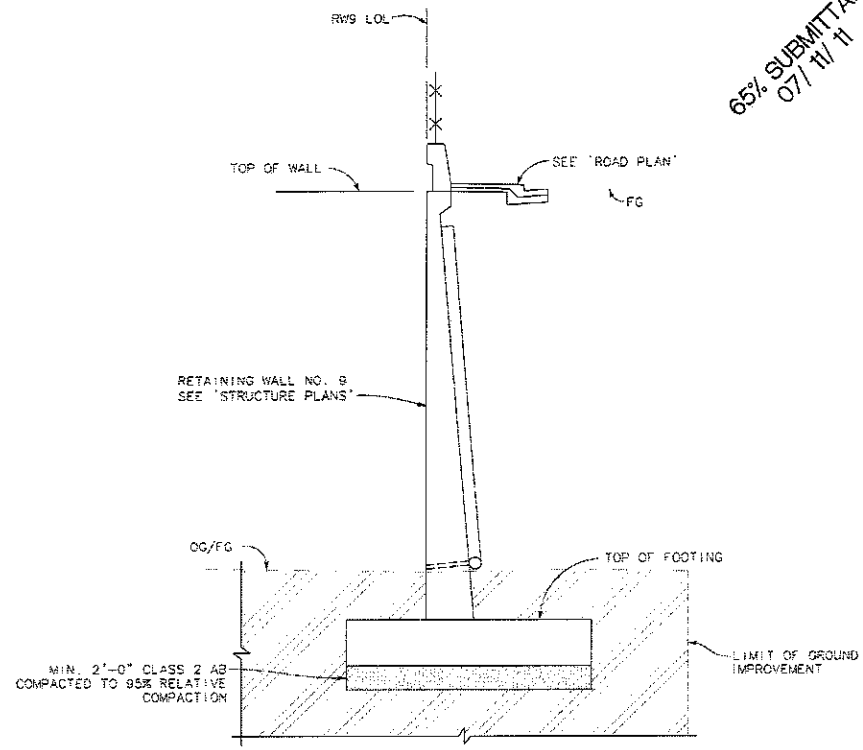
65% SUBMITTAL
07/11/11

LEGEND

GROUND IMPROVEMENT



ELEVATION
1" = 10'



TYPICAL SECTION - RETAINING WALL NO. 9
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL
CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM H. KENNEY
CALCULATED-DESIGNED BY: S. D. WARREN
CHECKED BY: W. M. KENNEY
REVISED BY
DATE REVISED

USERNAME => $USER
RELATIVE BORDER SCALE 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0000000000

ATTACHMENT B
Calculations

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Job Name: 80/680/12 Walls 8 + 9 By: WMK Sheet No. 1
Job No.: AC 157 Date:

CLSM GIC Composite Bearing Capacity (ULT.)

Two Zones : Zone 1 = Type 1 Wall
Zone 2 = MSE Wall / Field

$$q_{ac} = a_r \left(\frac{Q_{CLSM}}{q_{CLSM}}\right) + \beta (1 - a_r) q_s$$

Where: Q_{CLSM} = CLSM Cap (Ult.)
a_r = Area Replacement Ratio
β = Bearing Reduction Factor
0.5 - 1 for friction Col.
0.1 - 0.4 for end bearing
q_{CLSM} = Area CLSM GIC
q_s = Soil Bearing Cap (Ult.)

Determine Soil Bearing Cap. (q_s)

Generalized Soil Conditions
$\phi = 22°$ $c = 250$ psf $\gamma = 115$ pcf

Footing
$B = 20$ feet $D = \phi$ feet (Conservative)

$$q_s = c N_c + \gamma D_F N_q + \frac{\gamma B}{2} N_\gamma$$

For 22° $N_c = 16$ $N_q = 8$ $N_\gamma = 7$

$$q_s = (250)(16) + 0 + \frac{(115)(20)}{2}(7)$$

$q_s = 12{,}050$ psf

$$q_s = (750)(N_c) = (750)(5.5) = 4125 \Rightarrow 4{,}000 \text{ psf}$$

Area Replacement Ratio (a_r)

Zone 1, Rect. Spacing $= \frac{3.14}{(4.625)(3.75')} = 0.173$

Zone 2, Eq. Triang. $= \frac{3.14}{(.866)(4.83')^2} = 0.155$

Area CLSM GIC (q_{CLSM})

CLSM GIC diam = 24"

$\therefore$ $q_{CLSM} = 3.14$ ft²

CLSM GIC Bearing Capacity (Q_{CLSM})

$$Q_{CLSM} = (750 \text{ psi})\left(\frac{144 \text{ in}^2}{\text{ft}^2}\right) = 108{,}000 \text{ psf}$$

Composite Bearing Capacity - Zone 1 - Type 1 Wall Ftg.

$q_{ac} = (.17)(108{,}000) + (.75)(1-.17)(4{,}000)$

$q_{ac} = 20{,}850$ psf $\Rightarrow$ 20,500 psf

Composite Bearing Capacity - Zone 2 - MSE Wall / Field

$q_{ac} = (.155)(108{,}000) + (.75)(1-.155)(4{,}000)$

$q_{ac} = 19{,}275$ psf $\Rightarrow$ 19,500 psf

Bearing Capacity GIC Only (No Soil Contribution)

$q = (.17)(108{,}000) = 18{,}360$ psf $\Rightarrow$ 18,000 psf Zone 1

$q = (.155)(108{,}000) = 16{,}740$ psf $\Rightarrow$ 16,500 psf Zone 2

CLSM GIC Composite Shear Strength

$C = f_{CLSM}\, a_r + r\, C_o\, (1 - a_r)$

Where: f_{CLSM} = CLSM GIC Shear Strength = ½ Compressive Strength
a_r = Area Replacement Ratio
r = reduction factor for low strain in Soil
C_o = Soil Shear Strength

Zone 1 - Type 1 Wall
Zone 2 - MSE Wall / Field

Area Replacement Ratios

Zone 1 = 0.17
Zone 2 = 0.155

Use $r = 1$

C_o = Undrained Shear Strength
C_o = 750 psf

Composite Shear - Zone 1

$C = \left(\frac{108{,}000}{2}\right)(.17) + (1)(750)(1 - .17)$

$C = \underline{9803 \text{ psf}} \Rightarrow C = \underline{9800}$

Composite Shear - Zone 2

$C = \left(\frac{108{,}000}{2}\right)(.155) + (1)(750)(1 - .155)$

$C = 9004 \text{ psf} \Rightarrow \underline{C = 9000 \text{ psf}}$

Shear GIC ONLY (No Soil Contribution)

$C = \left(\frac{108{,}000}{2}\right)(.17) = \underline{9180}$ For Zone 1

$C = \left(\frac{108{,}000}{2}\right)(.155) = \underline{8370}$ For Zone 2

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Job Name: 80/680/12 Walls 8+9 By: WMK Sheet No. 4
Job No.: AC 157 Date:

Soil Profile For Settlement Estimate

Use R-10-003A

BOF MSE = 22.0'

Bottom of Ground Imp = -15'

-20 LZ1 = 5'

-26 LZ2 = 6'

-33 LZ3 = 7'

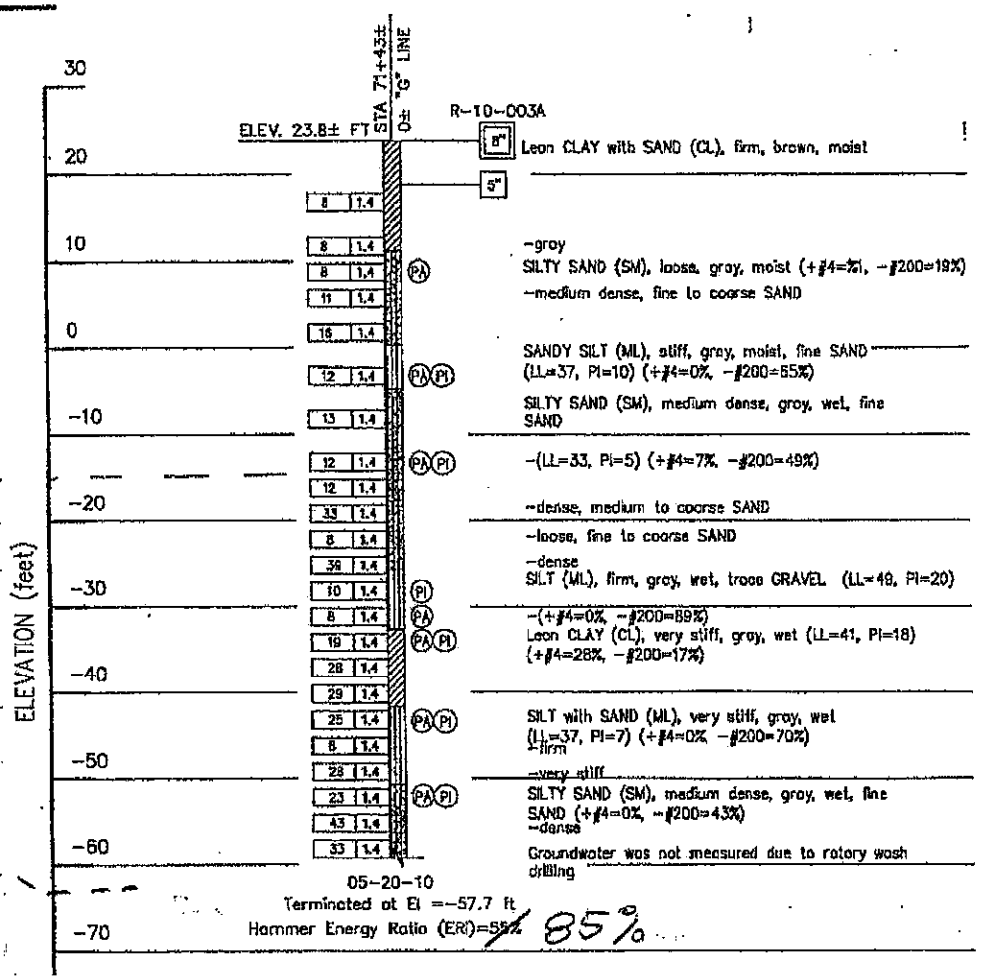
-41 LZ4 = 8'

-51 LZ5 = 10'

-67 LZ6 = 16'

LZ7 = 10'

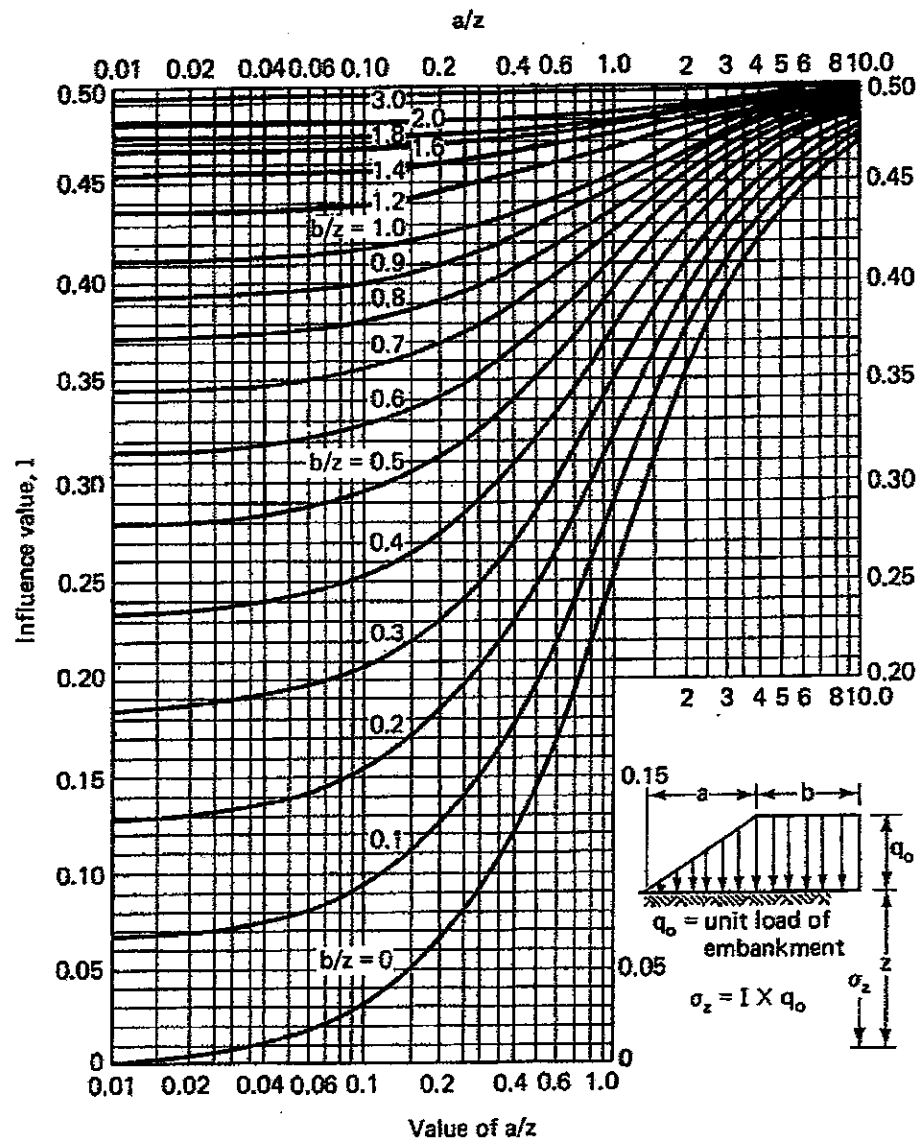
-77



		Mid Pt Depth
LZ1: Sand	E ~ 600 ksf	39.5
LZ2: Sand	E ~ 600 ksf	45.0
LZ3: Silt	E ~ 150 ksf	51.5
LZ4: Clay	E ~ 1000 ksf	59.0
LZ5: Silt	E ~ 250 ksf	68.0
LZ6: Sand	E ~ 600 ksf	81.0
* Below -63'	E ~ 600 ksf	94.0

Assume 10' Zone

* Based on CPT-10-003A



Influence factors for vertical stress under a very long embankment (after NAVFAC, 1971 as reported in Holtz and Kovacs, 1981)

Figure 9-2

Sheet No. 5

Job Name: 80/680/92
Job No.: AC 157
Engineer(s): WMK
Date: July 9, 2011

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Parameter	Symb	Val.
Column diameter (ft)	d	24
Depth to groundwater (ft)	dgw	18
Total unit weight of soil (pcf)	g	120
Soil frict. angle (degr)	f	22
Soil undr shear str (psf)	c	500
Max. hor. pressure (psf)	pmax	2500
Column cap. (kips)	Qcell	110
Bearing press. (ksf)	qall	5.5
Column stiffn. modulus (pci)	kcol	1000
Soil stiffness modulus (pci)	km	15

GIC ZONE SETTLEMENT CALCULATIONS

Parameter	Symb	Equation		
Load (kips)	P		111.38	
Cell width (ft)	B		4.5	
Cell length (ft)	L		4.5	
Cell bearing pressure	q	P/(B*L)	5.50	
No. Columns	N		1	
Area replacement ratio	Ra	N*Acol/(B*L)	0.16	
Stiffness ratio	Rs	kg/km	66.67	
Stress at top of Column (ksf)	qcol	q*Rs/(Rs*Ra-Ra+1)	32.77	
Load at top of Column (kips)	Qcol	qcol*Acol	102.96	
Improved zone settlement (in)	siz	qcol/kcol	0.23	

UZ = ↑

Notes:

For triangular spacing trib area = (.866)(a)(a)
Where a = on-center spacing
Equvalent sqaure are used in worksheet

INFLUENCE FACTORS FROM NAVFAC 1971

a = 1

Unform Load (q) = 5500

Determine Influence Factor Using "Long" Embankment

Mid Pt Depth	Width	Unit Load				(psf)	(ft)	(psf)	(ft)
(z)	(b)	(q)	(a/z)	b/z	I	I*q	H	E	s
39.5	27.4	5500	0.025316	0.693671	0.34	1870	5	600000	0.016
45	27.4	5500	0.022222	0.608889	0.32	1760	6	600000	0.018
51.5	27.4	5500	0.019417	0.532039	0.29	1595	7	150000	0.074
59	27.4	5500	0.016949	0.464407	0.26	1430	8	1000000	0.011
68	27.4	5500	0.014706	0.402941	0.235	1292.5	10	250000	0.052
81	27.4	5500	0.012346	0.338272	0.21	1155	16	600000	0.031
94	27.4	5500	0.010638	0.291489	0.17	935	10	600000	0.016

Lower Zone Settlement (ft) = 0.217
Lower Zone Settlement (in) = 2.6

LZ = ↑

Assume 3000 sf of embnkment load
Equivalent square = 54.77 feet E.W.
Therefore b= 1/2 side = 27.4 feet

NOTE: Due to the primarily granular (sandy) nature of zones 1, 2, 6, 7, and granular behavior of zone 5
About 1/2 to 1/3 of the total settlement should occur immediatley as the fill is placed

UZ + LZ = 2.8"

ATTACHMENT C
Load Test Requirements

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Ground Improvement Column (GIC)
Modulus Test Schedule

Prepared: July 11, 2011

Job: I-80/I-680/SR-12 ICP "G" Line Walls 8 & 9
Job No.: AC 157

Test Criteria

GIC Col. Diameter = 24 inches

Test Load (100% ASD) = 110 kips

Jack Calibration Date: _____

Jack No.: _____
Pump No.: _____
Guage No.: _____

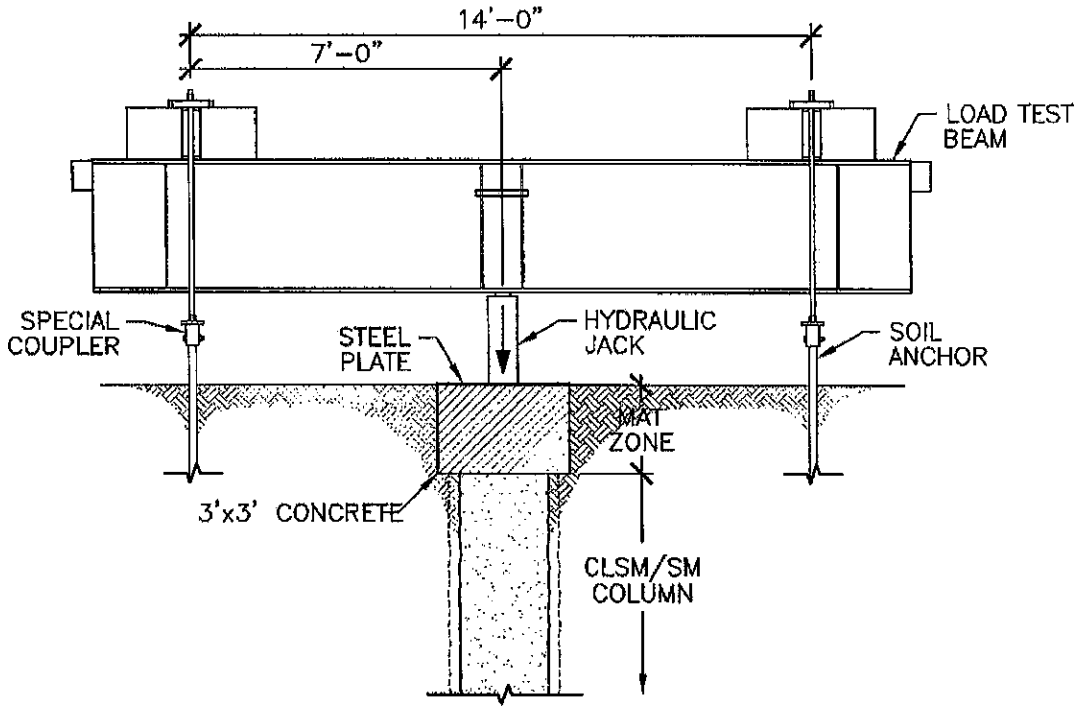
** - Gauge Factor to be based on latest Calibration for the Jack/Pump Gauge Setup used by the Testing Contractor

Gauge factor ** 31 in^2
Curve factor** 0 kips

Load No.	Percent of Design Load(%)	Gauge Pressure (psi)	Load (kips)	Load Duration (min.) MIN.	Load Duration (min.) MAX.
1	5%	177 / 200	5.5	0	0
2	17%	603 / 650	18.7	15	60
3	33%	1170 / 1200	36.3	15	60
4	50%	1774 / 1800	55.0	15	60
5	67%	2377 / 2400	73.7	15	60
6	83%	2945 / 2950	91.3	15	60
7	100%	3548 / 3550	110.0	15	60
8	115%	4080 / 4100	126.5	60	120
9	133%	4719 / 4750	146.3	15	60
10	150%	5322 / 5350	165.0	15	60
11	167%	5925 / 5950	183.7	15	60
12	183%	6493 / 6500	201.3	15	60
13	200%	7096 / 7100	220.0	15	60
14	167%	5925 / 5950	183.7	-	-
15	133%	4719 / 4750	146.3	-	-
16	100%	3548 / 3550	110.0	-	-
17	67%	2377 / 2400	73.7	-	-
18	33%	1170 / 1200	36.3	-	-
19	0%	-	0.0	-	-

Test Procedure

Apply seat load. Read dial gauges and apply first load increment. When Geopier average deflection is less than 0.01 inches per 1 hour or 0.0025 inches per 15 minutes go to next load increment or go to maximum load time of 1 hour if average deflection is greater. Hold load minimum of 60 minutes at 115% load increment.



CLSM/SM COLUMN SPECIFICATIONS	
APPRX. MAT ZONE	-- FT
MIN. CLSM/SMC SHAFT LENGTH (CSL)	-- FT
APPRX. CLSM/SMC DIA. (MAY VARY)	--- IN
TEST LOAD (100%)	-- KIPS
TEST LOAD (150%)	--- KIPS

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Placerville, CA 95667
Tel: 530.748.1336
Fax: 530.621.4837 www.acaciace.com

Base Documents

Sample Details

Load Test Setup

PROJECT NO.	AC 157		FIGURE NO.
DATE	JULY 11, 2011		1
REVISION	0		
DRAWN SW	CHECKED WK		

APPENDIX D
Special Provisions CLSM GIC

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10-1.XX DRILL DISPLACEMENT CLSM GROUND IMPROVEMENT COLUMN

This work shall consist of furnishing and installing Controlled Low Strength Material (CLSM) Ground Improvement Columns (GIC) by the drill displacement method at the locations shown on the plans.

CLSM GIC shall be performed by displacing soil with a specialized auger attachment and injecting CLSM in the displaced cavity under pressure as the displacement auger is removed from the ground to form a columnar inclusion of cemented material within the densified soil matrix. Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications regarding damage by CLSM GIC to existing utilities, improvements and facilities. The foundation information represents existing conditions at the specific boring locations at the time the borings were performed.

Installation of CLSM GIC shall create a soil/cemented column "raft" to improve strength properties of the foundation soils for the Type 1 wall and Mechanically Reinforced Earth (MSE) wall above. The Contractor shall confirm that the installed CLSM GIC achieves the required compressive strength and ensure that it is installed in the design configuration and within the specified limits.

The ground improvement shall extend to the designated depths shown on the plans. CLSM GIC installation equipment shall be capable of advancing through soil conditions as shown in the project boring logs.

CLSM GROUND IMPROVEMENT COLUMN

CLSM GIC shall improve strength properties of foundation soils within the area shown on the plans. CLSM GIC shall be placed according to the treatment pattern shown on the plans. The CLSM GIC displacement method shall displace at least 95 percent of the diameter of the displacement auger. The replacement of CLSM in the displaced cavity shall exceed 110 percent of the diameter of the displacement auger. The average 56-day unconfined compressive strength of CLSM shall be no less than 750 psi.

The Contractor may provide an alternative plan meeting the minimum performance requirement specified herein. The alternative plan shall be submitted as an attachment to the pre-construction submittal for approval by the Engineer.

The Contractor shall conduct a Pre-Production (PPC) Program within the limit of ground improvement areas shown on the plans prior to commencing CLSM GIC installation to establish production parameters procedures, and materials to be used during the production phase. The PPC Program shall produce CLSM mix design and procedures for production installation based upon the information provided from the PPC Program including: estimated 28-day and 56-day compressive strength of the CLSM, CLSM volume at the bottom of the GIC, injection pressure, injection volume per foot, and withdrawal rate of the auger, and complete description of all CLSM GIC operations.

SUBMITTALS

The submittals and other additional submittals shall conform to, the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions, and shall be stamped by a California Registered Professional Civil Engineer except for survey data which shall be stamped by a California Registered Professional Civil Engineer or a California Registered Land Surveyor.

The Contractor shall submit, for review by the Engineer, a statement of the previous work experience similar to that described in these special provisions. The statement shall include at least 3 successful CLSM GIC projects within past five years. This statement shall include a written description of each project, owner's contact name and current phone number, the dates and the extent of the work, the manner of its execution, and any other information that supports the Contractor's ability to carry out the work described in these special provisions.

Pre-construction Submittals

At least four weeks prior to commencement of mobilization of CLSM GIC equipment for production installation, the Contractor shall submit the following to the Engineer:

1. Names and qualifications of the ground improvement personnel including project experience, resumes and other documentation that demonstrate the experience qualifications of the project engineers, each field superintendent, and rig operator for the CLSM GIC installation.
2. A list of Contractors, responsible engineers, project descriptions and personnel responsibilities from CLSM GIC projects completed by the Project Engineers and Field Superintendents. Contractor's names, addresses and telephone numbers shall be included for these projects representing the individual's comparable experience. The projects listed shall demonstrate personnel qualifications using similar equipment and auger configuration(s) as proposed for the work of this Contract.
3. Submit data on equipment to be used for the CLSM GIC installation.
4. Sequence and time schedule of all operations including plan location and sequence of all CLSM GIC. The Contractor shall submit a CLSM GIC element Layout Plan based on the limits shown on the Plans to achieve the required plan area configurations and coverage. Plan locations of all proposed CLSM GIC shall be shown on Layout Plans. CLSM GIC elements on the Layout Plans shall be numbered and dimensioned and of suitable scale to clearly show the details of the layout.
5. CLSM mix design including: cement type and source, flyash type and source, water-cement ratio by weight and other pertinent details.
6. The results of the PPC Program including, but not limited-to: CLSM estimated 28-day and 56-day compressive strengths, injection pressure and rates, and complete description of all installation operations.

7. Description of Quality Control Plan for CLSM GIC installation including, but not limited to, the following:
   a. A detailed description of the Quality Control Plan to be undertaken each day during CLSM GIC installation to confirm that the installed columns conform to the required compressive strengths specified, the plan area coverage over the required depths and limits, and required horizontal and vertical alignments.
   b. Details of procedures used to obtain CLSM samples.
   c. Measures to be implemented each day during CLSM GIC to continuously monitor and control: CLSM injection pressures and quantities; withdrawal rates of the installation equipment; horizontal and vertical alignments of the CLSM GIC elements, and other related aspects of the installation process.
   d. Example formats of Daily Field Reports conforming to the requirements stated herein.
   e. Names, certifications and licenses of the Laboratory to be responsible for performing quality control tests.
   f. Proposed details and formats of all required data presentations to be submitted to the Engineer during the course of the Work.

Construction Submittals

Within two working days after the completion of each CLSM GIC element, submit the following:

1. Any deviation of the center coordinates from the layout plan to the nearest 3 inches at the top of the element.
2. The Daily Quality Control Report shall include as a minimum the results of the following QC parameter monitoring for each element:
   a. Rig Identification
   b. Type and size of installation tool
   c. Date and time (start and finish) of column construction
   d. Column number and reference drawing number
   e. Column diameter
   f. Column top and bottom elevations
   g. CLSM mix design designation
   h. CLSM slump measurements
   i. Description of obstructions, interruptions, or other difficulties during installation and how they were resolved.
3. Ready Mix plant production records (delivery tickets) including mix designation.

The Daily Quality control Reports shall also include the following parameters recorded automatically or manually for every 5th CLSM GIC at intervals no greater than and submitted in the form of either tables or figures (as agreed to by the Engineer):

a. Elevation in feet vs. depth

b. Displacement auger rotation speed in RPMs vs. depth

c. Vertical withdrawal rates in feet per minute vs. depth

d. Average volume of CLSM injection rates in cubic feet per foot vs. depth

Within one working day after the end of a work shift, submit Daily Production Reports for the work shift to the Engineer. Daily Production Reports shall be filled out, checked for correctness, and signed by the CLSM GIC Contractor's field superintendent and the Contractor's field superintendent at the end of every work shift. The reports shall contain, but not be limited to, the following information:

1. Day, month, year, time of work, shift, beginning and end; names of superintendent in charge of the Work for both the CLSM GIC Contractor and the Contractor; a list of all workers' names associated with each installation rig; and a summary of equipment used during the shift.

2. The location as shown on the Working Drawings of each completed CLSM GIC element installed during the work shift and all CLSM GIC elements completed to date, on a plan of suitable scale to clearly detail the locations of the elements.

3. Other pertinent observations including, but not limited to, spoil return, CLSM escapes, ground settlement and/or heave, collapse of the CLSM GIC, withdraw rates of the displacement auger, any unusual behavior of equipment during the installation process or any other noteworthy events. In the event of any Contractor claim, the Daily Production Reports shall be the primary documents to substantiate the reasons and basis for the claim.

4. Date, time, sample designation, and other details of CLSM sampling.

5. Summary of any downtime or unproductive time, including start and end time, duration, and reason.

4. Within five weeks after completion of the CLSM GIC, the Contractor shall submit survey data including:

   a. A final Layout Plan of suitable scales showing the locations of each CLSM GIC element at the top of the element.

   b. A tabular summary of layout center coordinates modified to reflect any measured- deviations of each CLSM GIC element at the top of the element, the elevation of the top and bottom of each element.

CLSM GIC QUALITY CONTROL

The Contractor shall verify that the installed CLSM GIC elements conform to these special provisions.

The Contractor shall obtain CLSM samples and provide them to the Laboratory for testing specified in these special provisions. The Laboratory shall cast preserve, cure, transport, and test the

samples and report the test results to the Engineer. The test results shall be signed and stamped by a California licensed Civil Engineer from the Laboratory. The Contractor shall coordinate sampling activities and CLSM GIC Quality Control with the Engineer and the Laboratory. The Contractor shall supply incidental items, access, inside storage space, curing boxes and electrical power to the curing boxes as necessary. The Laboratory shall supply molds for use in casting the samples.

CLSM GIC Samples

A minimum of two CLSM sampling rounds shall be performed daily during the PPC Program. The Contractor shall obtain Samples from the ready mix truck prior to introduction into the pump as selected by the Engineer. Each sample shall be of sufficient volume to produce a minimum of six full cylinders, 6 inches diameter by 12 inches deep.

Samples shall be formed, cured and preserved in accordance with ASTM D 4832 and protected from freezing and extreme weather conditions which could have deleterious effect, at all times.

Unless otherwise directed by the Engineer, the Laboratory shall test one each cylinder at 7 days, 14 days and 28 days for unconfined compressive strength in accordance with ASTM Designation D4832. The Laboratory shall submit the laboratory test results to the Engineer in accordance with these special provisions. Submit 3 cylinders from each sample round to the Engineer.

CLSM - CONTROLLED LOW STRENGTH MATERIAL - Materials

Controlled low strength material (CLSM) shall consist of a workable mixture of aggregate, cementitious materials, and water and shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications and these special provisions. CLSM shall be a flowable, excavatable mixture of cement, pozzolan, coarse and fine aggregate and water which has been mixed in accordance with ASTM C 94.

Controlled low strength material in new construction shall not be permanently placed higher than the basement soil. When controlled low strength material is proposed for use, the Contractor shall submit a mix design and test data to the Engineer for approval prior to excavating the trench for which controlled low strength material is proposed for use. The test data and mix design shall provide for the following:

A. A 28-day compressive strength between 500 and 750 psi. Compressive strength shall be determined in conformance with the requirements in ASTM Designation D4832.

B. Cement shall be any type of Portland cement conforming to the requirements in ASTM Designation C150; or any type of blended hydraulic cement conforming to the requirements in ASTM Designation C595M or the physical requirements in ASTM Designation C1157M. Testing of cement will not be required.

C. Admixtures may be used in conformance with the provisions in Section 90-4, "Admixtures," the Standard Specifications. Chemical admixtures containing chlorides as CL in excess of one percent by mass of admixture, as determined in conformance with the requirements of California Test 415, shall not be used. If an air-entraining admixture is used, the maximum air content shall be limited to 20 percent. Mineral admixtures shall be used at the Contractor's option.

CLSM Properties:

1. Density shall be between 120 PCF minimum and 145 PCF maximum.
2. Slump shall be as approved by minimum 6 inches up to 10 inches.
3. Compressive strength at 28 days for CLSM shall at least 750 psi.
4. Cement: Cement shall be Type II in accordance with the requirements of ASTM C150.
5. Pozzolan: Pozzolan shall be Type F in accordance with the requirements of ASTM C618.
6. Aggregate: Aggregate shall consist of a well graded mixture of crushed rock, or sand with a maximum size aggregate of 3/8 inch. 100 percent shall pass the 3/8 inch sieve. Not more than 12 percent shall pass the No. 200 sieve. All material shall be free from organic matter and not contain more alkali, sulfates, or salts than the native materials at the site of the work.

Materials for CLSM shall be thoroughly machine-mixed in a pugmill, rotary drum or other approved mixer. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Controlled low strength material shall be placed in the work within 3 hours after introduction of the cement to the aggregates, unless retarders are added as approved by the Engineer.

HORIZONTAL AND VERTICAL ALIGNMENT TOLERANCES

The maximum horizontal deviation of the as-installed center of any CLSM GIC element at the ground surface shall not exceed 3 inches from the layout center coordinate, shown on the approved Contractor's submittal.

The measured vertical alignment of CLSM GIC elements shall not deviate in any direction more than two percent from vertical of the measured length.

At the direction of the Engineer, any CLSM GIC element which exceeds the allowable horizontal or vertical alignment tolerances shall be re-installed or supplemented with one or more adjacent or overlapping elements, at no additional cost.

OBSTRUCTIONS

Where obstructions are encountered during CLSM GIC installation, the Contractor shall remove the obstruction or install additional CLSM GIC, at the direction of the Engineer. If such conditions are encountered, the Contractor shall notify the Engineer in writing, and provide all pertinent information relating to the nature, depth, plan location coordinates, expected extent of the obstruction, and proposed procedures to overcome the obstruction. Such construction to overcome an unknown obstruction shall only be performed with the written authorization of the Engineer, and will be paid for as extra work as provided in Section 4-1.030 of the Standard Specifications.

If difficult drilling is encountered due to the presence of naturally occurring cobbles, boulders or dense well-cemented soils or other characteristics of the naturally occurring soils, the Contractor may elect to remove the hindrances, install CLSM GIC by an alternate pattern that avoids or encapsulates the hindrance but that achieves the required CLSM area ratio, subject to the approval of the Engineer.

CONTAINMENT, COLLECTION AND DISPOSAL OF SPOIL

The Contractor shall remove and dispose of all waste materials in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The Contractor shall take all necessary precautions and implement measures to prevent any spoil material or stockpiled materials from entering storm drain structures, drainage courses and other utility lines or from leaving the site via surface runoff.

MEASUREMENT

CLSM GIC installation will be measured by volume using the cubic yard. The volume shall be determined by multiplying the treated area, by the required depth of the CLSM GIC elements in treatment areas shown on the plans.

PAYMENT

The contract price per cubic yard for CLSM GIC shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing CLSM GIC, complete-in-place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for CLSM GIC quality control shall be considered as included in the contract price paid per cubic meter for CLSM GIC volume treated and no separate payment will be allowed therefor.

APPENDIX E
Special Provisions DSM GIC

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10-1.XX DEEP SOIL CEMENT MIXING GROUND IMPROVEMENT COLUMNS

This work shall consist of furnishing and installing soil-cement by deep mixing at the locations shown on the plans.

Deep soil-cement mixing shall be performed by mixing in-situ soil with cement grout to form a uniform mixture, blended thoroughly and evenly by controlled methods. Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to "Order of Work 11 and "Obstructions" elsewhere in these special provisions. Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications regarding damage by soil mixing operations to existing utilities, improvements and facilities.

The foundation information represents existing conditions at the specific boring locations at the time the borings were performed.

Installation of soil-cement by deep mixing auger;" methods shall create soil-cement foundations to improve strength properties of the foundation soils for the Type 1 Retaining Wall and Mechanically Reinforced Earth (MSE) wall above. The Contractor shall confirm that the installed soil- cement achieves the required compressive strength and ensure that it is installed in the design configuration and within the specified limits.

The ground improvement shall extend to the designated depths shown on the plans. Soil-cement mixing equipment shall be capable of advancing through previously installed and cured soil-cement.

DEEP-MIXING

Deep soil-cement mixing shall improve strength properties of foundation soils within the area shown on the plans. Soil-cement elements shall be placed according to the treatment pattern shown on the plans. The average 56-day unconfined compressive strength of soil-cement throughout the depth of each soil-cement element shall be no less than XXXX psi for a minimum XXX inch diameter element. •

The Contractor may provide an alternative plan meeting the minimum performance requirement specified herein. The alternative plan shall be submitted as an attachment to the pre-construction submittal for approval by• the Engineer.

The Contractor shall conduct a Pre-Production (PPC) Program within the limits of soil-cement areas shown on the plans prior to commencing soil-cement mixing to establish production parameters) procedures, and materials to be used during the production phase. The PPC Program shall produce soil-cement mix design and procedures for production mixing based upon the information provided from the PPC Program including: estimated in-situ 28-day and 56-day compressive strength of the soil- cement, cement-grout injection pre sure and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing tools, and mixing times at bottom of the soil-cement element when, there is no vertical movement of the mixing tool, and complete description of all mixing operations.

SUBMITTALS

The submittals and other additional submittals shall conform to, the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions, and shall be stamped by a California Registered Professional Civil Engineer except for survey data which shall be stamped by a California Registered Professional Civil Engineer or a California Registered Land Surveyor.

The Contractor shall submit, for review by the Engineer, a statement of the previous work experience similar to that described in these special provisions. The statement shall include at least 5 successful soil cement mixing projects within past three years. This statement shall include a written description of each project, owner's contact name and current phone number, the dates and the extent of the work, the manner of its execution, and any other information that supports the Contractor's ability to carry out the work described in these special provisions.

Pre-construction Submittals

At least four weeks prior• to commencement of any mobilization of deep soil-cement mixing equipment for production mixing, the Contractor shall submit the following to the Engineer:

1. Names and qualifications of the soil-cement mixing personnel and surveyors, including project experience, resumes and other documentation that demonstrate the experience qualifications of the project engineers, each field superintendents, rig operators, and batch plant operators for the deep soil-cement mixing.
2. A list of Contractors, responsible engineers, project descriptions and personnel responsibilities from soil-cement mixing projects completed by the soil-cement mixing Project Engineers and Field Superintendents during the past three years. Contractor's names, addresses and telephone numbers shall be included for these projects representing the individual's comparable experience. The projects listed to demonstrate personnel qualifications shall have employed equipment using similar auger configuration(s) as proposed for the work of this Contract.
3. Data on equipment to be used for the deep soil-cement mixing, proportioning, pumping, injecting and mixing soil-cement as wells as all other ancillary equipment; including equipment capable of remixing non-conforming soil-cement.
4. Spoil containment (sheet piling or other) structures and methods to be used to prevent the migration or leakage of spoil return, disturbed in-situ soils or other spoil material beyond the immediate limits of soil-cement mixing operations. The Contractor shall demonstrate that the containment structure is stable under loads applied by soil-cement, water, in-situ soils, overlying fill materials, construction equipment, other surcharge load and loads applied by the subsequent deep mixing operations. Include also details and methods to be used to collect and dispose of the spoil return and other spoil materials.
5. Sequence and time schedule of all operations including plan location and sequence of all deep soil-cement mixing. The Contractor shall submit a soil-cement element Layout Plan based on the limits shown on the Plans to achieve the required plan area configurations and coverages, necessary overlaps, auger re-penetrations over the depths, and limits shown on the Plans. Plan locations of all proposed soil-cement mixing shall be shown on Layout Plans of suitable scale

to clearly show the details of the layout. Soil-cement elements on the Layout Plans shall be numbered and dimensioned.

6. Cement grout mix design including: cement type, cement source, cement compound composition, water-cement ratio by weight and other pertinent details. Limit water-cement ratio to (1:1 maximum), unless otherwise demonstrated in the Pre-Production (PPC) Program specified in these special provisions.

The results of the PPC Program including, but not limited to estimated in-situ 28-day and 56-day compressive strengths of the soil-cement, cement-grout injection pressure and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing tools, and mixing times at bottom of the soil-cement element when there is no vertical movement of the mixing tools, and complete description of all mixing operations.

1. Description of Quality Control Plan for deep soil-cement mixing including, but not limited to the following:

   a. A detailed description of the Quality Control Plan to be undertaken each day during soil-cement mixing to confirm that the installed soil-cement conforms to the required compressive strengths and unit weights specified, the plan area coverage over the required depths and limits, and required horizontal and vertical alignments.

   b. Details of procedures to obtain soil-cement samples, catalog cuts of the soil-cement sampling device and curing boxes.

   c. Measures to be implemented each day during soil-cement mixing to continuously monitor, modify and control: water-cement ratios, cement-grout injection pressures and quantities, mixing rotational speeds, penetration and withdrawal rates of the mixing equipment, horizontal and vertical alignments of the soil-cement elements, and other related aspects of the soil-cement mixing process.

   d. Example formats of Daily Production Reports conforming to the requirements stated herein.

   e. Names, certifications and licenses of the Laboratory and companies to be responsible for performing quality control tests.

   f. Proposed details and formats of all required tabular and graphical data presentations to be submitted to the Engineer during the course of the Work.

Construction Submittals

Within two working days after the completion of each soil-cement element, submit the following:

2. Deviations of the center coordinates from the Layout Plan to the nearest 3 inches at the top of the element.

3. Vertical alignment profiles shall be submitted in accordance with the frequencies specified to the nearest ½ inch over the measurement length along axes parallel and perpendicular to the line of longitudinal progression; the elevation to the nearest 30 mm of the top and bottom of the element.

4. The Daily Quality Control Report shall" include as a minimum the results of the following QC parameter monitoring for each element:

    a. Rig number.
    b. Type of mixing tool.
    c. Date and time (start and finish) of column construction.
    d. Column number and reference drawing number.
    e. Column diameter.
    f. Column top and bottom elevations.
    g. Grout mix design designation.
    h. Slurry specific gravity measurements.
    i. Description of obstructions, interruptions, or other difficulties during installation and how they were resolved.

5. The Daily Quality Control Reports shall also include the following parameters recorded automatically or manually for each element at intervals no greater than 3 feet and submitted in the form of either tables or figures (as agreed to by the Engineer):

    a. Elevation in meter vs. depths.
    b. Shaft rotation speed in RPMs vs. depths.
    c. Penetration and withdrawal rates in feet per minute vs. depths.
    d. Grout injection rate in gpm vs. depths.
    e. The average quantity of grout in gallons per foot injected per vertical foot of column vs. depth.

6. Batch plant production records, water-cement ratios, cement type, brand, and cement grout injection pressures.

Within one working day after the end of a work shift, submit Daily Production Reports for the work shift to the Engineer. Daily Production Reports shall be filled out, checked for correctness, and signed by the Deep Soil Mixing Contractor's field superintendent and the Contractor's field superintendent at the end of every work shift. The reports shall contain, but not be limited to, the following information:

1. Day, month, year, time of work, shift, beginning and end; names of each superintendent in charge of the Work for both the soil-cement mixing firm and the Contractor; a list of all workers' names associated with each soil-cement mixing machine; and a summary of equipment used during the shift.

2. The location and "neat" limits as shown on the Working Drawings of each completed soil-cement element installed during the work shift and all soil-cement elements

completed to date, on a plan of suitable scale to clearly detail the locations of the elements.

3. Other pertinent observations including, but not limited to, spoil returns, cement grout escapes, ground settlement and/or heave, collapses of the soil-cement element advancement rates of the mixing equipment, and any unusual behavior of any equipment during the soil-cement mixing process and other noteworthy events. In the event of any Contractor claim, the Daily Production Reports shall be the primary documents to substantiate the reasons and basis for the claim.

4. Date, time, plan location, sample designation and elevation, and other details of soil-cement sampling.

5. Summary of any downtime or unproductive time, including start and end time, duration, and reason.

Within five weeks after completion of the deep soil-cement mixing, the Contractor shall submit survey data including:

1. A final Layout Plan of suitable scales showing the locations of each soil-cement element at the top of the element.

2. A tabular summary of layout center coordinates modified to reflect any measured-deviations of each soil-cement element at the top of the element, the elevation of the top and bottom of each element.

3. A compilation of all vertical alignment profiles.

SOIL-CEMENT QUALITY CONTROL

The Contractor shall verify that the installed soil-cement elements conform to these special provisions.

The Contractor shall obtain soil-cement samples, including fluid and core samples, and provide them to the Laboratory for testing specified in these special provisions. The Laboratory shall form, preserve, cure, transport, and test the samples and report the test results to the Engineer. The test results shall be signed and stamped by a California licensed Civil Engineer from the Laboratory. The Contractor shall coordinate sampling activities and Soil-Cement Quality Control with the Engineer and the Laboratory. The Contractor shall supply incidental items, access, inside storage space, curing boxes and electrical power to the curing boxes. The Contractor shall supply molds for use in forming the samples.

Wet Grab Soil-Cement Samples

A minimum of two in-situ sampling rounds shall be performed daily during the PPC Program at locations selected by the Engineer. The Contractor shall obtain sampling rounds at the same soil-cement element, which shall consist of moist-cured soil-cement samples from three depths selected by the Engineer. Separate soil-cement samples shall be retrieved within

60 minutes of the completion of the soil-cement column. The device used to retrieve the wet grab soil-cement samples shall be capable of obtaining a discrete fluid sample of soil-cement at a depth determined by the Engineer and shall be capable of accepting particles not thoroughly mixed that are up to 4 inches in dimension. The sampler shall be lowered empty, air only, to the required depth in the soil-cement element and then opened. Once filled with the soil-cement, the sampler shall be closed to exclude entry or loss of soil-cement and shall be expeditiously raised to ground surface.

Each retrieved soil-cement sample shall be of sufficient volume to produce a minimum of eight full cylinders, 3 inch diameter by 6 inches deep. The Contractor shall separate and retain all soil-cement retrieved from each depth. The Contractor shall then cut all retrieved particles of soil larger than 1 inch into smaller pieces that will pass a 1 inch sieve, and then immediately form the six cylinders with material passing through a 1 inch sieve, including particles of soil that were cut up.

Soil-cement samples shall be formed, cured and preserved in accordance with AASHTO T23 and protected from freezing and extreme weather conditions which could have deleterious effect, at all times.

The Contractor may obtain additional samples and perform additional testing for his or her own information, at the Contractor's expense.

If the Contractor cannot obtain all of the required wet grab samples of the soil-cement in the designated soil-cement element, the Contractor shall obtain a full round of wet grab samples from the next soil-cement element installed by that rig. Continue taking wet grab samples in subsequent soil-cement elements until a full round is obtained. From each sampling round, one cylinder from each sampling depth shall be used to determine the cement factor based on the cement content determined in accordance with AASHTO Specification T 144 (or ASTM D806). Unless otherwise directed by the Engineer, for each soil-cement element, the Laboratory shall test every one cylinder at 7 days, 14 days, 28 days, and 56 days for unconfined compressive strength in accordance with ASTM D2166. The Laboratory shall submit the laboratory test results to the Engineer in accordance with these special provisions. Submit 3 cylinders from each sampled depth for each soil-cement element to the Engineer.

Wet Grab Soil Cement Sampling and Testing Schedule

	Frequency	Quantity	Notes
Number of Sampling Rounds (soil-cement elements)	Per Day	2	At soil-cement determined by the engineer
Number of wet grab soil-cement samples	Per soil-cement element	2	At depths determined by the engineer
Number of Cylinders	Per wet grab soil-cement sample	8	3 inch diameter by 6 inch high cylinder
Total Cylinders	Per sampling round	16	
Number of cylinders for test of cement factor and cement content	Per sampling round	2	At each of the 2 sampling depths
Number of cylinders for unconfined compressive strength test	Per sampling round	8	Test at 7 days, 14 days, 28 days and 56 days for each depth
Number of cylinders shall be submitted to the Engineer	Per sampling round	6	3 at each of the 2 sampling depths

Core Samples

Core samples shall be taken by the Contractor for the purpose of obtaining and testing in-situ samples to evaluate compressive strength, unit weight, vertical alignment, and composition of the soil-cement. Coring of soil-cement shall be performed in accordance with AASTHO T225 and the requirements stated herein.

The Contractor shall take precautions such that vibration from the soil-cement work will not cause undue interference or damage to neighboring properties or buildings. If, in the opinion of the Engineer, ground vibrations, movements or noise from soil-cement mixing work adversely affect the project and neighboring properties and buildings, the Engineer may direct the Contractor to use alternative methods or procedures of soil- cement mixing construction. Alternate methods shall be subject to the prior approval of the Engineer but shall remain the responsibility of the Contractor.

CEMENT GROUT

Cement shall conform to AASHTO M85, Type II, and shall be as specified in the submitted cement grout mix design approved by the Engineer. Slag cement or fly ash shall not be allowed without the approval of the Engineer and submission of test data by the Contractor, which confirms no deleterious impact to the soil-cement.

Measure, handle, transport and store bulk cement in accordance with the manufacturer's recommendations. Cement packaged in cloth or paper bags shall be sealed within plastic or rubber vapor barriers.

Cement shall be stored to prevent damage by moisture. Material that has become caked due to moisture absorption shall not be used. Bags of cement shall be stacked no more than ten bags high to avoid compaction. Cement containing lumps or foreign matter of a nature and in amounts that may be deleterious to the grouting operations shall not be used. Tricalcium aluminate content shall not exceed 8 percent.

Water used in soil-cement and cement grout mixing and all other applications shall be potable, clean, of neutral pH and free from sewage, oil, acid, alkali, salts, organic materials and other contamination.

Cement grout shall be a stable homogeneous mixture of cement and water. The ratios of the components shall be included in the pre-construction submittal. Cement grout composition shall not change throughout the soil-cement mixing unless requested in writing by the Contractor and approved in writing by the Engineer.

SOIL-CEMENT

Soil-cement shall be a stable, uniform mixture of cement grout and the in-situ soils. The properties listed below shall be verified in conformance with the approved Soil-cement Quality submittal.

The ratios of various soil-cement components shall be proposed by the Contractor or as approved in the pre-construction submittal subject to review by .the Engineer. The Contractor shall adjust the mix design throughout the course of the Work in order to achieve the required compressive strengths and total unit weights. After final grouting of the soil-cement element, the Contractor shall obtain samples of in-situ soil-cement samples in accordance with the locations and frequencies in "Soil- Cement Quality Control" of these special provisions.

Water, debris or spoil material shall not be dumped or otherwise allowed to enter the soil-cement element.

Any soil cement element which exhibits partial or total instability, shall be backfilled with cement grout and be remixed full depth, at the Contractor's expense. Among other possibilities signs of instability which could be observed during construction could include excess flow of grout from the hole, settlement of ground, and squeezing in on the drill stem.

Horizontal and Vertical Alignment Tolerances

The maximum horizontal deviation of the as-installed center of any soil-cement element at the ground surface shall not exceed inches from the layout center coordinate, shown on the approved Contractor's submittal.

The measured vertical alignment of soil-cement elements shall not deviate in any direction more than two percent from vertical of the measured length, or be inclined more than two percent from vertical anywhere along the measured length.

At the direction of the Engineer any soil-cement elements which exceed the allowable horizontal or vertical alignment tolerances shall be re-mixed or supplemented with one or more adjacent or overlapping elements, at no additional cost to Caltrans.

Obstructions

Where obstructions are encountered during deep soil-cement mixing, the Contractor shall remove the obstruction or install additional soil-cement to encapsulate the obstruction, at the direction of the Engineer. If such conditions are encountered, the Contractor shall notify the Engineer in writing, and provide all pertinent information relating to the nature, depth, plan location coordinates, expected extent of the obstruction, and proposed procedures to overcome the obstruction. Such construction to overcome an unknown obstruction shall only be performed with the written authorization of the Engineer, and will be paid for as extra work as provided in Section 4-1.030 of the Standard Specifications.

If difficult drilling is encountered due to the presence of naturally occurring cobbles, boulders or dense well-cemented soils or other characteristics of the naturally occurring soils, the Contractor may elect to remove the hindrances, install soil cement by an alternate soil-cement mixing pattern that avoids or encapsulates the hindrance but that achieves the required soil-cement area ratio, subject to the approval of the Engineer.

Containment, Collection and Disposal of Spoil Return

At all times during and at completion of soil-cement mixing operations, the site shall be maintained cleared of all debris and water. Spoil return and other spoil material shall be piped or channeled to holding ponds, tanks, or other retention structures or facilities. The Contractor shall remove and dispose of all waste materials in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

All soil-cement collection, containment and disposal methods shall be thoroughly explained and shown on Working Drawings in the Contractor's submittals to the Engineer prior to the start of deep soil-cement mixing. The Contractor shall incorporate and be responsible for all sedimentation and turbidity control measures required by applicable federal, state and local regulations.

The Contractor shall take all necessary precautions and implement measures to prevent any spoil return, other spoil material or stockpiled materials from entering storm drain •structures, drainage courses and other utility lines or from leaving the site via surface runoff. The Contractor shall prevent the migration of spoil return, spoil material or stockpiled materials into any surface water body, beyond the immediate limits of soil-cement mixing operations.

MEASUREMENT

Soil-cement will be measured by the cubic yard. The volume shall be determined by multiplying the treated area by the required depth of the soil-cement elements. The quantity of soil-cement to be paid for shall be the quantity of soil-cement furnished and installed within the

soil-cement treatment areas shown on the plans. Areas of overlapping and overdrilling will not be measured more than once.

PAYMENT

The contract price per cubic meter for soil-cement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all. the work involved in mixing soil-cement, complete-in-place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for soil-cement quality control shall be considered as included in the contract price paid per cubic yard for soil-cement and no separate payment will be allowed therefor.

Full compensation for containment and disposal of spoils shall be considered as included in the contract price paid per cubic yard for soil-cement and no separate payment will be allowed therefor.

APPENDIX VI

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 0A5341 Project Name: I-80/I-680/SR-12 ICP OSFP Liaison: Tracy Bertram Phone: (916)227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☒ PS&E (Review No. 1) ☐ Construction Support ☐ Other: Foundation Report Parikh Dated 05-11-2012	Reviewer Name: A. Suja/R. Nashed/Sunny Yang Functional Unit: GS-GDW Phone Number: (510) 286-4752/ (510)266-1773/ (510) 286-4808 e-mail: _____ Date of Review: 06-29-2012
	Structure Information (Use when necessary to document comments by individual structure) Structure Name: Green Valley Road Overcrossing Br No: 23-0246		

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	_____	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1		Section 9.4, Seismic Design Criteria (Page 14)	Mention the "Seismic Design Criteria". Make sure it does match with Bridge Plan SDC (Version 1.6, November 2010).	The texts have been revised and SDC Ver.1.6 (dated November 2010) is mentioned in the report.	
	SEISMIC COMMENTS BY SUNNY YANG		In Tables 4.2 through 4.5 in the Report dated 5/11/12 (pages 16-17): At the abutments, the loads per pile don't match the loads per support. The nominal resistance per pile should be 10510/65*2=324 kips at Abutment 1 and 8140/50*2=326 kips at Abutment 3. Actually, we only need 10510/200 ~= 53 piles at Abutment 1 and 8140/200 ~= 41 piles at Abutment 3.	Per our discussion with the structural engineer, load does not equally distribute to all the piles. Based on the calculations, the loads at the toe and heel piles are different. The load per pile shown in Table 4.2 is the maximum load.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

	GEOLOGIC COMMENTS BY R. NASHED		See Attached Sheet.		
			1-		

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
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✓= Comment Resolved
(for Reviewer's use)

GEOLOGIC COMMENS

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 0A5341 Project Name: I-80/I- 680/SR-12 ICP OSFP Liaison: _____ Phone: _____ e-mail: _____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☒ PS&E (Review No. 1) ☐ Construction Support ☐ Other: Foundation Report	Reviewer Name: R. Nashed/A.Suja Functional Unit: GS-GDW Phone Number: (510) 622-1773 e-mail: _____ Date of Review: 6/20/2012
	Structure Information (Use when necessary to document comments by individual structure) Structure Name: Green Valley Road Overcrossing Br No: 23-0246		

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	_____	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
1	FR	N/A	Foundation Report prepared by Parikh Consultant, Inc., dated July 11, 2011.		Foundation Report prepared by Parikh Consultant, Inc., dated May 11, 2012.
2	FR	6.2 Subsurface Conditions Page 5	1- Bent 1: two layers of loose sand and silty sand at depth 13 ft and 44 ft in order , should be mentioned. 2- Bent 2: The subsoils at the vicinity of Bent 2 should be described as follows: 54 ft of clayey/silty sand, followed by	1- The following sentence has been included in the report: " Submerged, loosed and were encountered at 12.5-22.5-foot depths and 32.5 foot to 40-foot depths. A relatively thin layer of loose sand was encountered at about 44-foot depth." 2- Concur. The text has been revised	Our comments dated 08/09/2011 have been adequately addressed.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

			10 ft of stiff sandy silt overlie medium dense silty sand and silt.		
3		**Appendix II**	1- All the LOTB's do not include the bench mark for their location as the Soil/Rock classification Manual stated	Concur. The bench mark has been included.	Our comment dated 08/09/2011 has been adequately addressed.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 0A5341 **Project Name: Green Valley Road Overcrossing (Br. No: 23-0138)** **OSFP Liaison: Tracy Bertram** **Phone: (916)227-8397** **e-mail:_____**	☐ **PSR/PDS (Review No. _)** ☐ **APS/PSR (Review No. _)** ☐ **APS/PR (Review No. _)** ☐ **Type Selection**	☐ **65% PS&E Unchecked Details** ☐ **PS&E (Review No. _)** ☐ **Construction Support** ☒ **Other: Foundation Report (65% Submittal)-Parikh 07-11-2011**	**Reviewer Name: A. Suja/R. Nashed/Sunny Yang** **Functional Unit: GS-GDW** **Phone Number: (510) 286-4752/ (510)266-1773/ (510) 286-4808** **e-mail: _____** **Date of Review: 08/09/2011**
	Structure Information (Use when necessary to document comments by individual structure) **Structure Name:_____** **Br No: _____**		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	Page 2, Line 7	Type1 (Mod) wall is proposed	Concur. The text has been revised.	
2	FR	Page 6, Line 1	Ground water information for A-09-005 is incorrect	The groundwater was encountered at 26 feet deep in Boring A-09-005. The groundwater elevation on the boring log has been revised to Elev. -2.1 feet.	
3	FR	Page 6, Section 8	Test results are presented in Appendix IV not Appendix III	Concur. The text has been revised.	
4	FR	Page 6, Section 8	Table-1-Corrosion Test Results Correct the Sample depth (10') @R-10-003A	Concur. The text has been revised.	
5	FR	Page 17, Table 4	Footing/Cutt-off elevation for Abt.1 does not match with Foundation Plan	The table has been revised according to the latest design.	
	GEOLOGIC COMMENTS BY R. NASHED				
	FR	N/A	Foundation Report prepared by Parikh Consultant, Inc., dated July 11, 2011.		
6	FR	6.2 Subsurface Conditions	1- Bent 1: two layers of loose sand and silty sand at depth 13 ft and 44 ft in order	1- The following sentence has been included in the report:	

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		Page 5	, should be mentioned. 2- Bent 2: The subsoils at the vicinity of Bent 2 should be described as follows: 54 ft of clayey/silty sand, followed by 10 ft of stiff sandy silt overlie medium dense silty sand and silt.	"Submerged, loose sand were encountered at 12.5- to 22.5-foot depths and 32.5-foot to 40-foot depths. A relatively thin layer of loose sand was encountered at about 44-foot depth." 2- Concur. The text has been revised.	
7		Appendix II	1- All the LOTB's do not include the bench mark for their location as the Soil/Rock classification Manual stated	Concur. The bench mark has been included.	
	SEISMIC COMMENTS BY SUNNY YANG		No comments		
8		Ground Improvement (by Acacia CE)	Geotechnical Engineer's (William M. Kenney) Stamp date has been expired.	The page has been revised with the current expiration date (3/31/13).	

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✓= Comment Resolved
(for Reviewer's use)

FOUNDATION REPORT

GREEN VALLEY ROAD OVERCROSSING
(OVER SB 680 ON-RAMP)
(BR. NO. 23-0247)
SOLANO COUNTY, CALIFORNIA
04-SOL-80 PM 12.8 EA 04-0A5341

For

MARK THOMAS & CO., INC. | NOLTE VERTICAL FIVE
A Joint Venture

3000 Oak Road, Suite 650
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September 6, 2012 Job No. 2009-130-GDR

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APPENDIX V **CALTRANS REVIEW COMMENTS AND RESPONSES**

FOUNDATION REPORT
GREEN VALLEY ROAD OVERCROSSING (OVER SB 680 ON-RAMP)
(BR. NO. 23-0247)
SOLANO COUNTY, CALIFORNIA
04-SOL-80 PM 12.8 EA 04-0A5341

1.0 SCOPE OF WORK

The purpose of this investigation was to evaluate the general soil conditions at the project site, to evaluate their engineering properties, and to provide foundation design recommendations for the proposed Green Valley Road Overcrossing (Over SB 680 On-Ramp), as part of the I-80/I-680/SR 12 Interchange project, located in Solano County, California. The scope of work performed for this investigation included a review of the readily available geologic literature pertaining to the site, obtaining representative soil samples and logging soil materials encountered in the exploratory borings, laboratory testing of the collected samples, engineering analysis of the field and laboratory data, and preparation of this report. This report presents the results of our geotechnical engineering investigation for the proposed overcrossing structure. The approximate location of the site is shown on the Site Map (Plate I-1) in Appendix I of the report.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. These recommendations should not be used directly for bidding purposes or for construction cost estimates.

2.0 PROJECT DESCRIPTION

It is proposed to construct an "interim" overcrossing to carry Green Valley Road over the existing EB I-80 to SB I-680 on-ramp. This structure will ultimately be removed in future phases when the ultimate alignment of Green Valley Road is routed to utilize the existing I-680 right of way as part of the ultimate interchange project.

The new bridge will be a precast, single span, precast concrete super girder bridge with a maximum span length of 166 ft over the SB 680 on-ramp. The bridge will be 165.5 ft long and 52.4 ft minimum width to accommodate two lanes, two 8-foot shoulders, 6-foot sidewalk and barriers. Abutments will be high-cantilever abutments on 16-inch diameter open ended steel pipe piles (Caltrans standard Class 200 Alt. "W").

New approach embankments up to 35 to 40 feet are required at both abutments. The embankment at Abutment 1 will be supported by a Mechanically Stabilized Earth (MSE) wall (Retaining Wall No. 7) on the east side and have side slopes of 4H:1V on the west side. The embankment at Abutment 2 will be supported by a Mechanically Stabilized Earth (MSE) wall (Retaining Wall No. 8) on the west side and a cantilever retaining wall (Caltrans Standard Type 1, Retaining Wall No. 9) on the east side.

Due to the presence of the liquefiable soils, the lateral spreading potential is considered high for the embankment at Abutment 2, which will be supported by Retaining Walls 8 and 9. Therefore, it is proposed to conduct ground treatment with Controlled Low Strength Material (CLSM) columns to mitigate the potential hazard. We engaged Acacia Consultants & Engineers (Acacia CE) to perform the design of the CLSM system.

3.0 EXCEPTIONS TO POLICY

Normal procedures were assumed for construction of the bridge structure throughout our analysis and represent one of the bases of recommendations presented herein. The investigation and design for the proposed foundations has followed Caltrans policy. Exception to policy is not needed.

4.0 FIELD INVESTIGATION AND TESTING PROGRAM

Based on the readily available information (as-built plans), two exploratory borings (Borings A-09-001 and A-09-002) were conducted to a maximum depth of 100 feet below the existing ground surface. The approximate locations of the boring are shown on the Log of Test Borings in Appendix II.

The test borings were advanced with truck-mounted drill rigs with hollow stem auger (8-inch diameter). The borings were drilled under the technical supervision of one of our engineers, who classified and logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were obtained during drilling and by driving 2.5 inches I.D. Modified California and 1.4 inches I.D. Standard Penetration Test samplers into the subsurface soils under the impact of a 140 lb hammer falling through 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the "Log of Test Borings", Appendix II. After visual examination, the collected samples were sealed and transported to our laboratory for further evaluation and testing.

The bore logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations.

5.0 LABORATORY TESTING PROGRAM

Laboratory tests were performed on selected samples in the laboratory to evaluate the physical and engineering properties of the subsoils. The tests performed for the study include the following: Laboratory determination of Moisture (California Test Method 226), Unit Weight (California Test Method 212), Atterberg Limits (California Test Method 204), Grain Size Analysis (California Test Method 202), Unconfined Compression Test (California Test Method 221), Consolidation Test (California Test Method 219), and Corrosion Test (California Test Method 643, 417 & 422). The laboratory test results are attached in Appendix III.

6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1 Site Geology

The Jameson Canyon area and to the north is largely underlain by broadly folded Eocene Markley Formation and flat or gently tilted Pliocene Sonoma Volcanics. The Sonoma Volcanics are mostly andesitic tuff and breccias, but there is also some basalt and rhyolite. The area east of the Green Valley Fault, is largely underlain by late Pleistocene to Holocene alluvial fan deposits.

The Green Valley Fault, which intersects the project area, separates the Sonoma Volcanics from the Cretaceous. Great Valley Sequence on the east. (CGS 2002, Bezore, S.P., Wagner, D.L, and Sowers, J.M., Geologic Map of Cordelia 7.5' Quadrangle, Solano and Napa Counties, California).

General geologic features pertaining to the site were evaluated with reference to the “Geologic Map and Map Database of Northeastern San Francisco Bay Region, California”, by R.W. Graymer, D.L. Jones, and E.E. Brabb (U.S.G.S., Miscellaneous Field Studies Map MF-2403, 2002)”. Based on the map, the subsoils at the project site mainly consist of Alluvial Fan Deposits (Qpf, late Pleistocene). A geologic map of the general project area is shown on Plate I-2. Descriptions of the main geologic units are presented as follows:

Qpf – Alluvial fan deposits (late Pleistocene): Poorly sorted, moderately to poorly bedded sand, gravel, silt, and clay deposited in gently sloping alluvial fans. Late Pleistocene age is indicated by erosional dissection and development of alfisols. These deposits are about 10% denser and have 50% greater penetration resistance than unit Qhf (Clahan and others, 2000)

6.2 Subsurface Conditions

Per our discussion with the design team, two borings (A-09-001 & A-09-002 were conducted at the vicinity of the planned locations of the abutments. In general, the subsoils along the proposed overcrossing structure generally consist of interbedded silt and sand.

Abutment 1 (south abutment). Based on the boring data (A-09-001), the subsoils at the vicinity of Abutment 1 consist of about 10 feet of clayey sand and about 20 feet of clay and silt (to about Elev. -5 feet) overlying dense silty sand to about 57.5 feet depth (to about Elev. -32.5 feet). Below that depth, the boring encountered approx. 35 feet of sandy lean clay and silt. Very dense silty sand was encountered below the hard silt layer to 100 feet deep, the maximum depth explored.

Abutment 2 (north abutment). Based on the boring data (A-09-002), the subsoils at the vicinity of Abutment 2 generally consist of 15-foot-thick very stiff sandy lean clay and 10-foot-thick medium dense silty sand, which are underlain by 40-foot-thick very stiff sandy silt interbedded by 5 feet of medium dense silty sand, followed by 30-foot-thick dense sand above hard silt with sand.

Groundwater level was encountered at 20 feet and 14 feet depth in Borings A-09-001 and A-09-002, respectively. The as-built boring data (Green Valley Road Overcrossing, Caltrans, 1957) indicate that the groundwater was measured or encountered at Elev. 15 feet, approximately 7 to 8 feet below grade. The groundwater level is anticipated to vary with the

passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off, tide, and other factors that may not be present at the time of our investigation. For the proposed structure, we have assumed groundwater at Elev. 15 feet, approximately 8 to 10 feet below grade for design purpose.

7.0 SCOUR EVALUATION

The subject was considered and was determined to be not applicable for the project since there is no water body passes the project site.

8.0 CORROSION EVALUATION

Corrosion tests were conducted on selected samples to evaluate the corrosion potential and its impact to the pile design. The test results from the nearby borings (A-09-005 & A-09-137) indicate that the on-site soils have low resistivities (<1000 ohm-cm) and high water soluble chloride concentration (>500 ppm). These two test results are presented in Appendix III. Other corrosion tests performed in the vicinity also indicate low resistivity. Based on the Caltrans corrosion guidelines, the on-site soil may be considered corrosive due to high Chloride content (>500 ppm). The test results from A-09-005 and A-09-137 are tabulated as follows:

TABLE 1 – CORROSION TEST RESULTS

Boring No.	Location	Depth (ft)	pH	Minimum Resistivity (ohms-cm)	Chloride Content (ppm)	Sulfate Content (ppm)
A-09-137	9+00 “GR1” Line	4.5	7.52	220	576.4	1167.3
A-09-005	74+00 “G” Line	4.5	8.67	190	2114.8	142.3

Per Caltrans Memo-to-Designer 3-1, a corrosion allowance (sacrificial metal loss) should be assumed for the foundation design for the planned Caltrans Class 200 Alt. “W” piles, and the region of greatest concern for corrosion is the portion of the pile from the bottom of the pile cap or footing down to 3 feet below the water table. This region of the soil typically has a replenishible source of oxygen needed to sustain corrosion. According to the boring data, we have assumed a

corrosion allowance of 0.05 inch (a corrosion rate of 0.001 inch per year with a design life of 50 years) above Elev. 0 feet.

Alternatively, corrosion mitigation measures, such as coatings and/or cathodic protection, may be considered.

9.0 SEISMIC RECOMMENDATIONS

9.1 Seismic Sources

The project site is located in a seismically active part of northern California. Many faults in the San Francisco Bay Area are capable of producing earthquakes, which may cause strong ground shaking at the site. Maximum moment magnitudes of some of the closest faults in the area based on 2007 Caltrans Deterministic PGA Map and ARS Online Report are summarized below. These maximum magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment.

TABLE 2 – FAULT DATA

Fault	Fault ID	Fault Type	Maximum Magnitude (M_{max})	Approximate Distance From Site
Cordelia Fault	212	RLSS	6.7	0.15 mile
Green Valley Fault	213	RLSS	6.9	1.0 mile

Based on the publication, the proposed structure is located between Cordelia Fault and Green Valley Fault. It is our understanding that site-specific fault study was performed by another consultant. Caltrans is currently reviewing the report for final acceptance. However, this should not have significant impact on the proposed structure.

9.2 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is

relatively low. Based on available geological and seismic data, the possibility of the site to experience strong ground shaking is considered high.

9.3 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and low plasticity silts of low relative density are the type of soils which usually are susceptible to liquefaction. Clays of medium to high plasticity are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001) using the boring data. As indicated by recent advances in soil liquefaction engineering (Bray, 2006), for soils with sufficient fines content so as to separate the coarser particles and control behavior, liquefaction appears to occur primarily in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their LL (W%> 0.85LL).

The Peak Ground Acceleration (PGA) was estimated based on the latest Caltrans ARS Online website, which is based on several input parameters, including the site location (longitude/latitude), average shear wave velocity for the top 30m/100 feet (Vs_{30m}). We have assumed an average PGA of 0.7g for analysis purpose. As mentioned in the previous section, we have assumed groundwater at about 8 feet below existing grade.

With the high PGA, submerged granular materials with $N_{1,60,CS}$ less than 30 are generally found to be potentially liquefiable. Based on our analysis, potentially liquefiable soils were identified at various depths. In addition to Borings A-09-001 and A-09-002, we have also reviewed and compared other available data from the nearby borings and CPTs. The recently conducted Borings R-10-003A and R-10-133A, advanced by rotary wash drilling method, were referred

to verify the liquefaction potential at the north and south abutments, respectively. Those borings were performed by Technicon Engineering Services, Inc. of Fresno, California. All samples were obtained from the 1.4-inch I.D. Standard Penetration Tess (SPT) samplers at various depths, and the samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. The average hammer energy is about 88% based on the calibration results provided by the driller. For liquefaction analysis, a lower hammer energy ratio of 85% was conservatively assumed in the calculation to account for variations.

Based on the analysis results, liquefaction potential is considered moderate to high. However, the corrected $N_{1,60,CS}$ in some of the liquefiable soils are relatively high and close to 30. The laboratory test results also indicate that the fines contents are generally high (greater than 35%) for most of the sand layers encountered. The anticipated 100% development of pore pressure in such materials (i.e. high $N_{1,60,CS}$ and high fines content) may be more correctly ascribed to "cyclic mobility", which results in limited soil deformations without liquid-like flow. In our opinion, the engineering consequences of such phenomenon in those layers may be limited to temporarily loss of strength (cyclic softening). Volumetric strain induced by liquefaction, i.e. post-liquefaction settlement, is considered relatively small.

In general, liquefaction hazards are most severe in the upper 50 feet of the surface as mentioned in Special Publication 117A (CGS, 2008). In our opinion, the impact due to the potential liquefiable soils below 50 feet is considered insignificant, especially when the layer is relatively thin and discontinuous.

Based on the above, the soil layers that may be subject to liquefaction under the design earthquake event are summarized as follows:

Abutment 1 (south abutment). Liquefiable soils were encountered in Boring A-09-001. We have also reviewed Boring R-10-133A, drilled for the approach embankment, for comparison. Liquefiable soils were identified in the following layers:

Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
10.0' to 12.0'	9.5	SC	0.47	16.0	38%	0.5± (1)
26.5' to 31.5'	29.5	ML	0.44	22.0	64%	- (2)
57.0' to 63.5'	59.5	ML	0.31	14.9	63%	- (2)(3)

Note:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992)
(2) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was neglected.
(3) The depth of the liquefiable soils is greater than 50 feet below existing grade. The impact is considered insignificant.

The low plasticity silt was encountered at about 26.5- to 31.5-foot and 57.0- to 63.5-foot depths. However, these pockets are relatively deep with high fines content. Therefore, the impact to the foundation design of this liquefiable layer is considered low.

Abutment 2 (north abutment). Liquefiable soils were encountered in Boring A-09-002. We have also reviewed Boring R-10-003A, drilled at the planned location of south abutment of the proposed Green Valley Road Overcrossing structure, for comparison. Liquefiable soils were identified in the following layers:

Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
14.0' to 18.0'	14.5	SC	0.63	23.5	>35%	- (1)
18.0' to 22.5'	19.5	SM	0.71	26.8	37%	- (1)
38.5' to 42.0'	39.5	ML	0.45	23.6	>50%	- (1)
42.0' to 47.0'	44.5	SM	0.50	25.3	20%	- (1)

Note:
(1) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was neglected.

The fines contents and $N_{1,60,CS}$ are relatively high for all the layers shown in the above table. As discussed in the previous section, ground failure/post-liquefaction settlement may not be expected. However, the liquefaction potential will be considered when designing the pile by conservatively neglecting capacity within these layers.

Silty sand was encountered in Boring A-09-002 between approx. 62.5- and 85-foot depths. The factor of safety against liquefaction is considered marginal based on the analysis. However, this sand layer is relatively deep (>50 feet deep), and the $N_{1,60,CS}$ of this layer is relatively close to 30. In addition, the liquefaction potential of the soils at the similar depth encountered in R-10-003A is considered low. In our opinion, this should not be an design issue.

Based on the above, the liquefaction potential is considered high at the project site. Liquefaction has been considered for foundation design. The vertical pile capacity contribution is neglected within the liquefiable soils. Down drag loads have been considered where the post-liquefaction settlement is more than 0.6 inch. For lateral pile capacity analysis, the effect of liquefaction was accounted for by using the p-y relationship for liquefied sand presented by Rollins et al (2003). More detailed discussions are presented in Sections 11.2 and 11.3.

9.3.1 Liquefaction Mitigation

Due to the high liquefaction potential at the project site, we have evaluated the potential of lateral spreading per Caltrans latest guideline (February 2011). As a result, the liquefaction induced lateral spreading will be a design issue for the embankment and Retaining Wall No. 8 (MSE wall) and Retaining Wall No. 9 (Caltrans Standard Type 1) at Abutment 1. Consequently, ground improvement is proposed to mitigate the potential hazard. More detailed information is provided in the document provided by Acacia CE (attached, dated July 11, 2011).

Several ground improvement methods, such as dynamic compaction, stone columns, cement deep soil mixing (CDSM) and Controlled Low Strength Material (CLSM) columns, are commonly used in California. However, based on the subsurface condition, CLSM column ground improvement method is deemed appropriate and cost-effective for the proposed project. CLSM columns may be a proprietary method and its applicability should be verified with the contract requirement.

The CLSM columns are formed in drilled or displaced soil cavity. The columns replace or displace the compressible or liquefiable soil with cemented CLSM. It is recommended that these ground improvement columns be separated from the bottom of the footings using a layer of compacted Aggregate Base (AB). No connectivity of the ground improvement columns and overlying structural element should be anticipated. Lateral resistance is provided by the friction at the footing/concrete to crushed rock interface and passive resistance of the side of the footing. In addition, CLSM ground improvement columns provide enhanced engineering properties for the matrix soil/CLSM column composite. The composite improved ground provides increased density and shear capacity to resist liquefaction and increased shear resistance for global stability of supported structures.

The target strengths of the CLSM backfill material are generally on the order of 200 to 750 psi at 28 days, depending on load demands. The CLSM strength is tested using standard sampling and loading methods. The settlement properties of the improved soil/CLSM composite can be verified using a full scale modulus load test.

The CLSM columns generally are constructed with a minimum 18 inch diameter and maximum 36 inch diameter displacement barrels above a short section of standard auger. For Drill Displacement CLSM columns the expanded cavities are filled with CLSM under pressure as the displacement auger is withdrawn.

9.4 Seismic Design Criteria

The recommended response spectrum was determined based on the new 2007 Caltrans Deterministic PGA Map and the Caltrans ARS Online (Ver. 1.0.4) per Caltrans Seismic Design Criteria (SDC, Version 1.6, dated November 2010). The development of the design ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 30 m/100 feet (V_{S30m}), and other site parameters, such as fault characteristics, site-to-fault distances. The design methods incorporate both deterministic and probabilistic seismic hazards to produce the Design Response Spectrum.
Average shear wave velocity (Vs) for the top 30m (100 feet) at the site was estimated by using established correlations and the procedure provided in the Caltrans Design Manual (Ver. 1.0.4, August 2009). As mentioned in the previous section, liquefaction potential is considered high at the project site. Therefore, when estimating the V_{30m}, we have assumed the residual shear strengths and modeled those as soft clays for the potential liquefiable soils.

For developing the ARS curve, we have considered both profiles: (1) liquefaction case; and (2) non-liquefaction case. Based on our calculation, we have estimated Vs_{30m} of 205 m/s and 285 m/s for liquefaction case and non-liquefaction case, respectively. According to the analysis results, the recommended response spectrum for structure design is based on the data from 2008 USGS Deaggregation Hazard (beta). Lower V_{S30m} yields higher spectral acceleration at longer periods (>0.5 sec.), and the higher V_{S30m} yields higher spectral accelerations at shorter periods (<0.5 sec.). Therefore, the envelope of these two curves is recommended.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented in Appendix IV.

1. Site Location: 38.2154 ºN/ 122.1383ºW
2. Estimated Vs30m = 205 m/s (liquefaction case); 285 m/s (non-liquefaction case)
3. The recommended ARS curve is the envelope of two curves based on different Vs30m, which were governed by 2008 USGS Deaggregation Hazard (beta).

10.0 AS-BUILT FOUNDATION DATA

The proposed new structure will be located about 250 feet northeast of the existing Green Valley Road Overcrossing (Br. No. 23-138). This existing overcrossing was built in 1961. Based on the as-built plans, the existing structure is a four-span structure of about 304 feet long and 34 feet wide. The General Plan indicates that the structure is supported on P.C.C. piles (presumably Portland Cement Concrete Piles) with a design load of 45 tons. According to the Pile Details, several different pile types were listed. However, the actual pile type used is not noted. The specified pile tip elevations vary from location to location. The foundation data are summarized in the following table:

TABLE 3 – AS-BUILT FOUNDATION DATA

Pile Location	Pile Type	Design Load	Footing Elev. (ft)	Specified Pile Tip Elev. (ft)
Abutment 1	P.C.C. Piles	45 tons	32.5	-23
Bent 2			18.5	-23
Bent 3			18.5	-23
Bent 4			18.5	-13
Abutment 5			32.0	-13

11.0 FOUNDATION RECOMMENDATIONS

11.1 General

This report was prepared specifically for the proposed project as described earlier. Normal procedures were assumed for construction of the bridge structure throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event

that these conditions are changed, so as to modify or amend our recommendations. In addition, bridge plans should be reviewed by our office prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

11.2 Foundation

Based on the subsurface condition, the subsoils at the project site consist of interbedded clay/silt and sand layers, and groundwater level appears relatively shallow. Liquefiable soils have been identified within the project limit. Therefore, liquefaction has been considered for foundation design. The pile capacity contribution is neglected within the soil layers where potential liquefaction or cyclic mobility is anticipated. Based on the liquefaction analysis results, down drag loads have been considered when estimating the pile capacity, where the post-liquefaction settlement is more than 0.6 inch.

Dense sand formation was encountered at depths, and there appears to be variable dense sand lenses through the profile. Therefore, concrete driven piles are not recommended due to potential hard-driving condition. Per our discussion with the designer, steel open-ended pipe piles (Caltrans standard Class 200 Alt. "W") will be used for foundation support. According to the latest plans provided by the designer, step footings are proposed at Abutment 1, and the footing elevations are at Elev. 21.5, 27.0 and 32.0 feet. For Abutment 2, the bottom of footing is at Elev. 19.0 feet. Pile cut-off elevations are about 5 inches above the bottom of the footings.

Consistent with the current Caltrans requirements, the abutment foundations are evaluated for the foundation design data and loading conditions using Working Stress Design (WSD) methods, per AASHTO LRFD Bridge Design Specifications – 4th Edition, with California Amendments.

For the proposed structure, pertinent foundation design information are provided by the designer, including Foundation Design Data (Table 4.1) and Foundation Design Loads (Table

4.2). Based on the load demand and subsoil information, the recommended specified pile tip elevations are summarized in the following tables (Tables 4.3 to 4.5) per Memo-To-Designers 3-1.

TABLE 4 – FOUNDATION DESIGN

TABLE 4.1 – FOUNDATION DESIGN DATA

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (in)	No. of Piles per Support
					B	L		
Abut 1	WSD	Class 200 Alt. "W"	35±	21.92 27.42 32.42	11± to 18.5±	59±	1	26
Abut 2	WSD	Class 200 Alt. "W"	35±	19.42	18.5±	59±	1	33

Note: Pile cut-off elevations are about 5 inches above the bottom of the footings.

TABLE 4.2 – FOUNDATION RECOMMENDATIONS FOR ABUTMENTS

Support	Pile Type	Cut-off Elev. (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance Required (kips)
			Total	Perma -nent					
Abut 1	Class 200 Alt. "W"	21.92 27.42 32.42	3790	3585	200	400	-53.0 (a) -3.5 (c) -20.0 (d)	-53.0	550
Abut 2	Class 200 Alt. "W"	19.42	5085	4880	200	400	-65.0 (a) -15.5 (c) -35.0 (d)	-65.0	525

Notes:
(1) Design tip elevations are controlled by (a) compression; (c) settlement; (d) lateral loads.
(2) For Abutment 1, the capacity above Elev. 12 feet were neglected due to potential liquefaction, and down drag has been considered when estimating the pile lengths. Consequently, same specified pile tip elevation is recommended despite the stepped footings.

TABLE 4.3 – PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut 1	Class 200 Alt. "W"	400	0	-53.0 (a), -3.5 (c), -20.0 (d)	-53.0	550
Abut 2	Class 200 Alt. "W"	400	0	-65.0 (a), -15.5 (c), -35.0 (d)	-65.0	525

Note: Design tip elevations for abutments are controlled by (a) compression; (c) settlement; (d) lateral loads

The pile capacities of the open end steel pipe piles (Caltrans Standard Class 200 Alt. "W") were estimated based on procedures published by American Petroleum Institute (API) from "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design" (API RP 2A-WSD, 2002). We have utilized computer program "APILE Plus" (ENSOFT, v5.0) for calculation purpose.

The recommended minimum pile spacing is three times the pile diameter (3D) to minimize the group effect for vertical pile capacities. Liquefaction was considered when estimating the pile capacities. The vertical pile capacity contribution is neglected within the liquefiable soils. Down drag loads have been considered where the post-liquefaction settlement is more than 0.6 inch for the piles at Abutment 1. In addition, due to the corrosive environment, we have assumed a corrosion allowance of 0.05 inch (a corrosion rate of 0.001 inch per year with a design life of 50 years) above Elev. 0 feet. The impact appears to be relatively minor as portion of the capacities along the corrosive zones have already been neglected due to liquefaction concern. The pile group settlement was evaluated, and it does not appear to be a governing factor for foundation design.

New embankment up to about 30 feet is anticipated at Abutment 1 and about 40 feet at Abutment 2. The estimated ground settlements at Abutment 1 (south abutment) are expected to be on the order of 6 inches. The settlements are expected mainly within the over-consolidated (OC) range, which should occur relatively fast and probably during earthwork construction. To reduce potential down drag load on abutment piles, a waiting period of 60 days is recommended after embankment/MSE wall construction prior to the pile construction at abutments.

Due to the potential lateral spreading at Abutment 2, ground treatment with CLSM Columns is recommended to mitigate the potential hazard. It is expected that the amount of settlement will

be on the order of 3 inches. The settlements are expected mainly within the elastic range, which should also occur relatively fast and probably during earthwork construction. A waiting period of 30 days is recommended after embankment/MSE wall construction prior to the pile construction at abutments. More discussions regarding anticipated ground settlement are presented in Section 11.5 of this report.

11.3 Lateral Pile Capacity

Under seismic loading conditions, lateral load analyses were performed for the proposed steel open-ended pipe piles (Caltrans standard Class 200 Alt. "W") using the LPILE program (ENSOFT, v6.0). The effect of liquefaction was accounted for by using the p-y relationship for liquefied sand presented by Rollins et al (2003). An average "p-y Curve Modification Factor" of 0.6 was adopted for non-liquefiable soils in the lateral pile analysis for pile spacing of 3 times the pile diameter.

In addition, due to the corrosive potential (see Section 8.0), a corrosive allowance of 0.05 inch (a corrosion rate of 0.001 inch per year with a design life of 50 years) was assumed for the shell thickness above Elev. 0 feet per Caltrans Memo-To-Designer 3-1. The results of lateral pile analyses, with the plots of the pile deflection, moment, shear and soil reaction along the pile length and the input files are included in the Appendix C.

11.4 Lateral Earth Pressures

Abutment retaining walls should be designed to resist the following Applied Lateral Earth Pressures and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil.

Applied Lateral Earth Pressure

Active Condition	36 pcf Equivalent Fluid Pressure (EFP) for the engineered backfill.
At-Rest Condition	55 pcf Equivalent Fluid Pressure (EFP) for the engineered backfill.
Passive Resistance	5 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet high or greater); for activated height less than 5.5 feet modify proportionally, i.e. 5×(H/5.5) ksf. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive pressure is required.

Cantilever walls which are free to rotate at least 0.004 radian may be assumed flexible for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.3 and 0.5 may be used to determine the additional earth pressure resulting from the surcharge for active and at-rest conditions, respectively.

11.5 Embankments

11.5.1 Embankment Settlements & Settlement Monitoring

New approach embankments are planned at the abutments of the proposed structure. The height of the embankment is up to 30 feet at Abutment 1 and 40 feet at Abutment 2. Consequently, consolidation settlement is expected from the additional load exerted from the embankment.

In order to estimate the amount of settlement, consolidation tests were conducted on selected samples obtained from the borings. We have reviewed and adopted correlations from various references with revision to the site-specific laboratory test results for estimating the indexes for settlement calculation.

The estimation of pre-consolidation pressure is based Su/p per Skempton (1957) and NAVFAC D.M. 7.1. The modified compression index ($C_c/(1+e_0)$) and the modified recompression index ($C_r/(1+e_0)$) were obtained from the laboratory test results, and the indices were compared to the correlation with natural moisture contents suggested by Lambe and Whitman (1969). After reviewing the laboratory data and the correlation, we have revised the correlation for estimating the modified compression index accordingly. For the recompression index (C_r, in the over-consolidated range), it is typically 10% of the compression index (per Holtz and Kovacs, 1982). According to the test data, the ratio of C_r/C_c range from 13% to 30%, which is in general accordance with the suggested value. Therefore, we have assumed a ratio of 20% (C_r/C_c) for estimating the modified recompression index ($C_r/(1+e_0)$).

Ground treatment has been considered under the embankment north of Abutment 2 to mitigate the potential lateral spreading due to the presence of liquefiable soils. With the proposed ground treatment, the consolidation settlement under the embankment up to 40 feet at Abutment 2 is expected to be on the order of 3 inches.

At Abutment 1, new embankments up to about 30 feet are anticipated. In general, the subsoils consist of interbedded very stiff to hard silt/clay in the upper depths overlying medium dense to dense sand. It appears that granular materials are more prominent toward the northeast and the clay thicknesses appear to be thicker on the southwest. Based on the results of the settlement analyses, the amount of consolidation settlements is estimated to be on the order of 6 inches. The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast.

A waiting period of 60 and 30 days are recommended for the embankment at Abutment 1 and 2, respectively, prior to pile construction at the abutment of the new structure and the construction of the pavement. It will reduce potential down drag load on abutment piles

due to consolidation settlement. The settlement monitoring is recommended and should be performed as per Caltrans Standard Test Method 112. In addition, the method of constructing the concrete facing (panels) might have to be delayed. Special details would be required to allow for the settlement of the panels or to attach them after the settlement has occurred.

11.5.2 Evaluation of Embankment Stability

After the Type Selection meeting in January 2011, Caltrans issued a new publication regarding lateral spreading, "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading" in February 2011. Consequently, we have re-visited the analyses that were performed during 35% design accordingly. Specifically, more analyses were performed along longitudinal direction to evaluate the potential of lateral spreading and its impact to the abutments.

Previously (during the 35% design phase), due to the presence of liquefiable soils on site, the stability of the embankment was evaluated under three different scenarios: 1) Static Condition (short-term, immediately after construction); 2) Seismic Condition (pseudo-static with seismic coefficient, k); and 3) Post-Liquefaction Condition. Per our previous discussion with Caltrans engineer, short-term, undrained shear strength (non-liquefied) parameters were used for seismic condition, since liquefaction generally is not expected to occur in conjunction with the peak ground acceleration. Residual shear strengths (Sr) were adopted only for the post-liquefaction condition without seismic coefficient.

According to the latest Caltrans guideline of lateral spreading, we have revised our pseudo-static analysis by using residual shear strengths (Sr, estimated based on Kramer and Wang (2007) as cited in Caltrans guideline) for liquefiable soils. As mentioned previously, liquefaction is generally not expected to occur in conjunction with peak ground

acceleration. Therefore, this approach (pseudo-static analysis coupled with residual shear strengths) appears relatively conservative.

In our opinion, if the derived factor of safety is greater than unity, the design seismic coefficient is considered less than the yield acceleration (ky), and the ground deformation under the design earthquake event should be relatively insignificant and should not pose impact to the structure/foundation design. On the other hand, if the derived factor of safety is less than unity, the ground deformation can be excessive and lateral spreading should be considered.

For the seismic coefficient (k), we have referenced to Caltrans guidelines (Guidelines for Structures Foundation Reports manual, Ver. 2.0, 2006), which recommends that the seismic factor equal to one third of the horizontal peak acceleration and not exceeding 0.2g. An average PGA of 0.7g was assumed for design at the project site. Therefore, a seismic coefficient (k) of 0.2g was used for pseudo-static analysis. In addition, the strengths of the non-liquefiable fine-grained materials were increased by 30% due to the effect of rapid loading (per Ishihara, 1985) and strength increase from the consolidation under the embankment/retaining walls. For the proposed structure, stability analyses were conducted at both abutments. The analysis results are summarized in the following table.

TABLE 5 – SUMMARY OF SLOPE STABILITY ANALYSIS

Location	**Factor of Safety**	
	Static Condition – Short term (immediately after construction)	**Pseudo-Static Analysis (k=0.2+residual shear strength)**
Abutment 1 (South)	2.62	1.40
Abutment 2 (North)	2.71	0.70

Based on our analysis, the embankment/retaining wall at Abutment 1 appear stable for both analyses. Therefore, lateral spreading is not a design concern. For the embankment/ retaining walls at Abutment 2 located between Green Valley Road OC and Green Valley Road OC (Over SB 680 On-Ramp), the stability under pseudo-static analysis (with residual shear strengths) is not satisfactory (F.S. less than 1). The results indicate that the potential deformation during the design seismic event can be excessive. Per Bray and Travasarou (2007) as cited in Caltrans guideline, the anticipated deformation is estimated on the order of 12 inches (with an yield acceleration, ky, of 0.145g). Therefore, the potential of lateral spreading is considered high, and it will impose additional loads onto the abutment wall and the foundations at Abutment 2. This will complicate the design considerably.

Consequently, ground treatment by using CLSM columns is recommended. We have engaged Acacia CE to perform the design of the CLSM system. According to their evaluation, the planned ground treatment will consist of 24-inch diameter Drill Displacement Column (DDC) with a typical spacing of 4'-10" on center. The proposed treatment ratio is about 17% under the footprint of Retaining Wall No. 9 (Type 1) and about 15.5% under the embankment and Retaining Wall No. 8 (MSE wall). The CLSM columns will extend to Elev. -15 feet (approximate 39 feet below grade). It is recommended that the CLSM have an average 28-day unconfined compressive strength of at least 750 psi.

Based on the assumptions, a composite shear strength of 9800 psf is recommended under Retaining Wall No. 9 and 9000 psf under Retaining Wall No. 8 and embankment are recommended. The composite strength is calculated based on a residual shear strength of 750 psf for the liquefiable soils.

We have performed pseudo-static slope stability analysis with an average improved composite shear strength of 9 ksf under the embankment and retaining walls. The results indicate the stability to be satisfactory.

12.0 NOTES TO DESIGNER

It is recommended that the structure engineer verify the pile tip elevations when finalizing the pile data table. Should the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Geotechnical Engineer must be contacted for further recommendations.

13.0 CONSTRUCTION CONSIDERATIONS

13.1 General

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of grading operations should be carried out by Caltrans and/or Solano County. If the encountered subsurface conditions differ from those forming the basis of our recommendations, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

13.2 Open End Steel Pipe Piles

Based on the boring data, the site is underlain by alluvial materials with some relatively thick granular layers. For the proposed open end steel pipe piles, local hard driving conditions should be expected. In our opinion, the overall drivability should not be an issue. However, this will depend on the type and setup of the pile driving hammer. We recommend that the piles be driven to the specified tip elevations. The pile capacity will be derived primarily from frictional resistance along the pile shaft.

In the event that unanticipated pile driving conditions are encountered, it is recommended that the Gates formula per Caltrans standard specifications (Section 49-1.08) be used in the field for driving and capacity verification. Should difficult driving be encountered where the vertical compression requirement is met (per Gates formula), pile driving should be allowed to terminate short of the specified tip elevation provided that either one of the following conditions are satisfied:

- Other requirements including tension and lateral demands are met;
- Any pile refusal within 5 feet above the specified tip elevation, which may be considered acceptable and cut off at the option of the contractor.

If the piles do not attain the nominal driving resistance at the specified tip elevation (per Gates Formula), the piles may be allowed to stand for a "set period" of minimum 12 hours without driving. If the nominal driving resistance is attained for each pile designated to be re-driven, the remaining piles in that footing are considered acceptable.

14.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a

properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

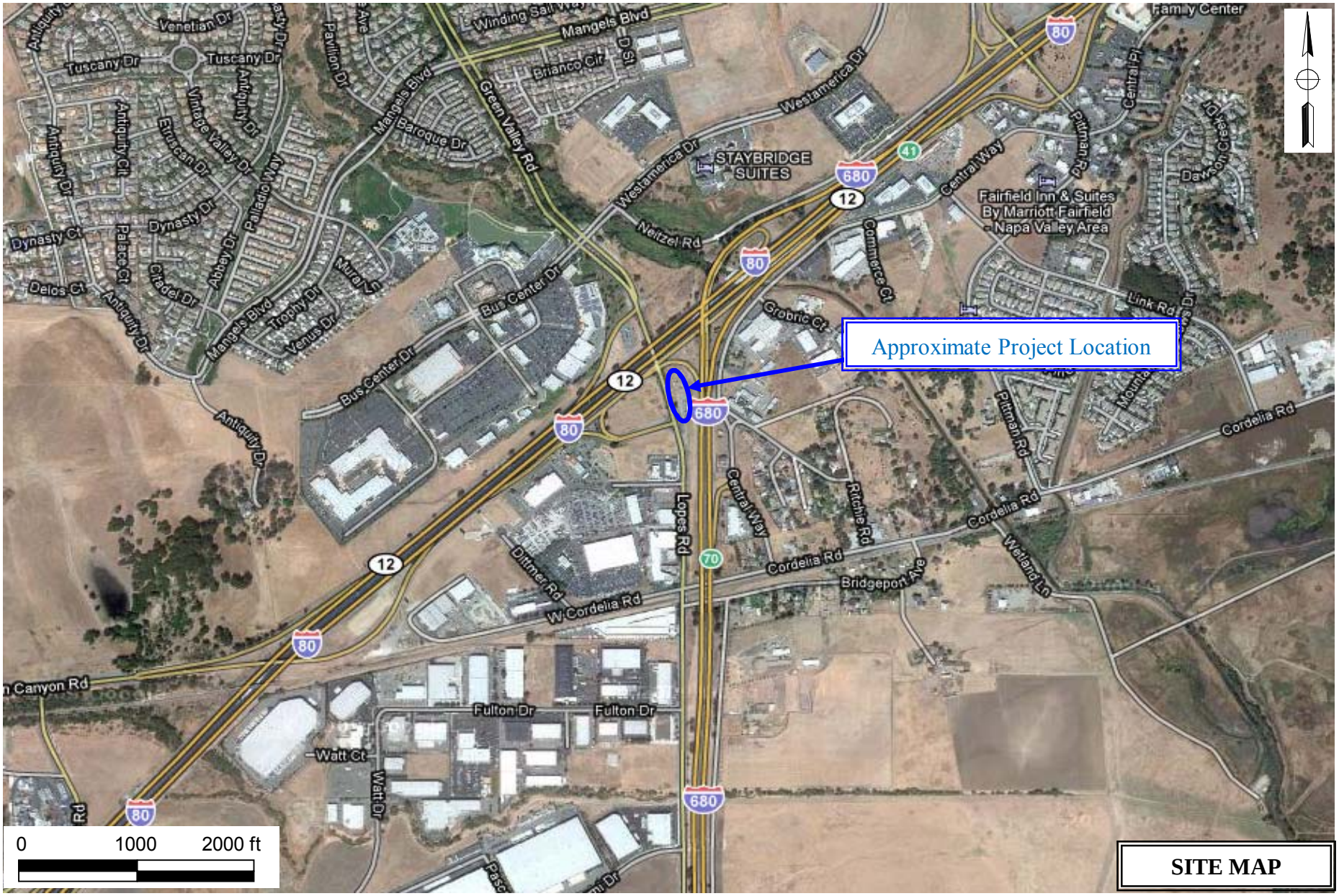
Respectfully submitted,
PARIKH CONSULTANTS, INC.

Frank Wang, P.E., G.E. 2862
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

APPENDIX I

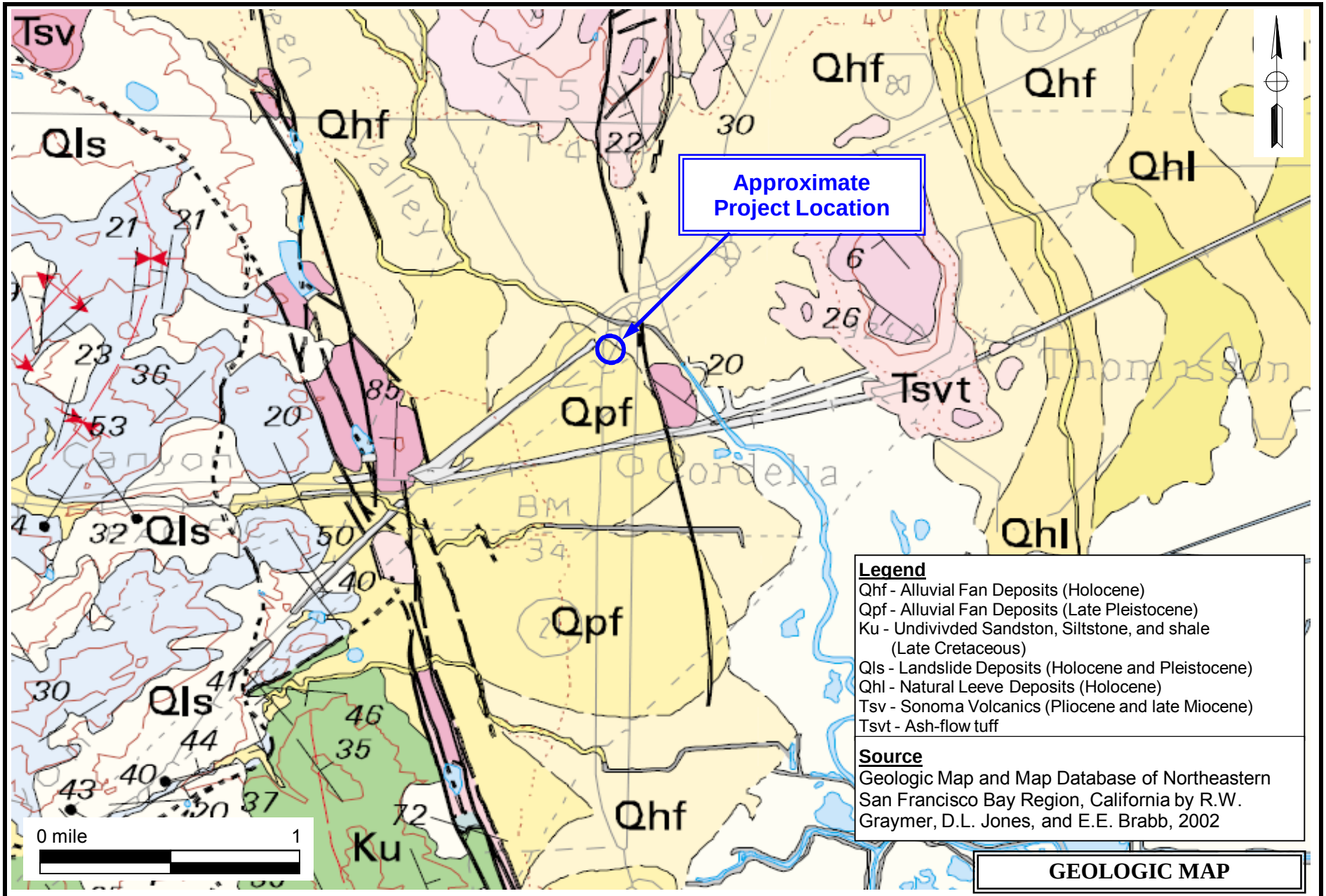


SITE MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR	PLATE NO.: I-1



GEOLOGIC MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.: I-2

APPENDIX II

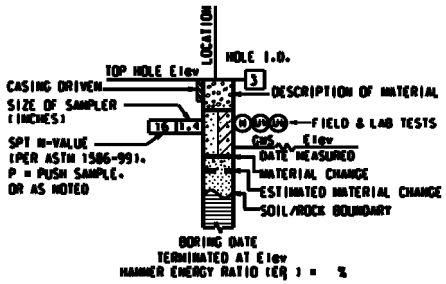
REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

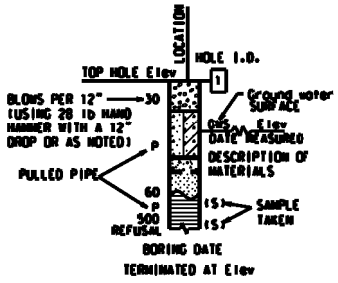
CEMENTATION	
DESCRIPTION	CRITERIA
WEAK	CRUMBLES OR BREAKS WITH HANDLING OR LITTLE FINGER PRESSURE.
MODERATE	CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE.
STRONG	WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE.

BOREHOLE IDENTIFICATION		
SYMBOL	HOLE TYPE	DESCRIPTION
	A	AUGER BORING (HOLLOW OR SOLID STEM BUCKET)
	R RW RC P	ROTARY DRILLED BORING (CONVENTIONAL) ROTARY DRILLED WITH SELF-CASING WIRE-LINE ROTARY CORE WITH CONTINUOUSLY-SAMPLED, SELF-CASING WIRE-LINE ROTARY PERCUSSION BORING (AIR)
	R	ROTARY DRILLED DIAMOND CORE
	HD HA	HAND DRIVEN (1-INCH SOIL TUBE) HAND AUGER
	D	DYNAMIC CONE PENETRATION BORING
	CPT	CONE PENETRATION TEST (ASTM D 5778)
	O	OTHER (NOTE ON LOTB)
Note: Size in inches.		

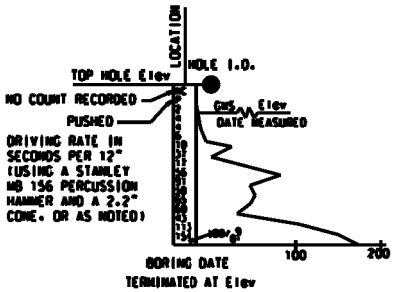
CONSISTENCY OF COHESIVE SOILS				
DESCRIPTION	SHEAR STRENGTH (tsf)	POCKET PENETROMETER MEASUREMENT, PP, (tsf)	TORVANE MEASUREMENT, TV, (tsf)	VANE SHEAR MEASUREMENT, VS, (tsf)
VERY SOFT	LESS THAN 0.12	LESS THAN 0.25	LESS THAN 0.12	LESS THAN 0.12
SOFT	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
MEDIUM STIFF	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
STIFF	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
VERY STIFF	1 - 2	2 - 4	1 - 2	1 - 2
HARD	GREATER THAN 2	GREATER THAN 4	GREATER THAN 2	GREATER THAN 2



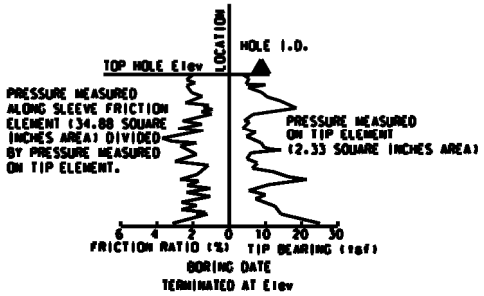
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

LEGEND – SOIL
(SHEET 1 OF 2)
NO SCALE

A10F

2010 STANDARD PLAN A10F

5-24-10

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

GROUP SYMBOLS AND NAMES

GRAPHIC/SYMBOL	GROUP NAMES
GW	WELL-GRADED GRAVEL WELL-GRADED GRAVEL WITH SAND
GP	POORLY-GRADED GRAVEL POORLY-GRADED GRAVEL WITH SAND
GW-GM	WELL-GRADED GRAVEL WITH SILT WELL-GRADED GRAVEL WITH SILT AND SAND
GW-GC	WELL-GRADED GRAVEL WITH CLAY (OR SILTY CLAY) WELL-GRADED GRAVEL WITH CLAY AND SAND (OR SILTY CLAY AND SAND)
GP-GM	POORLY-GRADED GRAVEL WITH SILT POORLY-GRADED GRAVEL WITH SILT AND SAND
GP-GC	POORLY-GRADED GRAVEL WITH CLAY (OR SILTY CLAY) POORLY-GRADED GRAVEL WITH CLAY AND SAND (OR SILTY CLAY AND SAND)
GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL WITH SAND
SW	WELL-GRADED SAND WELL-GRADED SAND WITH GRAVEL
SP	POORLY-GRADED SAND POORLY-GRADED SAND WITH GRAVEL
SW-SM	WELL-GRADED SAND WITH SILT WELL-GRADED SAND WITH SILT AND GRAVEL
SW-SC	WELL-GRADED SAND WITH CLAY (OR SILTY CLAY) WELL-GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
SP-SM	POORLY-GRADED SAND WITH SILT POORLY-GRADED SAND WITH SILT AND GRAVEL
SP-SC	POORLY-GRADED SAND WITH CLAY (OR SILTY CLAY) POORLY-GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
SM	SILTY SAND SILTY SAND WITH GRAVEL
SC	CLAYEY SAND CLAYEY SAND WITH GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND WITH GRAVEL
PT	PEAT
	COBBLES COBBLES AND BOULDERS BOULDERS

GRAPHIC/SYMBOL	GROUP NAMES
CL	LEAN CLAY LEAN CLAY WITH SAND LEAN CLAY WITH GRAVEL SANDY LEAN CLAY SANDY LEAN CLAY WITH GRAVEL GRAVELLY LEAN CLAY GRAVELLY LEAN CLAY WITH SAND
CL-ML	SILTY CLAY SILTY CLAY WITH SAND SILTY CLAY WITH GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY WITH GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY WITH SAND
ML	SILT SILT WITH SAND SILT WITH GRAVEL SANDY SILT SANDY SILT WITH GRAVEL GRAVELLY SILT GRAVELLY SILT WITH SAND
OL	ORGANIC LEAN CLAY ORGANIC LEAN CLAY WITH SAND ORGANIC LEAN CLAY WITH GRAVEL SANDY ORGANIC LEAN CLAY SANDY ORGANIC LEAN CLAY WITH GRAVEL GRAVELLY ORGANIC LEAN CLAY GRAVELLY ORGANIC LEAN CLAY WITH SAND
OL	ORGANIC SILT ORGANIC SILT WITH SAND ORGANIC SILT WITH GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT WITH GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT WITH SAND
CH	FAT CLAY FAT CLAY WITH SAND FAT CLAY WITH GRAVEL SANDY FAT CLAY SANDY FAT CLAY WITH GRAVEL GRAVELLY FAT CLAY GRAVELLY FAT CLAY WITH SAND
MH	ELASTIC SILT ELASTIC SILT WITH SAND ELASTIC SILT WITH GRAVEL SANDY ELASTIC SILT SANDY ELASTIC SILT WITH GRAVEL GRAVELLY ELASTIC SILT GRAVELLY ELASTIC SILT WITH SAND
OH	ORGANIC FAT CLAY ORGANIC FAT CLAY WITH SAND ORGANIC FAT CLAY WITH GRAVEL SANDY ORGANIC FAT CLAY SANDY ORGANIC FAT CLAY WITH GRAVEL GRAVELLY ORGANIC FAT CLAY GRAVELLY ORGANIC FAT CLAY WITH SAND
OH	ORGANIC ELASTIC SILT ORGANIC ELASTIC SILT WITH SAND ORGANIC ELASTIC SILT WITH GRAVEL SANDY ORGANIC ELASTIC SILT SANDY ORGANIC ELASTIC SILT WITH GRAVEL GRAVELLY ORGANIC ELASTIC SILT GRAVELLY ORGANIC ELASTIC SILT WITH SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL WITH SAND ORGANIC SOIL WITH GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL WITH GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL WITH SAND

FIELD AND LABORATORY TESTING

- (C) CONSOLIDATION (ASTM D 2435)
- (CL) COLLAPSE POTENTIAL (ASTM D 5333)
- (CP) COMPACTION CURVE (CTM 216)
- (CR) CORROSIVITY TESTING (CTM 643, CTM 422, CTM 417)
- (CU) CONSOLIDATED UNDRAINED TRIAXIAL (ASTM D 4767)
- (DS) DIRECT SHEAR (ASTM D 3080)
- (EI) EXPANSION INDEX (ASTM D 4829)
- (M) MOISTURE CONTENT (ASTM D 2216)
- (OC) ORGANIC CONTENT-% (ASTM D 2974)
- (P) PERMEABILITY (CTM 220)
- (PA) PARTICLE SIZE ANALYSIS (ASTM D 422)
- (PI) PLASTICITY INDEX (AASHTO T 90)
LIQUID LIMIT (AASHTO T 89)
- (PL) POINT LOAD INDEX (ASTM D 5731)
- (PM) PRESSURE METER
- (R) R-VALUE (CTM 301)
- (SE) SAND EQUIVALENT (CTM 217)
- (SG) SPECIFIC GRAVITY (AASHTO T 100)
- (SL) SHRINKAGE LIMIT (ASTM D 427)
- (SW) SWELL POTENTIAL (ASTM D 4546)
- (UC) UNCONFINED COMPRESSION-SOIL (ASTM D 2166)
UNCONFINED COMPRESSION-ROCK (ASTM D 2938)
- (UU) UNCONSOLIDATED UNDRAINED TRIAXIAL (ASTM D 2850)
- (UW) UNIT WEIGHT (ASTM D 4767)

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APPARENT DENSITY OF COHESIONLESS SOILS

DESCRIPTION	SPT N_{60} (BLOWS / 12 INCHES)
VERY LOOSE	0 - 5
LOOSE	5 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	GREATER THAN 50

MOISTURE

DESCRIPTION	CRITERIA
DRY	NO DISCERNABLE MOISTURE
MOIST	MOISTURE PRESENT, BUT NO FREE WATER
WET	VISIBLE FREE WATER

PERCENT OR PROPORTION OF SOILS

DESCRIPTION	CRITERIA
TRACE	PARTICLES ARE PRESENT BUT ESTIMATED TO BE LESS THAN 5%
FEW	5% - 10%
LITTLE	15% - 25%
SOME	30% - 45%
MOSTLY	50% - 100%

PARTICLE SIZE

DESCRIPTION		SIZE
BOULDER		GREATER THAN 12"
COBBLE		3" - 12"
GRAVEL	COARSE	3/4" - 3"
	FINE	1/5" - 3/4"
SAND	COARSE	1/16" - 1/5"
	MEDIUM	1/64" - 1/16"
	FINE	1/300" - 1/64"
SILT AND CLAY		LESS THAN 1/300"

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

LEGEND – SOIL
(SHEET 2 OF 2)
NO SCALE

A10G

2010 STANDARD PLAN A10G

5-5-10

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	12.80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL 9/10/12 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER G. PARIKH NO. 666 EXP. 12/31/13 GEOTECHNICAL STATE OF CALIFORNIA

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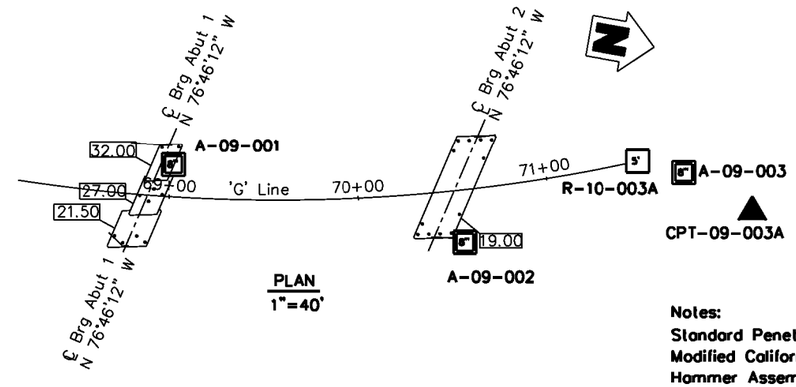
SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

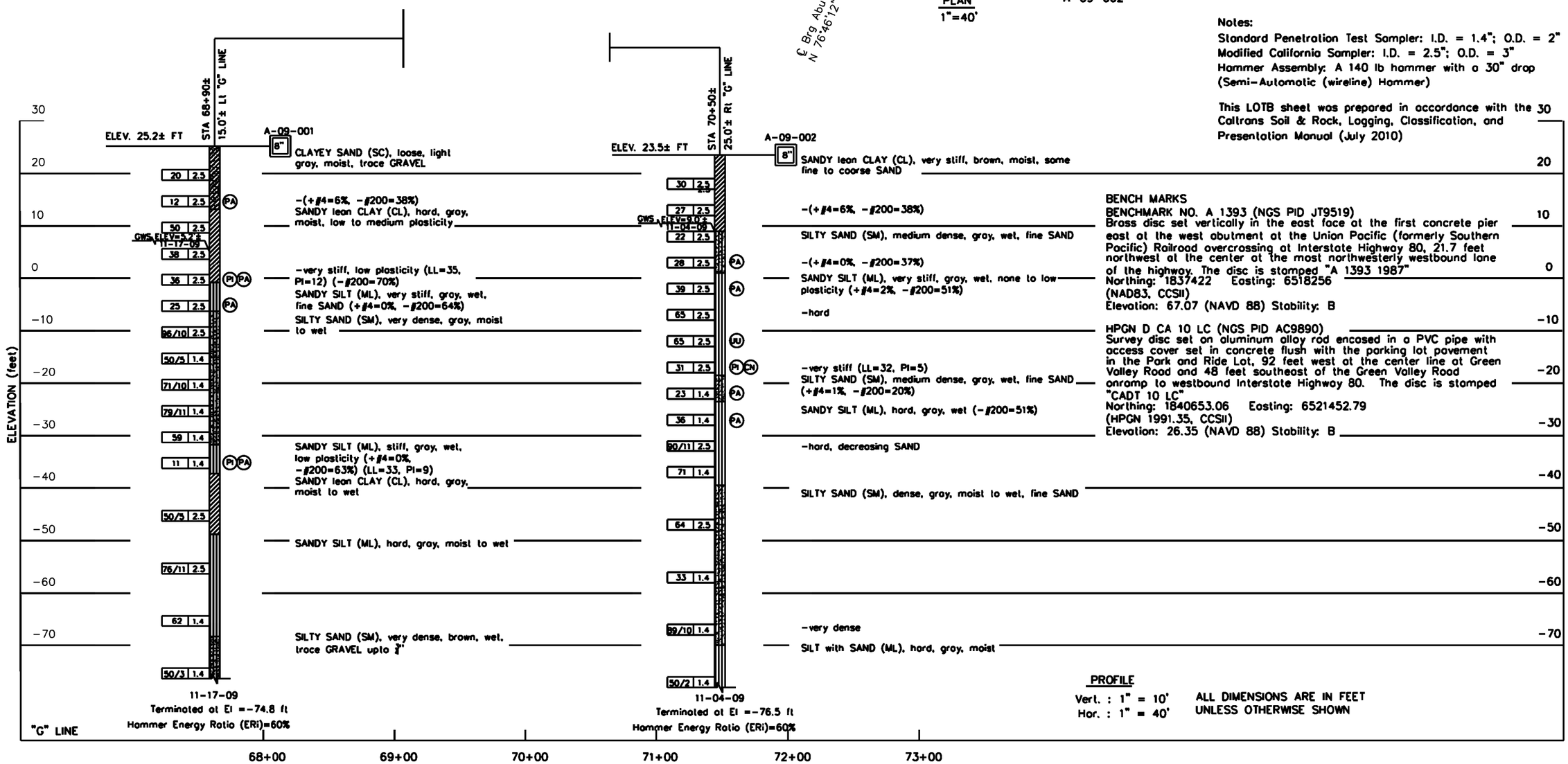
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
1"=40'

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Semi-Automatic (wireline) Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)



BENCH MARKS

BENCHMARK NO. A 1393 (NGS PID JT9519)
Brass disc set vertically in the east face at the first concrete pier east of the west abutment at the Union Pacific (formerly Southern Pacific) Railroad overcrossing at Interstate Highway 80, 21.7 feet northwest of the center of the most northwesterly westbound lane of the highway. The disc is stamped "A 1393 1987"
Northing: 1837422 Easting: 6518256
(NAD83, CCSII)
Elevation: 67.07 (NAVD 88) Stability: B

HPGN D CA 10 LC (NGS PID AC9890)
Survey disc set on aluminum alloy rod encased in a PVC pipe with access cover set in concrete flush with the parking lot pavement in the Park and Ride Lot, 92 feet west at the center line at Green Valley Road and 48 feet southeast of the Green Valley Road onramp to westbound Interstate Highway 80. The disc is stamped "CADT 10 LC"
Northing: 1840653.06 Easting: 6521452.79
(HPGN 1991.35, CCSII)
Elevation: 26.35 (NAVD 88) Stability: B

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 40'

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DRAWN BY	L. DUDDU	L.S. BHANGOO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: NOVEMBER 2009		

BRIDGE NO. 23-0247
POST MILES 12.8

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)

LOG OF TEST BORINGS 1 OF 4

OS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0741
PROJECT NUMBER & PHASE: 04000211311 CONTRACT NO.: 04-0A5341

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET 21 | OF 24

FILE = $REQUEST

USERNAME = $USER DATE PLOTTED = $DATE TIME PLOTTED = $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	12.80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL 9/10/12 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER G. PARIKH NO. 666 EXP. 12/31/13 GEOTECHNICAL STATE OF CALIFORNIA

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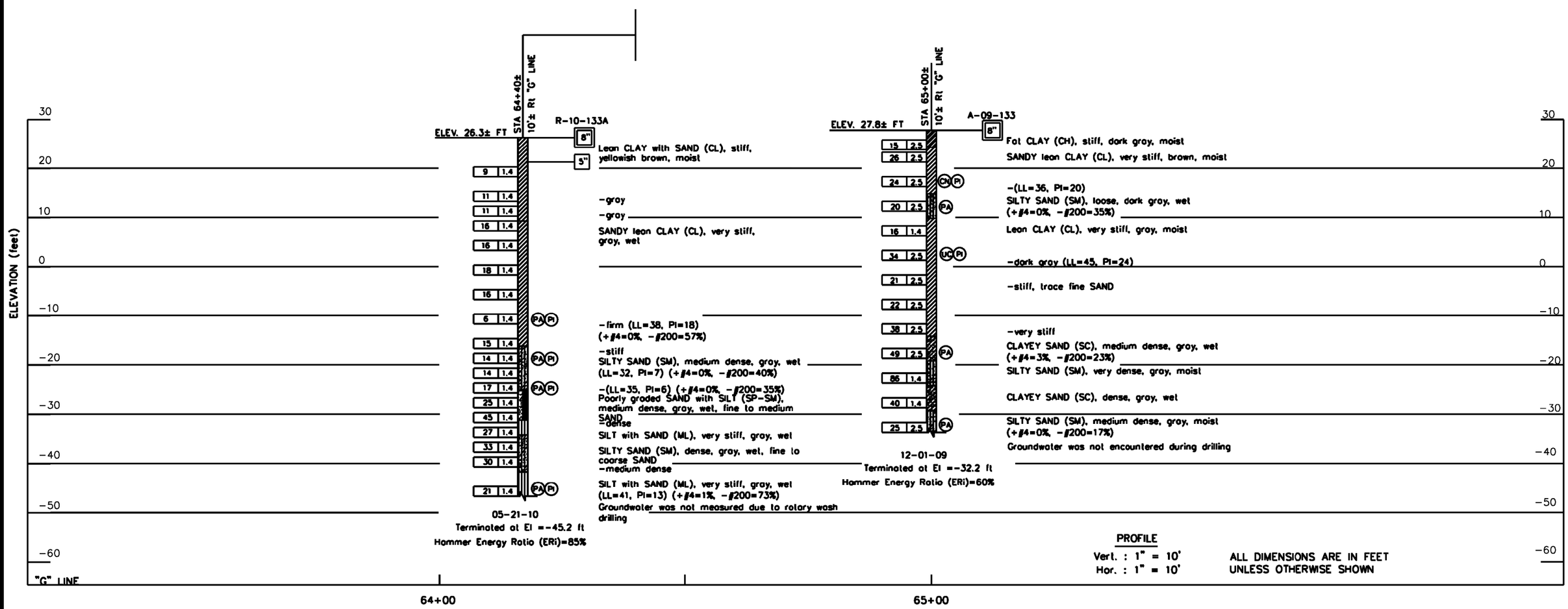
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON SHEET 1 OF 4)



DESIGN OVERSIGHT	DRAWN BY	L. DUDDU	L.S. BHANGOO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: NOVEMBER 2009		

BRIDGE NO. 23-0247 | POST MILES 12.8

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)

LOG OF TEST BORINGS 2 OF 4

OS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0741
PROJECT NUMBER & PHASE: 04000211311 CONTRACT NO.: 04-0A5341

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET 22 | OF 24

FILE =¢ $REQUEST

USERNAME =¢ $USER DATE PLOTTED =¢ $DATE TIME PLOTTED =¢ $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	12.80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL 9/10/12 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER G. PARIKH NO. 666 EXP. 12/31/13 GEOTECHNICAL STATE OF CALIFORNIA

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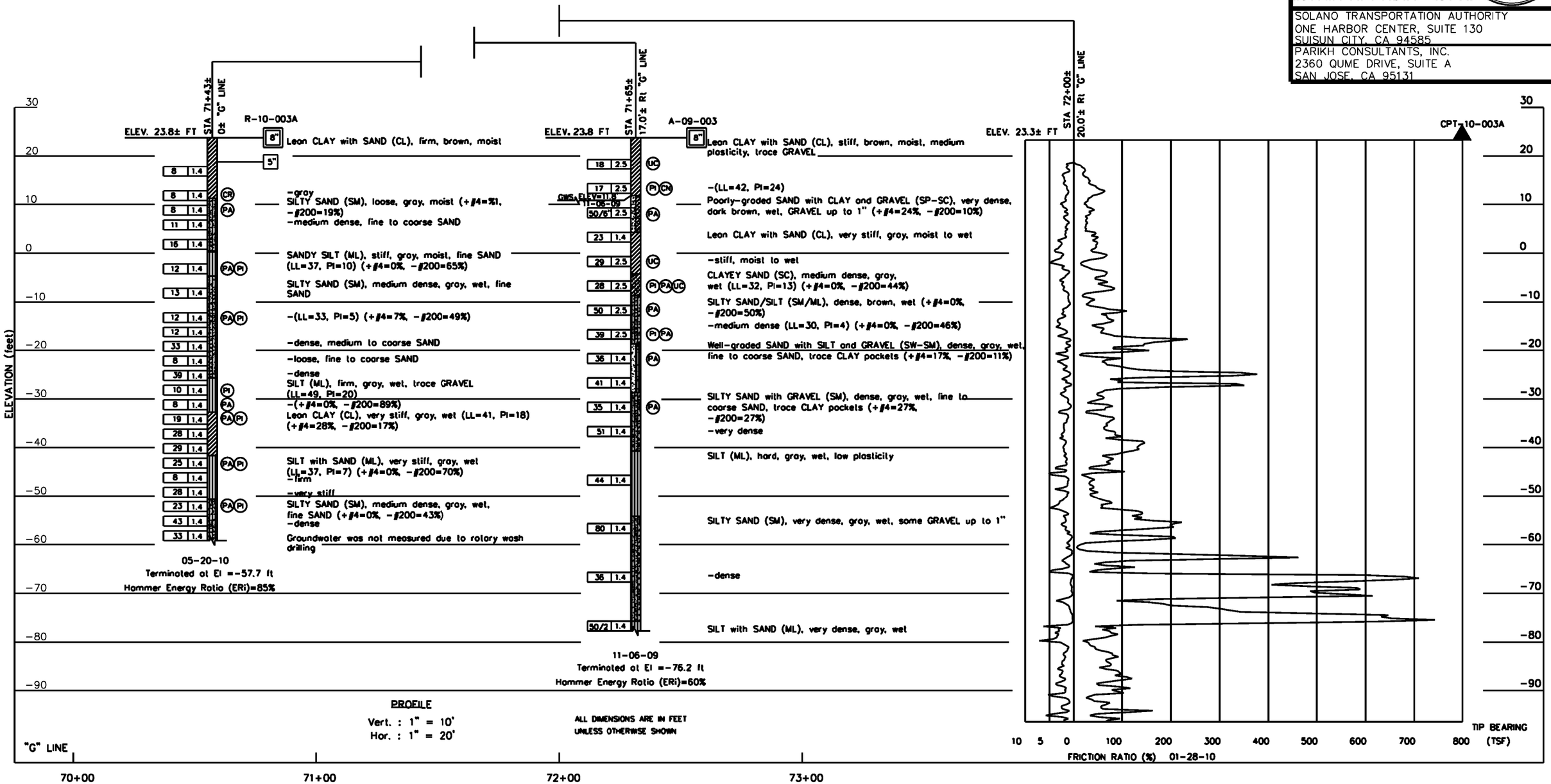
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Semi-Automatic (wireline) Hammer for A-09-003 and Automatic Hammer for R-10-003A)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)



DESIGN OVERSIGHT	DRAWN BY	L. DUDDU	L.S. BHANGOO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: NOVEMBER 2009		

BRIDGE NO. 23-0247
POST MILES 12.8

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)

LOG OF TEST BORINGS 3 OF 4

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0741
PROJECT NUMBER & PHASE: 04000211311 CONTRACT NO.: 04-0A5341

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET 23 | OF 24

FILE = $REQUEST

USERNAME = $USER DATE PLOTTED = $DATE TIME PLOTTED = $TIME

I-080-2(11)43

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CAL.			160	239

DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
X	Sol	80	B	10	10

BRIDGE ENGINEER — CIVIL ENGINEER—LICENSE 5565

DATE APPROVED January 18, 1960

DIVISION OF ENGINEERING SERVICES – GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILES – TOTAL PROJECT	Sheet No.	Total Sheets
04	Sol	12,80	2.3/2.8 12.0/13.1		

CERTIFIED ENGINEER — DATE 9/10/12

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)

LOG OF TEST BORINGS 4 OF 4

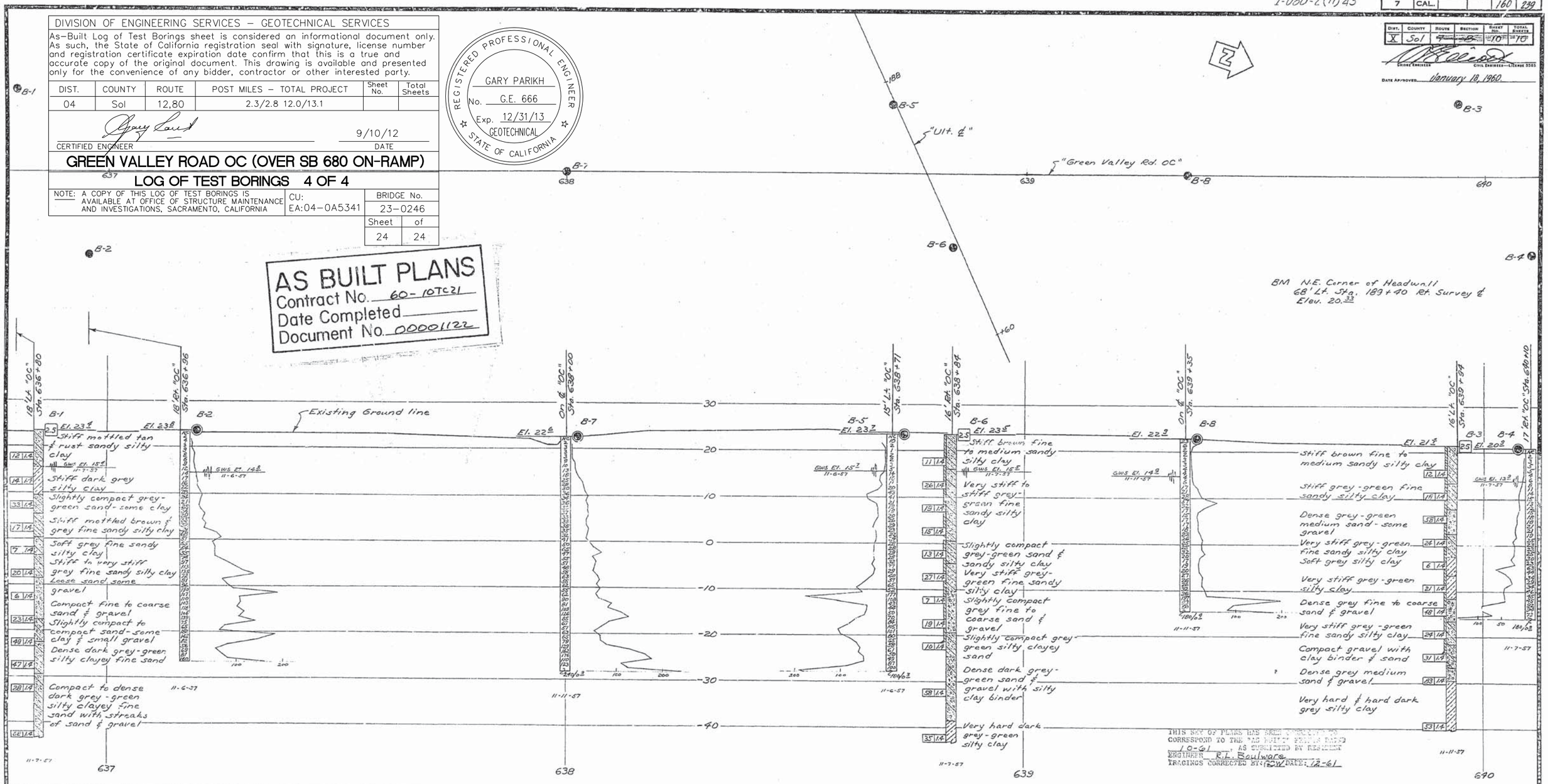
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA

CU: EA:04-0A5341

BRIDGE No. 23-0246

Sheet 24 of 24

AS BUILT PLANS
Contract No. 60-10TC21
Date Completed
Document No. 00001122



BRIDGE DEPARTMENT

FIELD STUDY	Wm. Strawther
DRAWN	M. Aparicio 1-30-58
CHECKED	C. Hinck 2-3-58

Approved Recommended by — Engineering Geologist — Engineering Geology

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

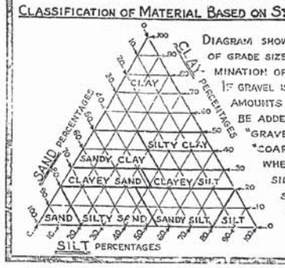


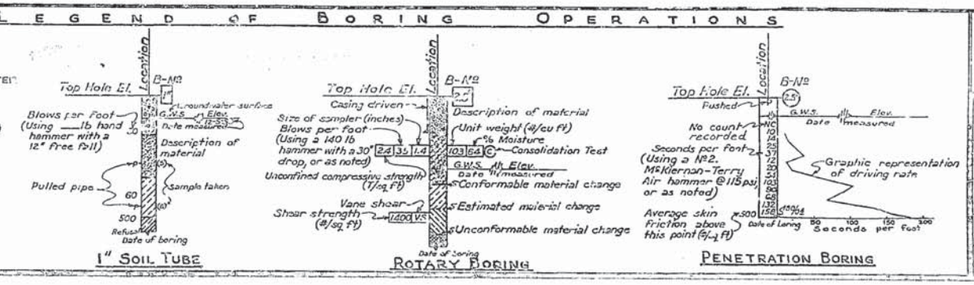
DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES. IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY CLAY OR CLAYEY SAND
- SANDY SILT OR SILTY SAND
- SILTY CLAY OR CLAYEY SILT
- PEAT AND/OR ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- 2½" CONE PENETROMETER
- SAMPLER BORING (L.R.V.)
- ROTARY BORING (W.E.)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT



NOTES

Classification of earth materials as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

GREEN VALLEY ROAD OVERCROSSING

LOG OF TEST BORINGS

SCALE 1" = 10'	BRIDGE 23-138	FILE E-23	DRAWING C-5801-10

PREL. DRAWING No. 1-5801 19

160

APPENDIX III

APPENDIX III
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System (ASTM Test Method D 2488, Visual-Manual Procedure). The classification has been verified with laboratory data as necessary. The classification tests are presented on "Log of Test Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with California Test Method 226 (Moisture Content) and 212 (Unit Weight). This information was used to classify and correlate the soils. The results are presented on Plate III-2A and III-2B.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with California Test Method 204. The results of these tests are presented on Plates III-3, "Plasticity Chart".

Grain Size Classification

Grain size classification tests (California Test Method 202) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plate III-4A and III-4B, "Grain Size Distribution Curves".

Consolidation Tests

Consolidation tests were performed on selected samples in accordance with California Test Method 219. The test resulrs are presented on the Plates III-5A and III-5C.

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-001	1	4.5	SM								59.2	45.5	
	2	9.5	SC	5.6	57.0	37.5					107.8	18.1	
	3	14.5	CL								109.2	19.0	
	4	19.5	CL								-	18.9	
	5	24.5	CL			69.5	35	23	12		100.6	25.0	
	6	29.5	ML	0.0	36.3	63.7					100.1	26.1	
	7	34.5	ML								101.1	23.3	
	8	39.5	SM								-	22.3	
	9	44.5	SM								-	19.6	
	10	49.5	SM								-	20.1	
	11	54.5	SM								-	14.2	
	12	59.5	ML	0.0	37.0	63.0	33	24	9		-	35.9	
	13	69.5	ML								-	27.0	
	14	79.5	SM								103.4	22.3	
	15	89.5	SM								-	27.0	
	16	99.5	SM								-	10.7	

SUMMARY OF LABORATORY TEST RESULTS

GREEN VALLEY ROAD OVERCROSSING (OVER SB 680 ON-RAMP)
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
Practicing in the Geosciences

Notes:
* Unified Soil Classification System
C. = Consolidation D.S. = Direct Shear
G. = Gradation P.I. = Plasticity Index
R. = R-Value U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR | Plate No.: III-2A

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-002	1	4.5	CL								99.8	24.4	
	2	9.5	CL								108.0	20.4	
	3	14.5	SM								108.0	20.0	
	4	19.5	SM	0.0	63.0	37.0					102.5	25.0	
	5	24.5	ML	1.9	47.7	50.5					107.0	21.7	
	6	29.5	ML								92.1	30.1	
	7	34.5	CL-ML								95.3	26.7	
	8	39.5	ML				32	27	5		94.1	29.7	C. - See Plate No: III-5A thru III-5C
	9	44.5	ML	1.3	79.0	19.6					-	34.8	
	10	49.5	ML			50.6					-	28.8	
	11	54.5	ML								91.3	31.6	
	12	59.5	ML								-	27.2	
	13	69.5	SM								101.0	24.2	
	14	79.5	SM								-	14.7	
	15	89.5	SM								-	14.6	
	16	99.5	SM								-	32.3	

SUMMARY OF LABORATORY TEST RESULTS

GREEN VALLEY ROAD OVERCROSSING (OVER SB 680 ON-RAMP)
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
Practicing in the Geosciences

Notes:
* Unified Soil Classification System
C. = Consolidation
D.S. = Direct Shear
G. = Gradation
P.I. = Plasticity Index
R. = R-Value
U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: III-2B

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-003	1	4.5	CL							2.0	98.9	22.9	
	2	9.5	CL				42	18	24		105.4	23.0	C. - See Plate No: III-5D thru III-5F
	3	14.5	SP-SC	23.8	66.4	9.8					-	36.6	
	4	19.5	SM								-	27.7	
	5	24.5	CL							1.0	86.2	35.0	
	6	29.5	SM	0.0	55.8	44.2	32	19	13	1.4	98.5	25.2	
	7	34.5	ML	0.0	49.9	50.1					96.6	27.0	
	8	39.5	SM	0.0	54.0	46.0	30	26	4		90.3	31.3	
	9	44.5	SM								-	15.6	
	10	49.5	SW-SM	16.7	72.4	10.9					-	16.8	
	11	54.5	SM	26.8	45.9	27.3					-	24.2	
	12	59.5	SM								-	18.0	
	13	69.5	ML								-	29.1	
	14	79.5	SM								-	21.0	
	15	89.5	SM								-	29.9	
	16	99.5	SM								-	18.0	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

PARIKH

Practicing in the Geosciences

Notes:

* Unified Soil Classification System

C. = Consolidation D.S. = Direct Shear

G. = Gradation P.I. = Plasticity Index

R. = R-Value U.C. = Unconf. Compression

Corr. = Corrosion

Job No.: 209130.GDR Plate No.: III-2C

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-003A	1	5.0	CL								-	-	
	2	10.0	CL								-	-	Corr. - See Plate No: B-7A
	3	13.0	SM	0.9	80.1	19.0					-	27.5	
	4	16.0	SM								-	-	
	5	20.0	SM								-	-	
	6	25.0	ML	0.0	34.7	65.3	37	27	10		-	36.2	
	7	30.0	SM								-	-	
	8	35.0	SM	7.3	43.8	48.9	33	28	5		-	28.8	
	9	38.0	SM								-	-	
	10	41.0	SM								-	-	
	11	44.0	SM								-	-	
	12	47.0	SM								-	-	
	13	50.0	ML				49	29	20		-	42.6	
	14	53.0	ML	0.3	10.8	88.9					-	37.4	
	15	56.0	CL	0.0	13.5	86.5	41	23	18		-	25.8	
	16	59.0	CL								-	-	
	17	62.0	CL								-	-	
	18	65.0	ML	0.0	29.7	70.3	37	30	7		-	33.7	
	19	68.0	ML								-	-	
	20	71.0	ML								-	-	
	21	74.0	SM	0.0	56.8	43.2					-	33.0	
	22	77.0	SM								-	-	
	23	80.0	SM								-	-	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

PARIKH

Practicing in the Geosciences

Notes:

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G. = Gradation P.I. = Plasticity Index

R. = R-Value U.C. = Unconf. Compression

Corr. = Corrosion

Job No.: 209130.GDR Plate No.: III-2D

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-133	1	2.0	CH								97.5	26.3	
	2	5.0	CL								104.5	20.6	
	3	10.0	CL				36	16	20		110.0	19.4	C. - See Plate No:III-5G thru III-5I
	4	15.0	SM	0.3	64.6	35.1					98.8	23.3	
	5	20.0	CL								-	26.4	
	6	25.0	CL				45	21	24	5.5	103.4	22.6	
	7	30.0	CL								101.8	25.7	
	8	35.0	CL								100.3	23.4	
	9	40.0	CL								99.5	25.7	
	10	45.0	SC	3.4	73.8	22.8					101.5	25.8	
	11	50.0	SM								-	27.1	
	12	55.0	SC								-	17.7	
	13	60.0	SM	0.0	82.7	17.3					87.3	30.6	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

PARIKH

Practicing in the Geosciences

Notes:

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G. = Gradation P.I. = Plasticity Index

R. = R-Value U.C. = Unconf. Compression

Corr. = Corrosion

Job No.: 209130.GDR Plate No.: III-2F

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-133A	1	5.0	CL								-	-	Corr. - See Plate No: B-7K
	2	10.0	CL								-	-	
	3	13.0	CL								-	-	
	4	16.0	CL								-	-	
	5	20.0	CL								-	-	
	6	25.0	CL								-	-	
	7	30.0	CL								-	-	
	8	35.0	CL	0.3	42.9	56.8	38	20	18		-	25.2	
	9	40.0	CL								-	-	
	10	43.0	SM	0.3	59.8	39.8	32	25	7		-	35.1	
	11	46.0	SM								-	-	
	12	49.0	SM	0.0	65.0	35.0	35	29	6		-	36.3	
	13	52.0	SP-SM								-	-	
	14	55.0	SP-SM								-	-	
	15	58.0	ML								-	-	
	16	61.0	SM								-	-	
	17	64.0	SM								-	-	
	18	70.0	ML	1.1	25.8	73.2	41	28	13		-	26.5	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

PARIKH

Practicing in the Geosciences

Notes:

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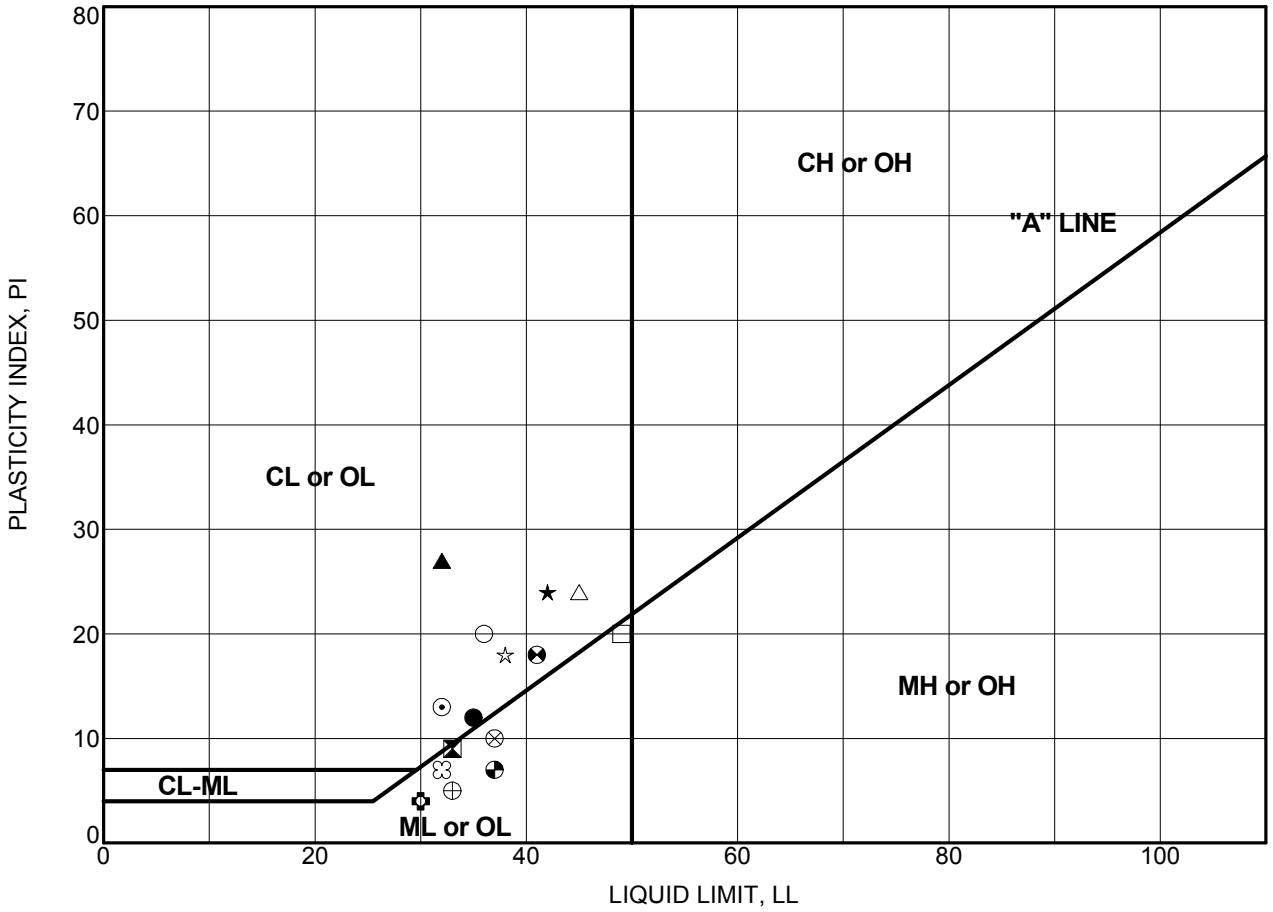
R. = R-Value U.C. = Unconf. Compression

Corr. = Corrosion

Job No.: 209130.GDR Plate No.: III-2G



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-001	MC-5	24.5	●	25	35	23	12	SANDY LEAN CLAY (CL)
A-09-001	SPT-12	59.5	⧗	36	33	24	9	SANDY SILT (ML)
A-09-002	MC-8	39.5	▲	30	32	5	27	SANDY SILT (ML)
A-09-003	MC-2	9.5	★	23	42	18	24	LEAN CLAY WITH SAND (CL)
A-09-003	MC-6	29.5	⊙	25	32	19	13	SILTY SAND (SM)
A-09-003	MC-8	39.5	✿	31	30	26	4	SILTY SAND (SM)
A-09-133	MC-3	10.0	○	19	36	16	20	SANDY LEAN CLAY (CL)
A-09-133	MC-6	25.0	△	23	45	21	24	LEAN CLAY (CL)
R-10-003A	SPT-6	25.0	⊗	36	37	27	10	SANDY SILT (ML)
R-10-003A	SPT-8	35.0	⊕	29	33	28	5	SILTY SAND (SM)
R-10-003A	SPT-13	50.0	□	43	49	29	20	SILT (ML)
R-10-003A	SPT-15	56.0	⊗	26	41	23	18	LEAN CLAY (CL)
R-10-003A	SPT-18	65.0	◕	34	37	30	7	SILT WITH SAND (ML)
R-10-133A	SPT-8	35.0	☆	25	38	20	18	SANDY LEAN CLAY (CL)
R-10-133A	SPT-10	43.0	⌘	35	32	25	7	SILTY SAND (SM)

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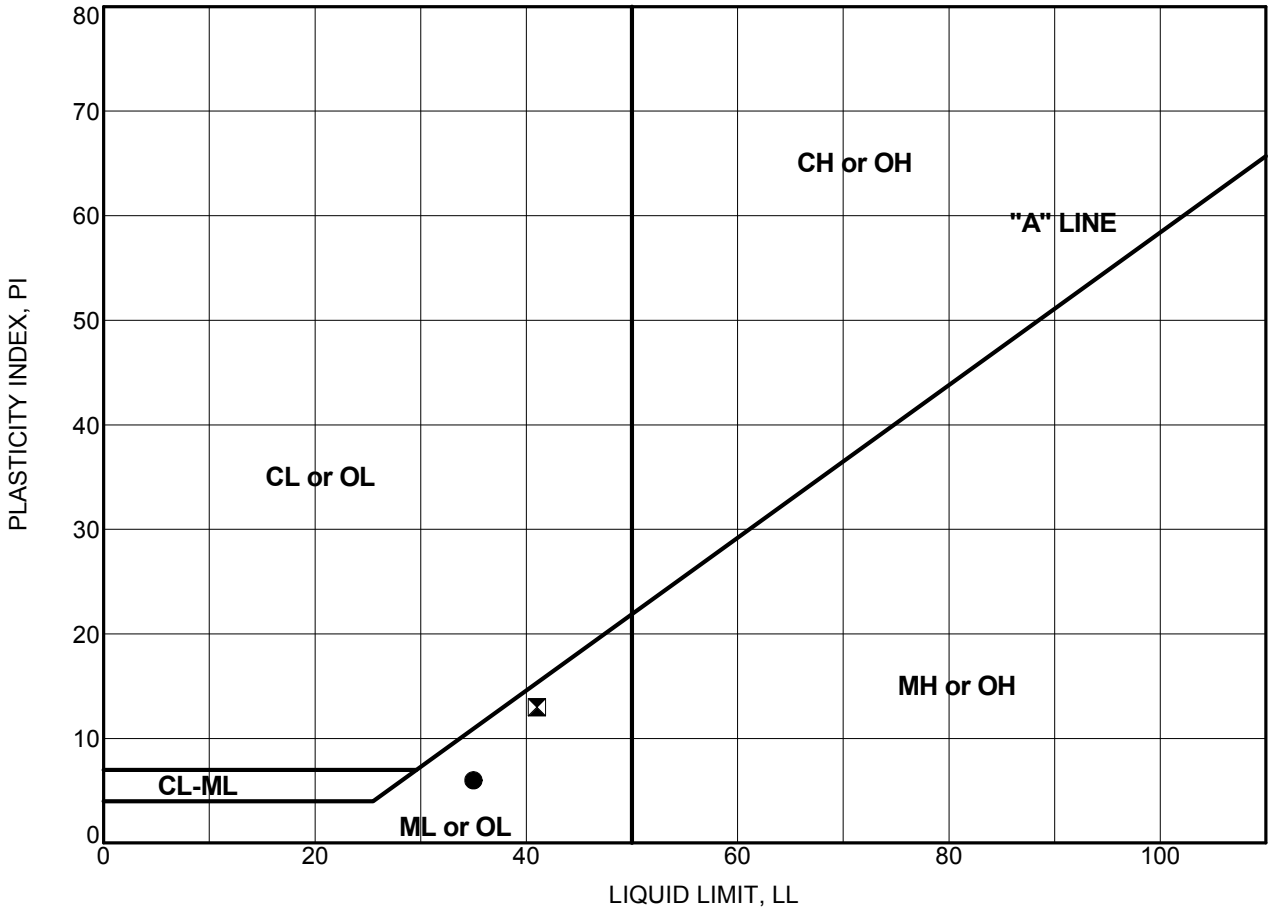
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR | PLATE NO: III-3A



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
R-10-133A	SPT-12	49.0	●	36	35	29	6	SILTY SAND (SM)
R-10-133A	SPT-18	70.0	⧗	27	41	28	13	SILT WITH SAND (ML)

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GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

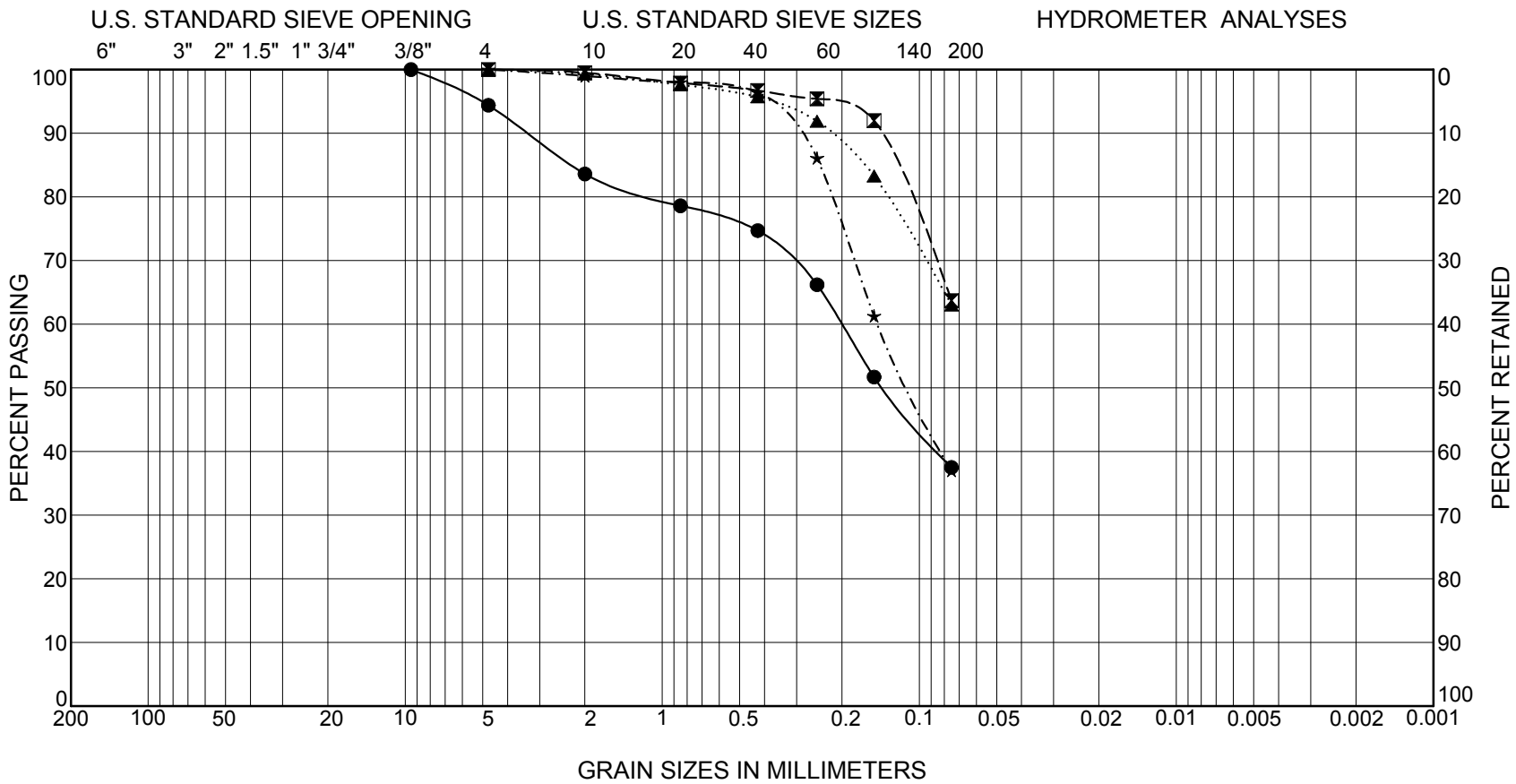
GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: III-3B

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-001	MC-2	9.5	●			CLAYEY SAND (SC)
A-09-001	MC-6	29.5	⧓			SANDY SILT (ML)
A-09-001	SPT-12	59.5	▲	33	9	SANDY SILT (ML)
A-09-002	MC-4	19.5	★			SILTY SAND (SM)

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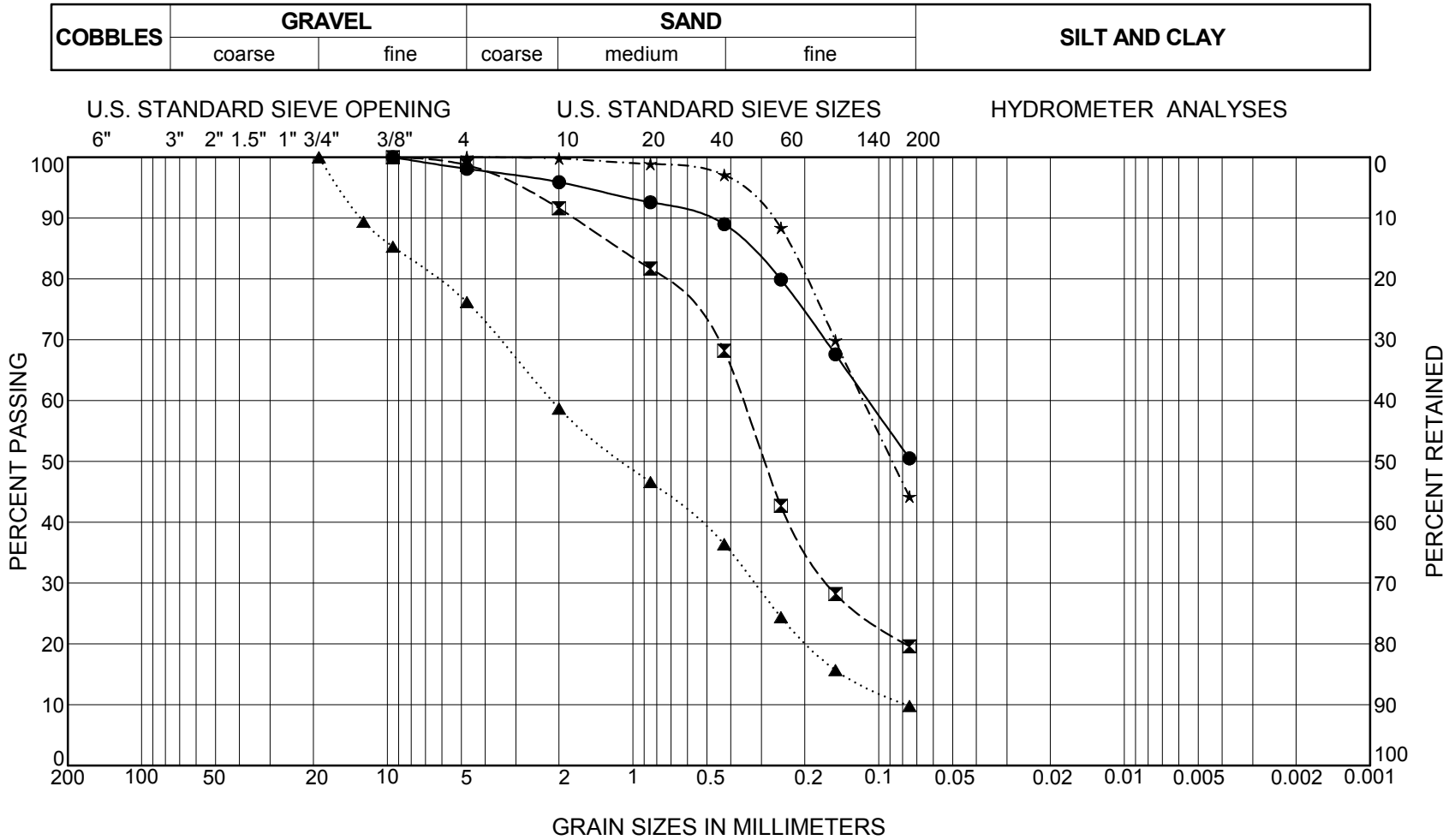
MATERIALS ENGINEERING

JOB NO: 2009-130-GDR

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

PLATE NO: III-4A

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-002	MC-5	24.5	●			SANDY SILT (ML)
A-09-002	SPT-9	44.5	⧗			SILTY SAND (SM)
A-09-003	MC-3	14.5	▲			POORLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC)
A-09-003	MC-6	29.5	★	32	13	SILTY SAND (SM)

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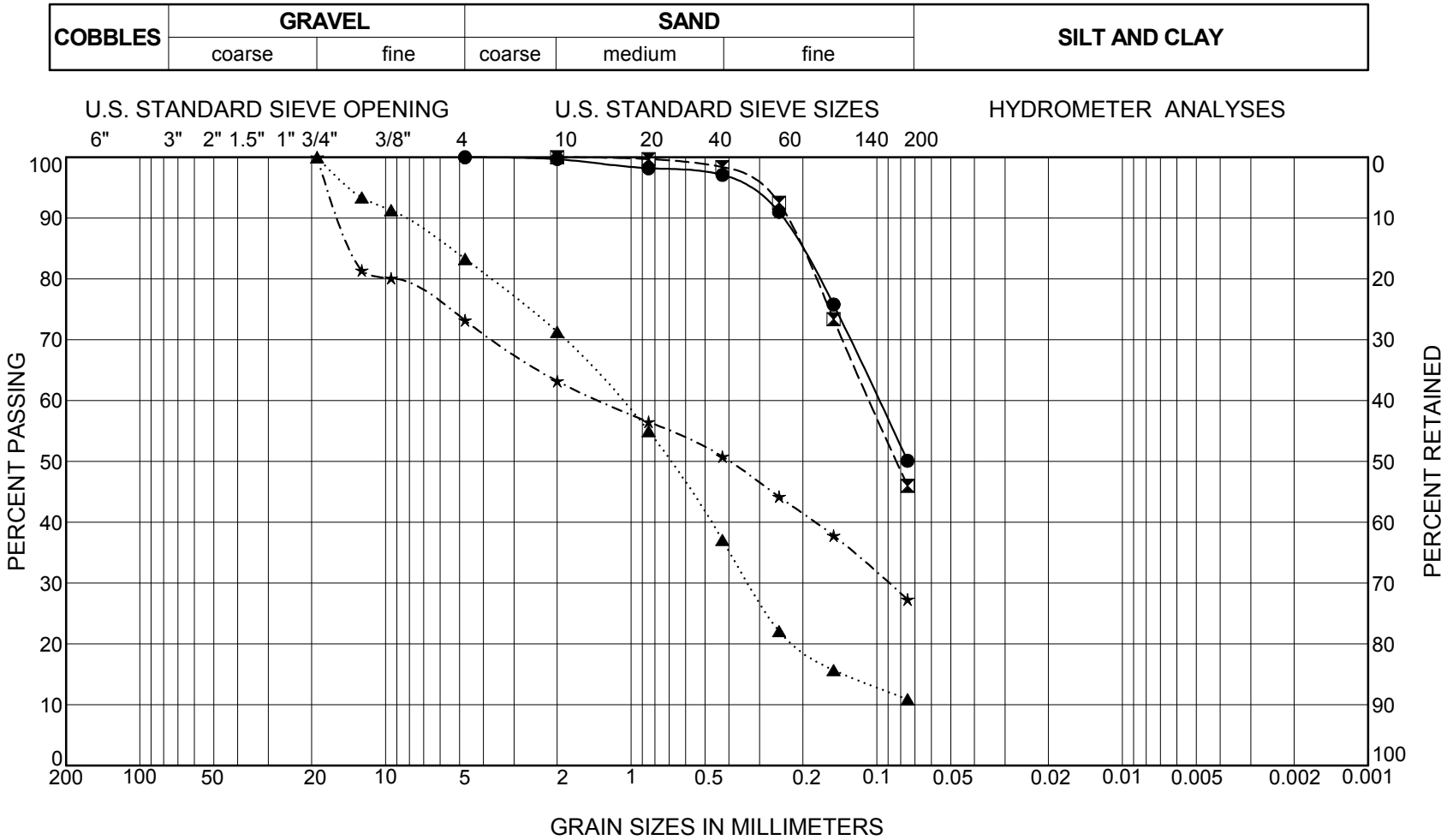
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: III-4B

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-003	MC-7	34.5	●			SANDY SILT (ML)
A-09-003	MC-8	39.5	⧗	30	4	SILTY SAND (SM)
A-09-003	MC-10	49.5	▲			WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)
A-09-003	MC-11	54.5	★			SILTY SAND WITH GRAVEL (SM)

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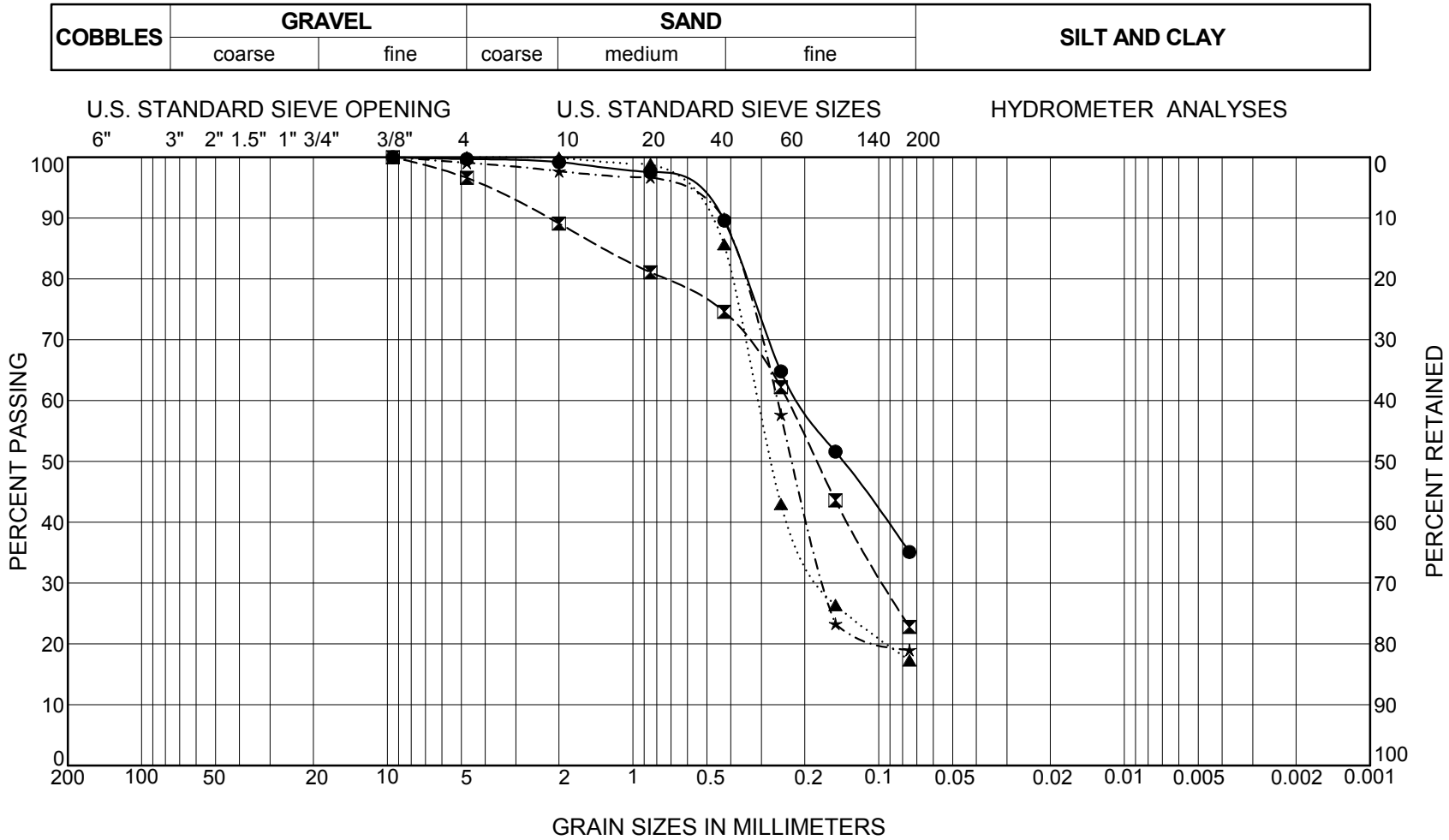
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: III-4C

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-133	MC-4	15.0	●			SILTY SAND (SM)
A-09-133	MC-10	45.0	⊠			CLAYEY SAND (SC)
A-09-133	MC-13	60.0	▲			SILTY SAND (SM)
R-10-003A	SPT-3	13.0	★			SILTY SAND (SM)

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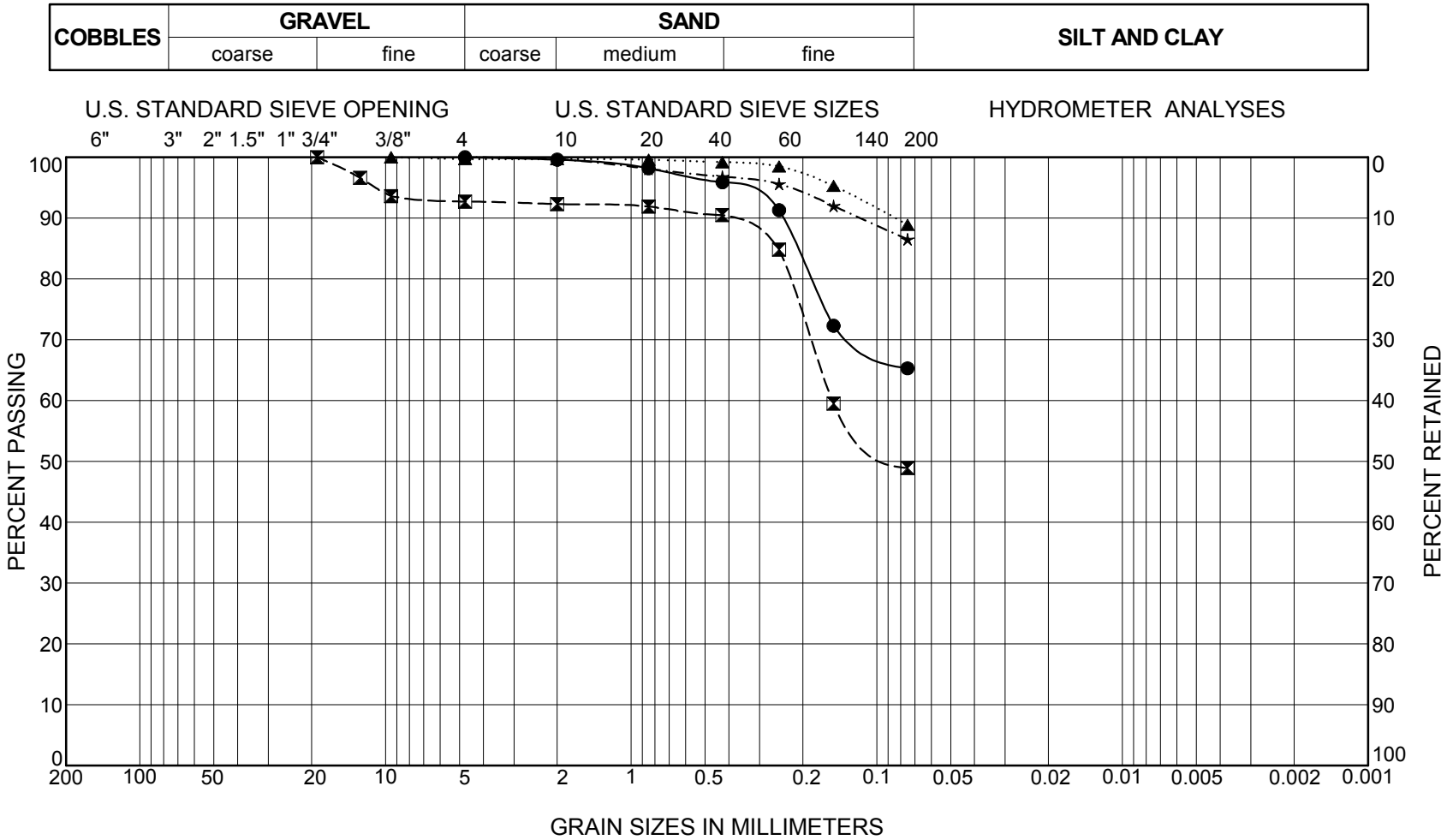
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: III-4D

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-003A	SPT-6	25.0	●	37	10	SANDY SILT (ML)
R-10-003A	SPT-8	35.0	⊠	33	5	SILTY SAND (SM)
R-10-003A	SPT-14	53.0	▲			SILT (ML)
R-10-003A	SPT-15	56.0	★	41	18	LEAN CLAY (CL)

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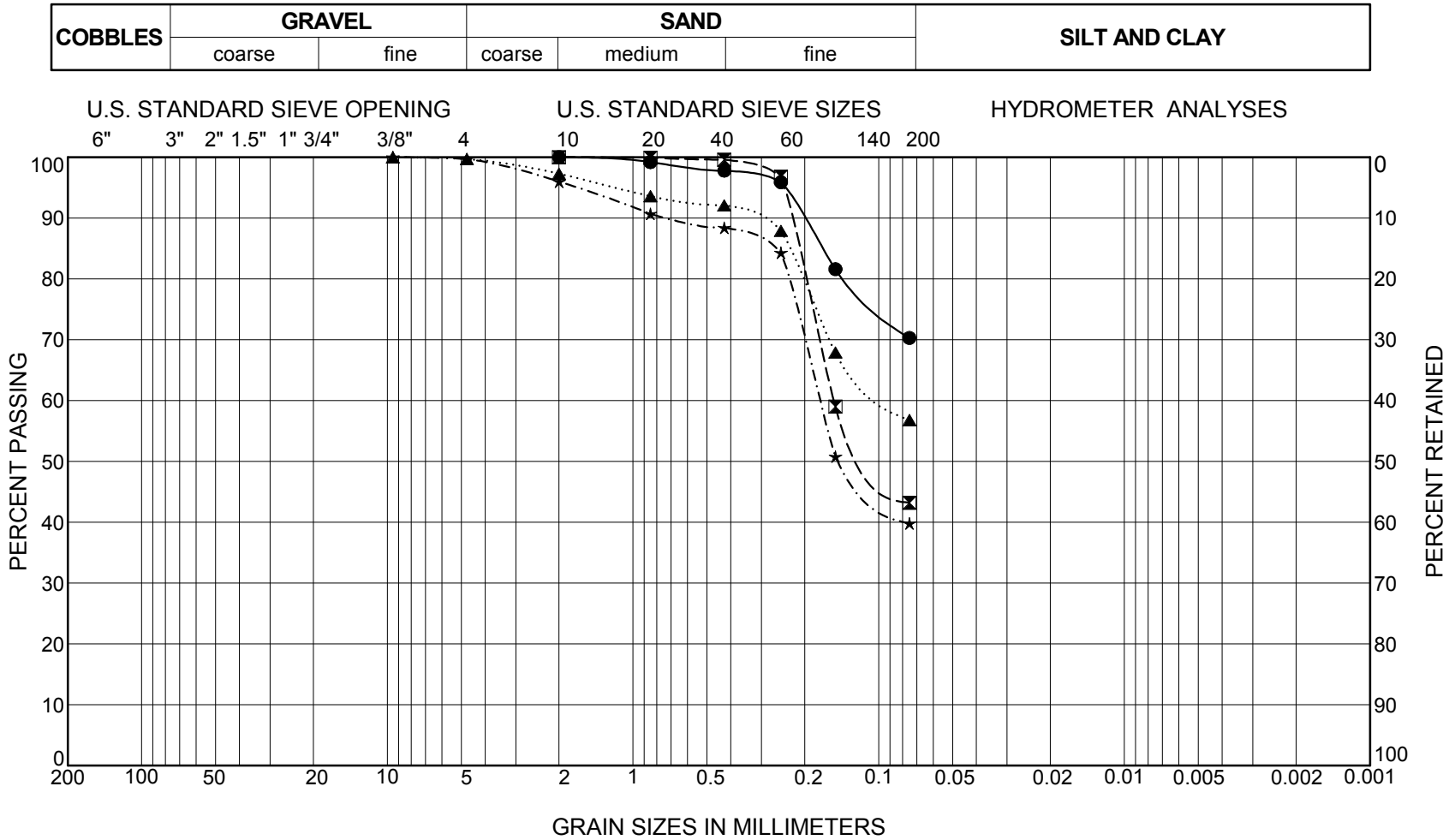
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: III-4E

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-003A	SPT-18	65.0	●	37	7	SILT WITH SAND (ML)
R-10-003A	SPT-21	74.0	⊠			SILTY SAND (SM)
R-10-133A	SPT-8	35.0	▲	38	18	SANDY LEAN CLAY (CL)
R-10-133A	SPT-10	43.0	★	32	7	SILTY SAND (SM)

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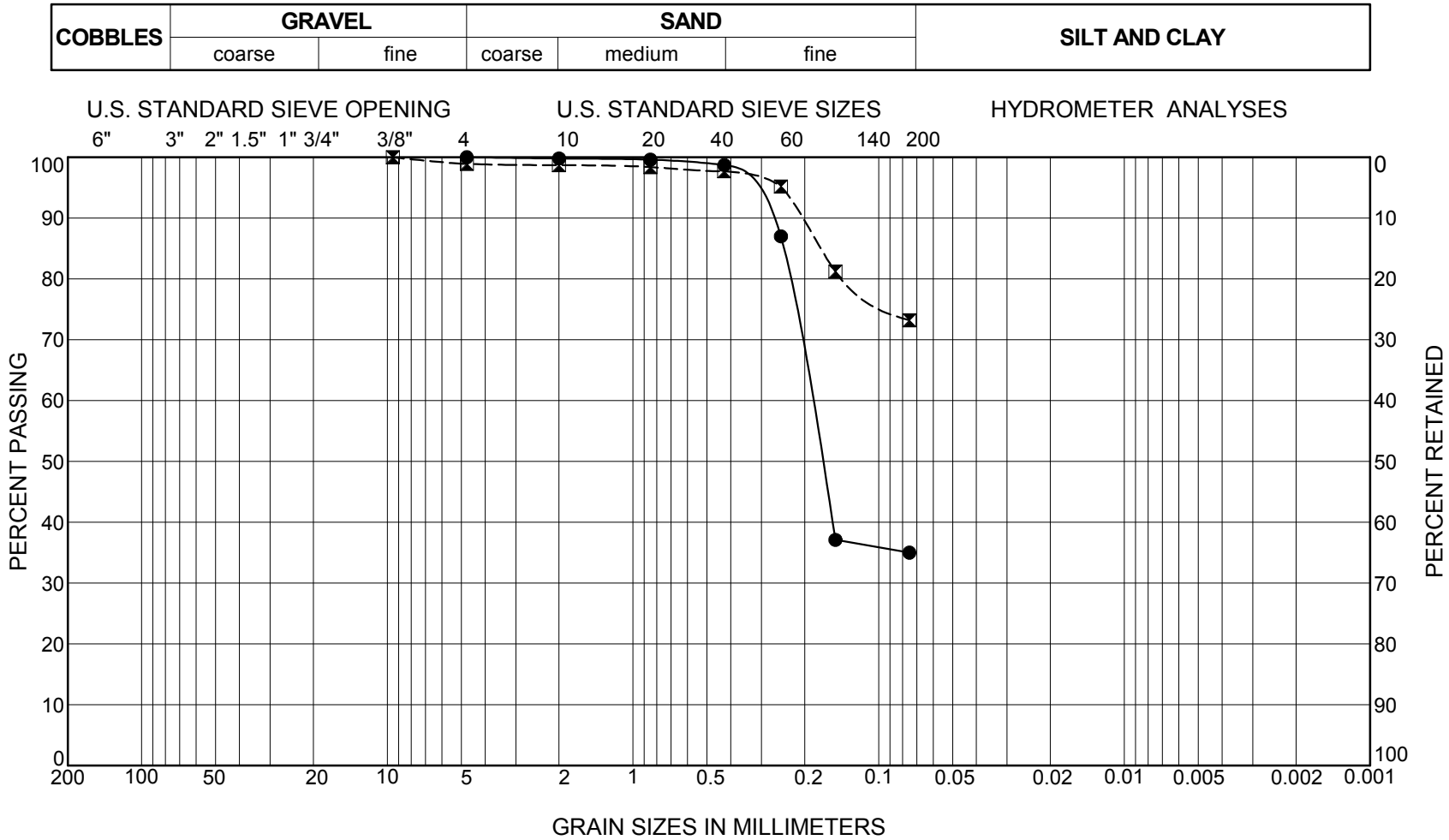
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: III-4F

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-133A	SPT-12	49.0	●	35	6	SILTY SAND (SM)
R-10-133A	SPT-18	70.0	⧗	41	13	SILT WITH SAND (ML)

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MATERIALS ENGINEERING

JOB NO: 2009-130-GDR

GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

PLATE NO: III-4G

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID :A-09-005 #1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115376.

EVALUATION FOR SOIL CORROSION

Soil pH	8.67		
Minimum Resistivity	0.19 ohm-cm (x1000)		
Chloride	2114.8 ppm	00.21148	%
Sulfate	142.3 ppm	00.01423	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
NOV 18 2009
By

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/02/2009
Date Submitted 11/23/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GRD-RTE680 Site ID : A-09-137 #2 @ 4.5.
Thank you for your business.

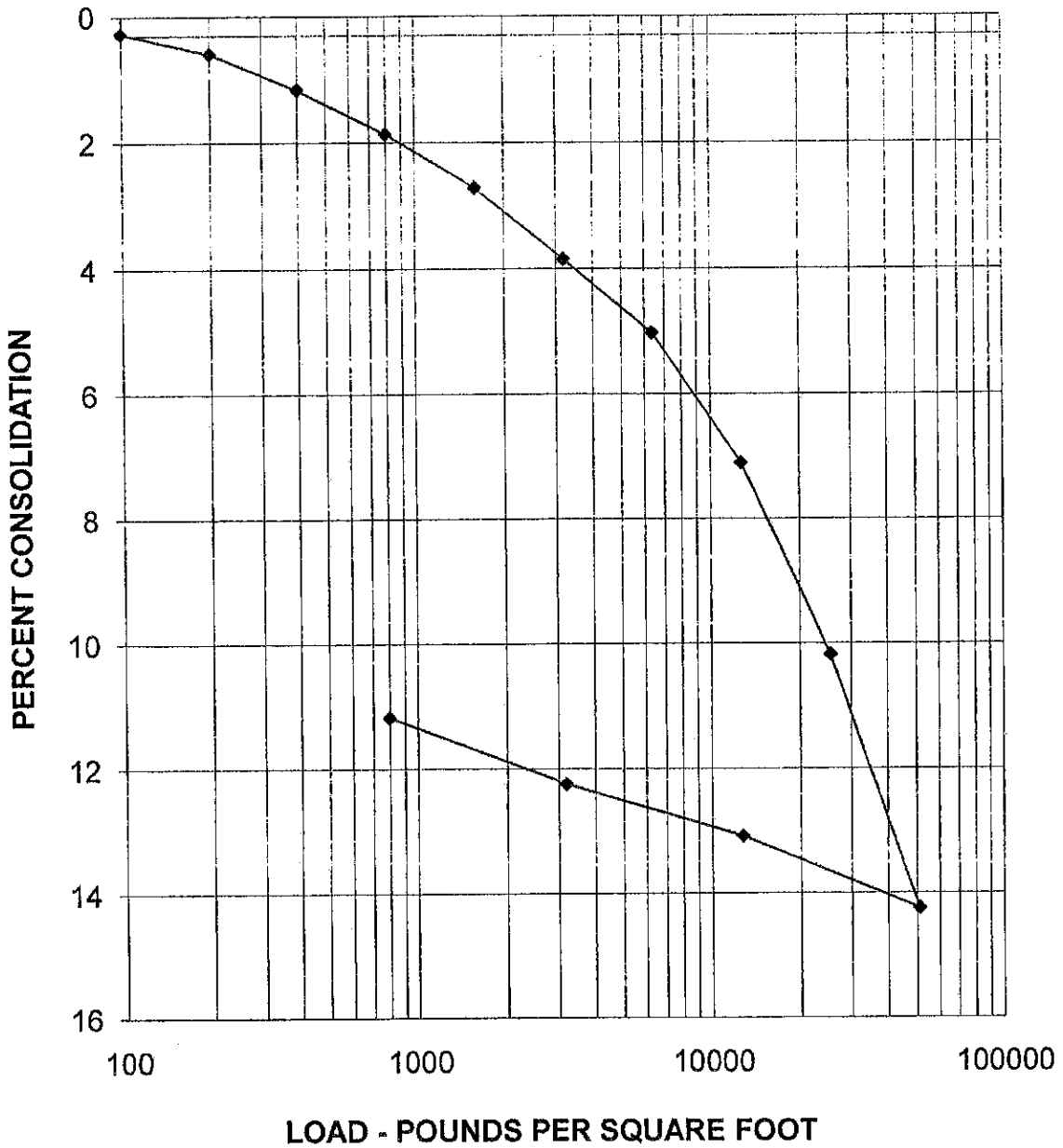
* For future reference to this analysis please use SUN # 57095-115608.

EVALUATION FOR SOIL CORROSION

Soil pH	7.52	
Minimum Resistivity	0.22 ohm-cm (x1000)	
Chloride	1167.3 ppm	00.11673 %
Sulfate	576.4 ppm	00.05764 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	29.7	94.1	1.0000	2.416
FINAL	24.1	106.0	0.8883	2.416

BORING NO.	B002	SAMPLE NO.	8	ELEV. OR DEPTH	39.5'
DESCRIPTION	Silt, Gray				

PARIKH CONSULTANTS, INC.
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MATERIALS ENGINEERING

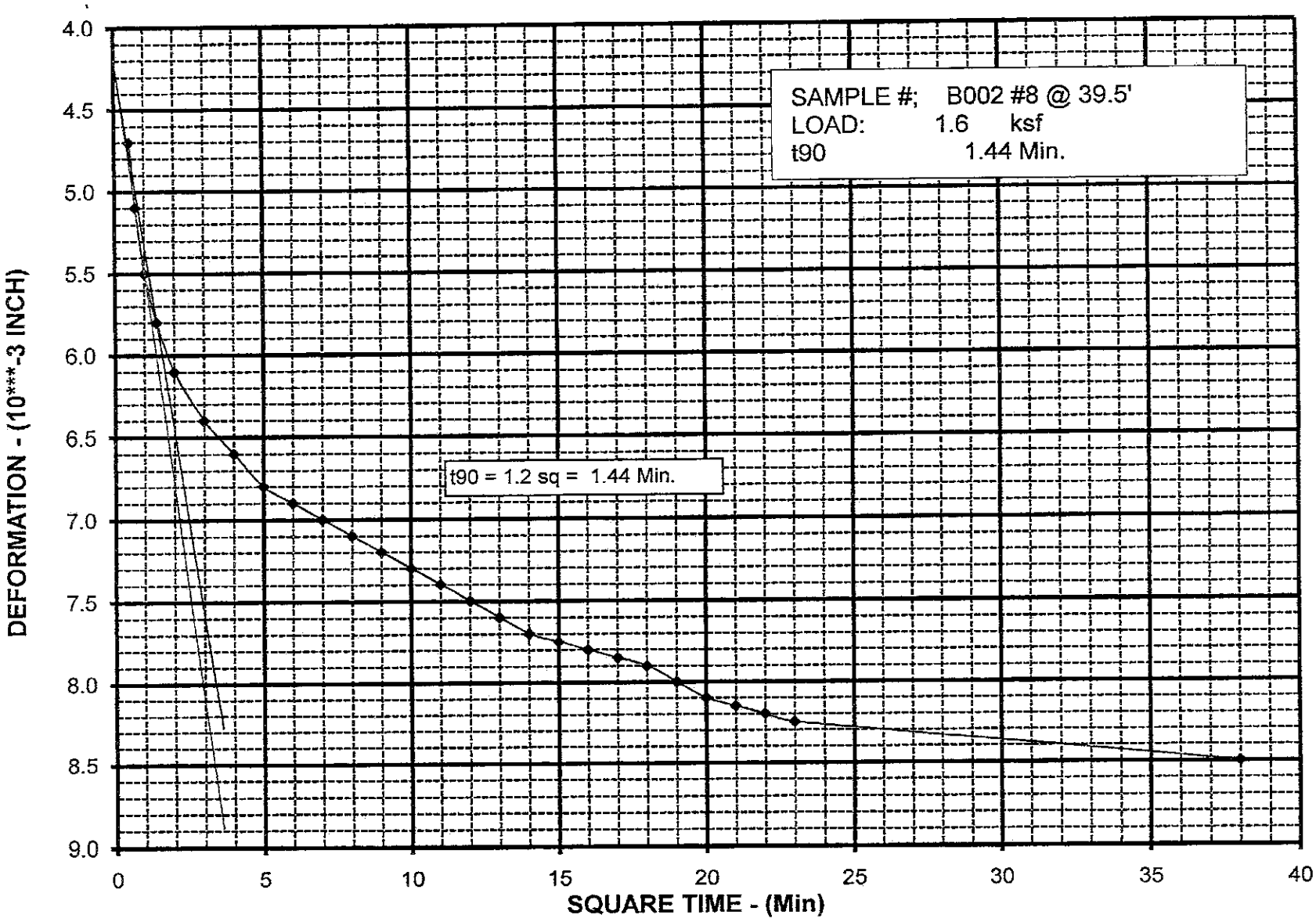
Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/20/2009	209130.GDR

Reported by: Prav Dayah

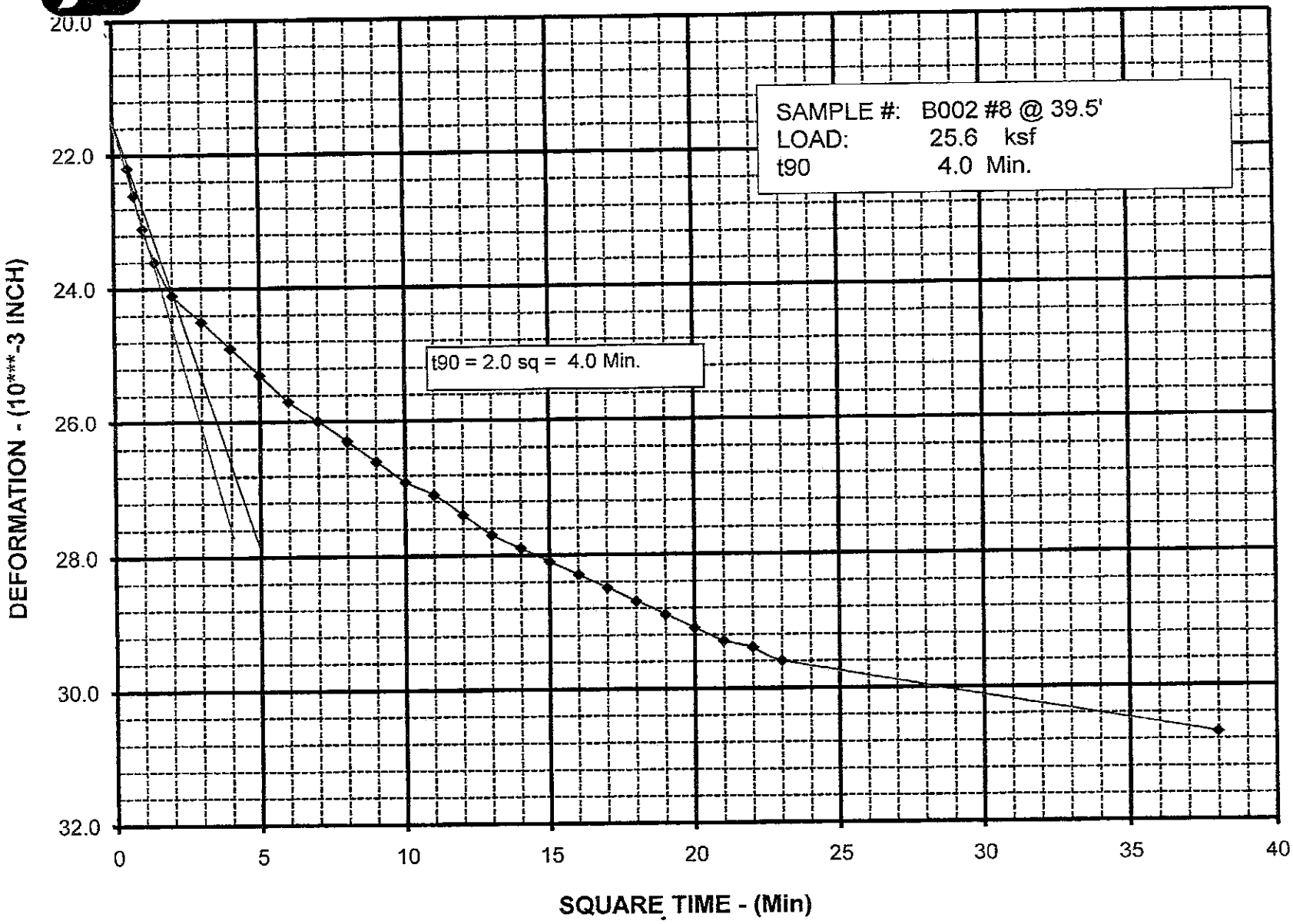
CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

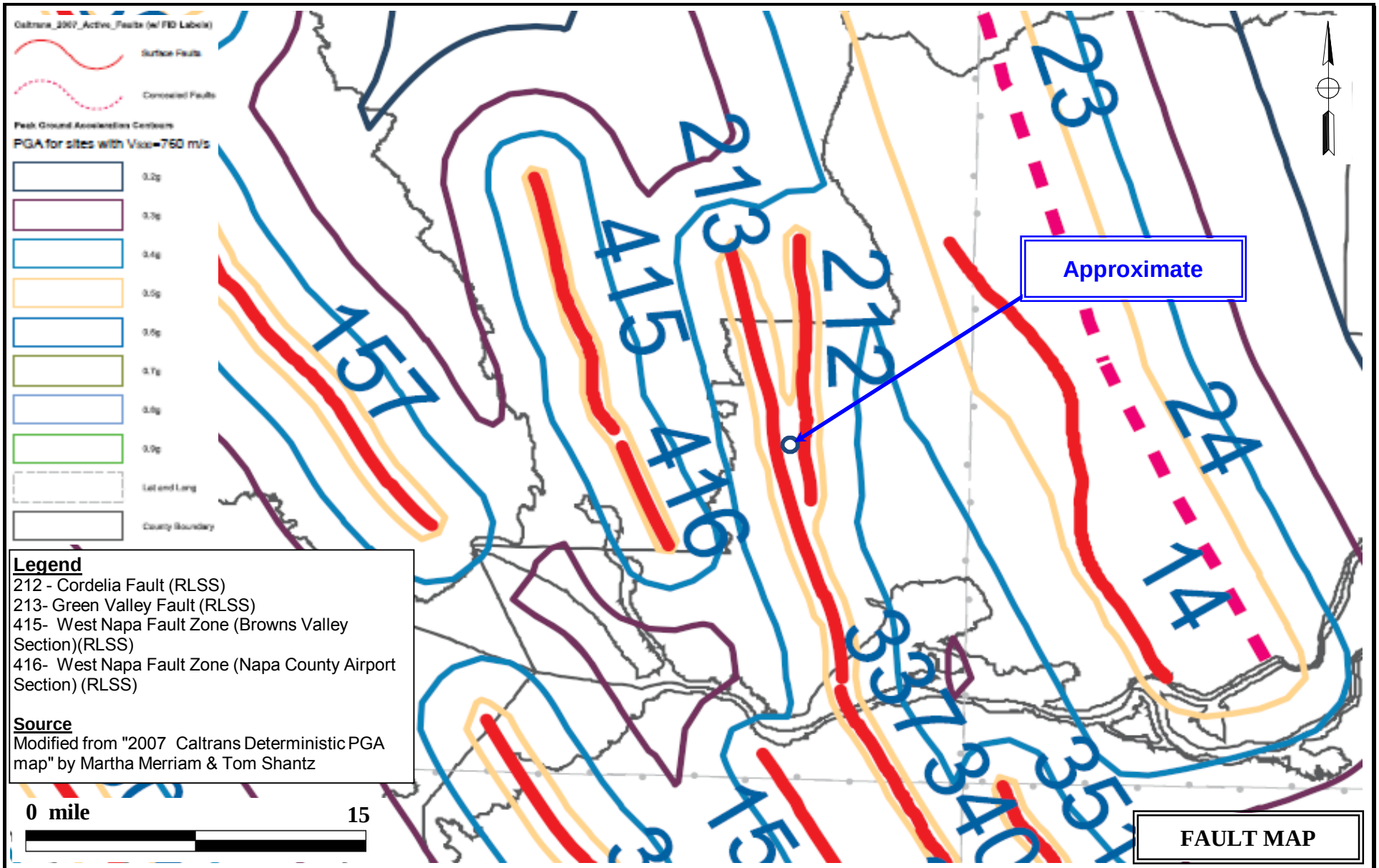


CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR



APPENDIX IV



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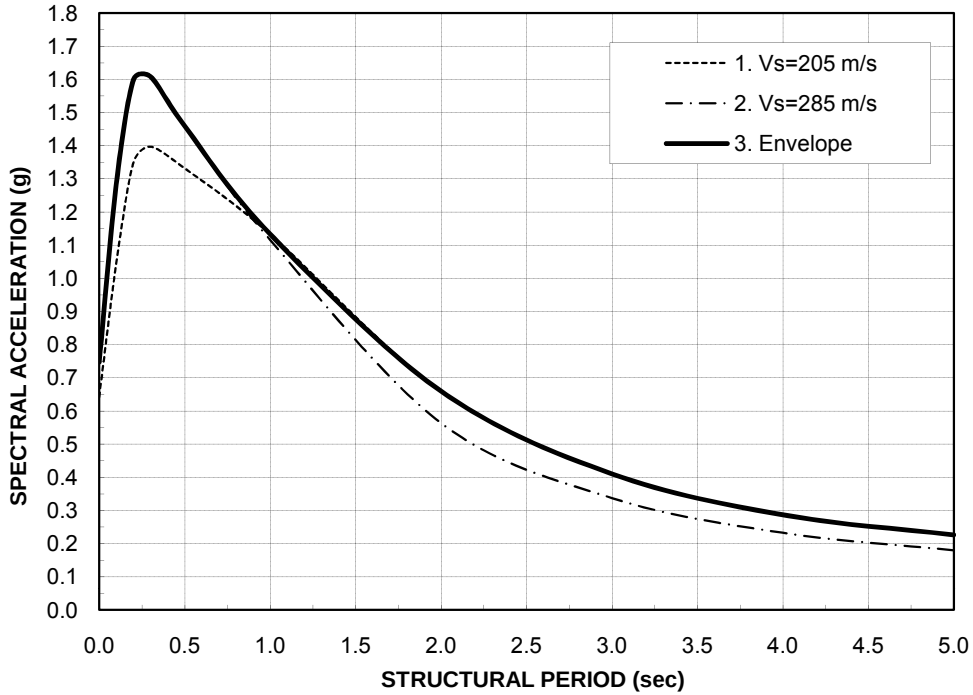
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.: IV-1

ARS DESIGN CURVE
GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA



Period (sec)	Spectral Accel. (g)	
	1. Vs=205 m/s	2. Vs=285 m/s
0.000	0.642	0.748
0.100	1.045	1.284
0.200	1.349	1.599
0.300	1.397	1.609
0.500	1.332	1.460
1.000	1.134	1.116
2.000	0.659	0.563
3.000	0.410	0.337
4.000	0.287	0.232
5.000	0.226	0.179

Site Location: 38.21537755 N/122.1383357 W
Seismic design criteria is governed by USGS 2008 Deaggregation (beta)
1. Vs=205 m/s (liquefiable soils modeled as clay with residual strength per Seed & Harder (1990)
2. Vs=285 m/s (non-liquefied case)
3. Recommended Design Curve = Envelope of above two curves

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GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

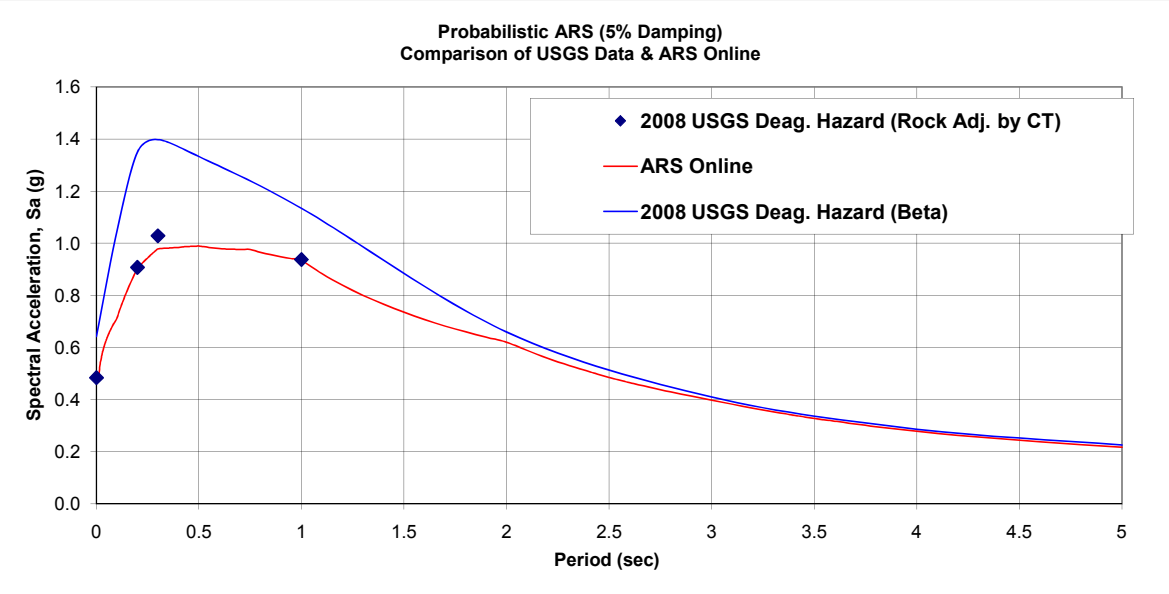
JOB NO.: 2009-130-GDR

PLATE NO.: IV-2

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
38.2154	-122.1383
V_{S30} (m/s) =	205
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	6.2
$Z_{1.0}$ (m) =	0
$Z_{2.5}$ (km) =	0



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.482	1	1	0.482
0.02	0.542	1	1	0.542
0.022	0.55	1	1	0.55
0.025	0.562	1	1	0.562
0.029	0.577	1	1	0.577
0.03	0.58	1	1	0.58
0.032	0.586	1	1	0.586
0.035	0.595	1	1	0.595
0.036	0.598	1	1	0.598
0.04	0.609	1	1	0.609
0.042	0.614	1	1	0.614
0.044	0.618	1	1	0.618
0.045	0.621	1	1	0.621
0.046	0.623	1	1	0.623
0.048	0.627	1	1	0.627
0.05	0.632	1	1	0.632
0.055	0.642	1	1	0.642
0.06	0.651	1	1	0.651
0.065	0.66	1	1	0.66
0.067	0.664	1	1	0.664
0.07	0.668	1	1	0.668
0.075	0.676	1	1	0.676
0.08	0.684	1	1	0.684
0.085	0.691	1	1	0.691
0.09	0.697	1	1	0.697
0.095	0.704	1	1	0.704
0.1	0.71	1	1	0.71
0.11	0.734	1	1	0.734
0.12	0.756	1	1	0.756
0.13	0.777	1	1	0.777
0.133	0.783	1	1	0.783
0.14	0.798	1	1	0.798
0.15	0.817	1	1	0.817
0.16	0.835	1	1	0.835
0.17	0.853	1	1	0.853
0.18	0.87	1	1	0.87
0.19	0.887	1	1	0.887
0.2	0.903	1	1	0.903
0.22	0.92	1	1	0.92
0.24	0.936	1	1	0.936
0.25	0.943	1	1	0.943

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.695	1.000	0.696	1.000	0.484	0.482	0.5%
0.2	1.720	1.000	0.527	1.000	0.907	0.903	0.5%
0.3	1.444	1.000	0.712	1.000	1.029	0.978	4.9%
1	0.510	1.200	1.533	1.000	0.937	0.934	0.4%

Max % Difference = 4.9%

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

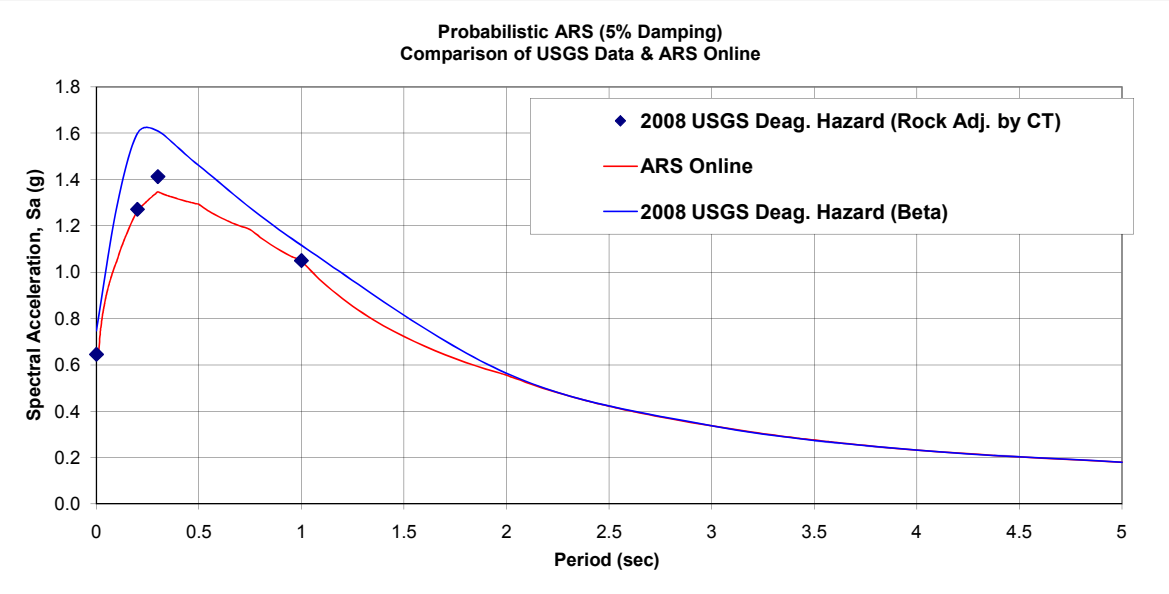
Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.6419	1.000	1.000	0.642	0.482	24.9%
0.1	1.0449	1.000	1.000	1.045	0.71	32.1%
0.2	1.3489	1.000	1.000	1.349	0.903	33.1%
0.3	1.3974	1.000	1.000	1.397	0.978	30.0%
0.5	1.3322	1.000	1.000	1.332	0.989	25.8%
1	0.9447	1.200	1.000	1.134	0.934	17.6%
2	0.5495	1.200	1.000	0.659	0.62	6.0%
3	0.3418	1.200	1.000	0.410	0.398	3.0%
4	0.2389	1.200	1.000	0.287	0.278	3.0%
5	0.1883	1.200	1.000	0.226	0.217	4.0%

Max % Difference = 25.8%

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
38.2154	-122.1383
V_{S30} (m/s) =	285
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	6.2
$Z_{1.0}$ (m) =	0
$Z_{2.5}$ (km) =	0



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.643	1	1	0.643
0.02	0.744	1	1	0.744
0.022	0.76	1	1	0.76
0.025	0.781	1	1	0.781
0.029	0.806	1	1	0.806
0.03	0.811	1	1	0.811
0.032	0.823	1	1	0.823
0.035	0.838	1	1	0.838
0.036	0.843	1	1	0.843
0.04	0.862	1	1	0.862
0.042	0.871	1	1	0.871
0.044	0.88	1	1	0.88
0.045	0.884	1	1	0.884
0.046	0.888	1	1	0.888
0.048	0.897	1	1	0.897
0.05	0.904	1	1	0.904
0.055	0.923	1	1	0.923
0.06	0.94	1	1	0.94
0.065	0.956	1	1	0.956
0.067	0.962	1	1	0.962
0.07	0.971	1	1	0.971
0.075	0.986	1	1	0.986
0.08	0.999	1	1	0.999
0.085	1.012	1	1	1.012
0.09	1.024	1	1	1.024
0.095	1.036	1	1	1.036
0.1	1.048	1	1	1.048
0.11	1.075	1	1	1.075
0.12	1.101	1	1	1.101
0.13	1.125	1	1	1.125
0.133	1.132	1	1	1.132
0.14	1.148	1	1	1.148
0.15	1.169	1	1	1.169
0.16	1.19	1	1	1.19
0.17	1.21	1	1	1.21
0.18	1.229	1	1	1.229
0.19	1.247	1	1	1.247
0.2	1.264	1	1	1.264
0.22	1.283	1	1	1.283
0.24	1.3	1	1	1.3
0.25	1.308	1	1	1.308

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.695	1.000	0.928	1.000	0.645	0.643	0.4%
0.2	1.720	1.000	0.739	1.000	1.272	1.264	0.6%
0.3	1.444	1.000	0.978	1.000	1.413	1.346	4.7%
1	0.510	1.200	1.717	1.000	1.050	1.046	0.4%

Max % Difference = 4.7%

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.7477	1.000	1.000	0.748	0.643	14.0%
0.1	1.2835	1.000	1.000	1.284	1.048	18.3%
0.2	1.5989	1.000	1.000	1.599	1.264	20.9%
0.3	1.609	1.000	1.000	1.609	1.346	16.3%
0.5	1.4599	1.000	1.000	1.460	1.292	11.5%
1	0.9299	1.200	1.000	1.116	1.046	6.3%
2	0.4695	1.200	1.000	0.563	0.555	1.5%
3	0.2809	1.200	1.000	0.337	0.337	0.0%
4	0.1935	1.200	1.000	0.232	0.232	0.1%
5	0.14957	1.200	1.000	0.179	0.18	0.3%

Max % Difference = 11.5%

Liquefaction Analysis Results

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-001***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	1	20	MC	562.5	563	0.99	0.45	13.0	0.92	1.00	1.0	1.05	12.5	1.49	18.6		18.6		1.00	1	
2	9.5	1	12	MC	1187.5	1188	0.98	0.45	7.8	0.92	1.00	1.0	1.05	7.5	1.23	9.2	38%	16.0	0.17	1.00	1	(0.47)
3	14.5	2	50	MC	1812.5	1531	0.97		32.5	0.92	1.00	1.0	1.05	31.3	1.12	35.0				1.00	1	
4	19.5	2	38	MC	2437.5	1844	0.96		24.7	0.92	1.00	1.0	1.05	23.8	1.04	24.6				1.00	1	
5	24.5	2	36	MC	3062.5	2156	0.94		23.4	0.92	1.00	1.0	1.05	22.5	0.97	21.8				0.97	1	
6	29.5	1	25	MC	3687.5	2469	0.92	0.63	16.3	0.92	1.00	1.0	1.05	15.6	0.90	14.1	64%	22.0	0.24	0.93	1	(0.44)
7	34.5	1	100	MC	4312.5	2781	0.89	0.63	65.0	0.92	1.00	1.0	1.05	62.6	0.85	53.1		53.1		0.88	1	NON-LIQ.
8	39.5	1	100	SPT	4937.5	3094	0.86	0.62	100.0	0.92	1.00	1.2	1.05	115.5	0.80	92.5		92.5		0.84	1	NON-LIQ.
9	44.5	1	100	SPT	5562.5	3406	0.81	0.60	100.0	0.92	1.00	1.2	1.05	115.5	0.76	87.5		87.5		0.81	1	NON-LIQ.
10	49.5	1	100	SPT	6187.5	3719	0.76	0.57	100.0	0.92	1.00	1.2	1.05	115.5	0.72	83.1		83.1		0.78	1	NON-LIQ.
11	54.5	1	69	SPT	6812.5	4031	0.71	0.54	69.0	0.92	1.00	1.2	1.05	79.7	0.68	54.5		54.5		0.76	1	NON-LIQ.
12	59.5	1	11	SPT	7437.5	4344	0.66	0.52	11.0	0.92	1.00	1.2	1.05	12.7	0.65	8.3	63%	14.9	0.16	0.81	1	(0.31)
13	69.5	2	100	MC	8687.5	4969	0.59		65.0	0.92	1.00	1.0	1.05	62.6	0.60	37.4				0.69	1	
14	79.5	2	100	MC	9937.5	5594	0.55		65.0	0.92	1.00	1.0	1.05	62.6	0.55	34.4				0.66	1	
15	89.5	2	62	SPT	11188	6219	0.52		62.0	0.92	1.00	1.2	1.05	71.6	0.51	36.6				0.64	1	
16	99.5	1	100	SPT	12438	6844	0.50	0.41	100.0	0.92	1.00	1.2	1.05	115.5	0.48	55.0		55.0		0.61	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-002***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	30	MC	562.5	563	0.99		19.5	0.92	1.00	1.0	1.05	18.8	1.49	27.9				1.00	1	
2	9.5	2	27	MC	1187.5	1188	0.98		17.6	0.92	1.00	1.0	1.05	16.9	1.23	20.7				1.00	1	
3	14.5	1	22	MC	1812.5	1531	0.97	0.52	14.3	0.92	1.00	1.0	1.05	13.8	1.12	15.4	35%	23.5	0.26	1.00	1	(0.63)
4	19.5	1	28	MC	2437.5	1844	0.96	0.58	18.2	0.92	1.00	1.0	1.05	17.5	1.04	18.2	37%	26.8	0.33	1.00	1	(0.71)
5	24.5	1	39	MC	3062.5	2156	0.94	0.61	25.4	0.92	1.00	1.0	1.05	24.4	0.97	23.6	51%	33.3		0.97	1	NON-LIQ.
6	29.5	2	65	MC	3687.5	2469	0.92		42.3	0.92	1.00	1.0	1.05	40.7	0.90	36.8				0.92	1	
7	34.5	2	65	MC	4312.5	2781	0.89		42.3	0.92	1.00	1.0	1.05	40.7	0.85	34.5				0.88	1	
8	39.5	1	31	MC	4937.5	3094	0.86	0.62	20.2	0.92	1.00	1.0	1.05	19.4	0.80	15.5	50%	23.6	0.27	0.85	1	(0.45)
9	44.5	1	23	SPT	5562.5	3406	0.81	0.60	23.0	0.92	1.00	1.2	1.05	26.6	0.76	20.1	20%	25.3	0.30	0.82	1	(0.50)
10	49.5	1	36	SPT	6187.5	3719	0.76	0.57	36.0	0.92	1.00	1.2	1.05	41.6	0.72	29.9	51%	40.9		0.78	1	NON-LIQ.
11	54.5	2	100	MC	6812.5	4031	0.71		65.0	0.92	1.00	1.0	1.05	62.6	0.68	42.8				0.76	1	
12	59.5	2	71	SPT	7437.5	4344	0.66		71.0	0.92	1.00	1.2	1.05	82.0	0.65	53.5				0.73	1	
13	69.5	1	64	MC	8687.5	4969	0.59	0.47	41.6	0.92	1.00	1.0	1.05	40.0	0.60	23.9	20%	29.4	0.43	0.69	1	(0.79)
14	79.5	1	33	SPT	9937.5	5594	0.55	0.44	33.0	0.92	1.00	1.2	1.05	38.1	0.55	21.0	20%	26.3	0.32	0.67	1	(0.60)
15	89.5	1	100	SPT	11188	6219	0.52	0.43	100.0	0.92	1.00	1.2	1.05	115.5	0.51	59.0		59.0		0.64	1	NON-LIQ.
16	99.5	2	100	SPT	12438	6844	0.50		100.0	0.92	1.00	1.2	1.05	115.5	0.48	55.0				0.61	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-003***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.66
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	18	MC	562.5	563	0.99		11.7	0.92	1.00	1.0	1.05	11.3	1.49	16.7				1.00	1	
2	9.5	2	17	MC	1187.5	1188	0.98		11.1	0.92	1.00	1.0	1.05	10.6	1.23	13.0				1.00	1	
3	14.5	1	100	MC	1812.5	1531	0.97	0.49	65.0	0.92	1.00	1.0	1.05	62.6	1.12	70.0		70.0		1.00	1	NON-LIQ.
4	19.5	2	23	MC	2437.5	1844	0.96		15.0	0.92	1.00	1.0	1.05	14.4	1.04	14.9				1.00	1	
5	24.5	2	29	MC	3062.5	2156	0.94		18.9	0.92	1.00	1.0	1.05	18.1	0.97	17.5				0.97	1	
6	29.5	1	28	MC	3687.5	2469	0.92	0.59	18.2	0.92	1.00	1.0	1.05	17.5	0.90	15.8	44%	24.0	0.27	0.93	1	(0.53)
7	34.5	1	50	MC	4312.5	2781	0.89	0.59	32.5	0.92	1.00	1.0	1.05	31.3	0.85	26.6	50%	36.9		0.88	1	NON-LIQ.
8	39.5	1	39	MC	4937.5	3094	0.86	0.59	25.4	0.92	1.00	1.0	1.05	24.4	0.80	19.5	46%	28.5	0.39	0.84	1	(0.69)
9	44.5	1	36	SPT	5562.5	3406	0.81	0.57	36.0	0.92	1.00	1.2	1.05	41.6	0.76	31.5	11%	33.6		0.81	1	NON-LIQ.
10	49.5	1	41	SPT	6187.5	3719	0.76	0.54	41.0	0.92	1.00	1.2	1.05	47.4	0.72	34.1	11%	36.2		0.78	1	NON-LIQ.
11	54.5	1	35	SPT	6812.5	4031	0.71	0.51	35.0	0.92	1.00	1.2	1.05	40.4	0.68	27.7	27%	35.7		0.76	1	NON-LIQ.
12	59.5	1	51	SPT	7437.5	4344	0.66	0.49	51.0	0.92	1.00	1.2	1.05	58.9	0.65	38.4	25%	47.1		0.73	1	NON-LIQ.
13	69.5	2	44	SPT	8687.5	4969	0.59		44.0	0.92	1.00	1.2	1.05	50.8	0.60	30.3				0.69	1	
14	79.5	1	80	SPT	9937.5	5594	0.55	0.42	80.0	0.92	1.00	1.2	1.05	92.4	0.55	50.9		50.9		0.66	1	NON-LIQ.
15	89.5	1	36	SPT	11188	6219	0.52	0.40	36.0	0.92	1.00	1.2	1.05	41.6	0.51	21.2	20%	26.5	0.33	0.65	1	(0.65)
16	99.5	1	100	SPT	12438	6844	0.50	0.39	100.0	0.92	1.00	1.2	1.05	115.5	0.48	55.0		55.0		0.61	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-003A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR $_{7.5}$)*												*F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6	2	8	SPT	750	750	0.99		8.0	1.42	0.75	1.2	1.05	10.7	1.40	15.0				1.00	1	
2	11	2	8	SPT	1375	1313	0.98		8.0	1.42	0.80	1.2	1.05	11.4	1.19	13.5				1.00	1	
3	14	1	8	SPT	1750	1500	0.97	0.52	8.0	1.42	0.85	1.2	1.05	12.1	1.13	13.7	19%	18.1	0.19	1.00	1	(0.46)
4	17	1	11	SPT	2125	1688	0.96	0.55	11.0	1.42	0.85	1.2	1.05	16.7	1.08	18.0	35%	26.6	0.33	1.00	1	(0.73)
5	21	1	16	SPT	2625	1938	0.95	0.59	16.0	1.42	0.95	1.2	1.05	27.1	1.01	27.5	10%	29.0	0.41	1.00	1	(0.86)
6	26	1	12	SPT	3250	2250	0.94	0.62	12.0	1.42	0.95	1.2	1.05	20.3	0.95	19.3	65%	28.1	0.37	0.96	1	(0.72)
7	31	1	13	SPT	3875	2563	0.92	0.63	13.0	1.42	1.00	1.2	1.05	23.2	0.89	20.6	35%	30.0		0.92	1	NON-LIQ.
8	36	1	12	SPT	4500	2875	0.88	0.63	12.0	1.42	1.00	1.2	1.05	21.4	0.83	17.9	49%	26.4	0.32	0.90	1	(0.57)
9	39	1	12	SPT	4875	3063	0.86	0.62	12.0	1.42	1.00	1.2	1.05	21.4	0.81	17.3	40%	25.7	0.31	0.88	1	(0.54)
10	42	1	33	SPT	5250	3250	0.83	0.61	33.0	1.42	1.00	1.2	1.05	58.9	0.78	45.9		45.9		0.82	1	NON-LIQ.
11	45	1	13	SPT	5625	3438	0.80	0.60	13.0	1.42	1.00	1.2	1.05	23.2	0.75	17.5	30%	24.9	0.29	0.85	1	
12	48	1	39	SPT	6000	3625	0.77	0.58	39.0	1.42	1.00	1.2	1.05	69.6	0.73	50.8		50.8		0.79	1	NON-LIQ.
13	51	2	10	SPT	6375	3813	0.74		10.0	1.42	1.00	1.2	1.05	17.9	0.71	12.6				0.84	1	
14	54	2	8	SPT	6750	4000	0.71		8.0	1.42	1.00	1.2	1.05	14.3	0.69	9.8				0.84	1	
15	57	2	19	SPT	7125	4188	0.68		19.0	1.42	1.00	1.2	1.05	33.9	0.67	22.7				0.78	1	
16	60	1	28	SPT	7500	4375	0.66	0.51	28.0	1.42	1.00	1.2	1.05	50.0	0.65	32.5		32.5		0.74	1	NON-LIQ.
17	63	1	29	SPT	7875	4563	0.64	0.50	29.0	1.42	1.00	1.2	1.05	51.8	0.63	32.7		32.7		0.73	1	NON-LIQ.
18	66	1	25	SPT	8250	4750	0.62	0.49	25.0	1.42	1.00	1.2	1.05	44.6	0.62	27.5	20%	33.3		0.73	1	NON-LIQ.
19	69	1	8	SPT	8625	4938	0.60	0.47	8.0	1.42	1.00	1.2	1.05	14.3	0.60	8.6		8.6	0.10	0.81	1	(0.21)
20	72	1	28	SPT	9000	5125	0.58	0.46	28.0	1.42	1.00	1.2	1.05	50.0	0.58	29.2		29.2	0.42	0.71	1	(0.79)
21	75	1	23	SPT	9375	5313	0.57	0.46	23.0	1.42	1.00	1.2	1.05	41.1	0.57	23.4	43%	33.1		0.72	1	NON-LIQ.
22	78	1	43	SPT	9750	5500	0.56	0.45	43.0	1.42	1.00	1.2	1.05	76.8	0.56	42.7		42.7		0.67	1	NON-LIQ.
23	81	1	33	SPT	10125	5688	0.54	0.44	33.0	1.42	1.00	1.2	1.05	58.9	0.54	32.0		32.0		0.67	1	NON-LIQ.

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001)
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$

   where α and β = coefficients determined from the following relationships

   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$

   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$

   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-133***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 60% *(spooling winch system, EGS B-60)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	15	MC	250	250	1.00		9.8	1.00	1.00	1.0	1.05	10.2	1.66	17.0				1.00	1	
2	4.5	2	26	MC	562.5	563	0.99		16.9	1.00	1.00	1.0	1.05	17.7	1.49	26.4				1.00	1	
3	9.5	2	24	MC	1187.5	1188	0.98		15.6	1.00	1.00	1.0	1.05	16.4	1.23	20.1				1.00	1	
4	14.5	1	20	MC	1812.5	1531	0.97	0.52	13.0	1.00	1.00	1.0	1.05	13.7	1.12	15.3	35%	23.3	0.26	1.00	1	(0.62)
5	19.5	2	16	MC	2437.5	1844	0.96		10.4	1.00	1.00	1.0	1.05	10.9	1.04	11.3				1.00	1	
6	24.5	2	34	MC	3062.5	2156	0.94		22.1	1.00	1.00	1.0	1.05	23.2	0.97	22.4				0.97	1	
7	29.5	2	21	MC	3687.5	2469	0.92		13.7	1.00	1.00	1.0	1.05	14.3	0.90	13.0				0.93	1	
8	34.5	2	22	MC	4312.5	2781	0.89		14.3	1.00	1.00	1.0	1.05	15.0	0.85	12.8				0.90	1	
9	39.5	2	38	MC	4937.5	3094	0.86		24.7	1.00	1.00	1.0	1.05	25.9	0.80	20.8				0.84	1	
10	44.5	1	49	MC	5562.5	3406	0.81	0.60	31.9	1.00	1.00	1.0	1.05	33.4	0.76	25.3	23%	31.9		0.81	1	NON-LIQ.
11	49.5	1	86	MC	6187.5	3719	0.76	0.57	55.9	1.00	1.00	1.0	1.05	58.7	0.72	42.2		42.2		0.78	1	NON-LIQ.
12	54.5	1	40	MC	6812.5	4031	0.71	0.54	26.0	1.00	1.00	1.0	1.05	27.3	0.68	18.7	15%	22.1	0.24	0.77	1	(0.42)
13	59.5	1	25	MC	7437.5	4344	0.66	0.52	16.3	1.00	1.00	1.0	1.05	17.1	0.65	11.1	17%	14.8	0.16	0.79	1	(0.30)

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-133A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	5	2	9	SPT	625	625	0.99		9.0	1.42	0.75	1.2	1.05	12.0	1.45	17.5				1.00	1	
2	10	2	11	SPT	1250	1250	0.98		11.0	1.42	0.80	1.2	1.05	15.7	1.21	18.9				1.00	1	
3	13	2	11	SPT	1625	1438	0.97		11.0	1.42	0.85	1.2	1.05	16.7	1.15	19.1				1.00	1	
4	16	2	16	SPT	2000	1625	0.97		16.0	1.42	0.85	1.2	1.05	24.3	1.09	26.5				1.00	1	
5	20	2	16	SPT	2500	1875	0.96		16.0	1.42	0.95	1.2	1.05	27.1	1.03	27.9				1.00	1	
6	25	2	18	SPT	3125	2188	0.94		18.0	1.42	0.95	1.2	1.05	30.5	0.96	29.3				0.97	1	
7	30	2	16	SPT	3750	2500	0.92		16.0	1.42	1.00	1.2	1.05	28.6	0.90	25.6				0.93	1	
8	35	2	6	SPT	4375	2813	0.89		6.0	1.42	1.00	1.2	1.05	10.7	0.84	9.0				0.92	1	
9	40	2	15	SPT	5000	3125	0.85		15.0	1.42	1.00	1.2	1.05	26.8	0.80	21.3				0.87	1	
10	43	1	14	SPT	5375	3313	0.82	0.61	14.0	1.42	1.00	1.2	1.05	25.0	0.77	19.2	40%	28.1	0.37	0.85	1	(0.65)
11	46	1	14	SPT	5750	3500	0.79	0.59	14.0	1.42	1.00	1.2	1.05	25.0	0.75	18.6	35%	27.4	0.35	0.84	1	(0.61)
12	49	1	17	SPT	6125	3688	0.76	0.58	17.0	1.42	1.00	1.2	1.05	30.3	0.72	21.9	35%	31.3		0.82	1	NON-LIQ.
13	52	1	25	SPT	6500	3875	0.73	0.56	25.0	1.42	1.00	1.2	1.05	44.6	0.70	31.3		31.3		0.78	1	NON-LIQ.
14	55	1	45	SPT	6875	4063	0.70	0.54	45.0	1.42	1.00	1.2	1.05	80.3	0.68	54.7		54.7		0.75	1	NON-LIQ.
15	58	1	27	SPT	7250	4250	0.68	0.52	27.0	1.42	1.00	1.2	1.05	48.2	0.66	31.9		31.9		0.75	1	NON-LIQ.
16	61	1	33	SPT	7625	4438	0.65	0.51	33.0	1.42	1.00	1.2	1.05	58.9	0.64	37.9		37.9		0.73	1	NON-LIQ.
17	64	1	30	SPT	8000	4625	0.63	0.50	30.0	1.42	1.00	1.2	1.05	53.6	0.63	33.5		33.5		0.72	1	NON-LIQ.
18	70	1	21	SPT	8750	5000	0.59	0.47	21.0	1.42	1.00	1.2	1.05	37.5	0.59	22.3		22.3	0.25	0.74	1	(0.48)

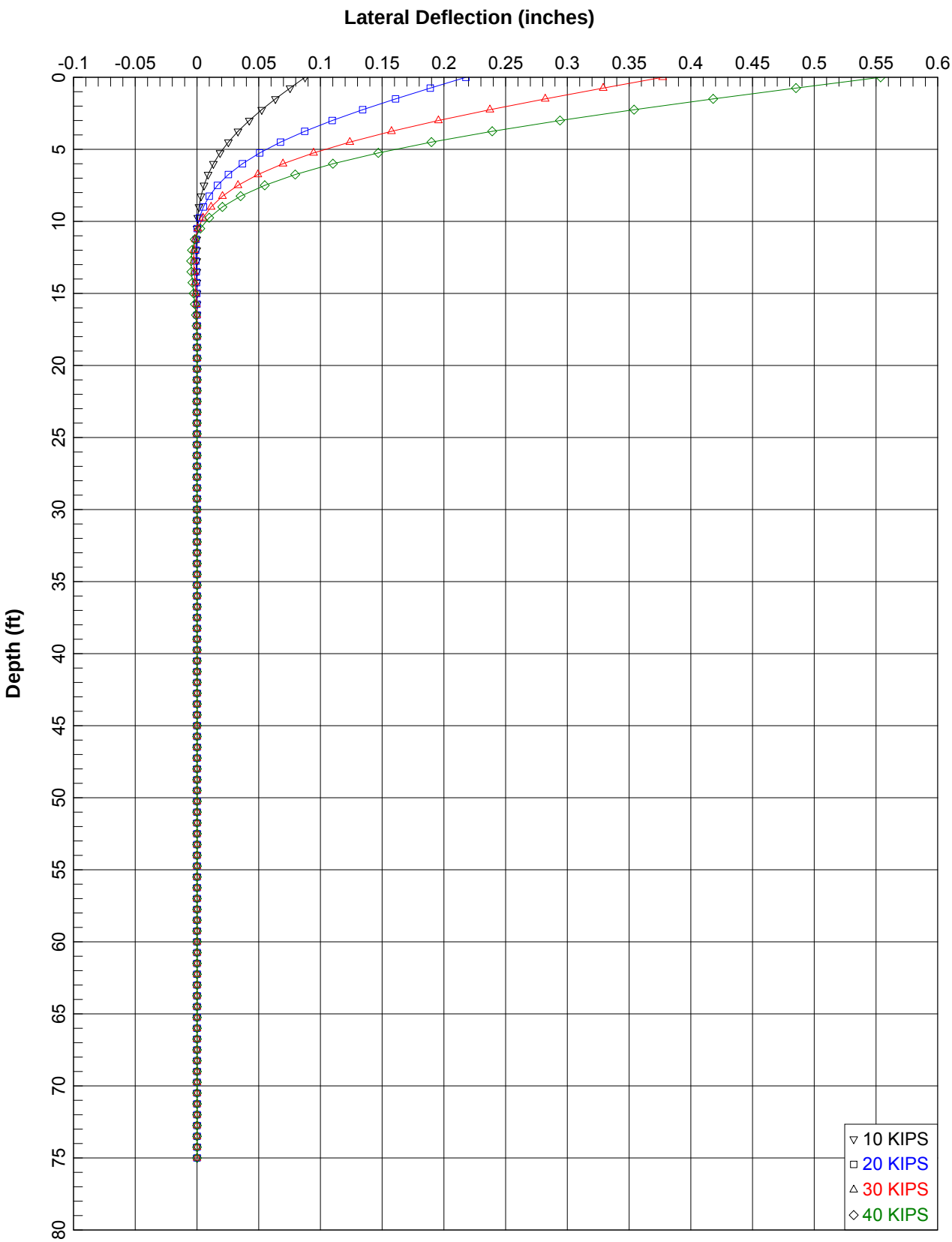
Note:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

L-PILE Analysis Results



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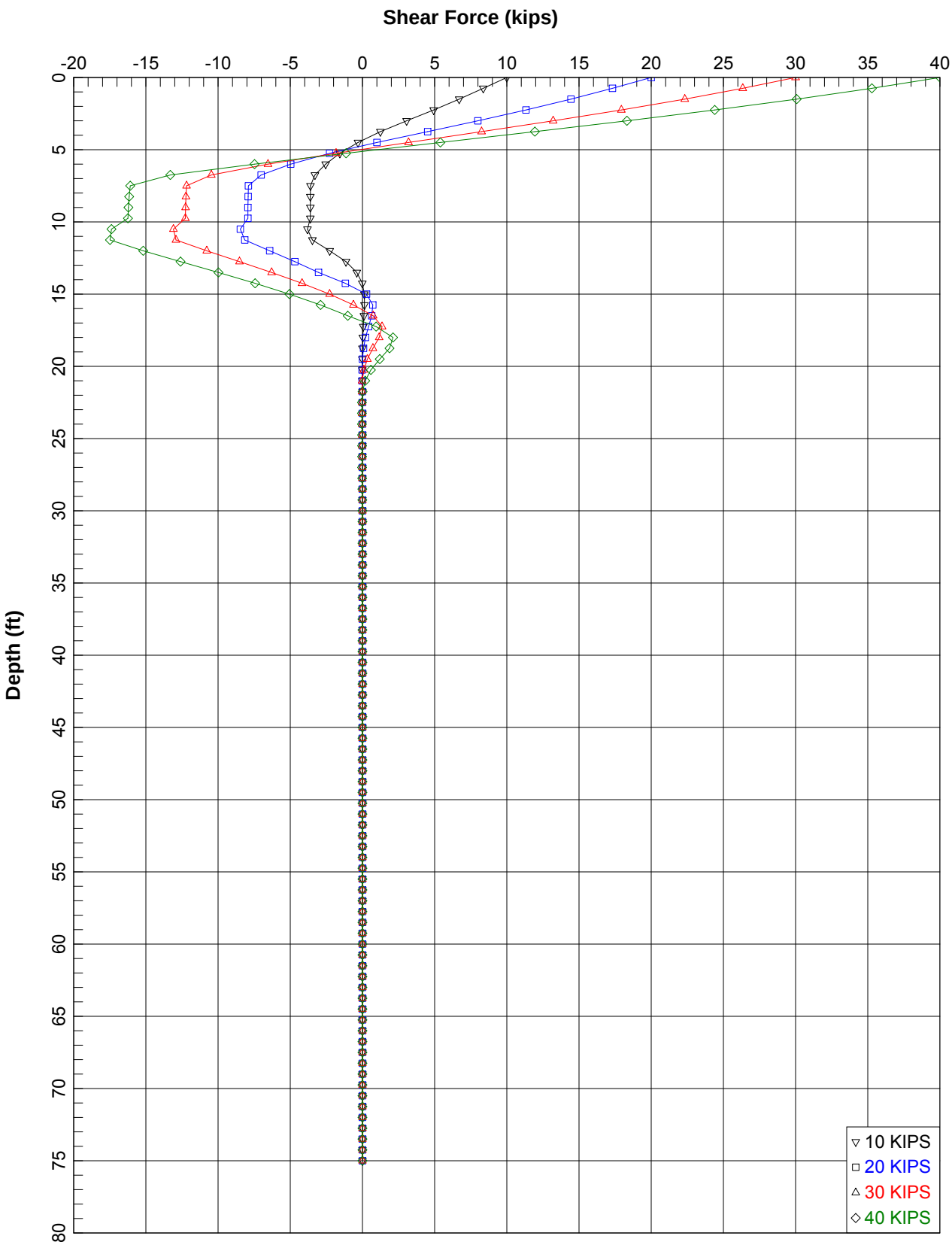

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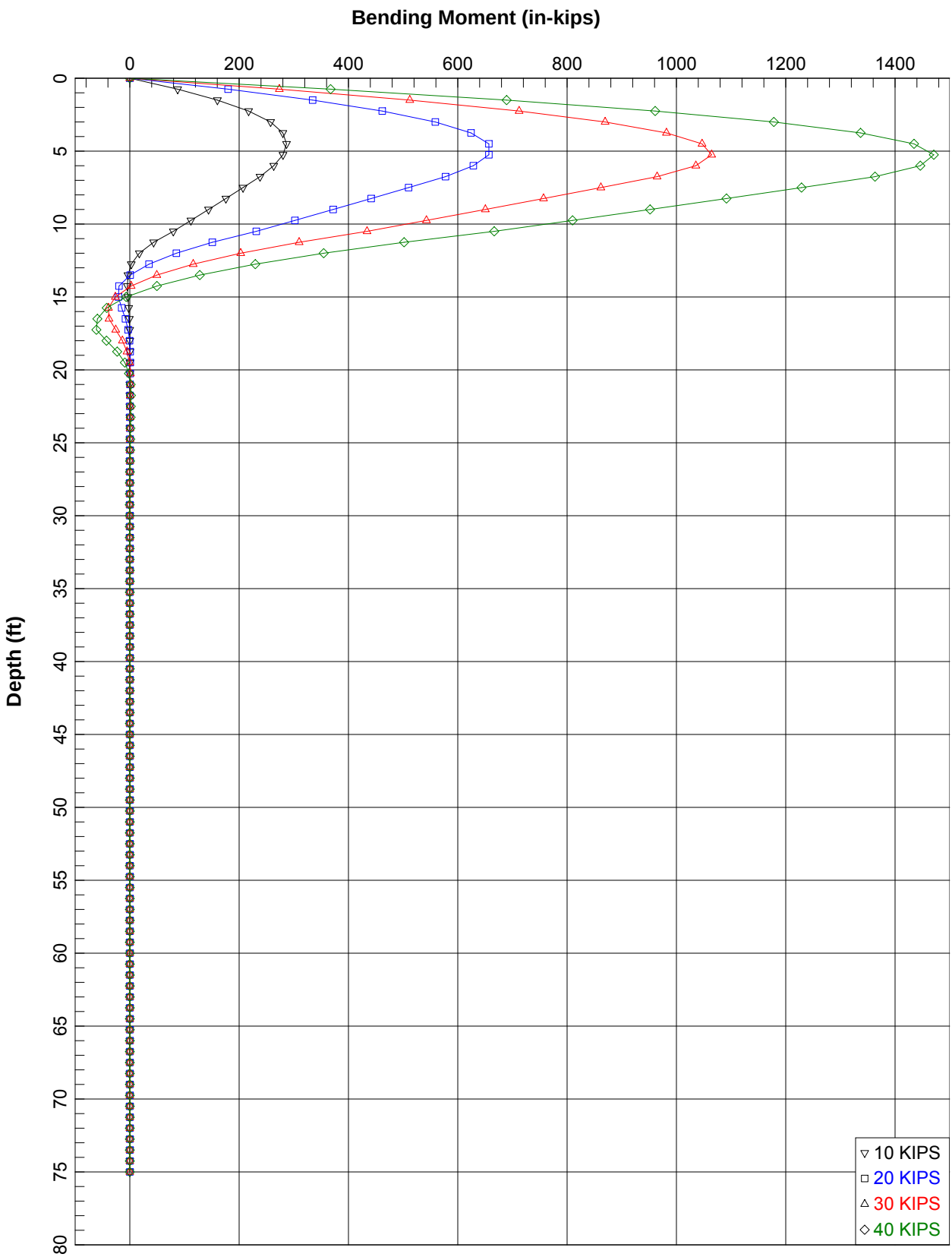
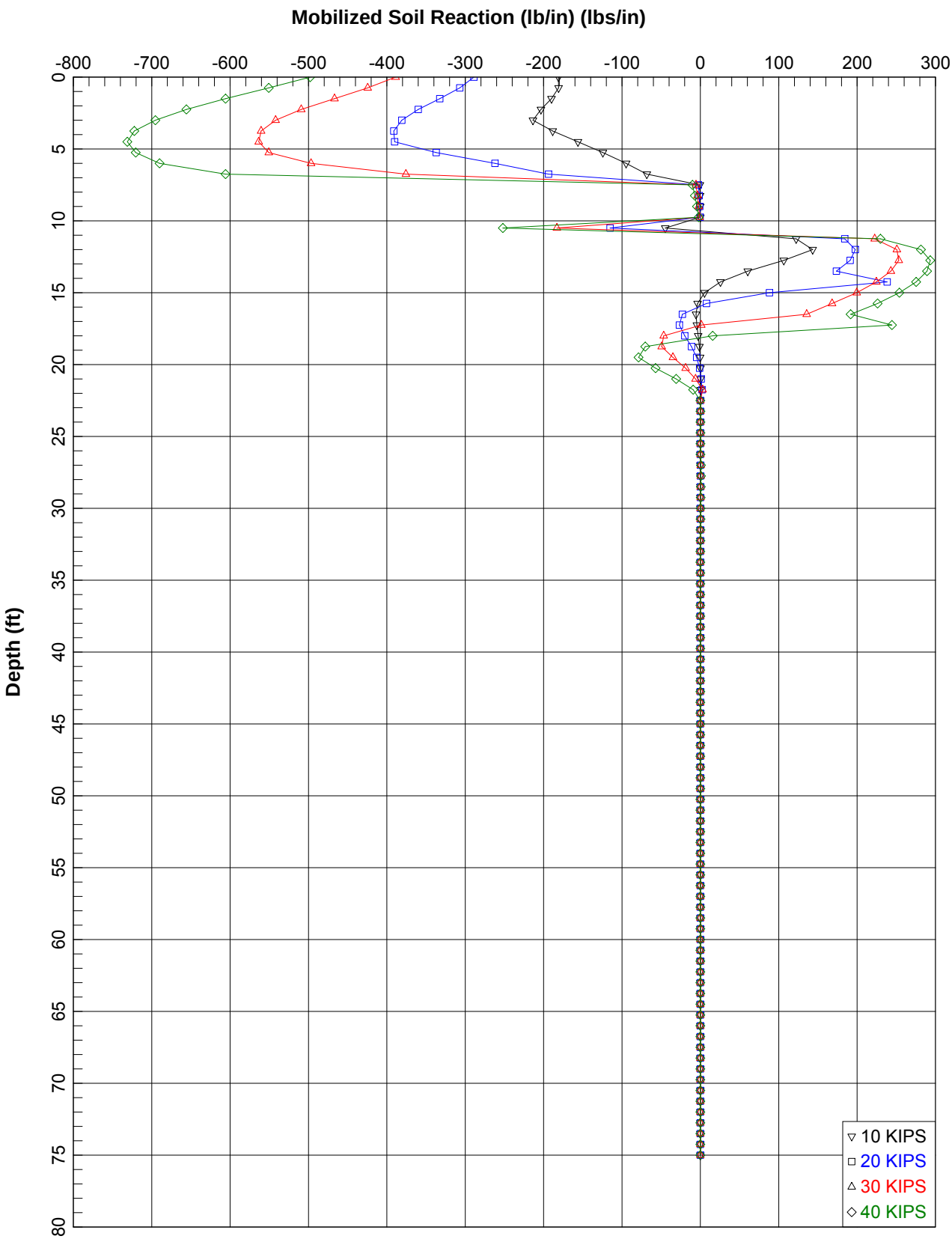
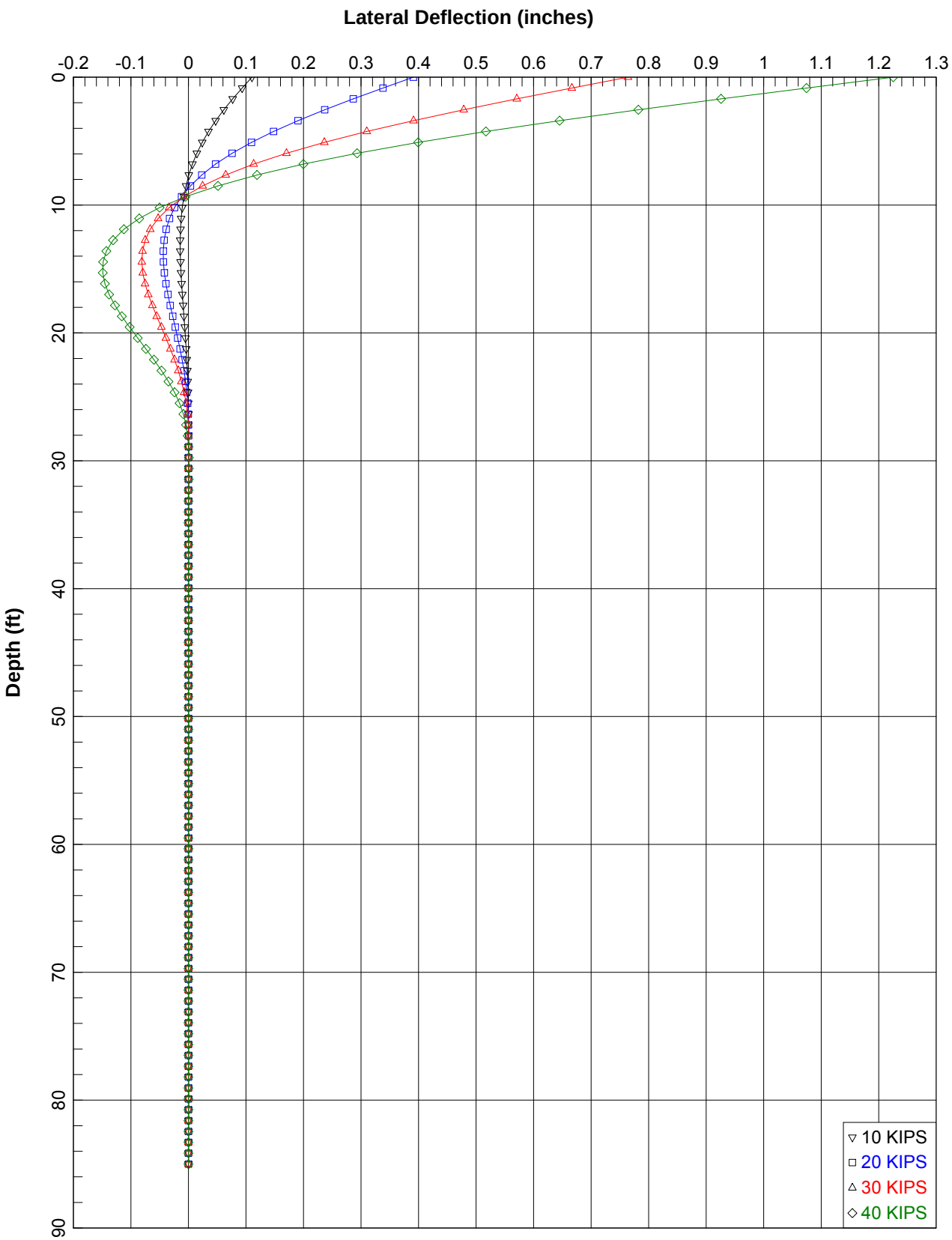


GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP), ABUT1, CLASS 200 ALT. "W'" (16" DIA.)



GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP), ABUT1, CLASS 200 ALT. "W'" (16" DIA.)



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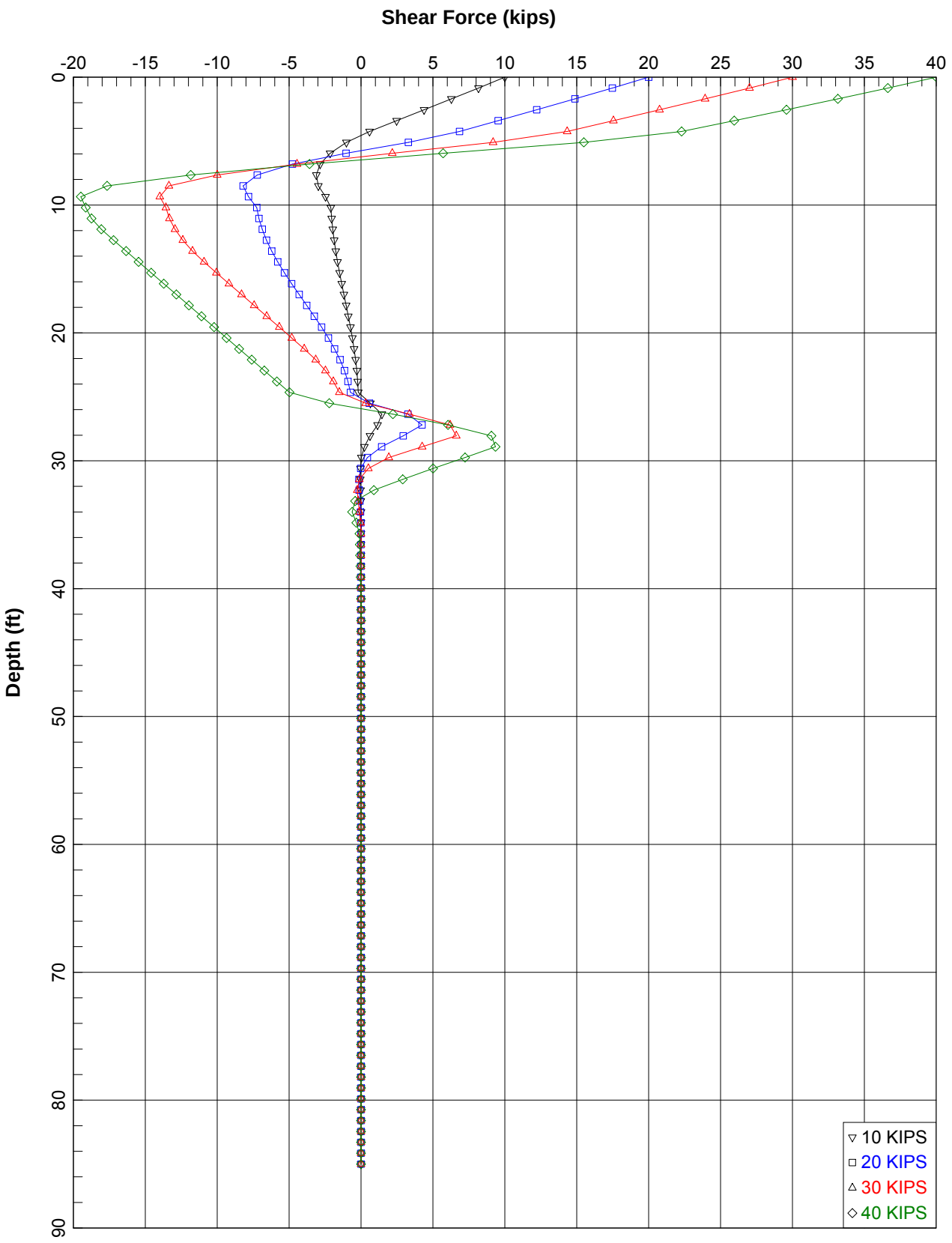
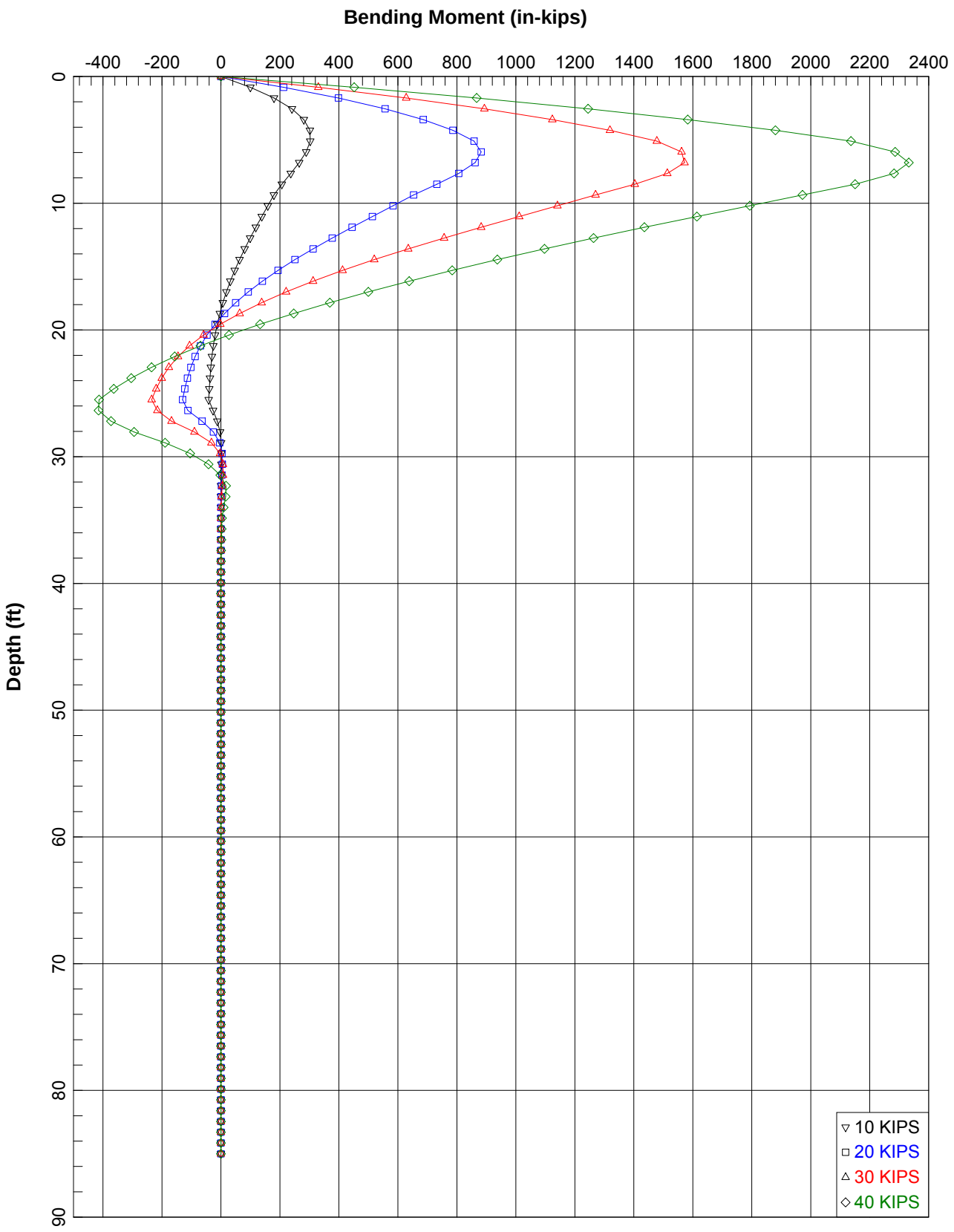
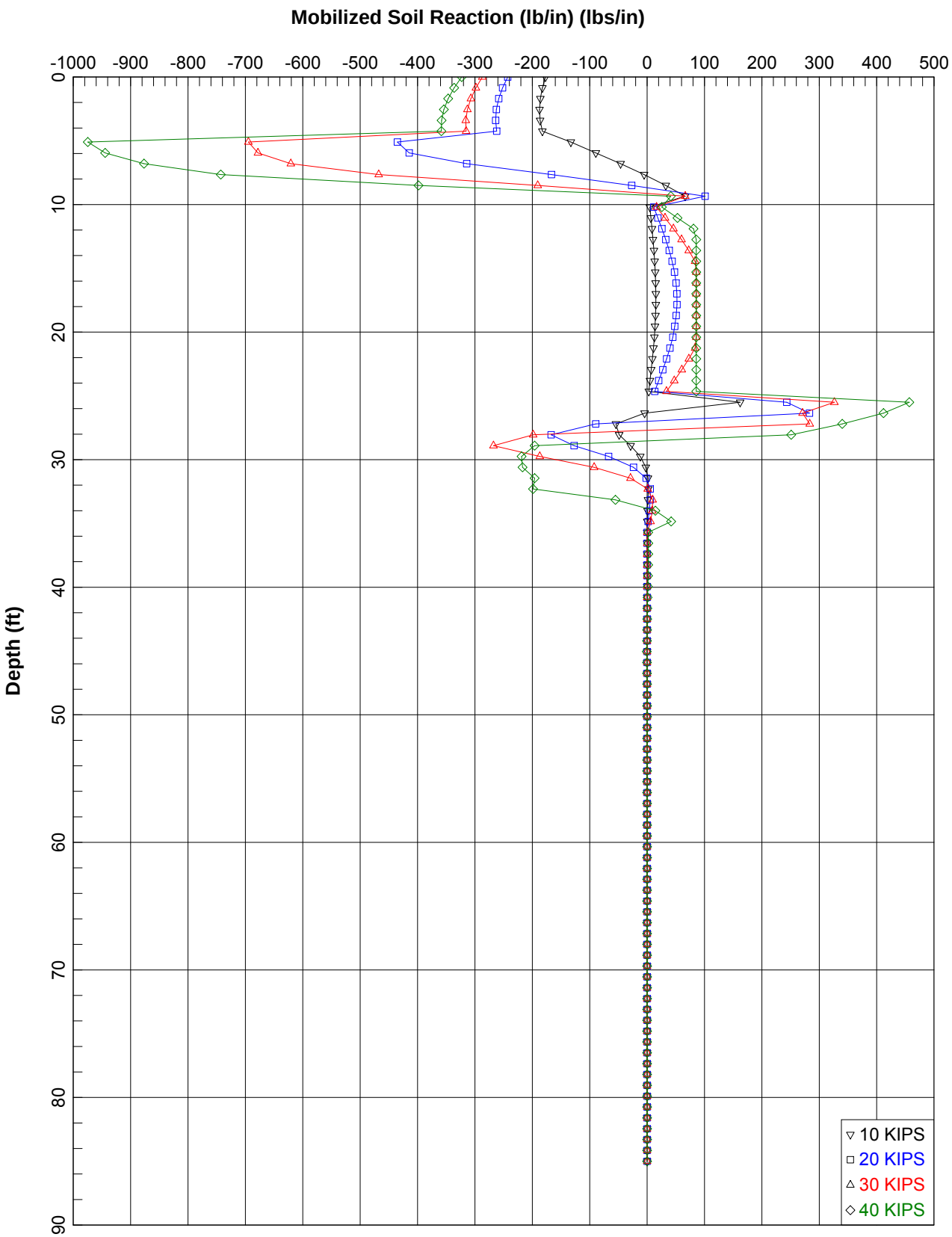


GREEN VALLEY ROAD OC (OVER SB 680 RAMP), ABUT 2, CLASS 200 ALT. "W"



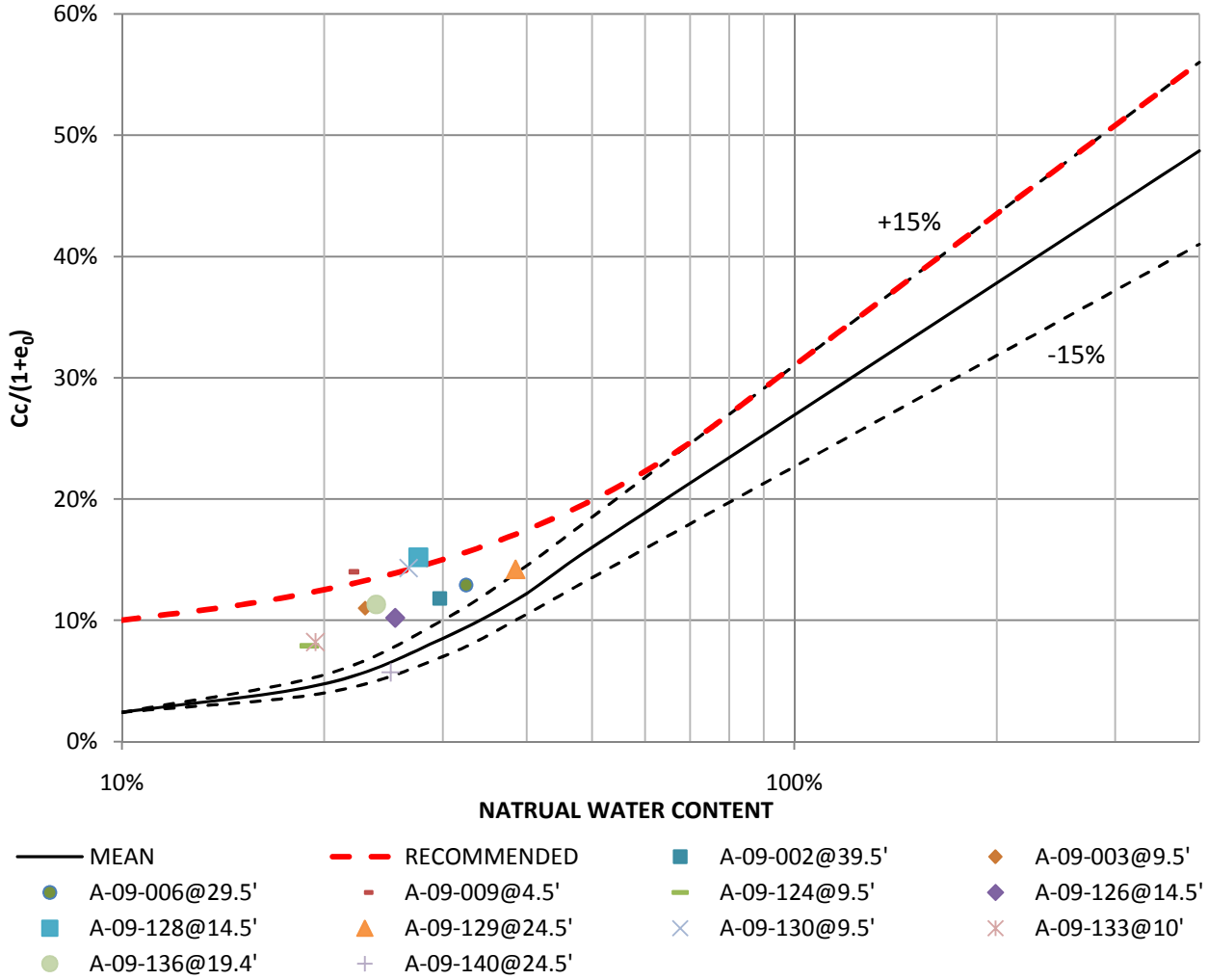
GREEN VALLEY ROAD OC (OVER SB 680 RAMP), ABUT 2, CLASS 200 ALT. "W"



GREEN VALLEY ROAD OC (OVER SB 680 RAMP), ABUT 2, CLASS 200 ALT. "W"

Settlement Analysis Results

Modified Compression Index v.s. Natural Moisture Content



Boring	Sample No.	Depth	Moisture Content	Cc/(1+e0)	Cr/(1+e0)	Cr/Cc
A-09-002	8	39.5	29.7%	11.8%	1.6%	13.6%
A-09-003	2	9.5	23.0%	11.0%	2.6%	23.6%
A-09-006	6	29.5	32.5%	12.9%	1.7%	13.2%
A-09-009	1	4.5	21.8%	14.0%	4.1%	29.3%
A-09-124	3	9.5	19.0%	7.9%	1.4%	17.7%
A-09-126	3	14.5	25.5%	10.2%	3.2%	31.4%
A-09-128	4	14.5	27.6%	15.2%	3.0%	19.7%
A-09-129	6	24.5	38.5%	14.2%	2.5%	17.6%
A-09-130	2	9.5	26.7%	14.3%	3.0%	21.0%
A-09-133	3	10.0	19.4%	8.2%	1.8%	22.0%
A-09-136	5	19.4	23.9%	11.3%	2.3%	20.4%
A-09-140	5	24.5	25.1%	5.7%	1.0%	17.5%

PARIKH
Practicing in the Geosciences

I-80/680/12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR | PLATE NO.:

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-001*** *(GREEN VALLEY ROAD OC (OVER SB 680 RAMP) ABUT 1/RW#7)*

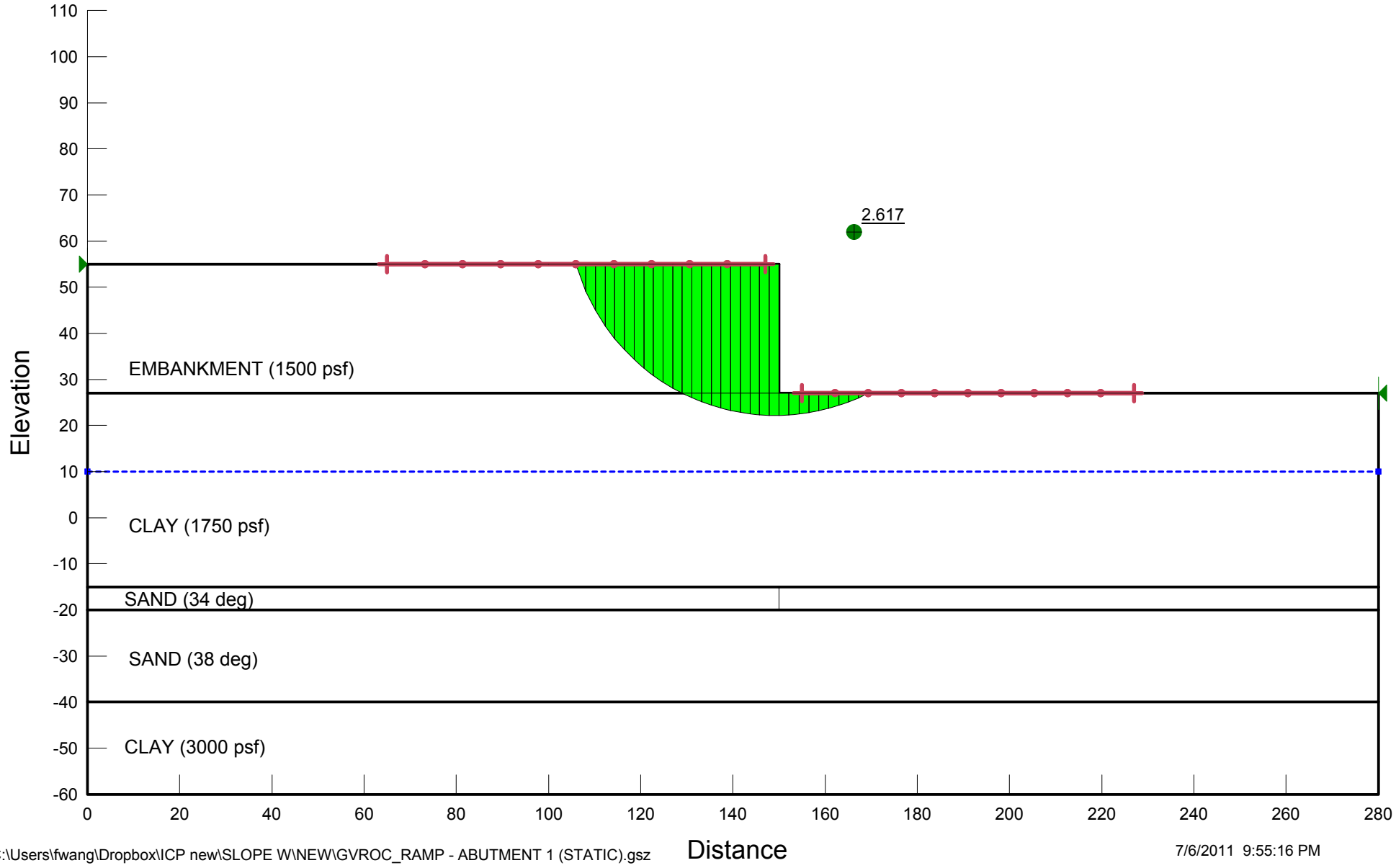
Embankment H (ft)=	32.5	*Contact Pressure (psf)=*	4062.5	*Contact Area, B (ft)=*	80	*Cr/Cc=*	20%
Unit Weight (pcf)=	125	*GW Level (ft)=*	20	*Contact Area, L (ft)=*	60		
				Plane Strain? (Y/N)=	Y		

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
1	0	8	13	SPT	13	125.0	125.0	45.5%	500	3869.0						
1	8	12	8	SPT	8	125.0	125.0	18.1%	1250	3611.1						
2	12	17	33	SPT	33	125.0	125.0	19.0%	1813	3439.2	16250	0.0245	0.1227	0.680		0.680
2	17	22	25	SPT	25	125.0	62.6	18.9%	2282	3266.3	12350	0.0245	0.1224	0.567		0.567
2	22	26.5	23	SPT	23	125.0	62.6	25.0%	2579	3117.5	11700	0.0275	0.1376	0.512		0.512
2	26.5	31.5	16	SPT	16	125.0	62.6	26.1%	2876	2981.7	8125	0.0281	0.1404	0.520		0.520
1	31.5	36.5	65	SPT	65	125.0	62.6	23.3%	3189	2850.9						
1	36.5	41.5	100	SPT	100	125.0	62.6	22.3%	3502	2731.1						
1	41.5	46.5	100	SPT	100	125.0	62.6	19.6%	3815	2621.0						
1	46.5	51.5	100	SPT	100	125.0	62.6	20.1%	4128	2519.4						
1	51.5	57	59	SPT	59	125.0	62.6	14.2%	4457	2420.9						
2	57	63.5	11	SPT	11	125.0	62.6	35.9%	4832	2317.3	5500	0.0329	0.1646	0.144	1.462	1.607
2	63.5	74	65	SPT	65	125.0	62.6	27.0%	5365	2184.9	32500	0.0285	0.1426	0.533		0.533
2	74	84	65	SPT	65	125.0	62.6	22.3%	6006	2044.0	32500	0.0262	0.1309	0.400		0.400
2	84	93.5	62	SPT	62	125.0	62.6	27.0%	6617	1925.9	31000	0.0285	0.1426	0.361		0.361
1	93.5	100	100	SPT	100	125.0	62.6	10.7%	7117	1838.8						
													Estimated Settlement (in)=	*3.7*	*1.5*	***5.2***

Slope Stability Analysis Results

80/680/12 INTERCHANGE PROJECT
GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
ABUTMENT 1 (SOUTH)
(STATIC CONDITION, SHORT-TERM, IMMEDIATELY AFTER CONSTRUCTION)



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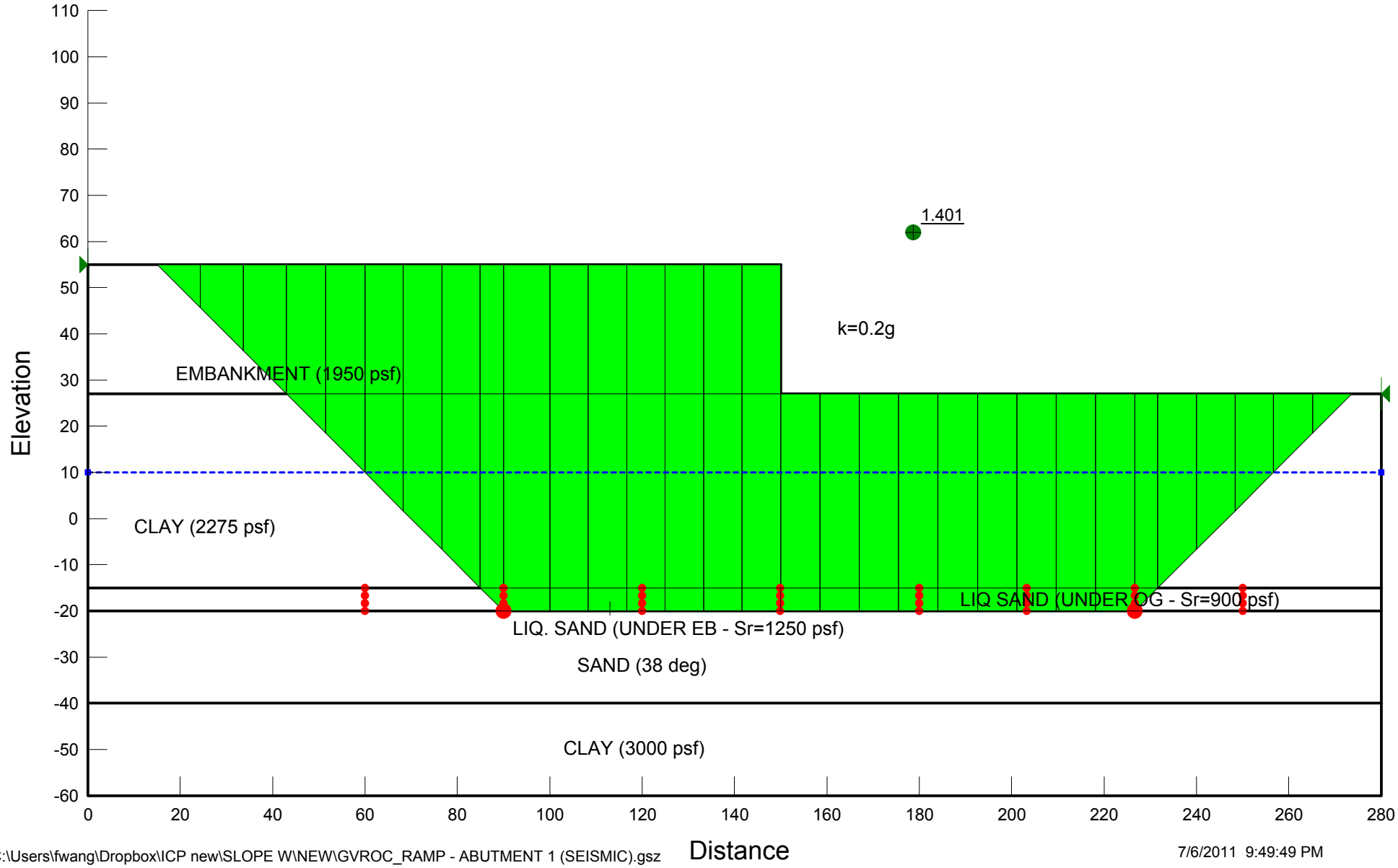
7/6/2011 9:55:16 PM

80/680/12 INTERCHANGE PROJECT
GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
ABUTMENT 1 (SOUTH)
(PSEUDO-STATIC k=0.2g+RESIDUAL STRENGTH)



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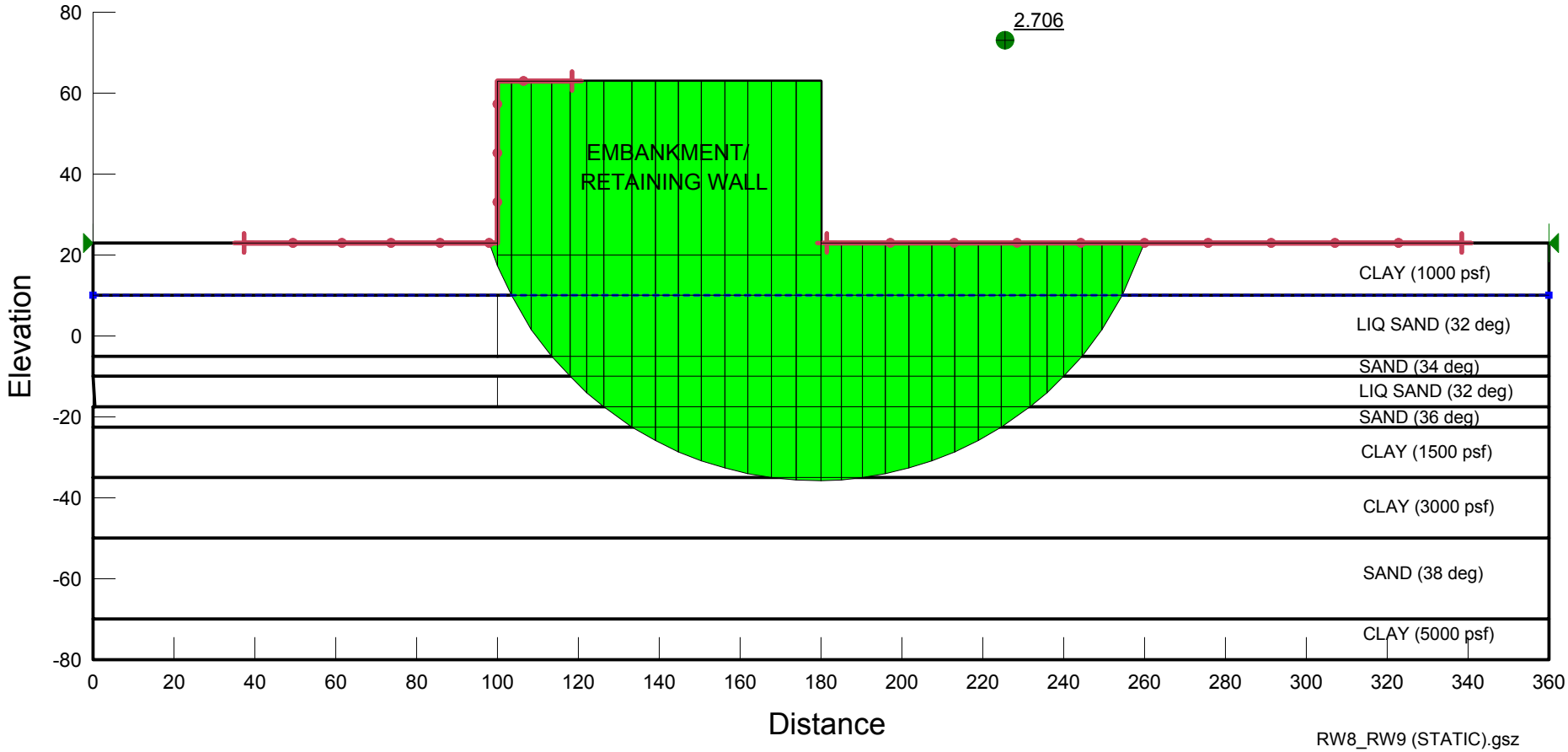
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9

(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUCTION)



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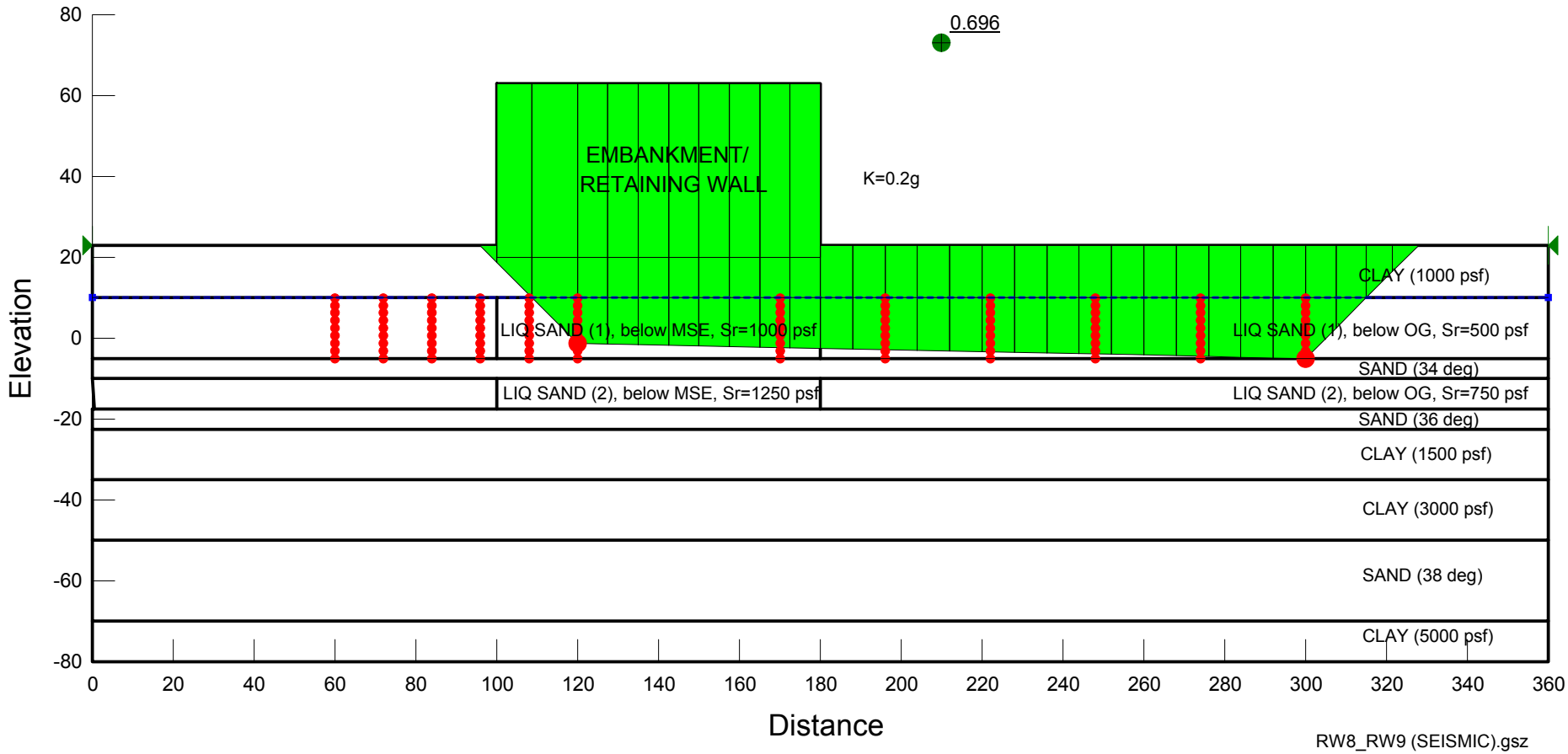
RW8_RW9 (STATIC).gsz
6/28/2011 8:26:47 PM

GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTH)



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RW8_RW9 (SEISMIC).gsz
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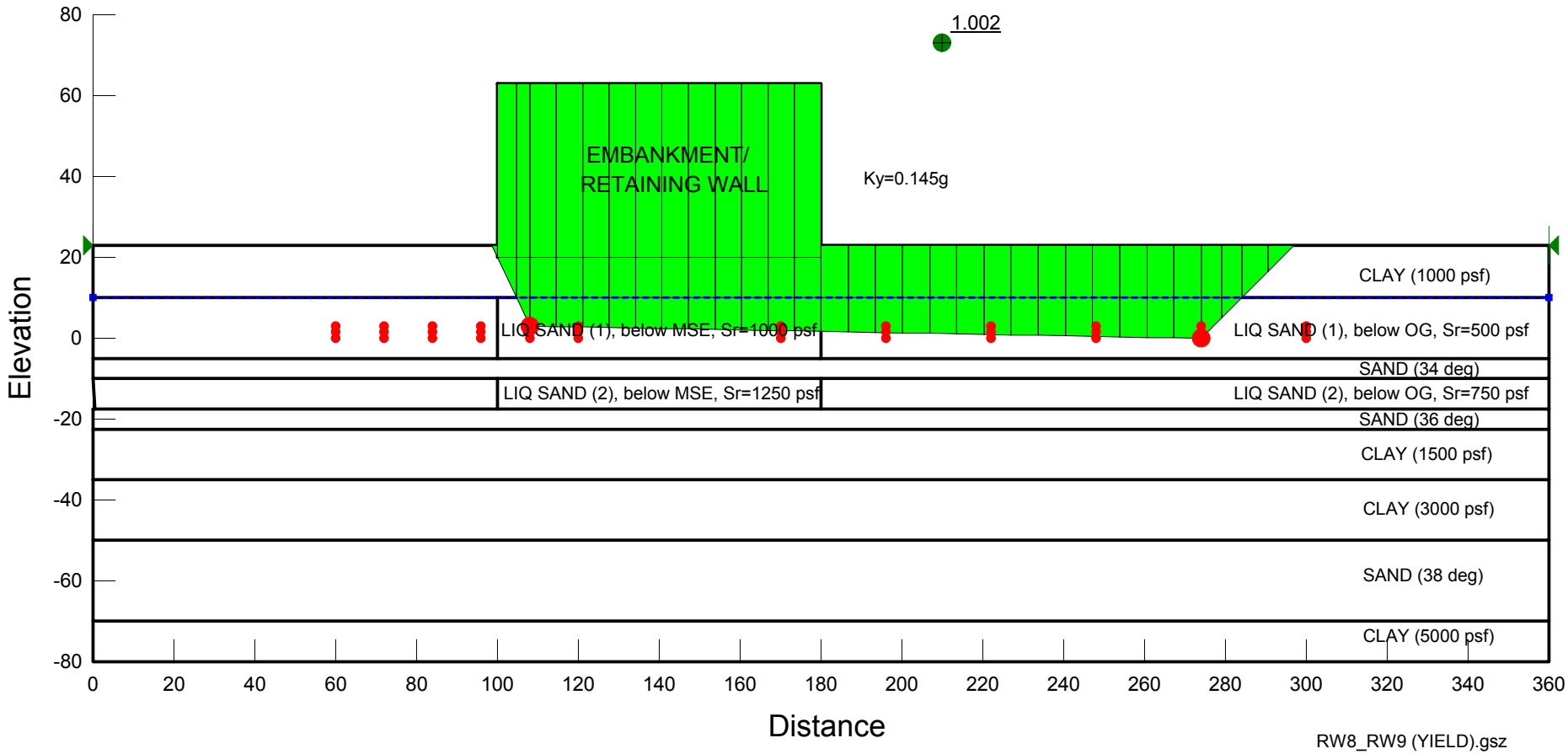
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9



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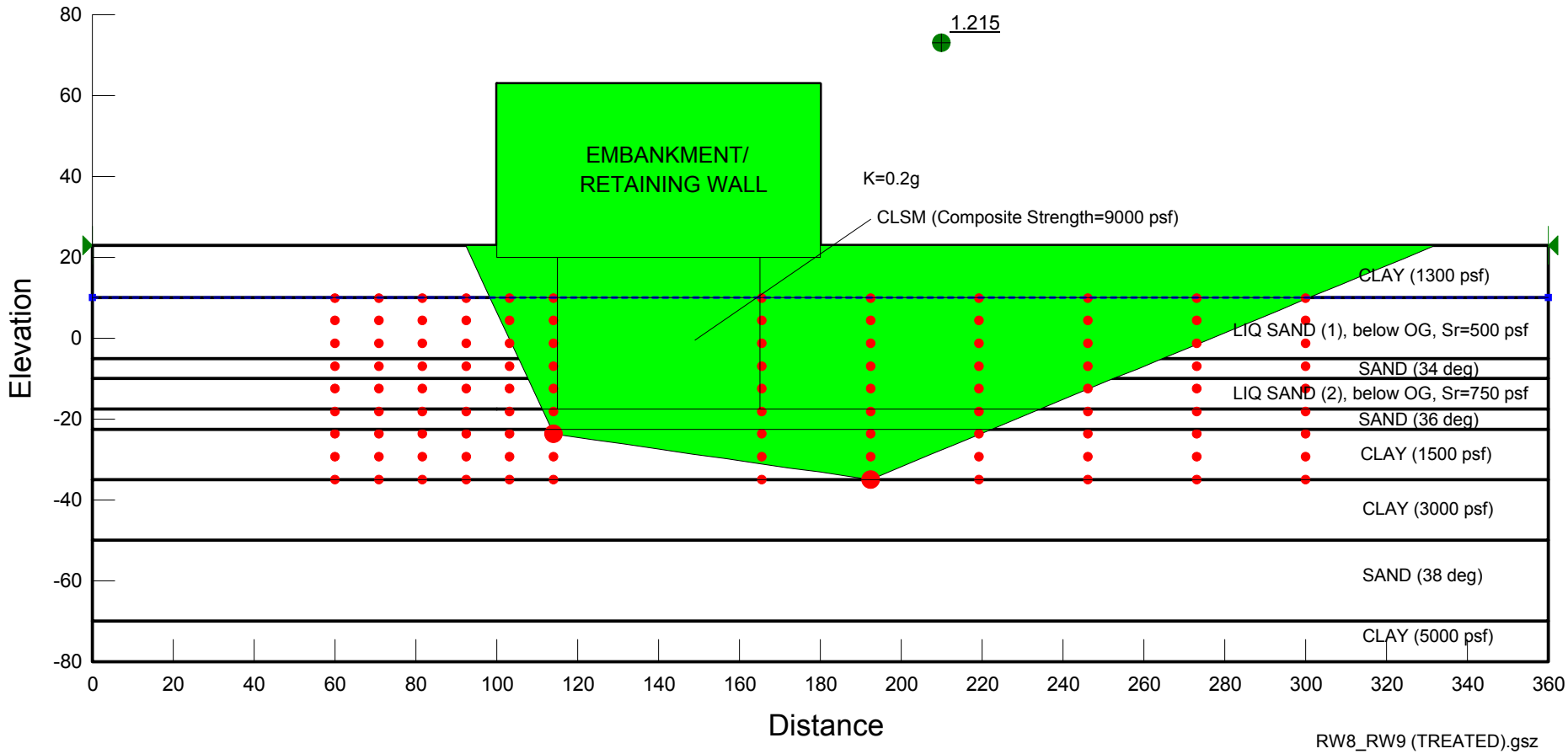
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTH+CLSM COLUMNS)



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Ground Improvement (by Acacia CE)

Acacia CE
Consultants & Engineers

GROUND IMPROVEMENT CONSTRUCTION DOCUMENTS

65% DESIGN DEVELOPMENT
NOT FOR CONSTRUCTION

I-80/I-680/SR-12 ICP
Retaining Walls 8 & 9
Solano County, CA

Submitted to:

Y. David Wang, Ph.D., PE
Parikh Consultants, Inc.
2360 Qume Drive, Suite A
San Jose, CA 95131

Prepared by:
William M. Kenney, GE

Acacia CE

July 11, 2011
REVISED September 28, 2011

Project Number: AC 157

3025 Venture Road, Placerville, CA 95667 tel 530.748.1336 fax 530.621.4837 www.acaciace.com

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Mr. Y. David Wang
Parikh Consultants, Inc.
2360 Qume Drive, Suite A
San Jose, CA 95131

Subject: I-80/I-680/SR-12 ICP
"G" Line Retaining Walls 8 & 9
Solano County, CA

GROUND IMPROVEMENT CONSTRUCTION DOCUMENTS
65% DESIGN DEVELOPMENT

Dear Mr. Wang:

Acacia CE is pleased to present the following Ground Improvement Design Development and Construction Documents for subsurface improvements in the Retaining Wall 8 & 9 are of the "G" line for the I-8-/I-680/SR-12 ICP in Solano County California.

Generally, liquefaction mitigation and performance criteria vary according to the acceptable level of risk and required levels of performance for each structure type. The ground improvement described herein, once implemented, will provide liquefaction mitigation in the improved ground areas such that acceptable performance in the Wall 8 & 9 "soil raft" (i.e., stability and deformation levels) is achieved.

The calculations included in this submittal are for 24 inch diameter controlled low strength material (CLSM) ground improvement columns (GIC) using a 750 psi CLSM backfill material. Final design will include documentation for Deep Soil Mix (DSM) GIC providing substantially similar engineering properties using lower strength material (soil-cement ~200 psi) and a larger diameter column (higher area replacement ratio).

This Transmittal is based on 65% Design Development information and should be used for review of the ground improvement methods proposed. This submittal should not be considered as basis for the bidding or construction phase of this project.

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This 65% Design Development package includes the following Attachments:

ATTACHMENT A – Plan Sheets
ATTACHMENT B – Calculations
ATTACHMENT C – Load Test Requirements
ATTACHMENT D – Special Provisions CLSM GIC
ATTACHMENT E – Special Provisions DSM GIC

We are pleased to serve you on this project. If you have any questions regarding the contents of this Transmittal, please contact me at (530) 748-1336 ext. 15.

Sincerely,

9/28/11

Acacia CE Inc.

REGISTERED PROFESSIONAL ENGINEER
WILLIAM M. KENNEY
No. GE 2760
Exp. 3/31/13
GEOTECHNICAL
STATE OF CALIFORNIA

William M. Kenney, GE
Principal Engineer

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ATTACHMENT A
Plan Sheets

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Dist.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12.80	2.5/2.8 12.0/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2760 Exp. 12/31/12 CIVIL STATE OF CALIFORNIA

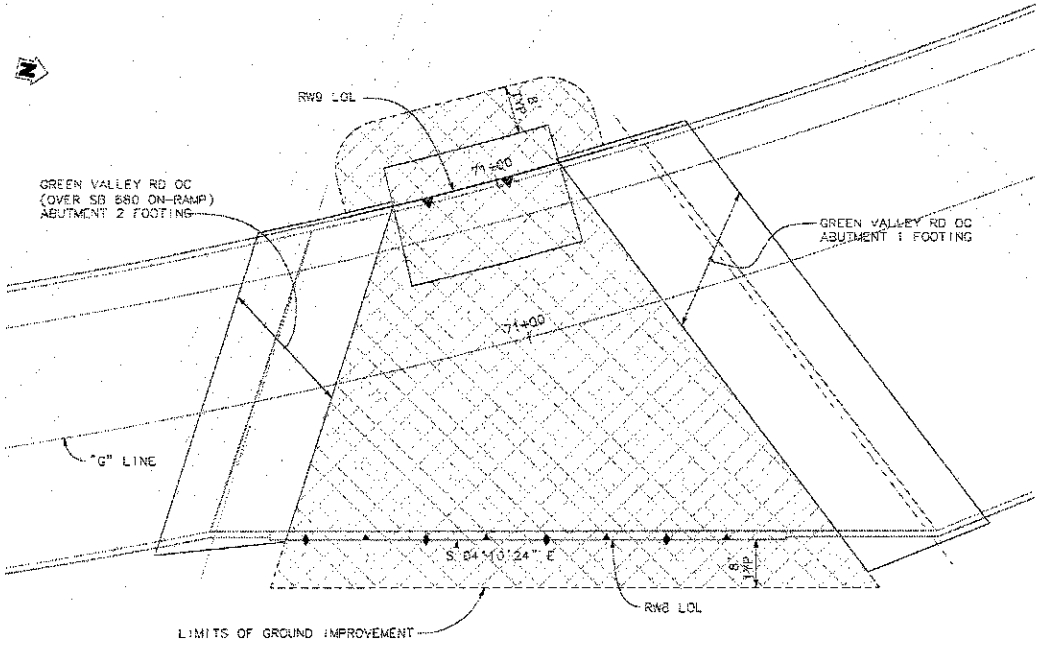
ACACIA CE
3025 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

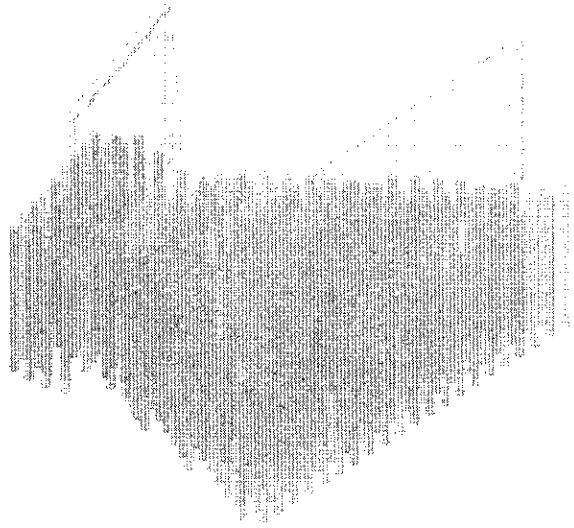
65% SUBMITTAL
07/11/11

LEGEND

GROUND IMPROVEMENT



PLAN
1" = 10'



CONCEPTUAL ISOMETRIC VIEW
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL

CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM M KENNEY

CALCULATED-DESIGNED BY: S. B. WARREN
CHECKED BY: W. M. KENNEY

REVISED BY
DATE REVISED

USERNAME => $USER | RELATIVE BORDER SCALE 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 0000000001

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	G-DET No.	TOTAL SHEETS
04	Sol	12,80	2.5/2.6 12.0/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2760 Exp. 3/31/13 CIVIL STATE OF CALIFORNIA

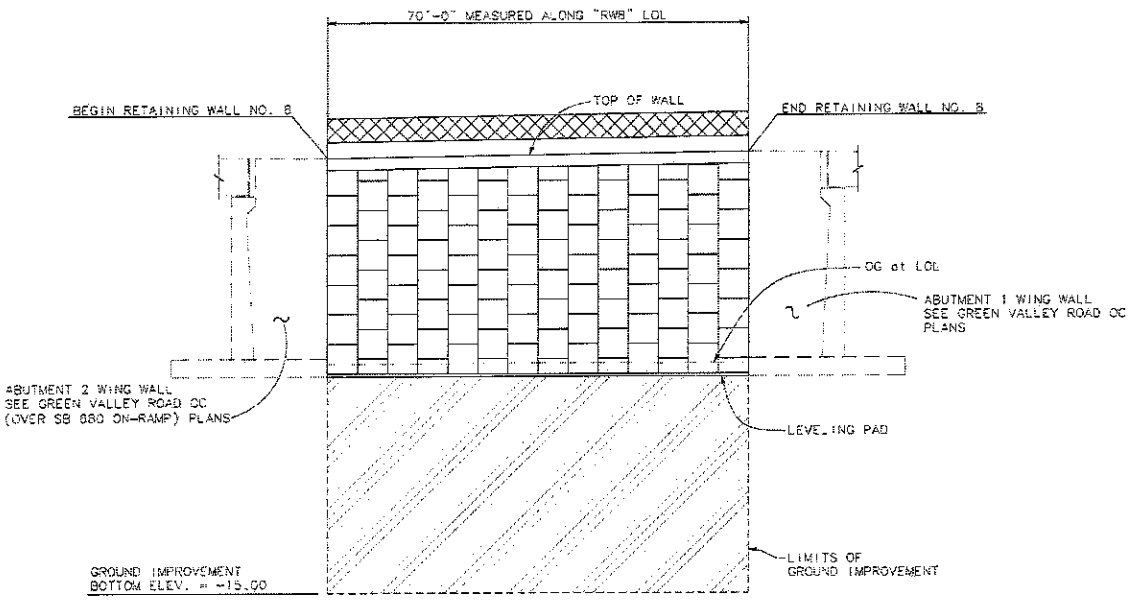
ACACIA CE
3525 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

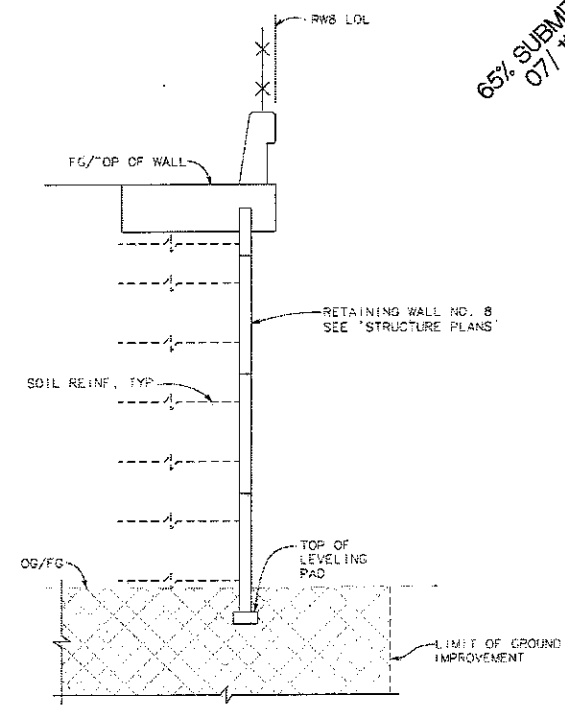
LEGEND

GROUND IMPROVEMENT

65% SUBMITTAL
07/11/11



ELEVATION
1" = 10'



TYPICAL SECTION - RETAINING WALL NO. 8
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL
CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM M. KENNEY
CALCULATED-DESIGNED BY: S. D. WARREN
CHECKED BY: W. M. KENNEY
REVISED BY
DATE REVISED

USERNAME =A$USER
RELATIVE BORDER SCALE 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0000000000
DATE PLOTTED = 11-JUL-2011

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.5/2.8 12.3/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2780 Exp. 3/31/13 GEOTECHNICAL STATE OF CALIFORNIA

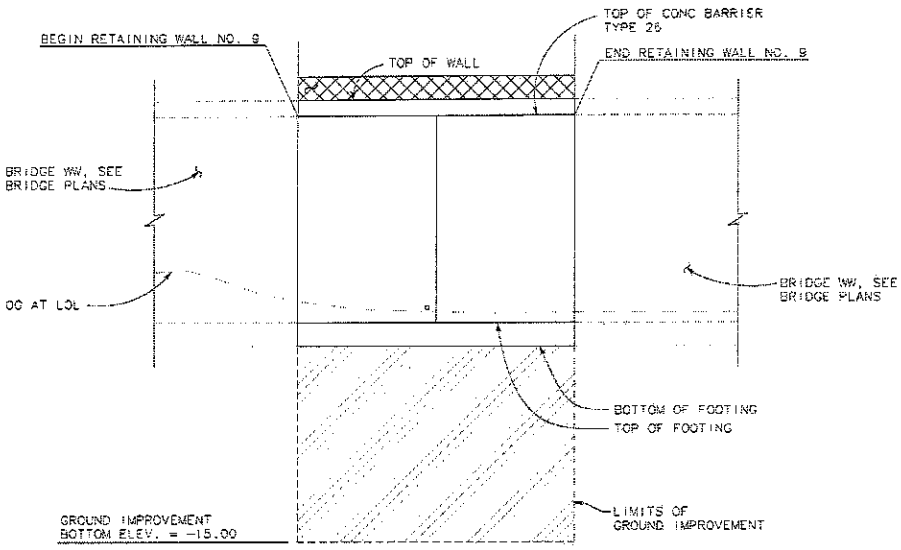
ACACIA CE
3025 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

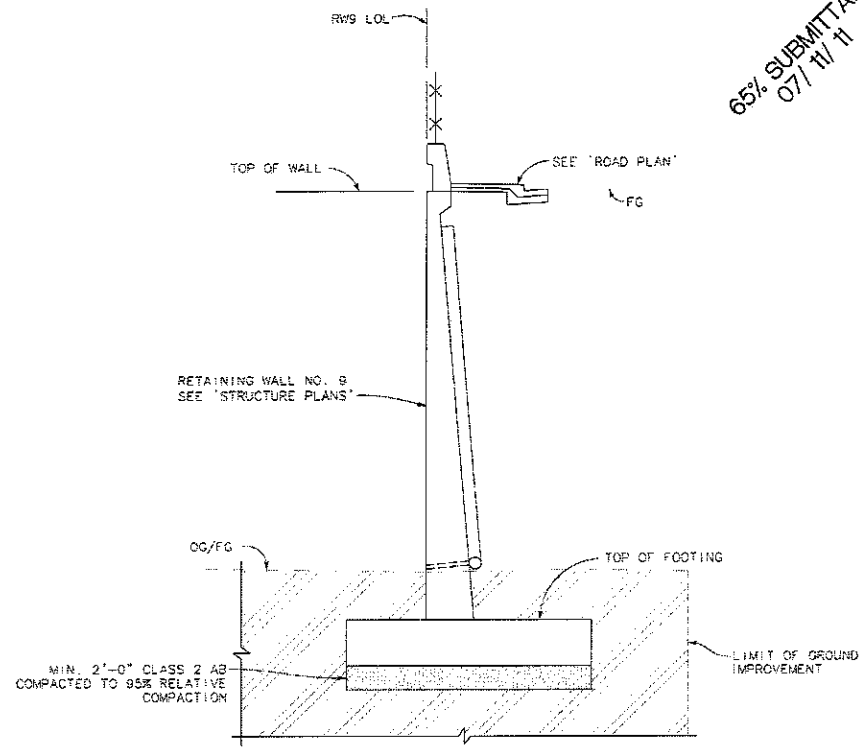
65% SUBMITTAL
07/11/11

LEGEND

GROUND IMPROVEMENT



ELEVATION
1" = 10'



TYPICAL SECTION - RETAINING WALL NO. 9
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL
CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM H. KENNEY
CALCULATED-DESIGNED BY: S. D. WARREN
CHECKED BY: W. M. KENNEY
REVISED BY
DATE REVISED

USERNAME => $USER
RELATIVE BORDER SCALE 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0000000000

ATTACHMENT B
Calculations

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Acacia CE
Consultants & Engineers
www.acaciace.com

Job Name: 80/680/12 Walls 8 + 9 By: WMK Sheet No. 1
Job No.: AC 157 Date:

CLSM GIC Composite Bearing Capacity (ULT.)

Two Zones : Zone 1 = Type 1 Wall
Zone 2 = MSE Wall / Field

$$q_{ac} = a_r \left(\frac{Q_{CLSM}}{q_{CLSM}}\right) + \beta (1 - a_r) q_s$$

Where: Q_{CLSM} = CLSM Cap (Ult.)
a_r = Area Replacement Ratio
β = Bearing Reduction Factor
0.5 - 1 for friction Col.
0.1 - 0.4 for end bearing
q_{CLSM} = Area CLSM GIC
q_s = Soil Bearing Cap (Ult.)

Determine Soil Bearing Cap. (q_s)

Generalized Soil Conditions
$\phi = 22°$ $c = 250$ psf $\gamma = 115$ pcf

Footing
$B = 20$ feet $D = \phi$ feet (Conservative)

$$q_s = c N_c + \gamma D_F N_q + \frac{\gamma B}{2} N_\gamma$$

For 22° $N_c = 16$ $N_q = 8$ $N_\gamma = 7$

$$q_s = (250)(16) + 0 + \frac{(115)(20)}{2}(7)$$

$q_s = 12{,}050$ psf

$$q_s = (750)(N_c) = (750)(5.5) = 4125 \Rightarrow 4{,}000 \text{ psf}$$

Area Replacement Ratio (a_r)

Zone 1, Rect. Spacing $= \frac{3.14}{(4.625)(3.75')} = 0.173$

Zone 2, Eq. Triang. $= \frac{3.14}{(.866)(4.83')^2} = 0.155$

Area CLSM GIC (q_{CLSM})

CLSM GIC diam = 24"

$\therefore$ $q_{CLSM} = 3.14$ ft²

CLSM GIC Bearing Capacity (Q_{CLSM})

$$Q_{CLSM} = (750 \text{ psi})\left(\frac{144 \text{ in}^2}{\text{ft}^2}\right) = 108{,}000 \text{ psf}$$

Composite Bearing Capacity - Zone 1 - Type 1 Wall Ftg.

$q_{ac} = (.17)(108{,}000) + (.75)(1-.17)(4{,}000)$

$q_{ac} = 20{,}850$ psf $\Rightarrow$ 20,500 psf

Composite Bearing Capacity - Zone 2 - MSE Wall / Field

$q_{ac} = (.155)(108{,}000) + (.75)(1-.155)(4{,}000)$

$q_{ac} = 19{,}275$ psf $\Rightarrow$ 19,500 psf

Bearing Capacity GIC Only (No Soil Contribution)

$q = (.17)(108{,}000) = 18{,}360$ psf $\Rightarrow$ 18,000 psf Zone 1

$q = (.155)(108{,}000) = 16{,}740$ psf $\Rightarrow$ 16,500 psf Zone 2

CLSM GIC Composite Shear Strength

$C = f_{CLSM}\, a_r + r\, C_o\, (1 - a_r)$

Where: f_{CLSM} = CLSM GIC Shear Strength = ½ Compressive Strength
a_r = Area Replacement Ratio
r = reduction factor for low strain in Soil
C_o = Soil Shear Strength

Zone 1 - Type 1 Wall
Zone 2 - MSE Wall / Field

Area Replacement Ratios

Zone 1 = 0.17
Zone 2 = 0.155

Use $r = 1$

C_o = Undrained Shear Strength
C_o = 750 psf

Composite Shear - Zone 1

$C = \left(\frac{108{,}000}{2}\right)(.17) + (1)(750)(1 - .17)$

$C = \underline{9803 \text{ psf}} \Rightarrow C = \underline{9800}$

Composite Shear - Zone 2

$C = \left(\frac{108{,}000}{2}\right)(.155) + (1)(750)(1 - .155)$

$C = 9004 \text{ psf} \Rightarrow \underline{C = 9000 \text{ psf}}$

Shear GIC ONLY (No Soil Contribution)

$C = \left(\frac{108{,}000}{2}\right)(.17) = \underline{9180}$ For Zone 1

$C = \left(\frac{108{,}000}{2}\right)(.155) = \underline{8370}$ For Zone 2

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Job Name: 80/680/12 Walls 8+9 By: WMK Sheet No. 4
Job No.: AC 157 Date:

Soil Profile For Settlement Estimate

Use R-10-003A

BOF MSE = 22.0'

Bottom of Ground Imp = -15'

-20 LZ1 = 5'

-26 LZ2 = 6'

-33 LZ3 = 7'

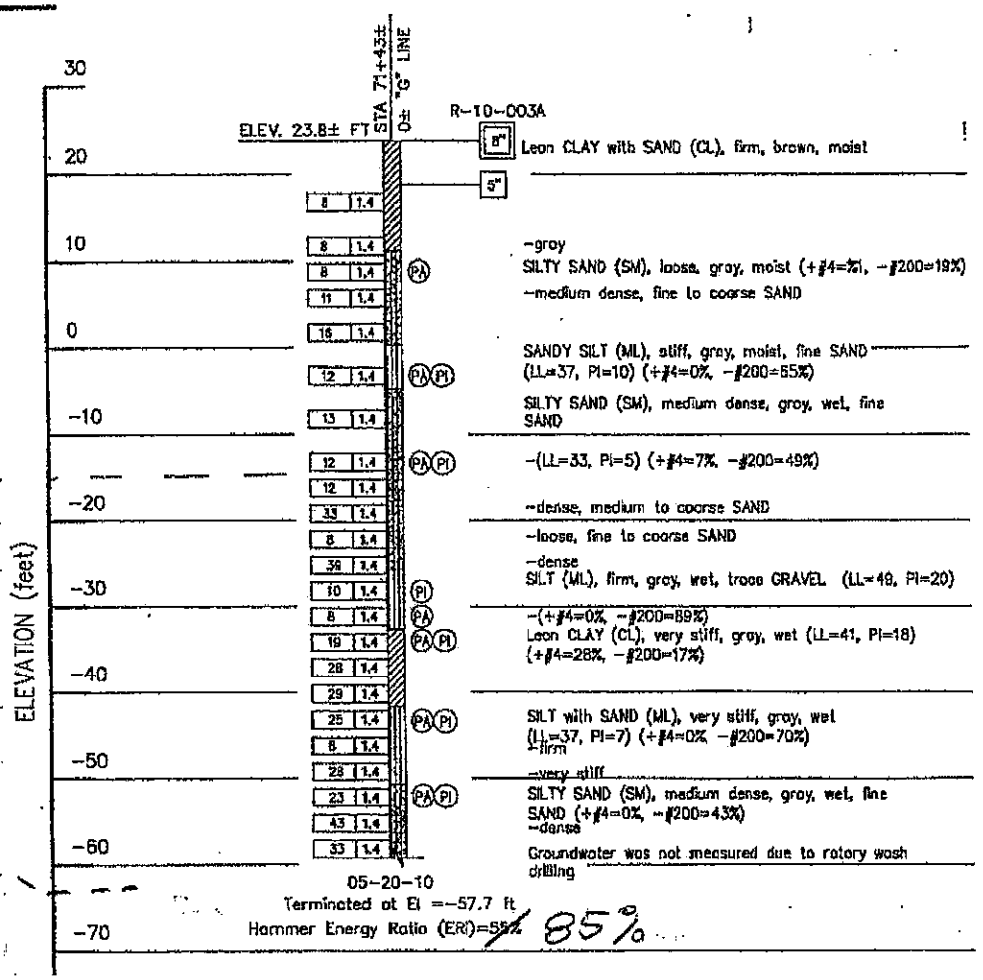
-41 LZ4 = 8'

-51 LZ5 = 10'

-67 LZ6 = 16'

LZ7 = 10'

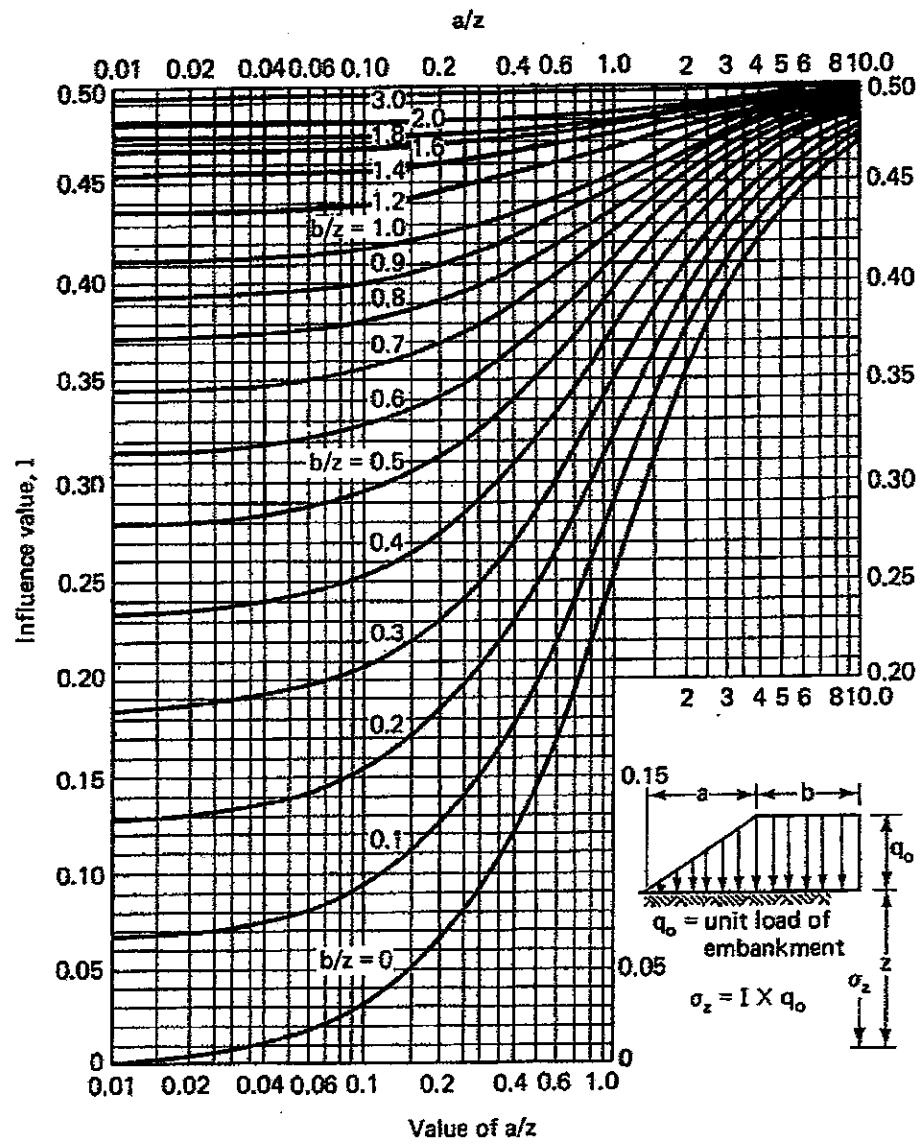
-77



		Mid Pt Depth
LZ1: Sand	E ~ 600 ksf	39.5
LZ2: Sand	E ~ 600 ksf	45.0
LZ3: Silt	E ~ 150 ksf	51.5
LZ4: Clay	E ~ 1000 ksf	59.0
LZ5: Silt	E ~ 250 ksf	68.0
LZ6: Sand	E ~ 600 ksf	81.0
* Below -63'	E ~ 600 ksf	94.0

Assume 10' Zone

* Based on CPT-10-003A



Influence factors for vertical stress under a very long embankment (after NAVFAC, 1971 as reported in Holtz and Kovacs, 1981)

Figure 9-2

Sheet No. 5

Job Name: 80/680/92
Job No.: AC 157
Engineer(s): WMK
Date: July 9, 2011

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Parameter	Symb	Val.
Column diameter (ft)	d	24
Depth to groundwater (ft)	dgw	18
Total unit weight of soil (pcf)	g	120
Soil frict. angle (degr)	f	22
Soil undr shear str (psf)	c	500
Max. hor. pressure (psf)	pmax	2500
Column cap. (kips)	Qcell	110
Bearing press. (ksf)	qall	5.5
Column stiffn. modulus (pci)	kcol	1000
Soil stiffness modulus (pci)	km	15

GIC ZONE SETTLEMENT CALCULATIONS

Parameter	Symb	Equation		
Load (kips)	P		111.38	
Cell width (ft)	B		4.5	
Cell length (ft)	L		4.5	
Cell bearing pressure	q	P/(B*L)	5.50	
No. Columns	N		1	
Area replacement ratio	Ra	N*Acol/(B*L)	0.16	
Stiffness ratio	Rs	kg/km	66.67	
Stress at top of Column (ksf)	qcol	q*Rs/(Rs*Ra-Ra+1)	32.77	
Load at top of Column (kips)	Qcol	qcol*Acol	102.96	
Improved zone settlement (in)	siz	qcol/kcol	0.23	

UZ = ↑

Notes:

For triangular spacing trib area = (.866)(a)(a)
Where a = on-center spacing
Equvalent sqaure are used in worksheet

INFLUENCE FACTORS FROM NAVFAC 1971

a = 1

Unform Load (q) = 5500

Determine Influence Factor Using "Long" Embankment

Mid Pt Depth	Width	Unit Load				(psf)	(ft)	(psf)	(ft)
(z)	(b)	(q)	(a/z)	b/z	I	I*q	H	E	s
39.5	27.4	5500	0.025316	0.693671	0.34	1870	5	600000	0.016
45	27.4	5500	0.022222	0.608889	0.32	1760	6	600000	0.018
51.5	27.4	5500	0.019417	0.532039	0.29	1595	7	150000	0.074
59	27.4	5500	0.016949	0.464407	0.26	1430	8	1000000	0.011
68	27.4	5500	0.014706	0.402941	0.235	1292.5	10	250000	0.052
81	27.4	5500	0.012346	0.338272	0.21	1155	16	600000	0.031
94	27.4	5500	0.010638	0.291489	0.17	935	10	600000	0.016

Lower Zone Settlement (ft) = 0.217
Lower Zone Settlement (in) = 2.6

LZ = ↑

Assume 3000 sf of embnkment load
Equivalent square = 54.77 feet E.W.
Therefore b= 1/2 side = 27.4 feet

NOTE: Due to the primarily granular (sandy) nature of zones 1, 2, 6, 7, and granular behavior of zone 5
About 1/2 to 1/3 of the total settlement should occur immediatley as the fill is placed

UZ + LZ = 2.8"

ATTACHMENT C
Load Test Requirements

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Ground Improvement Column (GIC)
Modulus Test Schedule

Prepared: July 11, 2011

Job: I-80/I-680/SR-12 ICP "G" Line Walls 8 & 9
Job No.: AC 157

Test Criteria

GIC Col. Diameter = 24 inches

Test Load (100% ASD) = 110 kips

Jack Calibration Date: _____

Jack No.: _____
Pump No.: _____
Guage No.: _____

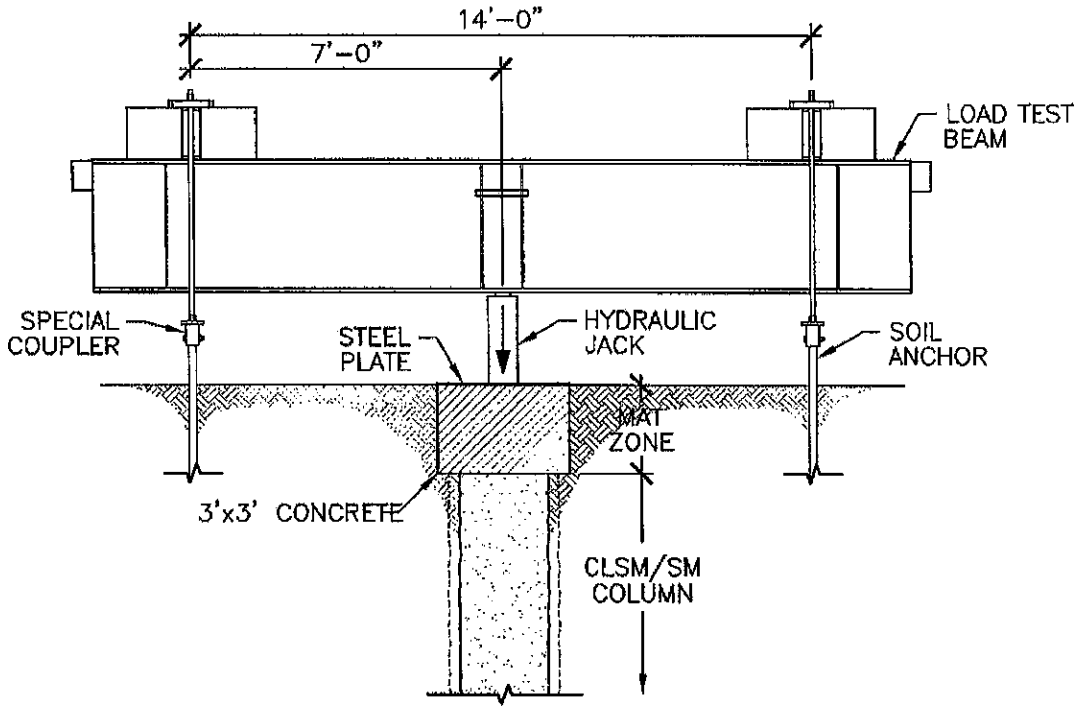
** - Gauge Factor to be based on latest Calibration for the Jack/Pump Gauge Setup used by the Testing Contractor

Gauge factor ** 31 in^2
Curve factor** 0 kips

Load No.	Percent of Design Load(%)	Gauge Pressure (psi)	Load (kips)	Load Duration (min.) MIN.	Load Duration (min.) MAX.
1	5%	177 / 200	5.5	0	0
2	17%	603 / 650	18.7	15	60
3	33%	1170 / 1200	36.3	15	60
4	50%	1774 / 1800	55.0	15	60
5	67%	2377 / 2400	73.7	15	60
6	83%	2945 / 2950	91.3	15	60
7	100%	3548 / 3550	110.0	15	60
8	115%	4080 / 4100	126.5	60	120
9	133%	4719 / 4750	146.3	15	60
10	150%	5322 / 5350	165.0	15	60
11	167%	5925 / 5950	183.7	15	60
12	183%	6493 / 6500	201.3	15	60
13	200%	7096 / 7100	220.0	15	60
14	167%	5925 / 5950	183.7	-	-
15	133%	4719 / 4750	146.3	-	-
16	100%	3548 / 3550	110.0	-	-
17	67%	2377 / 2400	73.7	-	-
18	33%	1170 / 1200	36.3	-	-
19	0%	-	0.0	-	-

Test Procedure

Apply seat load. Read dial gauges and apply first load increment. When Geopier average deflection is less than 0.01 inches per 1 hour or 0.0025 inches per 15 minutes go to next load increment or go to maximum load time of 1 hour if average deflection is greater. Hold load minimum of 60 minutes at 115% load increment.



CLSM/SM COLUMN SPECIFICATIONS	
APPRX. MAT ZONE	-- FT
MIN. CLSM/SMC SHAFT LENGTH (CSL)	-- FT
APPRX. CLSM/SMC DIA. (MAY VARY)	--- IN
TEST LOAD (100%)	-- KIPS
TEST LOAD (150%)	--- KIPS

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Base Documents

Sample Details

Load Test Setup

PROJECT NO.	AC 157		FIGURE NO.
DATE	JULY 11, 2011		1
REVISION	0		
DRAWN SW	CHECKED WK		

APPENDIX D
Special Provisions CLSM GIC

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10-1.XX DRILL DISPLACEMENT CLSM GROUND IMPROVEMENT COLUMN

This work shall consist of furnishing and installing Controlled Low Strength Material (CLSM) Ground Improvement Columns (GIC) by the drill displacement method at the locations shown on the plans.

CLSM GIC shall be performed by displacing soil with a specialized auger attachment and injecting CLSM in the displaced cavity under pressure as the displacement auger is removed from the ground to form a columnar inclusion of cemented material within the densified soil matrix. Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications regarding damage by CLSM GIC to existing utilities, improvements and facilities. The foundation information represents existing conditions at the specific boring locations at the time the borings were performed.

Installation of CLSM GIC shall create a soil/cemented column "raft" to improve strength properties of the foundation soils for the Type 1 wall and Mechanically Reinforced Earth (MSE) wall above. The Contractor shall confirm that the installed CLSM GIC achieves the required compressive strength and ensure that it is installed in the design configuration and within the specified limits.

The ground improvement shall extend to the designated depths shown on the plans. CLSM GIC installation equipment shall be capable of advancing through soil conditions as shown in the project boring logs.

CLSM GROUND IMPROVEMENT COLUMN

CLSM GIC shall improve strength properties of foundation soils within the area shown on the plans. CLSM GIC shall be placed according to the treatment pattern shown on the plans. The CLSM GIC displacement method shall displace at least 95 percent of the diameter of the displacement auger. The replacement of CLSM in the displaced cavity shall exceed 110 percent of the diameter of the displacement auger. The average 56-day unconfined compressive strength of CLSM shall be no less than 750 psi.

The Contractor may provide an alternative plan meeting the minimum performance requirement specified herein. The alternative plan shall be submitted as an attachment to the pre-construction submittal for approval by the Engineer.

The Contractor shall conduct a Pre-Production (PPC) Program within the limit of ground improvement areas shown on the plans prior to commencing CLSM GIC installation to establish production parameters procedures, and materials to be used during the production phase. The PPC Program shall produce CLSM mix design and procedures for production installation based upon the information provided from the PPC Program including: estimated 28-day and 56-day compressive strength of the CLSM, CLSM volume at the bottom of the GIC, injection pressure, injection volume per foot, and withdrawal rate of the auger, and complete description of all CLSM GIC operations.

SUBMITTALS

The submittals and other additional submittals shall conform to, the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions, and shall be stamped by a California Registered Professional Civil Engineer except for survey data which shall be stamped by a California Registered Professional Civil Engineer or a California Registered Land Surveyor.

The Contractor shall submit, for review by the Engineer, a statement of the previous work experience similar to that described in these special provisions. The statement shall include at least 3 successful CLSM GIC projects within past five years. This statement shall include a written description of each project, owner's contact name and current phone number, the dates and the extent of the work, the manner of its execution, and any other information that supports the Contractor's ability to carry out the work described in these special provisions.

Pre-construction Submittals

At least four weeks prior to commencement of mobilization of CLSM GIC equipment for production installation, the Contractor shall submit the following to the Engineer:

1. Names and qualifications of the ground improvement personnel including project experience, resumes and other documentation that demonstrate the experience qualifications of the project engineers, each field superintendent, and rig operator for the CLSM GIC installation.
2. A list of Contractors, responsible engineers, project descriptions and personnel responsibilities from CLSM GIC projects completed by the Project Engineers and Field Superintendents. Contractor's names, addresses and telephone numbers shall be included for these projects representing the individual's comparable experience. The projects listed shall demonstrate personnel qualifications using similar equipment and auger configuration(s) as proposed for the work of this Contract.
3. Submit data on equipment to be used for the CLSM GIC installation.
4. Sequence and time schedule of all operations including plan location and sequence of all CLSM GIC. The Contractor shall submit a CLSM GIC element Layout Plan based on the limits shown on the Plans to achieve the required plan area configurations and coverage. Plan locations of all proposed CLSM GIC shall be shown on Layout Plans. CLSM GIC elements on the Layout Plans shall be numbered and dimensioned and of suitable scale to clearly show the details of the layout.
5. CLSM mix design including: cement type and source, flyash type and source, water-cement ratio by weight and other pertinent details.
6. The results of the PPC Program including, but not limited-to: CLSM estimated 28-day and 56-day compressive strengths, injection pressure and rates, and complete description of all installation operations.

7. Description of Quality Control Plan for CLSM GIC installation including, but not limited to, the following:
   a. A detailed description of the Quality Control Plan to be undertaken each day during CLSM GIC installation to confirm that the installed columns conform to the required compressive strengths specified, the plan area coverage over the required depths and limits, and required horizontal and vertical alignments.
   b. Details of procedures used to obtain CLSM samples.
   c. Measures to be implemented each day during CLSM GIC to continuously monitor and control: CLSM injection pressures and quantities; withdrawal rates of the installation equipment; horizontal and vertical alignments of the CLSM GIC elements, and other related aspects of the installation process.
   d. Example formats of Daily Field Reports conforming to the requirements stated herein.
   e. Names, certifications and licenses of the Laboratory to be responsible for performing quality control tests.
   f. Proposed details and formats of all required data presentations to be submitted to the Engineer during the course of the Work.

Construction Submittals

Within two working days after the completion of each CLSM GIC element, submit the following:

1. Any deviation of the center coordinates from the layout plan to the nearest 3 inches at the top of the element.
2. The Daily Quality Control Report shall include as a minimum the results of the following QC parameter monitoring for each element:
   a. Rig Identification
   b. Type and size of installation tool
   c. Date and time (start and finish) of column construction
   d. Column number and reference drawing number
   e. Column diameter
   f. Column top and bottom elevations
   g. CLSM mix design designation
   h. CLSM slump measurements
   i. Description of obstructions, interruptions, or other difficulties during installation and how they were resolved.
3. Ready Mix plant production records (delivery tickets) including mix designation.

The Daily Quality control Reports shall also include the following parameters recorded automatically or manually for every 5th CLSM GIC at intervals no greater than and submitted in the form of either tables or figures (as agreed to by the Engineer):

a. Elevation in feet vs. depth

b. Displacement auger rotation speed in RPMs vs. depth

c. Vertical withdrawal rates in feet per minute vs. depth

d. Average volume of CLSM injection rates in cubic feet per foot vs. depth

Within one working day after the end of a work shift, submit Daily Production Reports for the work shift to the Engineer. Daily Production Reports shall be filled out, checked for correctness, and signed by the CLSM GIC Contractor's field superintendent and the Contractor's field superintendent at the end of every work shift. The reports shall contain, but not be limited to, the following information:

1. Day, month, year, time of work, shift, beginning and end; names of superintendent in charge of the Work for both the CLSM GIC Contractor and the Contractor; a list of all workers' names associated with each installation rig; and a summary of equipment used during the shift.

2. The location as shown on the Working Drawings of each completed CLSM GIC element installed during the work shift and all CLSM GIC elements completed to date, on a plan of suitable scale to clearly detail the locations of the elements.

3. Other pertinent observations including, but not limited to, spoil return, CLSM escapes, ground settlement and/or heave, collapse of the CLSM GIC, withdraw rates of the displacement auger, any unusual behavior of equipment during the installation process or any other noteworthy events. In the event of any Contractor claim, the Daily Production Reports shall be the primary documents to substantiate the reasons and basis for the claim.

4. Date, time, sample designation, and other details of CLSM sampling.

5. Summary of any downtime or unproductive time, including start and end time, duration, and reason.

4. Within five weeks after completion of the CLSM GIC, the Contractor shall submit survey data including:

   a. A final Layout Plan of suitable scales showing the locations of each CLSM GIC element at the top of the element.

   b. A tabular summary of layout center coordinates modified to reflect any measured- deviations of each CLSM GIC element at the top of the element, the elevation of the top and bottom of each element.

CLSM GIC QUALITY CONTROL

The Contractor shall verify that the installed CLSM GIC elements conform to these special provisions.

The Contractor shall obtain CLSM samples and provide them to the Laboratory for testing specified in these special provisions. The Laboratory shall cast preserve, cure, transport, and test the

samples and report the test results to the Engineer. The test results shall be signed and stamped by a California licensed Civil Engineer from the Laboratory. The Contractor shall coordinate sampling activities and CLSM GIC Quality Control with the Engineer and the Laboratory. The Contractor shall supply incidental items, access, inside storage space, curing boxes and electrical power to the curing boxes as necessary. The Laboratory shall supply molds for use in casting the samples.

CLSM GIC Samples

A minimum of two CLSM sampling rounds shall be performed daily during the PPC Program. The Contractor shall obtain Samples from the ready mix truck prior to introduction into the pump as selected by the Engineer. Each sample shall be of sufficient volume to produce a minimum of six full cylinders, 6 inches diameter by 12 inches deep.

Samples shall be formed, cured and preserved in accordance with ASTM D 4832 and protected from freezing and extreme weather conditions which could have deleterious effect, at all times.

Unless otherwise directed by the Engineer, the Laboratory shall test one each cylinder at 7 days, 14 days and 28 days for unconfined compressive strength in accordance with ASTM Designation D4832. The Laboratory shall submit the laboratory test results to the Engineer in accordance with these special provisions. Submit 3 cylinders from each sample round to the Engineer.

CLSM - CONTROLLED LOW STRENGTH MATERIAL - Materials

Controlled low strength material (CLSM) shall consist of a workable mixture of aggregate, cementitious materials, and water and shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications and these special provisions. CLSM shall be a flowable, excavatable mixture of cement, pozzolan, coarse and fine aggregate and water which has been mixed in accordance with ASTM C 94.

Controlled low strength material in new construction shall not be permanently placed higher than the basement soil. When controlled low strength material is proposed for use, the Contractor shall submit a mix design and test data to the Engineer for approval prior to excavating the trench for which controlled low strength material is proposed for use. The test data and mix design shall provide for the following:

A. A 28-day compressive strength between 500 and 750 psi. Compressive strength shall be determined in conformance with the requirements in ASTM Designation D4832.

B. Cement shall be any type of Portland cement conforming to the requirements in ASTM Designation C150; or any type of blended hydraulic cement conforming to the requirements in ASTM Designation C595M or the physical requirements in ASTM Designation C1157M. Testing of cement will not be required.

C. Admixtures may be used in conformance with the provisions in Section 90-4, "Admixtures," the Standard Specifications. Chemical admixtures containing chlorides as CL in excess of one percent by mass of admixture, as determined in conformance with the requirements of California Test 415, shall not be used. If an air-entraining admixture is used, the maximum air content shall be limited to 20 percent. Mineral admixtures shall be used at the Contractor's option.

CLSM Properties:

1. Density shall be between 120 PCF minimum and 145 PCF maximum.
2. Slump shall be as approved by minimum 6 inches up to 10 inches.
3. Compressive strength at 28 days for CLSM shall at least 750 psi.
4. Cement: Cement shall be Type II in accordance with the requirements of ASTM C150.
5. Pozzolan: Pozzolan shall be Type F in accordance with the requirements of ASTM C618.
6. Aggregate: Aggregate shall consist of a well graded mixture of crushed rock, or sand with a maximum size aggregate of 3/8 inch. 100 percent shall pass the 3/8 inch sieve. Not more than 12 percent shall pass the No. 200 sieve. All material shall be free from organic matter and not contain more alkali, sulfates, or salts than the native materials at the site of the work.

Materials for CLSM shall be thoroughly machine-mixed in a pugmill, rotary drum or other approved mixer. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Controlled low strength material shall be placed in the work within 3 hours after introduction of the cement to the aggregates, unless retarders are added as approved by the Engineer.

HORIZONTAL AND VERTICAL ALIGNMENT TOLERANCES

The maximum horizontal deviation of the as-installed center of any CLSM GIC element at the ground surface shall not exceed 3 inches from the layout center coordinate, shown on the approved Contractor's submittal.

The measured vertical alignment of CLSM GIC elements shall not deviate in any direction more than two percent from vertical of the measured length.

At the direction of the Engineer, any CLSM GIC element which exceeds the allowable horizontal or vertical alignment tolerances shall be re-installed or supplemented with one or more adjacent or overlapping elements, at no additional cost.

OBSTRUCTIONS

Where obstructions are encountered during CLSM GIC installation, the Contractor shall remove the obstruction or install additional CLSM GIC, at the direction of the Engineer. If such conditions are encountered, the Contractor shall notify the Engineer in writing, and provide all pertinent information relating to the nature, depth, plan location coordinates, expected extent of the obstruction, and proposed procedures to overcome the obstruction. Such construction to overcome an unknown obstruction shall only be performed with the written authorization of the Engineer, and will be paid for as extra work as provided in Section 4-1.030 of the Standard Specifications.

If difficult drilling is encountered due to the presence of naturally occurring cobbles, boulders or dense well-cemented soils or other characteristics of the naturally occurring soils, the Contractor may elect to remove the hindrances, install CLSM GIC by an alternate pattern that avoids or encapsulates the hindrance but that achieves the required CLSM area ratio, subject to the approval of the Engineer.

CONTAINMENT, COLLECTION AND DISPOSAL OF SPOIL

The Contractor shall remove and dispose of all waste materials in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The Contractor shall take all necessary precautions and implement measures to prevent any spoil material or stockpiled materials from entering storm drain structures, drainage courses and other utility lines or from leaving the site via surface runoff.

MEASUREMENT

CLSM GIC installation will be measured by volume using the cubic yard. The volume shall be determined by multiplying the treated area, by the required depth of the CLSM GIC elements in treatment areas shown on the plans.

PAYMENT

The contract price per cubic yard for CLSM GIC shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing CLSM GIC, complete-in-place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for CLSM GIC quality control shall be considered as included in the contract price paid per cubic meter for CLSM GIC volume treated and no separate payment will be allowed therefor.

APPENDIX E
Special Provisions DSM GIC

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10-1.XX DEEP SOIL CEMENT MIXING GROUND IMPROVEMENT COLUMNS

This work shall consist of furnishing and installing soil-cement by deep mixing at the locations shown on the plans.

Deep soil-cement mixing shall be performed by mixing in-situ soil with cement grout to form a uniform mixture, blended thoroughly and evenly by controlled methods. Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to "Order of Work 11 and "Obstructions" elsewhere in these special provisions. Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications regarding damage by soil mixing operations to existing utilities, improvements and facilities.

The foundation information represents existing conditions at the specific boring locations at the time the borings were performed.

Installation of soil-cement by deep mixing auger;" methods shall create soil-cement foundations to improve strength properties of the foundation soils for the Type 1 Retaining Wall and Mechanically Reinforced Earth (MSE) wall above. The Contractor shall confirm that the installed soil- cement achieves the required compressive strength and ensure that it is installed in the design configuration and within the specified limits.

The ground improvement shall extend to the designated depths shown on the plans. Soil-cement mixing equipment shall be capable of advancing through previously installed and cured soil-cement.

DEEP-MIXING

Deep soil-cement mixing shall improve strength properties of foundation soils within the area shown on the plans. Soil-cement elements shall be placed according to the treatment pattern shown on the plans. The average 56-day unconfined compressive strength of soil-cement throughout the depth of each soil-cement element shall be no less than XXXX psi for a minimum XXX inch diameter element. •

The Contractor may provide an alternative plan meeting the minimum performance requirement specified herein. The alternative plan shall be submitted as an attachment to the pre-construction submittal for approval by• the Engineer.

The Contractor shall conduct a Pre-Production (PPC) Program within the limits of soil-cement areas shown on the plans prior to commencing soil-cement mixing to establish production parameters) procedures, and materials to be used during the production phase. The PPC Program shall produce soil-cement mix design and procedures for production mixing based upon the information provided from the PPC Program including: estimated in-situ 28-day and 56-day compressive strength of the soil- cement, cement-grout injection pre sure and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing tools, and mixing times at bottom of the soil-cement element when, there is no vertical movement of the mixing tool, and complete description of all mixing operations.

SUBMITTALS

The submittals and other additional submittals shall conform to, the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions, and shall be stamped by a California Registered Professional Civil Engineer except for survey data which shall be stamped by a California Registered Professional Civil Engineer or a California Registered Land Surveyor.

The Contractor shall submit, for review by the Engineer, a statement of the previous work experience similar to that described in these special provisions. The statement shall include at least 5 successful soil cement mixing projects within past three years. This statement shall include a written description of each project, owner's contact name and current phone number, the dates and the extent of the work, the manner of its execution, and any other information that supports the Contractor's ability to carry out the work described in these special provisions.

Pre-construction Submittals

At least four weeks prior• to commencement of any mobilization of deep soil-cement mixing equipment for production mixing, the Contractor shall submit the following to the Engineer:

1. Names and qualifications of the soil-cement mixing personnel and surveyors, including project experience, resumes and other documentation that demonstrate the experience qualifications of the project engineers, each field superintendents, rig operators, and batch plant operators for the deep soil-cement mixing.
2. A list of Contractors, responsible engineers, project descriptions and personnel responsibilities from soil-cement mixing projects completed by the soil-cement mixing Project Engineers and Field Superintendents during the past three years. Contractor's names, addresses and telephone numbers shall be included for these projects representing the individual's comparable experience. The projects listed to demonstrate personnel qualifications shall have employed equipment using similar auger configuration(s) as proposed for the work of this Contract.
3. Data on equipment to be used for the deep soil-cement mixing, proportioning, pumping, injecting and mixing soil-cement as wells as all other ancillary equipment; including equipment capable of remixing non-conforming soil-cement.
4. Spoil containment (sheet piling or other) structures and methods to be used to prevent the migration or leakage of spoil return, disturbed in-situ soils or other spoil material beyond the immediate limits of soil-cement mixing operations. The Contractor shall demonstrate that the containment structure is stable under loads applied by soil-cement, water, in-situ soils, overlying fill materials, construction equipment, other surcharge load and loads applied by the subsequent deep mixing operations. Include also details and methods to be used to collect and dispose of the spoil return and other spoil materials.
5. Sequence and time schedule of all operations including plan location and sequence of all deep soil-cement mixing. The Contractor shall submit a soil-cement element Layout Plan based on the limits shown on the Plans to achieve the required plan area configurations and coverages, necessary overlaps, auger re-penetrations over the depths, and limits shown on the Plans. Plan locations of all proposed soil-cement mixing shall be shown on Layout Plans of suitable scale

to clearly show the details of the layout. Soil-cement elements on the Layout Plans shall be numbered and dimensioned.

6. Cement grout mix design including: cement type, cement source, cement compound composition, water-cement ratio by weight and other pertinent details. Limit water-cement ratio to (1:1 maximum), unless otherwise demonstrated in the Pre-Production (PPC) Program specified in these special provisions.

The results of the PPC Program including, but not limited to estimated in-situ 28-day and 56-day compressive strengths of the soil-cement, cement-grout injection pressure and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing tools, and mixing times at bottom of the soil-cement element when there is no vertical movement of the mixing tools, and complete description of all mixing operations.

1. Description of Quality Control Plan for deep soil-cement mixing including, but not limited to the following:

   a. A detailed description of the Quality Control Plan to be undertaken each day during soil-cement mixing to confirm that the installed soil-cement conforms to the required compressive strengths and unit weights specified, the plan area coverage over the required depths and limits, and required horizontal and vertical alignments.

   b. Details of procedures to obtain soil-cement samples, catalog cuts of the soil-cement sampling device and curing boxes.

   c. Measures to be implemented each day during soil-cement mixing to continuously monitor, modify and control: water-cement ratios, cement-grout injection pressures and quantities, mixing rotational speeds, penetration and withdrawal rates of the mixing equipment, horizontal and vertical alignments of the soil-cement elements, and other related aspects of the soil-cement mixing process.

   d. Example formats of Daily Production Reports conforming to the requirements stated herein.

   e. Names, certifications and licenses of the Laboratory and companies to be responsible for performing quality control tests.

   f. Proposed details and formats of all required tabular and graphical data presentations to be submitted to the Engineer during the course of the Work.

Construction Submittals

Within two working days after the completion of each soil-cement element, submit the following:

2. Deviations of the center coordinates from the Layout Plan to the nearest 3 inches at the top of the element.

3. Vertical alignment profiles shall be submitted in accordance with the frequencies specified to the nearest ½ inch over the measurement length along axes parallel and perpendicular to the line of longitudinal progression; the elevation to the nearest 30 mm of the top and bottom of the element.

4. The Daily Quality Control Report shall" include as a minimum the results of the following QC parameter monitoring for each element:

    a. Rig number.
    b. Type of mixing tool.
    c. Date and time (start and finish) of column construction.
    d. Column number and reference drawing number.
    e. Column diameter.
    f. Column top and bottom elevations.
    g. Grout mix design designation.
    h. Slurry specific gravity measurements.
    i. Description of obstructions, interruptions, or other difficulties during installation and how they were resolved.

5. The Daily Quality Control Reports shall also include the following parameters recorded automatically or manually for each element at intervals no greater than 3 feet and submitted in the form of either tables or figures (as agreed to by the Engineer):

    a. Elevation in meter vs. depths.
    b. Shaft rotation speed in RPMs vs. depths.
    c. Penetration and withdrawal rates in feet per minute vs. depths.
    d. Grout injection rate in gpm vs. depths.
    e. The average quantity of grout in gallons per foot injected per vertical foot of column vs. depth.

6. Batch plant production records, water-cement ratios, cement type, brand, and cement grout injection pressures.

Within one working day after the end of a work shift, submit Daily Production Reports for the work shift to the Engineer. Daily Production Reports shall be filled out, checked for correctness, and signed by the Deep Soil Mixing Contractor's field superintendent and the Contractor's field superintendent at the end of every work shift. The reports shall contain, but not be limited to, the following information:

1. Day, month, year, time of work, shift, beginning and end; names of each superintendent in charge of the Work for both the soil-cement mixing firm and the Contractor; a list of all workers' names associated with each soil-cement mixing machine; and a summary of equipment used during the shift.

2. The location and "neat" limits as shown on the Working Drawings of each completed soil-cement element installed during the work shift and all soil-cement elements

completed to date, on a plan of suitable scale to clearly detail the locations of the elements.

3. Other pertinent observations including, but not limited to, spoil returns, cement grout escapes, ground settlement and/or heave, collapses of the soil-cement element advancement rates of the mixing equipment, and any unusual behavior of any equipment during the soil-cement mixing process and other noteworthy events. In the event of any Contractor claim, the Daily Production Reports shall be the primary documents to substantiate the reasons and basis for the claim.

4. Date, time, plan location, sample designation and elevation, and other details of soil-cement sampling.

5. Summary of any downtime or unproductive time, including start and end time, duration, and reason.

Within five weeks after completion of the deep soil-cement mixing, the Contractor shall submit survey data including:

1. A final Layout Plan of suitable scales showing the locations of each soil-cement element at the top of the element.

2. A tabular summary of layout center coordinates modified to reflect any measured-deviations of each soil-cement element at the top of the element, the elevation of the top and bottom of each element.

3. A compilation of all vertical alignment profiles.

SOIL-CEMENT QUALITY CONTROL

The Contractor shall verify that the installed soil-cement elements conform to these special provisions.

The Contractor shall obtain soil-cement samples, including fluid and core samples, and provide them to the Laboratory for testing specified in these special provisions. The Laboratory shall form, preserve, cure, transport, and test the samples and report the test results to the Engineer. The test results shall be signed and stamped by a California licensed Civil Engineer from the Laboratory. The Contractor shall coordinate sampling activities and Soil-Cement Quality Control with the Engineer and the Laboratory. The Contractor shall supply incidental items, access, inside storage space, curing boxes and electrical power to the curing boxes. The Contractor shall supply molds for use in forming the samples.

Wet Grab Soil-Cement Samples

A minimum of two in-situ sampling rounds shall be performed daily during the PPC Program at locations selected by the Engineer. The Contractor shall obtain sampling rounds at the same soil-cement element, which shall consist of moist-cured soil-cement samples from three depths selected by the Engineer. Separate soil-cement samples shall be retrieved within

60 minutes of the completion of the soil-cement column. The device used to retrieve the wet grab soil-cement samples shall be capable of obtaining a discrete fluid sample of soil-cement at a depth determined by the Engineer and shall be capable of accepting particles not thoroughly mixed that are up to 4 inches in dimension. The sampler shall be lowered empty, air only, to the required depth in the soil-cement element and then opened. Once filled with the soil-cement, the sampler shall be closed to exclude entry or loss of soil-cement and shall be expeditiously raised to ground surface.

Each retrieved soil-cement sample shall be of sufficient volume to produce a minimum of eight full cylinders, 3 inch diameter by 6 inches deep. The Contractor shall separate and retain all soil-cement retrieved from each depth. The Contractor shall then cut all retrieved particles of soil larger than 1 inch into smaller pieces that will pass a 1 inch sieve, and then immediately form the six cylinders with material passing through a 1 inch sieve, including particles of soil that were cut up.

Soil-cement samples shall be formed, cured and preserved in accordance with AASHTO T23 and protected from freezing and extreme weather conditions which could have deleterious effect, at all times.

The Contractor may obtain additional samples and perform additional testing for his or her own information, at the Contractor's expense.

If the Contractor cannot obtain all of the required wet grab samples of the soil-cement in the designated soil-cement element, the Contractor shall obtain a full round of wet grab samples from the next soil-cement element installed by that rig. Continue taking wet grab samples in subsequent soil-cement elements until a full round is obtained. From each sampling round, one cylinder from each sampling depth shall be used to determine the cement factor based on the cement content determined in accordance with AASHTO Specification T 144 (or ASTM D806). Unless otherwise directed by the Engineer, for each soil-cement element, the Laboratory shall test every one cylinder at 7 days, 14 days, 28 days, and 56 days for unconfined compressive strength in accordance with ASTM D2166. The Laboratory shall submit the laboratory test results to the Engineer in accordance with these special provisions. Submit 3 cylinders from each sampled depth for each soil-cement element to the Engineer.

Wet Grab Soil Cement Sampling and Testing Schedule

	Frequency	Quantity	Notes
Number of Sampling Rounds (soil-cement elements)	Per Day	2	At soil-cement determined by the engineer
Number of wet grab soil-cement samples	Per soil-cement element	2	At depths determined by the engineer
Number of Cylinders	Per wet grab soil-cement sample	8	3 inch diameter by 6 inch high cylinder
Total Cylinders	Per sampling round	16	
Number of cylinders for test of cement factor and cement content	Per sampling round	2	At each of the 2 sampling depths
Number of cylinders for unconfined compressive strength test	Per sampling round	8	Test at 7 days, 14 days, 28 days and 56 days for each depth
Number of cylinders shall be submitted to the Engineer	Per sampling round	6	3 at each of the 2 sampling depths

Core Samples

Core samples shall be taken by the Contractor for the purpose of obtaining and testing in-situ samples to evaluate compressive strength, unit weight, vertical alignment, and composition of the soil-cement. Coring of soil-cement shall be performed in accordance with AASTHO T225 and the requirements stated herein.

The Contractor shall take precautions such that vibration from the soil-cement work will not cause undue interference or damage to neighboring properties or buildings. If, in the opinion of the Engineer, ground vibrations, movements or noise from soil-cement mixing work adversely affect the project and neighboring properties and buildings, the Engineer may direct the Contractor to use alternative methods or procedures of soil- cement mixing construction. Alternate methods shall be subject to the prior approval of the Engineer but shall remain the responsibility of the Contractor.

CEMENT GROUT

Cement shall conform to AASHTO M85, Type II, and shall be as specified in the submitted cement grout mix design approved by the Engineer. Slag cement or fly ash shall not be allowed without the approval of the Engineer and submission of test data by the Contractor, which confirms no deleterious impact to the soil-cement.

Measure, handle, transport and store bulk cement in accordance with the manufacturer's recommendations. Cement packaged in cloth or paper bags shall be sealed within plastic or rubber vapor barriers.

Cement shall be stored to prevent damage by moisture. Material that has become caked due to moisture absorption shall not be used. Bags of cement shall be stacked no more than ten bags high to avoid compaction. Cement containing lumps or foreign matter of a nature and in amounts that may be deleterious to the grouting operations shall not be used. Tricalcium aluminate content shall not exceed 8 percent.

Water used in soil-cement and cement grout mixing and all other applications shall be potable, clean, of neutral pH and free from sewage, oil, acid, alkali, salts, organic materials and other contamination.

Cement grout shall be a stable homogeneous mixture of cement and water. The ratios of the components shall be included in the pre-construction submittal. Cement grout composition shall not change throughout the soil-cement mixing unless requested in writing by the Contractor and approved in writing by the Engineer.

SOIL-CEMENT

Soil-cement shall be a stable, uniform mixture of cement grout and the in-situ soils. The properties listed below shall be verified in conformance with the approved Soil-cement Quality submittal.

The ratios of various soil-cement components shall be proposed by the Contractor or as approved in the pre-construction submittal subject to review by .the Engineer. The Contractor shall adjust the mix design throughout the course of the Work in order to achieve the required compressive strengths and total unit weights. After final grouting of the soil-cement element, the Contractor shall obtain samples of in-situ soil-cement samples in accordance with the locations and frequencies in "Soil- Cement Quality Control" of these special provisions.

Water, debris or spoil material shall not be dumped or otherwise allowed to enter the soil-cement element.

Any soil cement element which exhibits partial or total instability, shall be backfilled with cement grout and be remixed full depth, at the Contractor's expense. Among other possibilities signs of instability which could be observed during construction could include excess flow of grout from the hole, settlement of ground, and squeezing in on the drill stem.

Horizontal and Vertical Alignment Tolerances

The maximum horizontal deviation of the as-installed center of any soil-cement element at the ground surface shall not exceed inches from the layout center coordinate, shown on the approved Contractor's submittal.

The measured vertical alignment of soil-cement elements shall not deviate in any direction more than two percent from vertical of the measured length, or be inclined more than two percent from vertical anywhere along the measured length.

At the direction of the Engineer any soil-cement elements which exceed the allowable horizontal or vertical alignment tolerances shall be re-mixed or supplemented with one or more adjacent or overlapping elements, at no additional cost to Caltrans.

Obstructions

Where obstructions are encountered during deep soil-cement mixing, the Contractor shall remove the obstruction or install additional soil-cement to encapsulate the obstruction, at the direction of the Engineer. If such conditions are encountered, the Contractor shall notify the Engineer in writing, and provide all pertinent information relating to the nature, depth, plan location coordinates, expected extent of the obstruction, and proposed procedures to overcome the obstruction. Such construction to overcome an unknown obstruction shall only be performed with the written authorization of the Engineer, and will be paid for as extra work as provided in Section 4-1.030 of the Standard Specifications.

If difficult drilling is encountered due to the presence of naturally occurring cobbles, boulders or dense well-cemented soils or other characteristics of the naturally occurring soils, the Contractor may elect to remove the hindrances, install soil cement by an alternate soil-cement mixing pattern that avoids or encapsulates the hindrance but that achieves the required soil-cement area ratio, subject to the approval of the Engineer.

Containment, Collection and Disposal of Spoil Return

At all times during and at completion of soil-cement mixing operations, the site shall be maintained cleared of all debris and water. Spoil return and other spoil material shall be piped or channeled to holding ponds, tanks, or other retention structures or facilities. The Contractor shall remove and dispose of all waste materials in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

All soil-cement collection, containment and disposal methods shall be thoroughly explained and shown on Working Drawings in the Contractor's submittals to the Engineer prior to the start of deep soil-cement mixing. The Contractor shall incorporate and be responsible for all sedimentation and turbidity control measures required by applicable federal, state and local regulations.

The Contractor shall take all necessary precautions and implement measures to prevent any spoil return, other spoil material or stockpiled materials from entering storm drain •structures, drainage courses and other utility lines or from leaving the site via surface runoff. The Contractor shall prevent the migration of spoil return, spoil material or stockpiled materials into any surface water body, beyond the immediate limits of soil-cement mixing operations.

MEASUREMENT

Soil-cement will be measured by the cubic yard. The volume shall be determined by multiplying the treated area by the required depth of the soil-cement elements. The quantity of soil-cement to be paid for shall be the quantity of soil-cement furnished and installed within the

soil-cement treatment areas shown on the plans. Areas of overlapping and overdrilling will not be measured more than once.

PAYMENT

The contract price per cubic meter for soil-cement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all. the work involved in mixing soil-cement, complete-in-place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for soil-cement quality control shall be considered as included in the contract price paid per cubic yard for soil-cement and no separate payment will be allowed therefor.

Full compensation for containment and disposal of spoils shall be considered as included in the contract price paid per cubic yard for soil-cement and no separate payment will be allowed therefor.

APPENDIX V

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 0A5341 Project Name: I-80/I-680/SR-12 ICP OSFP Liaison: Tracy Bertram Phone: (916)227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☒ PS&E (Review No. 1) ☐ Construction Support ☐ Other: Foundation Report Parikh- Dated 05-11-2012	Reviewer Name: A. Suja/R. Nashed/Sunny Yang Functional Unit: GS-GDW Phone Number: (510) 286-4752/ (510)266-1773/(510) 286-4808 e-mail: _____ Date of Review: 06-29-12
	Structure Information (Use when necessary to document comments by individual structure) Structure Name: Green Valley Road Overcrossing (Over SB 680 on-ramp) Br No: 23-0247		

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	_____	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1		Section 8, Page 6	Provide the "Corrosion Test Results" in Appendix ----. Mention Appendix ---- in section 8.	The corrosion test results are attached in Appendix III-5.	
2			Bridge Plan mentioned Vs30m =205 m/s for Liquefaction case which doesn't match with FR. Discuss this with the Designed.	This was conveyed to the structural engineer and the plan has been revised.	
3		Section 9.4, Seismic Design Criteria	Mention the "Seismic Design Criteria". Make sure it does match with Bridge Plan SDC (Version 1.6, November 2010).	The texts have been revised and SDC Ver. 1.6 (dated November 2010) is mentioned in the report.	
	Geological comments by R. Nashed		See Attached Sheet.		

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

	Seismic comments by Sunny Yang		. In Tables 4.2 and 4.3 in the Report dated 5/11/12 (page 16): the loads per pile don't match the loads per support. Actually, we only need 3790/200 ~= 19 piles at Abutment 1 and 5085/200 ~= 26 piles at Abutment 2. Pile Data Table on the Foundation Plan should also be modified accordingly.	Per our discussion with the structural engineer, load does not equally distribute to all the piles. Based on the calculations, the loads at the toe and heel piles are different. The load per pile shown in Table 4.2 is the maximum load.	

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GEOLOGIC COMMENTS

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 0A5341 Project Name: I-80/I- 680/SR-12 ICP OSFP Liaison: _____ Phone: _____ e-mail: _____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☒ PS&E (Review No. 1) ☐ Construction Support ☐ Other: Foundation Report **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: Green Valley Road OC (Ramp) Br No: 23-0247	Reviewer Name: R. Nashed/A.Suja Functional Unit: GS-GDW Phone Number: (510) 622-1773 e-mail: _____ Date of Review: 06/20/12

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
1	FR	N/A	Foundation Report prepared by Parikh Consultant, Inc., dated July 11, 2011.		Foundation Report prepared by Parikh Consultant, Inc., dated May 11, 2012.
2	FR	6.2 Subsurface Conditions Page 5	1- Abutment 1(South abutment).The subsoil consists of 10 ft of clayey sand and 20 ft of clay and silt overlying **stiff sandy silt** and not dense silty sand	1- In order to clarify, the text has been revised as follows: "Based on the boring data (A-09-001), the subsoils at the vicinity of Abutment 1 consist of about 10 feet of clayey sand and about 20 feet of clay and silt (to about Elev. -5feet) overlying dense silty sand to about 57.5 feet depth(to about Elev.-32.5 feet). Below that depth, the boring encountered approx. 35 feet of sandy lean clay	Our comments dated 08/09/2011 have been adequately addressed.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
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			2- Abutment 2 (north abutment): The subsoils at the vicinity of Bent 2 should be described as follows: 15 ft very stiff sandy lean clay and 10 ft medium dense silty sand are underlain by 40 ft very stiff sandy silt interbedded by 5 ft of medium dense silty sand, followed by 30ft dense sand above hard silt with sand.	and silt. Very dense silty sand was encountered below the hard silt layer to 100 feet deep, the maximum depth explored." 2- Concur. The text has been revised accordingly.	
3		**Appendix II**	1- The LOTB does not include the bench mark for the borings location as the Soil/Rock classification Manual stated	1- Concur. The bench mark has been included.	Our comment dated 08/09/2011 has been adequately addressed.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 0A5341 **Project Name: Green Valley Road Overcrossing (Over SB 680 on-ramp)** **OSFP Liaison: Tracy Bertram** **Phone: (916)227-8397** **e-mail:_____**	☐ **PSR/PDS (Review No. _)** ☐ **APS/PSR (Review No. _)** ☐ **APS/PR (Review No. _)** ☐ **Type Selection**	☐ **65% PS&E Unchecked Details** ☐ **PS&E (Review No. _)** ☐ **Construction Support** ☒ **Other: Foundation Report (65% Submittal)-Parikh- 07-11-2011**	**Reviewer Name: A. Suja/R. Nashed/Sunny Yang** **Functional Unit: GS-GDW** **Phone Number: (510) 286-4752/ (510)266-1773/(510) 286-4808** **e-mail: _____** **Date of Review: 08/09/2011**
	Structure Information (Use when necessary to document comments by individual structure) **Structure Name:_____** **Br No: _____**		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	Page 2, Paragraph 2	Length of the Bridge is 165.5 ft	Concur. The text has been revised.	
2	FR	Page 4, 1st Paragraph	California Test method for Consolidation is 219	Concur. The text has been revised.	
3	FR	Page 8, 4th Paragraph	Provide Boring Logs for R-10-003A & R-10-133A in Appendix II. Also provide other nearby Borings and CPT's that you consider for liquefaction analysis in Appendix II.	Concur. Borings A-09-003, R-10-003A, CPT-10-003, A-09-133 and R-10-133A have been included.	
4	FR	Appendix IV	Include the Liquefaction analysis results for Boring R-10-003A & R-10-133A	Concur. The analysis results for Borings R-10-003A and R-10-133A have been included.	
5	FR	Page 21, Table 5	Abutment 1 (North) should be Abutment 2 (North) ????	The text should read as "Abutment 1 (South)" and "Abutment 2 (North)". The table has been revised.	
6	FR	Page 22, 3rd. line	"Abutment 1" should be "Abutment 2"????	Concur. The text has been revised.	
7	FR	Ground	Geotechnical Engineer's (William M.	Concur. The page has been revised with	

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		Improvement (by Acacia CE)	Kenney) Stamp date has been expired.	the current expiration date (3/31/13).	
	Geological comments by R. Nashed				
8	FR	N/A	Foundation Report prepared by Parikh Consultant, Inc., dated July 11, 2011.		
9	FR	6.2 Subsurface Conditions Page 5	1- Abutment 1(South abutment).The subsoil consists of 10 ft of clayey sand and 20 ft of clay and silt overlying **stiff sandy silt** and not dense silty sand 2- Abutment 2 (north abutment): The subsoils at the vicinity of Bent 2 should be described as follows: 15 ft very stiff sandy lean clay and 10 ft medium dense silty sand are underlain by 40 ft very stiff sandy silt interbedded by 5 ft of medium dense silty sand, followed by 30ft dense sand above hard silt with sand.	1- In order to clarify, the text has been revised as follows: "Based on the boring data (A-09-001), the subsoils at the vicinity of Abutment 1 consist of about 10 feet of clayey sand and about 20 feet of clay and silt (to about Elev. -5 feet) overlying dense silty sand to about 57.5 feet depth (to about Elev. -32.5 feet). Below that depth, the boring encountered approx. 35 feet of sandy lean clay and silt. Very dense silty sand was encountered below the hard silt layer to 100 feet deep, the maximum depth explored." 2- Concur. The text has been revised accordingly.	
10		Appendix II	1- The LOTB does not include the bench mark for the borings location as the Soil/Rock classification Manual stated	Concur. The bench mark has been included.	
	Seismic comments by Sunny Yang		No comments.		

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
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(for Reviewer's use)

FOUNDATION REPORT

WB 80 TO WB 12 SEPARATION
(OVER WB 80 ON-RAMP)
(BR. NO. 23-0248)
SOLANO COUNTY, CALIFORNIA

For

MARK THOMAS & CO., INC. | NOLTE VERTICAL FIVE
A Joint Venture

3000 Oak Road, Suite 650
Walnut Creek, CA 94597

PARIKH CONSULTANTS, INC.
2360 Qume Drive, Suite A
San Jose, CA 95131
(408) 452-9000

September 6, 2012 Job No. 2009-130-GDR

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FOUNDATION REPORT
WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
(BR. NO. 23-0248)
SOLANO COUNTY, CALIFORNIA

1.0 SCOPE OF WORK

The purpose of this investigation was to evaluate the general soil conditions at the project site, to evaluate their engineering properties, and to provide foundation design recommendations for the proposed WB 80 to WB 12 Separation (Over WB 80 On-Ramp) structure, as part of the I-80/I-680/SR 12 Interchange project, located in Solano County, California. The scope of work performed for this investigation included a review of the readily available geologic literature pertaining to the site, obtaining representative soil samples and logging soil materials encountered in the exploratory borings, conducting Cone Penetration Tests (CPT), laboratory testing of the collected samples, engineering analysis of the field and laboratory data, and preparation of this report. This report presents the results of our geotechnical engineering investigation for the proposed overcrossing structure. The approximate location of the site is shown on the Site Map (Plate I-1) in Appendix I of the report.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore, recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

The geotechnical recommendations presented in this report are intended for design input and are not intended to be used as specifications. These recommendations should not be used directly for bidding purposes or for construction cost estimates.

2.0 PROJECT DESCRIPTION

The “WB I-80 to WB SR12 Connector Package” (previously referred to as “Initial Construction Package” or “ICP”) is Package 1 of the I-80/I-680/SR12 Interchange Project and will construct

braided ramps on westbound I-80 between the Green Valley Road Overcrossing and State Route 12 (SR 12) to improve traffic flow. As part of the proposed improvement, a structure crossing over the WB I-80 Green Valley Road on ramp will be constructed. This structure will accommodate two traffic lanes and standard shoulders and will carry traffic from westbound I-80 to westbound SR12 (West).

The structure will be a three span structure, approximately 450 feet in length and 42 feet wide. Bent supports will be single column bents. Abutments at both ends of the bridge will be open face with short seat type abutments. It is planned to use 16-inch diameter open ended steel pipe piles (Caltrans standard Class 200 Alt. "W") for foundation support.

New approach embankments up to about 35 feet are required at both abutments. Mechanically Stabilized Earth (MSE) walls are planned along the northwest side of the embankment in order to accommodate additional traffic lanes northwest of the braided ramps (Retaining Walls No. 2 and 4). The southeast side of the embankment will have side slopes of 4H:1V to 2H:1V.

3.0 EXCEPTIONS TO POLICY

Normal procedures were assumed for construction of the bridge structure throughout our analysis and represent one of the bases of recommendations presented herein. The investigation and design for the proposed foundations have followed Caltrans policy. Exception to policy is not needed.

4.0 FIELD INVESTIGATION AND TESTING PROGRAM

Along the planned location of the structure, three exploratory borings (Borings A-09-006, A-09-009 and R-10-009A) and two CPTs (CPT-09-007 and CPT-09-008) were originally conducted to a maximum depth of 100 feet below the existing ground surface. The approximate locations of the boring are shown on the Log of Test Borings in Appendix II and the CPT results are shown in Appendix III.

The test borings were advanced with truck-mounted drill rigs. Both hollow stem auger (using 8-inch diameter augers) and rotary wash drilling methods were utilized to advance the borings. The borings were drilled under the technical supervision of one of our engineers, who classified and logged the soils encountered during drilling and supervised the collection of soil samples at various depths for visual examination and laboratory testing. The soil samples were obtained during drilling and by driving 2.5 inches I.D. Modified California and 1.4 inches I.D. Standard Penetration Test samplers into the subsurface soils under the impact of a 140 lb hammer falling through 30 inches. The blow counts required to drive the sampler for the last 12 inches are presented on the "Log of Test Borings", Appendix II. After visual examination, the collected samples were sealed and transported to our laboratory for further evaluation and testing.

The Cone Penetration Tests (CPT) were performed by Gregg Drilling & In Situ, Inc. of Martinez, California. The CPT was conducted using a 60-degree cone attached to a 1.7-inch diameter (tip area of 15 cm^2) rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil behavior type and strength characteristics.

The bore logs presented in Appendix II were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations.

5.0 LABORATORY TESTING PROGRAM

Laboratory tests were performed on selected samples in the laboratory to evaluate the physical and engineering properties of the subsoils. The tests performed for the study include the following: Laboratory determination of Moisture (California Test Method 226) Unit Weight (California Test Method 212), Atterberg Limits (California Test Method 204), Grain Size Analysis (California Test Method 202), Unconfined Compression Test (California Test Method 221), Consolidation Test

(California Test Method 219), and Corrosion Test (California Test Method 643, 417 & 422). The laboratory test results are attached in Appendix IV.

6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1 Site Geology

The Jameson Canyon area and to the north is largely underlain by broadly folded Eocene Markley Formation and flat or gently tilted Pliocene Sonoma Volcanics. The Sonoma Volcanics are mostly andesitic tuff and breccias, but there is also some basalt and rhyolite. The area east of the Green Valley Fault, is largely underlain by late Pleistocene to Holocene alluvial fan deposits.

The Green Valley Fault, which intersects the project area, separates the Sonoma Volcanics from the Cretaceous. Great Valley Sequence on the east. (CGS 2002, Bezore, S.P., Wagner, D.L, and Sowers, J.M., Geologic Map of Cordelia 7.5' Quadrangle, Solano and Napa Counties, California).

General geologic features pertaining to the site were evaluated with reference to the "Geologic Map and Map Database of Northeastern San Francisco Bay Region, California", by R.W. Graymer, D.L. Jones, and E.E. Brabb (U.S.G.S., Miscellaneous Field Studies Map MF-2403, 2002)". Based on the map, the subsoils at the location of the proposed structure mainly consist of Alluvial Fan Deposits (Qpf). A geologic map of the general project area is shown on Plate I-2. Descriptions of the main geologic units are presented as follows:

Qpf - Alluvial fan deposits (late Pleistocene)-Poorly sorted, moderately to poorly bedded sand, gravel, silt, and clay deposited in gently sloping alluvial fans. Late Pleistocene age is indicated by erosional dissection and development of alfisols. These deposits are about 10% denser and have 50% greater penetration resistance than unit Qhf (Clahan and others, 2000).

6.2 Subsurface Conditions

Based on the boring data (Borings A-09-006, A-09-009, CPT-09-007 & CPT-09-008, R-10-009A), the subsoils along the proposed overcrossing structure consist of predominantly clay. An interbedded silty/clayey sand layer, approximately 5 feet thick, was encountered at about 15- to 20-foot depth in all locations. The subsurface conditions are generally uniform along the proposed structure. More detailed subsurface conditions are summarized in the following paragraphs.

Abutment 1 (west abutment). Boring A-09-006 was drilled at the planned location of Abutment 1. The boring encountered about 50 feet of stiff to very stiff clay materials with a layer of fat clay between 40- and 45-foot depths. Below 50-foot depth, the boring encountered more granular formation compared to the nearby borings and CPTs (at various depths. Medium dense sand layers were encountered at 52- to 56.5-foot depth, 65.5- to 74-foot depth and 84- to 94.5-foot depth.

Bents 2 & 3 and Abutment 4 (east abutment). Based on the boring/CPT data (CPT-09-007, CPT-09-008, A-09-009 & R-10-009A), the subsoils consist of interbedded silty/clayey sand layers of apparent densities of medium dense, with the exception of Boring R-10-009A, which encountered a loose clayey/silty sand layer approximately 16 to 22.5 feet below grade. A 10-foot thick very stiff to hard fat clay layer was encountered in Boring A-09-009 at a depth of 31.5 to 41.5 feet below grade and underlain by very stiff to hard lean clay.

Groundwater level was encountered at 18 feet and 21 feet deep in Borings A-09-006 and A-09-009, respectively. Pore pressure dissipation tests were conducted during CPT operation. The estimated groundwater level is at 12.3 feet and 22.7 feet below existing grade. Based on the as-built boring data (Green Valley Road O.C., Caltrans, 1957), located at approximately 3000 feet north of the proposed structure, groundwater was measured or encountered at Elev. 15 feet, approximately 7 to 8 feet below grade.

Based on the above, groundwater within the project limit is expected to be relatively shallow. We have assumed groundwater at Elev. 35 feet, approximately 12 feet below existing grade for design purpose. However, the groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off, tide, and other factors that may not be present at the time of our investigation.

7.0 SCOUR EVALUATION

The subject was considered and was determined to be not applicable for the project since there is no water body passes the project site.

8.0 CORROSION EVALUATION

The corrosion investigation for this project was performed on selected samples in general accordance with the provisions of California Test Method 643. The test results are presented in Appendix IV. A summary of the corrosion test results is presented in the following table.

TABLE 1 – CORROSION TEST RESULTS

Boring	Depth (ft)	pH	Minimum Resistivity (ohms-cm)	Water-soluble Chloride (ppm)	Water-soluble Sulfate (ppm)
A-09-006	6.5	6.76	560	377.6	188.9
A-09-009	4.5	7.72	560	176.1	60.8

Based on the test results, the resistivities within the project limits are relatively low (less than 1000 ohm-cm). Caltrans currently defines a corrosive environment as an area where the soil has either a chloride concentration of 500 ppm or greater, a sulfate concentration of 2000 ppm or greater, or has a pH of 5.5 or less. Consequently, the on-site soils are generally considered non-corrosive.

9.0 SEISMIC RECOMMENDATIONS

9.1 Seismic Sources

The project site is located in a seismically active part of northern California. Many faults in the San Francisco Bay Area are capable of producing earthquakes, which may cause strong ground

shaking at the site. Maximum moment magnitudes of some of the closest faults in the area based on 2007 Caltrans Deterministic PGA Map and ARS Online Report are summarized below. These maximum magnitudes represent the largest earthquake a fault is capable of generating and is related to the seismic moment.

TABLE 2 – FAULT DATA

Fault	Fault ID	Fault Type	Maximum Moment Magnitude (M_{max})	Approximate Distance From Site
Green Valley Fault	213	RLSS	6.9	0.8 mile
Cordelia Fault	212	RLSS	6.7	1.0 mile

Based on the publication, the proposed structure is located between Cordelia Fault and Green Valley Fault. It is our understanding that a site-specific fault study was performed by another consultant. Caltrans is currently reviewing the report for final acceptance. However, this should not have significant impact on the proposed structure.

9.2 Seismic Hazards

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic data, the possibility of the site to experience strong ground shaking is considered high.

9.3 Liquefaction Potential

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and low plasticity silts of low relative density are the type of soils which usually are susceptible to liquefaction. Clays of medium to high plasticity are generally not susceptible to liquefaction.

The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001) using the boring and CPT data. As indicated by recent advances in soil liquefaction engineering (Bray, 2006), for soils with sufficient fines content so as to separate the coarser particles and control behavior, liquefaction appears to occur primarily in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their LL (W%> 0.85LL).

The Peak Ground Acceleration (PGA) was estimated based on the latest Caltrans ARS Online website, which is based on several input parameters, including the site location (longitude/latitude), average shear wave velocity for the top 30m/100 feet (Vs_{30m}). We have adopted an average PGA of 0.7g for analysis purpose. As mentioned in the previous section, we have assumed groundwater at about 8 feet below existing grade.

With the high PGA, submerged granular materials with $N_{1,60,CS}$ less than 30 are generally found to be potentially liquefiable. Submerged soils with CPT data showing I_C<2.6 (most likely granular) and $q_{C1N,CS}$ less than 160 tons/ft^2 are also considered liquefiable, unless sampling and laboratory data from neighboring borings suggested otherwise.

Based on our analysis, potentially liquefiable soils were identified at various depths. We have reviewed and compared all the available data from the borings and CPTs. Per our discussion with the Caltrans engineer, the liquefaction potential was mainly evaluated according to the soil borings advanced by rotary-wash drilling method. The boring was performed by Technicon Engineering Services, Inc. of Fresno, California. All samples were obtained from the 1.4-inch

I.D. Standard Penetration Tess (SPT) samplers at various depths, and the samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. The average hammer energy is about 88% based on the calibration results provided by the driller. For liquefaction analysis, a lower hammer energy ratio of 85% was conservatively assumed in the calculation to account for variations.

Based on the analysis results, liquefaction potential is considered moderate to high. However, the laboratory test results indicate that the fines contents in some of the samples are relatively high (greater than 35%). The anticipated 100% development of pore pressure in such materials (i.e. high $N_{1,60,CS}$ and/or high fines content) may be more correctly ascribed to "cyclic mobility", which results in limited soil deformations without liquid-like flow. In our opinion, the engineering consequences of such phenomenon in those layers may be limited to temporarily loss of strength (cyclic softening). Volumetric strain induced by liquefaction, i.e. post-liquefaction settlement, is considered relatively small.

As mentioned in Special Publication 117A (CGS, 2008), liquefaction hazards are generally most severe in the upper 50 feet of the surface. In our opinion, the impact due to the potential liquefiable soils below 50 feet is considered insignificant, especially when the layer is relatively thin and discontinuous.

Based on the above, the soil layers that may be subject to liquefaction under the design earthquake event are summarized as follows:

Abutment 1 (west abutment). Boring A-09-006 indicates that granular materials were encountered at greater depth, approx. at 52- to 56.5-foot depth, 65.5- to 74-foot depth and 84- to 94.5-foot depth. Based on the site geology (Qpf, late Pleistocene) and the depths of these strata (greater than 50 feet), the impact to foundation design of these layers is considered low.

Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
52.0' to 56.5'	54.5	SM	0.31	15.6	19%	- (1)
65.5' to 74.0'	69.5	SC	0.36	16.9	40%	- (1)
84.0' to 94.5'	89.5	SP-SM	0.28	12.6	12%	- (1)

Note:
(1) The depths of the liquefiable soils are greater than 50 feet below existing grade. In addition, these layers appear to be localized and discontinuous. The impact on foundation design is considered insignificant.

Bents 2 & 3 and Abutment 4 (east abutment). Based on the boring/CPT data, an approximately 5-foot-thick sand layer was encountered at approximately 15 to 20 feet deep in CPT-09-007, CPT-09-008, A-09-009 & R-10-009A. According to our analysis, this submerged and loose sand layer may be subject to liquefaction during a strong earthquake event. Liquefaction potential and its engineering consequences were estimated mainly based on the data from Boring R-10-009A, which was conducted by rotary wash drilling method. The analysis results are summarized in the following table:

Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
15.0' to 21.0'	17	SM	0.37	14.2	33%	1.0~1.5 (1)
	20	SM	0.53	21.5	26%	

Note:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992)

9.4 Seismic Design Criteria

The recommended response spectrum was determined based on the new 2007 Caltrans Deterministic PGA Map and the Caltrans ARS Online (Ver. 1.0.4) per Caltrans Seismic Design Criteria (SDC, Version 1.6, dated November 2010). The development of the design ARS curve is based on several input parameters, including site location (longitude/latitude), average shear wave velocity for the top 30 m/100 feet (V_{S30m}), and other site parameters, such as fault characteristics, site-to-fault distances. The new design methods incorporate both deterministic and probabilistic seismic hazards to produce the Design Response Spectrum.

Average shear wave velocity (Vs) for the top 30m (100 feet) at the site was estimated by using established correlations and the procedure provided in the Caltrans Design Manual (Ver. 1.0.4, August 2009). As mentioned in the previous section, liquefaction potential is considered high at the project site. Therefore, when estimating the V_{30m}, we have assumed the residual shear strengths and modeled those as soft clays for the potential liquefiable soils.

For developing the ARS curve, we have considered both profiles: (1) liquefaction case; and (2) non-liquefaction case. Based on our calculation, we have estimated Vs_{30m} of 205 m/s and 255 m/s for liquefaction case and non-liquefaction case, respectively. According to the analysis results, the recommended response spectrum for structure design is based on the data from 2008 USGS Deaggregation Hazard (beta). Lower V_{S30m} yields higher spectral acceleration at longer periods (>0.5 sec.), and the higher V_{S30m} yields higher spectral accelerations at shorter periods (<0.5 sec.). Therefore, the envelope of these two curves is recommended.

The site location and the relevant parameters are summarized as follows, and the recommended design curve is presented in Appendix V.

1. Site Location: 38.2114°N/122.1468°W
2. Estimated V_{s30m} = 205 m/s (liquefaction case); 255 m/s (non-liquefaction case)
3. The recommended ARS curve is the envelope of two curves based on different Vs30m, which were governed by 2008 USGS Deaggregation Hazard (beta).

10.0 AS-BUILT FOUNDATION DATA

There is no existing structure at the planned location of the structure. As-built foundation data is not available.

11.0 FOUNDATION RECOMMENDATIONS

11.1 General

This report was prepared specifically for the proposed project as described earlier. Normal procedures were assumed for construction of the bridge structure throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations. In addition, bridge plans should be reviewed by our office prior to finalizing the plans to see that the intent of our recommendations is included in the plans.

11.2 Foundation

Based on the subsurface condition, the subsoils at the project site consist of predominantly clayey materials with interbedded sand lenses, and groundwater level appears relatively shallow. Liquefiable soils have been identified within the project limit. Liquefaction has been considered for foundation design. The pile capacity contribution is neglected within the soil layers where potential liquefaction or cyclic mobility is anticipated. Based on the liquefaction analysis results, down drag loads have been considered when estimating the pile capacity, where the post-liquefaction settlement is more than 0.6 inch.

Per our discussion with the designer, steel open-ended pipe piles (Caltrans standard Class 200 Alt. “W”) will be used for foundation support. According to the foundation design data provided, the design pile cut-off elevations are at Elev. 65.6 feet and Elev. 51.6 feet for Abutments 1 and 4, respectively. For Bents 2 and 3, the pile cut-off elevations are at Elev. 36.7 and 33.0 feet, respectively.

Consistent with the current Caltrans requirements, the abutment foundations are evaluated for the foundation design data and loading conditions using Caltrans November 2003 Bridge Design Specifications for foundations, using Working Stress Design (WSD) methods. The bents foundation of the proposed structure is evaluated for the foundation design data and

loading conditions using AASHTO LRFD Bridge Design Specifications – 4th Edition, with California Amendments.

For the proposed structure, pertinent foundation design information are provided by the designer, including Foundation Design Data (Table 3.1) and Foundation Design Loads (Table 3.2). Based on the load demand and subsoil information, the recommended specified pile tip elevations are summarized in the following tables (Tables 3.3 to 3.5) per Memo-To-Designers 3-1.

TABLE 3 – FOUNDATION DESIGN (PILE DATA TABLE)

TABLE 3.1 – FOUNDATION DESIGN DATA

Support No	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev. (ft)	Pile Cap Size (ft)		Permissible Settlement (in)	No. of Piles per Support
					B	L		
Abut 1	WSD	Class 200 Alt. W	72.30	65.62	10.25	43.83	1	16
Bent 2	LRFD	Class 200 Alt. W	48.35	36.73	16.5	31	1	32
Bent 3	LRFD	Class 200 Alt. W	47.14	33.00	16.5	31	1	32
Abut 4	WSD	Class 200 Alt. W	58.41	51.62	10.25	43.83	1	16

TABLE 3.2 – FOUNDATION DESIGN LOADS

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Perma-nent Loads	Compression		Tension		Compression		Tension	
	Per Support	Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	2170	170	1785	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	4055	155	3390	5465	240	0	0	-	385	-	165
Bent 3	4030	150	3365	5435	235	0	0	-	395	-	175
Abut 4	2195	180	1810	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 3.3 – FOUNDATION RECOMMENDATIONS FOR ABUTMENTS

Support	Pile Type	Cut-off Elev. (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance Required (kips)
			Total	Perma -nent					
Abut 1	Class 200 Alt. "W"	65.62	2170	1785	170	340	-10.0 (a) -5.0 (c) 35.0 (d)	-10.0	375
Abut 4	Class 200 Alt. "W"	51.62	2195	1810	180	360	-27.5 (a) 0.0 (c) 20.0 (d)	-27.5	480

Design tip elevations are controlled by (a) compression, (c) settlement, (d) lateral

TABLE 3.4 – FOUNDATION RECOMMENDATIONS FOR BENT

Support Location	Pile Type	Cut-off Elev. (ft)	Service-I Limit State Load (kips) per Support	Total Permissible Support Settlement (in.)	Required Factored Nominal Resistance (kips)				Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (ϕ=0.7)	Ten. (ϕ=0.7)	Comp. (ϕ=1)	Ten. (ϕ=1)			
Bent 2	Class 200 Alt. "W"	36.73	4055	1	240	0	385	165	-36.5 (a-I) -41.5 (a-II) -18.5 (b-II) -34.0 (c) 1.0 (d)	-41.5	400
Bent 3	Class 200 Alt. "W"	33.00	4030	1	235	0	395	175	-39.5 (a-I) -44.5 (a-II) -24.5 (b-II) -37.5 (c) -1.5 (d)	-44.5	400

Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (b-I) Tension (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (c) Settlement, (d) Lateral Load.

TABLE 3.5 – PILE DATA TABLE

Location	Pile Type	Nominal Resistance (kips)		Design Tip Elev. (ft)	Specified Tip Elev. (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
Abut 1	Class 200 Alt. "W"	340	0	-10.0 (a), -5.0 (c), 35.0 (d)	-10.0	375
Bent 2	Class 200 Alt. "W"	390	170	-41.5 (a); -18.5 (b); -34.0 (c); 1.0 (d)	-41.5	400
Bent 3	Class 200 Alt. "W"	400	180	-44.5 (a); -24.5 (b); -37.5 (c); -1.5 (d)	-44.5	400
Abut 4	Class 200 Alt. "W"	360	0	-27.5 (a); 0.0 (c); 20.0 (d)	-27.5	480

Design tip elevations are controlled by (a) compression; (b) tension; (c) settlement; (d) lateral Loads

The pile capacities of the open end steel pipe piles (Caltrans Standard Class 200 Alt. "W") were estimated based on procedures published by American Petroleum Institute (API) from

"Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design" (API RP 2A-WSD, 2002). We have utilized computer program "APILE Plus" (ENSOFT, v5.0) for calculation purpose.

The recommended minimum pile spacing is three times the pile diameter (3D) to minimize the group effect for vertical pile capacities. Liquefaction has been considered when estimating the pile capacities. The vertical pile capacity contribution is neglected within the liquefiable soils. Down drag loads have been considered where the post-liquefaction settlement is more than 0.6 inch for the piles at Abutment 4. The pile group settlement has been evaluated, and it does not appear to be a governing factor for foundation design.

New embankment up to about 35 and 25 feet high are anticipated at Abutments 1 and 4, respectively. Based on available boring data and laboratory test results, the estimated ground settlements are expected to be on the order of 12 inches for the embankments at Abutment 1, and on the order of 8 inches for the embankments at Abutment 4. The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast. However, the calculation based on A-09-006 shows that about 40% of the consolidation settlement is expected to occur in the normally-consolidated (NC) range.

Based on our analysis, a waiting period of 90 days is recommended prior to pile construction at both abutments of the new structure and the construction of the pavement. It will reduce potential down drag load on abutment piles due to consolidation settlement. The settlement monitoring is recommended and should be performed as per Caltrans Standard Test Method 112. More discussions regarding anticipated ground settlement are presented in Section 11.5 of this report.

Since the abutment footings will be in the new embankment, it is recommended that the existing embankment be pre-drilled to the native subgrade prior to the construction of the piles. It is primarily to reduce the impact to the newly constructed embankment from pile driving.

Therefore, when estimating vertical capacity for the proposed piles at the abutments, the frictional capacities are expected to be derived below the embankment. The pre-drilling and backfilling should conform to Caltrans Standard Specification (Section 49-1.06).

11.3 Lateral Pile Capacity

Under seismic loading conditions, lateral load analyses were performed for the proposed steel open-ended pipe piles (Caltrans standard Class 200 Alt. "W") using the LPILE program (ENSOFT, v6.0). The analyses were performed for the piles at Bent 2 and Abutment 4. An average "p-y Curve Modification Factor" of 0.6 was adopted in the lateral pile analysis for pile spacing of 3 times the pile diameter. The results of lateral pile analyses, with the plots of the pile deflection, moment, shear and soil reaction along the pile length and the input files are included in the Appendix C.

11.4 Lateral Earth Pressures

Abutment retaining walls should be designed to resist the following Applied Lateral Earth Pressures and live load. These values assume no hydrostatic pore pressure buildup behind the wall and are based on well-drained backfill behind the walls supported in native soil.

<u>Applied Lateral Earth Pressure</u>

Active Condition	36 pcf Equivalent Fluid Pressure (EFP) for the engineered backfill.
At-Rest Condition	55 pcf Equivalent Fluid Pressure (EFP) for the engineered backfill.
Passive Resistance	5 ksf (ultimate) for seismic design of the abutment backwall (5.5 feet high or greater); for activated height less than 5.5 feet modify proportionally, i.e. 5×(H/5.5) ksf. A minimum lateral wall movement of 2% of wall height to mobilize the full ultimate passive pressure is required.

Cantilever walls which are free to rotate at least 0.004 radian may be assumed flexible for the active condition. Walls that are not capable of this movement should be assumed rigid and designed for the at-rest condition. The effect of any surcharge (dead, live, or traffic load) should be added to the preceding lateral earth pressures. A coefficient of 0.3 and 0.5 may be used to determine the additional earth pressure resulting from the surcharge for active and at-rest conditions, respectively.

11.5 Embankments

11.5.1 Embankment Settlements & Settlement Monitoring

New approach embankments are planned at the abutments of the proposed structure. The height of the embankment is up to about 35 feet at Abutment 1 and about 25 feet at Abutment 4. Consequently, consolidation settlement is expected from the additional load exerted from the embankment.

In order to estimate the amount of settlement, consolidation tests were conducted on selected samples obtained from the borings. We have reviewed and adopted correlations from various references with revision to the site-specific laboratory test results for estimating the indexes for settlement calculation.

The estimation of pre-consolidation pressure is based Su/p per Skempton (1957) and NAVFAC D.M. 7.1. The modified compression index ($C_c/(1+e_0)$) and the modified recompression index ($C_r/(1+e_0)$) were obtained from the laboratory test results. The modified compression indices were compared to the correlation with natural moisture contents suggested by Lambe and Whitman (1969). After reviewing the laboratory data and the correlation, we have revised the correlation for estimating the modified compression index accordingly. For the recompression index (C_r, in the over-consolidated range), it is typically 10% of the compression index (per Holtz and Kovacs, 1982). According to the test data, the ratio of C_r/C_c range from 13% to 30%, which is in general

accordance with the suggested value. Therefore, we have assumed a ratio of 20% (C_r/C_c) for estimating the modified recompression index ($C_r/(1+e_0)$).

Based on the results of the settlement analyses, the amount of consolidation settlements is estimated to be on the order of 12 inches at Abutment 1 and on the order of 8 inches at Abutment 4. The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast.

However, the calculation based on A-09-006 (located at Abutment 1) shows that about 40% of the consolidation settlement is expected to occur in the normally-consolidated (NC) range. Based on our analysis, a waiting period of 90 days is recommended prior to pile construction and the construction of the pavement. It will reduce potential down drag load on abutment piles due to consolidation settlement. The settlement monitoring is recommended and should be performed as per Caltrans Standard Test Method 112. In addition, the method of constructing the concrete facing (panels) might have to be delayed. Special details would be required to allow for the settlement of the panels or to attach them after the settlement has occurred.

11.5.2 **Evaluation of Embankment Stability**

After the Type Selection meeting in January 2011, Caltrans issued a new publication regarding lateral spreading, "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading" in February 2011. Consequently, we have re-visited the analyses that were performed during 35% design accordingly. Specifically, more analyses were performed along longitudinal direction to evaluate the potential of lateral spreading and its impact to the abutments.

Previously (during the 35% design phase), due to the presence of liquefiable soils on site, the stability of the embankment was evaluated under three different scenarios: 1) Static Condition (short-term, immediately after construction); 2) Seismic Condition

(pseudo-static with seismic coefficient, k); and 3) Post-Liquefaction Condition. Per our previous discussion with Caltrans engineer, short-term, un-drained shear strength (non-liquefied) parameters were used for seismic condition, since liquefaction generally is not expected to occur in conjunction with the peak ground acceleration. Residual shear strengths (Sr) were adopted only for the post-liquefaction condition without seismic coefficient.

According to the latest Caltrans guideline of lateral spreading, we have revised our pseudo-static analysis by using residual shear strengths (Sr, estimated based on Kramer and Wang (2007) as cited in Caltrans guideline) for liquefiable soils. As mentioned previously, liquefaction is generally not expected to occur in conjunction with peak ground acceleration. Therefore, this approach (pseudo-static analysis coupled with residual shear strengths) appears relatively conservative.

In our opinion, if the derived factor of safety is greater than unity, the design seismic coefficient is considered less than the yield acceleration (ky), and the ground deformation under the design earthquake event should be relatively insignificant and should not pose impact to the structure/foundation design. On the other hand, if the derived factor of safety is less than unity, the ground deformation can be excessive and lateral spreading should be considered.

For the seismic coefficient (k), we have referenced to Caltrans guidelines (Guidelines for Structures Foundation Reports manual, Ver. 2.0, 2006), which recommends that the seismic factor equal to one third of the horizontal peak acceleration and not exceeding 0.2g. An average PGA of 0.7g was assumed for design at the project site. Therefore, a seismic coefficient (k) of 0.2g was used for pseudo-static analysis. In addition, the strengths of the non-liquefiable fine-grained materials were increased by 30% due to the effect of rapid loading (per Ishihara, 1985) and strength increase from the consolidation under the embankment/retaining walls.

Based on the subsurface condition, the embankment stability at Abutment 4 appears to be more critical as the liquefiable soils were encountered at shallower depth. The analysis was conducted based on the profiles from the preliminary plans provided by the designer and the boring data along the alignment. The results are summarized in the following table.

TABLE 4 – SLOPE STABILITY ANALYSIS SUMMARY

Location	Factor of Safety	
	Static Condition – Short term (immediately after construction)	**Pseudo-Static Analysis (k=0.2+residual shear strength)**
Abutment 4	2.85	1.05

For static condition, the un-drained shear strengths were derived directly from the boring data and the associated test results to represent the "immediately after construction" condition. The increase in shear strength due to consolidation is not considered. The result indicates that the stability appears satisfactory.

The pseudo-static analysis yields a factor of safety of 1.05, which indicates that the design seismic coefficient (k) of 0.2g is less than the yield acceleration and the potential of lateral spreading is considered low. Therefore, the stability of the embankment/retaining walls is considered satisfactory, and lateral spreading should not be a design issue for the proposed structure.

12.0 NOTES TO DESIGNER

It is recommended that the structure engineer verify the pile tip elevations when finalizing the pile data table. Should the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Geotechnical Engineer must be contacted for further recommendations.

13.0 CONSTRUCTION CONSIDERATIONS

13.1 General

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of grading operations should be carried out by Caltrans and/or Solano County. If the encountered subsurface conditions differ from those forming the basis of our recommendations, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

13.2 Open End Steel Pipe Piles

Based on the boring data, the site is underlain by alluvial materials with some granular layers. For the proposed open end steel pipe piles, local hard driving conditions may be expected. In our opinion, the overall drivability should not be an issue. However, this will depend on the type and setup of the pile driving hammer. We recommend that the piles be driven to the specified tip elevations. The pile capacity will be derived primarily from frictional resistance along the pile shaft.

In the event that unanticipated pile driving conditions are encountered, it is recommended that the Gates formula per Caltrans standard specifications (Section 49-1.08) be used in the field for driving and capacity verification. Should difficult driving be encountered where the vertical compression requirement is met (per Gates formula), pile driving should be allowed to terminate short of the specified tip elevation provided that either one of the following conditions are satisfied:

- Other requirements including tension and lateral demands are met;
- Any pile refusal within 5 feet above the specified tip elevation, which may be considered acceptable and cut off at the option of the contractor.

If the piles do not attain the nominal driving resistance at the specified tip elevation (per Gates Formula), the piles may be allowed to stand for a "set period" of minimum 12 hours without driving. If the nominal driving resistance is attained for each pile designated to be re-driven, the remaining piles in that footing are considered acceptable.

14.0 INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the subsurface conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Frank Wang, P.E., G.E. 2862
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

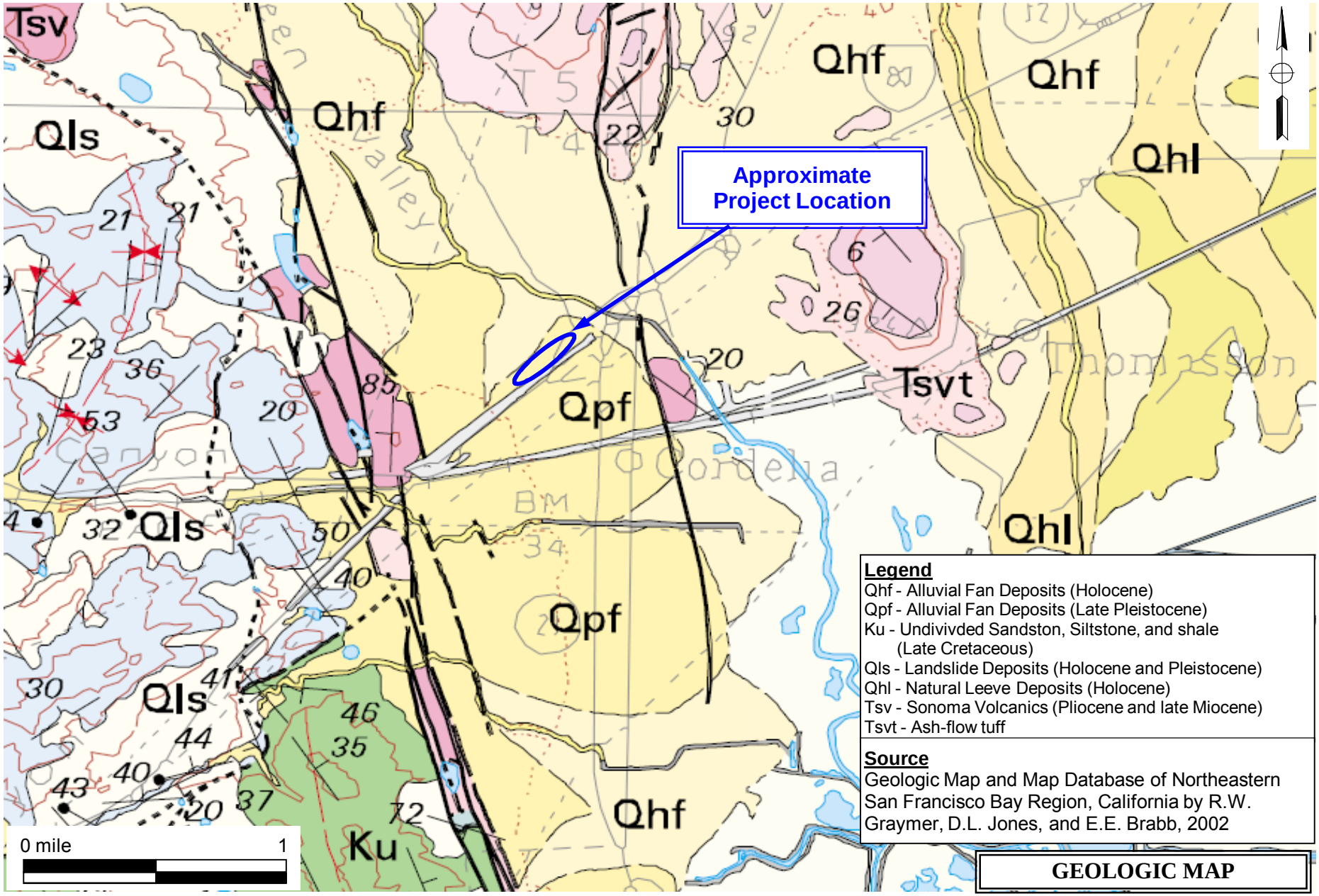
APPENDIX I

SITE MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

WB 80 TO WB 12 GRADE SEPARATION
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR	PLATE NO.: I-1



PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR	PLATE NO.: I-2

APPENDIX II

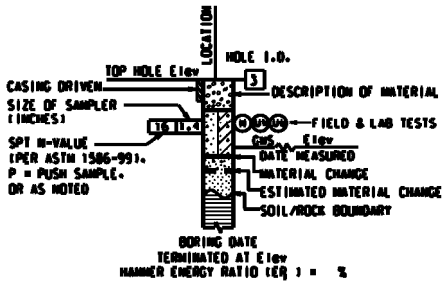
REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

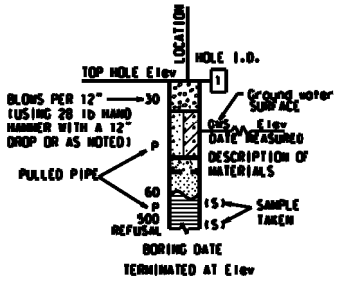
CEMENTATION	
DESCRIPTION	CRITERIA
WEAK	CRUMBLES OR BREAKS WITH HANDLING OR LITTLE FINGER PRESSURE.
MODERATE	CRUMBLES OR BREAKS WITH CONSIDERABLE FINGER PRESSURE.
STRONG	WILL NOT CRUMBLE OR BREAK WITH FINGER PRESSURE.

BOREHOLE IDENTIFICATION		
SYMBOL	HOLE TYPE	DESCRIPTION
	A	AUGER BORING (HOLLOW OR SOLID STEM BUCKET)
	R RW RC P	ROTARY DRILLED BORING (CONVENTIONAL) ROTARY DRILLED WITH SELF-CASING WIRE-LINE ROTARY CORE WITH CONTINUOUSLY-SAMPLED, SELF-CASING WIRE-LINE ROTARY PERCUSSION BORING (AIR)
	R	ROTARY DRILLED DIAMOND CORE
	HD HA	HAND DRIVEN (1-INCH SOIL TUBE) HAND AUGER
	D	DYNAMIC CONE PENETRATION BORING
	CPT	CONE PENETRATION TEST (ASTM D 5778)
	O	OTHER (NOTE ON LOTB)
Note: Size in inches.		

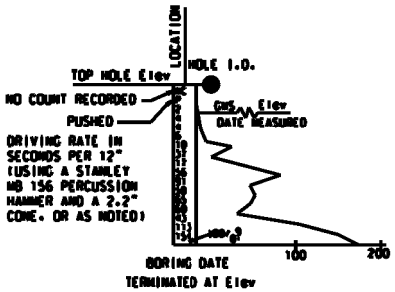
CONSISTENCY OF COHESIVE SOILS				
DESCRIPTION	SHEAR STRENGTH (tsf)	POCKET PENETROMETER MEASUREMENT, PP, (tsf)	TORVANE MEASUREMENT, TV, (tsf)	VANE SHEAR MEASUREMENT, VS, (tsf)
VERY SOFT	LESS THAN 0.12	LESS THAN 0.25	LESS THAN 0.12	LESS THAN 0.12
SOFT	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
MEDIUM STIFF	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
STIFF	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
VERY STIFF	1 - 2	2 - 4	1 - 2	1 - 2
HARD	GREATER THAN 2	GREATER THAN 4	GREATER THAN 2	GREATER THAN 2



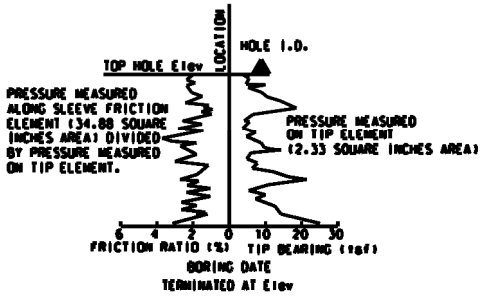
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

LEGEND – SOIL
(SHEET 1 OF 2)
NO SCALE

A10F

2010 STANDARD PLAN A10F

5-24-10

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

GROUP SYMBOLS AND NAMES

GRAPHIC/SYMBOL	GROUP NAMES
GW	WELL-GRADED GRAVEL WELL-GRADED GRAVEL WITH SAND
GP	POORLY-GRADED GRAVEL POORLY-GRADED GRAVEL WITH SAND
GW-GM	WELL-GRADED GRAVEL WITH SILT WELL-GRADED GRAVEL WITH SILT AND SAND
GW-GC	WELL-GRADED GRAVEL WITH CLAY (OR SILTY CLAY) WELL-GRADED GRAVEL WITH CLAY AND SAND (OR SILTY CLAY AND SAND)
GP-GM	POORLY-GRADED GRAVEL WITH SILT POORLY-GRADED GRAVEL WITH SILT AND SAND
GP-GC	POORLY-GRADED GRAVEL WITH CLAY (OR SILTY CLAY) POORLY-GRADED GRAVEL WITH CLAY AND SAND (OR SILTY CLAY AND SAND)
GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL WITH SAND
SW	WELL-GRADED SAND WELL-GRADED SAND WITH GRAVEL
SP	POORLY-GRADED SAND POORLY-GRADED SAND WITH GRAVEL
SW-SM	WELL-GRADED SAND WITH SILT WELL-GRADED SAND WITH SILT AND GRAVEL
SW-SC	WELL-GRADED SAND WITH CLAY (OR SILTY CLAY) WELL-GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
SP-SM	POORLY-GRADED SAND WITH SILT POORLY-GRADED SAND WITH SILT AND GRAVEL
SP-SC	POORLY-GRADED SAND WITH CLAY (OR SILTY CLAY) POORLY-GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
SM	SILTY SAND SILTY SAND WITH GRAVEL
SC	CLAYEY SAND CLAYEY SAND WITH GRAVEL
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND WITH GRAVEL
PT	PEAT
	COBBLES COBBLES AND BOULDERS BOULDERS

GRAPHIC/SYMBOL	GROUP NAMES
CL	LEAN CLAY LEAN CLAY WITH SAND LEAN CLAY WITH GRAVEL SANDY LEAN CLAY SANDY LEAN CLAY WITH GRAVEL GRAVELLY LEAN CLAY GRAVELLY LEAN CLAY WITH SAND
CL-ML	SILTY CLAY SILTY CLAY WITH SAND SILTY CLAY WITH GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY WITH GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY WITH SAND
ML	SILT SILT WITH SAND SILT WITH GRAVEL SANDY SILT SANDY SILT WITH GRAVEL GRAVELLY SILT GRAVELLY SILT WITH SAND
OL	ORGANIC LEAN CLAY ORGANIC LEAN CLAY WITH SAND ORGANIC LEAN CLAY WITH GRAVEL SANDY ORGANIC LEAN CLAY SANDY ORGANIC LEAN CLAY WITH GRAVEL GRAVELLY ORGANIC LEAN CLAY GRAVELLY ORGANIC LEAN CLAY WITH SAND
OL	ORGANIC SILT ORGANIC SILT WITH SAND ORGANIC SILT WITH GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT WITH GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT WITH SAND
CH	FAT CLAY FAT CLAY WITH SAND FAT CLAY WITH GRAVEL SANDY FAT CLAY SANDY FAT CLAY WITH GRAVEL GRAVELLY FAT CLAY GRAVELLY FAT CLAY WITH SAND
MH	ELASTIC SILT ELASTIC SILT WITH SAND ELASTIC SILT WITH GRAVEL SANDY ELASTIC SILT SANDY ELASTIC SILT WITH GRAVEL GRAVELLY ELASTIC SILT GRAVELLY ELASTIC SILT WITH SAND
OH	ORGANIC FAT CLAY ORGANIC FAT CLAY WITH SAND ORGANIC FAT CLAY WITH GRAVEL SANDY ORGANIC FAT CLAY SANDY ORGANIC FAT CLAY WITH GRAVEL GRAVELLY ORGANIC FAT CLAY GRAVELLY ORGANIC FAT CLAY WITH SAND
OH	ORGANIC ELASTIC SILT ORGANIC ELASTIC SILT WITH SAND ORGANIC ELASTIC SILT WITH GRAVEL SANDY ORGANIC ELASTIC SILT SANDY ORGANIC ELASTIC SILT WITH GRAVEL GRAVELLY ORGANIC ELASTIC SILT GRAVELLY ORGANIC ELASTIC SILT WITH SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL WITH SAND ORGANIC SOIL WITH GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL WITH GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL WITH SAND

FIELD AND LABORATORY TESTING

- (C) CONSOLIDATION (ASTM D 2435)
- (CL) COLLAPSE POTENTIAL (ASTM D 5333)
- (CP) COMPACTION CURVE (CTM 216)
- (CR) CORROSIVITY TESTING (CTM 643, CTM 422, CTM 417)
- (CU) CONSOLIDATED UNDRAINED TRIAXIAL (ASTM D 4767)
- (DS) DIRECT SHEAR (ASTM D 3080)
- (EI) EXPANSION INDEX (ASTM D 4829)
- (M) MOISTURE CONTENT (ASTM D 2216)
- (OC) ORGANIC CONTENT-% (ASTM D 2974)
- (P) PERMEABILITY (CTM 220)
- (PA) PARTICLE SIZE ANALYSIS (ASTM D 422)
- (PI) PLASTICITY INDEX (AASHTO T 90)
LIQUID LIMIT (AASHTO T 89)
- (PL) POINT LOAD INDEX (ASTM D 5731)
- (PM) PRESSURE METER
- (R) R-VALUE (CTM 301)
- (SE) SAND EQUIVALENT (CTM 217)
- (SG) SPECIFIC GRAVITY (AASHTO T 100)
- (SL) SHRINKAGE LIMIT (ASTM D 427)
- (SW) SWELL POTENTIAL (ASTM D 4546)
- (UC) UNCONFINED COMPRESSION-SOIL (ASTM D 2166)
UNCONFINED COMPRESSION-ROCK (ASTM D 2938)
- (UU) UNCONSOLIDATED UNDRAINED TRIAXIAL (ASTM D 2850)
- (UW) UNIT WEIGHT (ASTM D 4767)

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APPARENT DENSITY OF COHESIONLESS SOILS

DESCRIPTION	SPT N_{60} (BLOWS / 12 INCHES)
VERY LOOSE	0 - 5
LOOSE	5 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	GREATER THAN 50

MOISTURE

DESCRIPTION	CRITERIA
DRY	NO DISCERNABLE MOISTURE
MOIST	MOISTURE PRESENT, BUT NO FREE WATER
WET	VISIBLE FREE WATER

PERCENT OR PROPORTION OF SOILS

DESCRIPTION	CRITERIA
TRACE	PARTICLES ARE PRESENT BUT ESTIMATED TO BE LESS THAN 5%
FEW	5% - 10%
LITTLE	15% - 25%
SOME	30% - 45%
MOSTLY	50% - 100%

PARTICLE SIZE

DESCRIPTION		SIZE
BOULDER		GREATER THAN 12"
COBBLE		3" - 12"
GRAVEL	COARSE	3/4" - 3"
	FINE	1/5" - 3/4"
SAND	COARSE	1/16" - 1/5"
	MEDIUM	1/64" - 1/16"
	FINE	1/300" - 1/64"
SILT AND CLAY		LESS THAN 1/300"

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

LEGEND – SOIL
(SHEET 2 OF 2)
NO SCALE

A10G

2010 STANDARD PLAN A10G

5-5-10

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	12.80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/10/12

PLANS APPROVAL DATE

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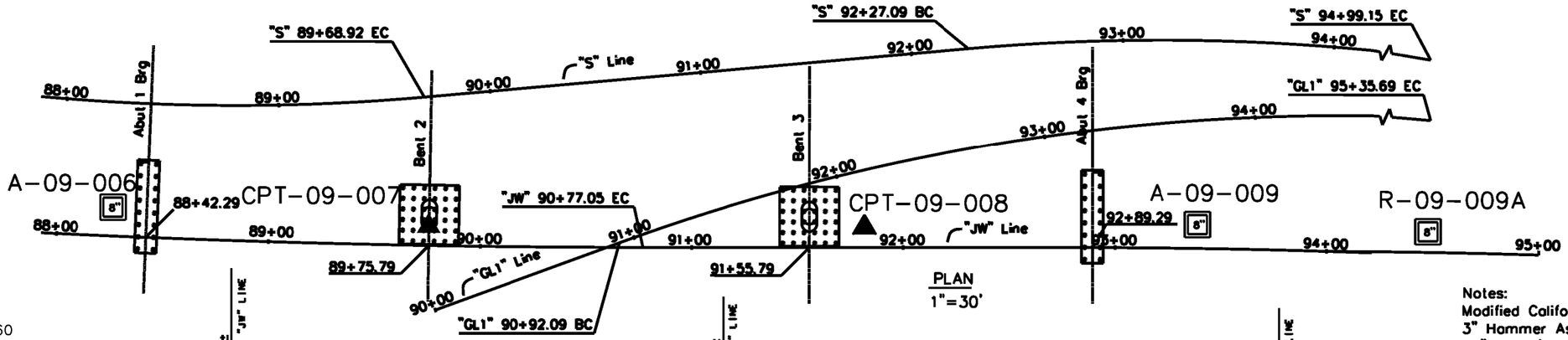
REGISTERED PROFESSIONAL ENGINEER — G. PARIKH — NO. 666 — EXP. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



PLAN
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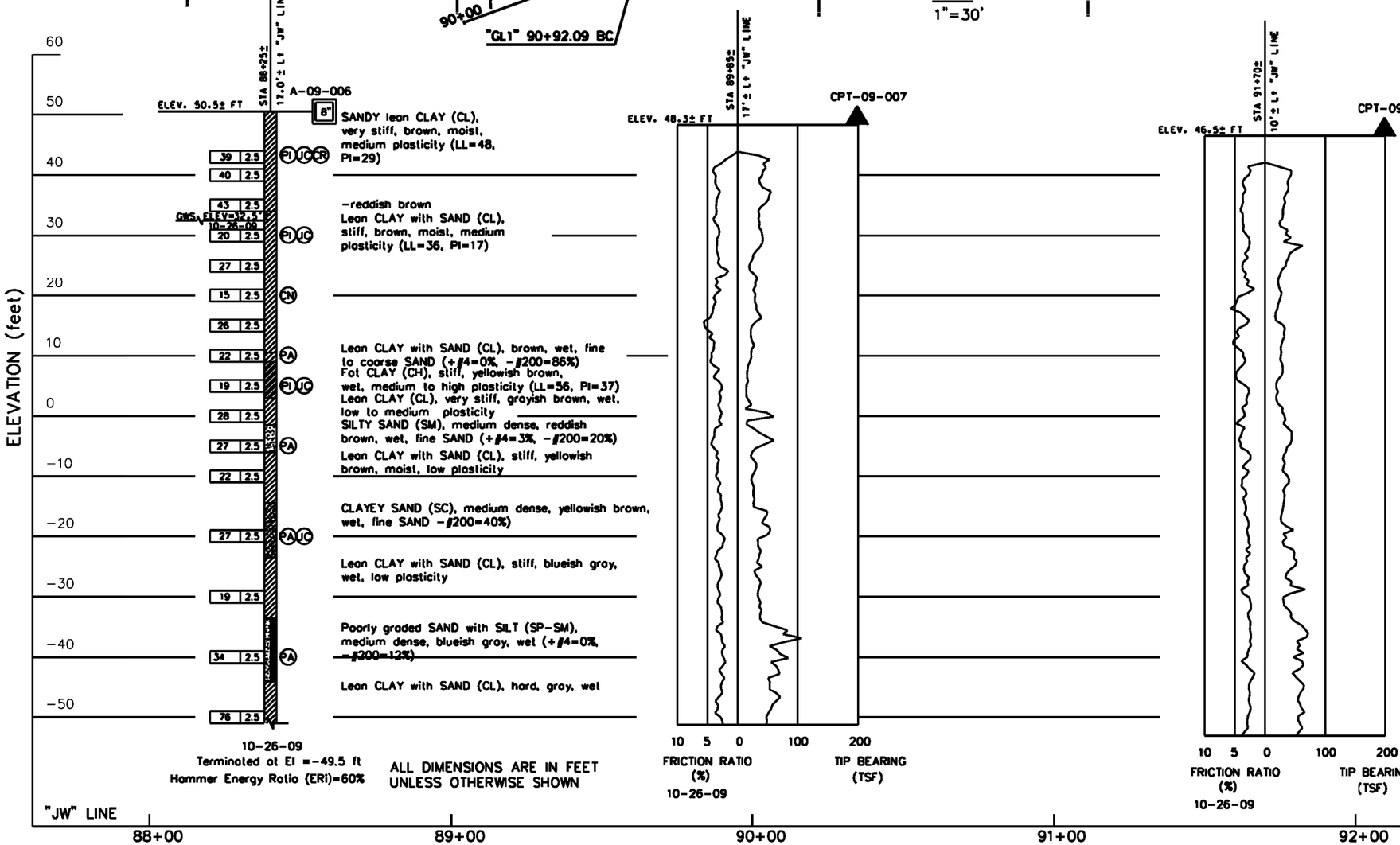


ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

Notes:
Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Semi-Automatic (wireline) Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

BENCHMARK:
BASIS OF BEARINGS AND COORDINATES:
The Horizontal coordinate values are in the California Coordinate System (CCS 83) Zone 2 and based on the North American Datum of 1983 (NAD83), as adjusted to the California High Precision Network (HPGN) 92 Epoch 1991.35

BASIS OF ELEVATIONS:
This Project is based on the North Vertical Datum of 1988 (NAVD88). The stations and respective elevations constrained are:
HPGN D CA 10 LC (PID AC 9890, Elevation 26.35)
V 1054 (PID JT0185, ELEVATION 46.90)

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 20'

DESIGN OVERSIGHT	DRAWN BY	L. DUODU	L.S. BHANGOO FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCTOBER 2009

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG — PROJECT ENGINEER

BRIDGE NO. 23-0248 — POST MILES 3.0/12.2

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)

LOG OF TEST BORINGS — 1 OF 2

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0741
PROJECT NUMBER & PHASE: 04000211311 CONTRACT NO.: 04-0A5341

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES — SHEET 24 OF 25

FILE = ¢ $REQUEST

USERNAME = ¢ $USER DATE PLOTTED = ¢ $DATE TIME PLOTTED = ¢ $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	12.80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL 9/10/12 DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER G. PARIKH NO. 666 EXP. 12/31/13 GEOTECHNICAL STATE OF CALIFORNIA

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

BENCHMARK:
BASIS OF BEARINGS AND COORDINATES:
The Horizontal coordinate values are in the California Coordinate System (CCS 83) Zone 2 and based on the North American Datum of 1983 (NAD83), as adjusted to the California High Precision Network (HPGN) 92 Epoch 1991.35

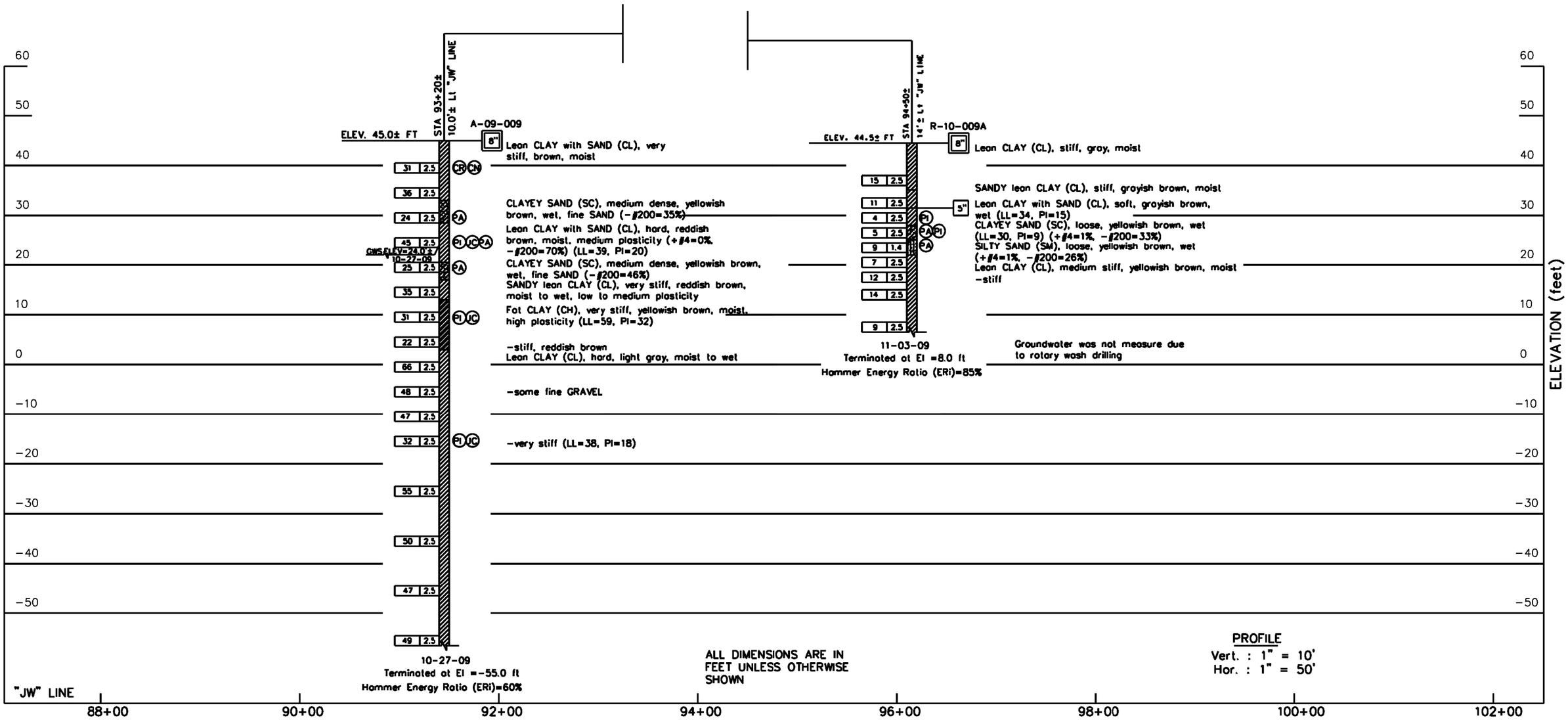
BASIS OF ELEVATIONS:
This Project is based on the North Vertical Datum of 1988 (NAVD88). The stations and respective elevations constrained are:

HPGN D CA 10 LC (PID AC 9890, Elevation 26.35)
V 1054 (PID JT0185, ELEVATION 46.90)

(SEE BORING LOCATIONS AND BENCH MARKS ON SHEET 1 OF 2)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2" Modified California Sampler: I.D. = 2.5"; O.D. = 3" Hammer Assembly: A 140 lb hammer with a 30" drop (Semi-Automatic (wireline) Hammer for A-09-009 and Automatic Hammer for R-10-009A)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)



ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	L. DUODU	L.S. BHANGOO FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCTOBER 2009

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG
PROJECT ENGINEER

BRIDGE NO. 23-0248
POST MILES 3.0/12.2

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)

LOG OF TEST BORINGS 2 OF 2

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0741
PROJECT NUMBER & PHASE: 04000211311 CONTRACT NO.: 04-0A5341

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET 25 | OF 25

FILE =C $REQUEST

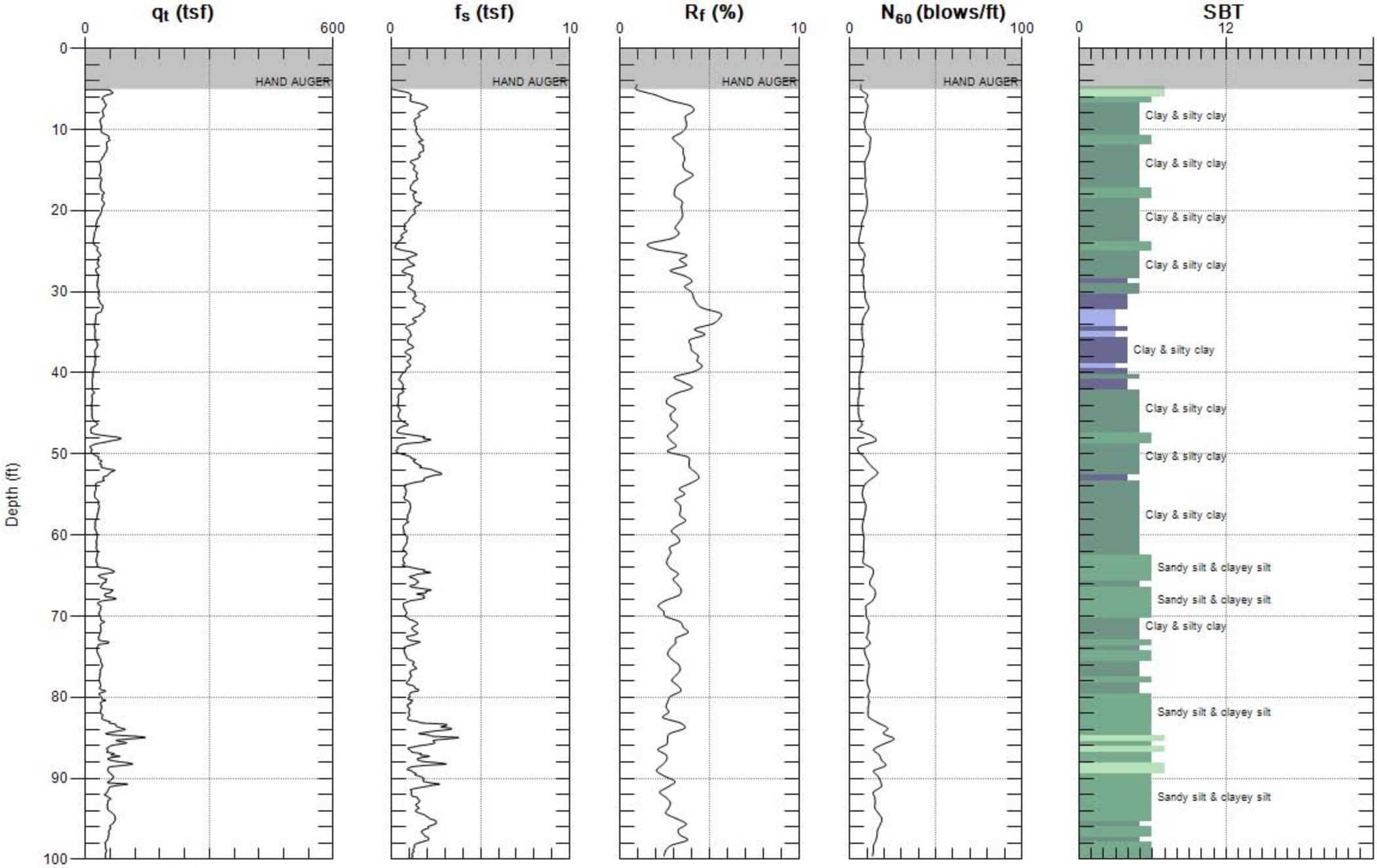
USERNAME =C $USER DATE PLOTTED =C $DATE TIME PLOTTED =C $TIME

APPENDIX III

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-07

Engineer: F.WANG
Date: 10/26/2009 12:25



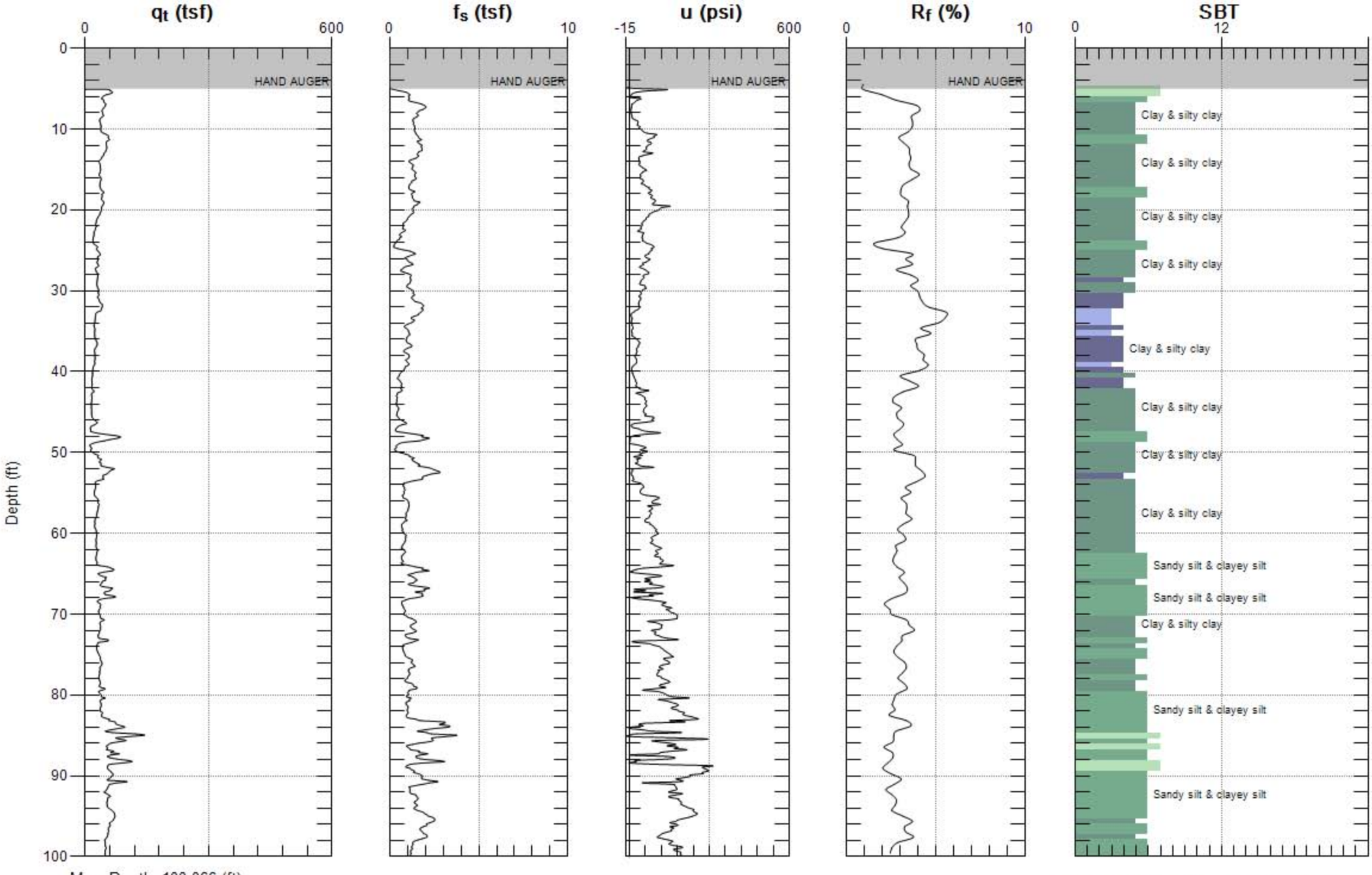
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-07

Engineer: F.WANG
Date: 10/26/2009 12:25



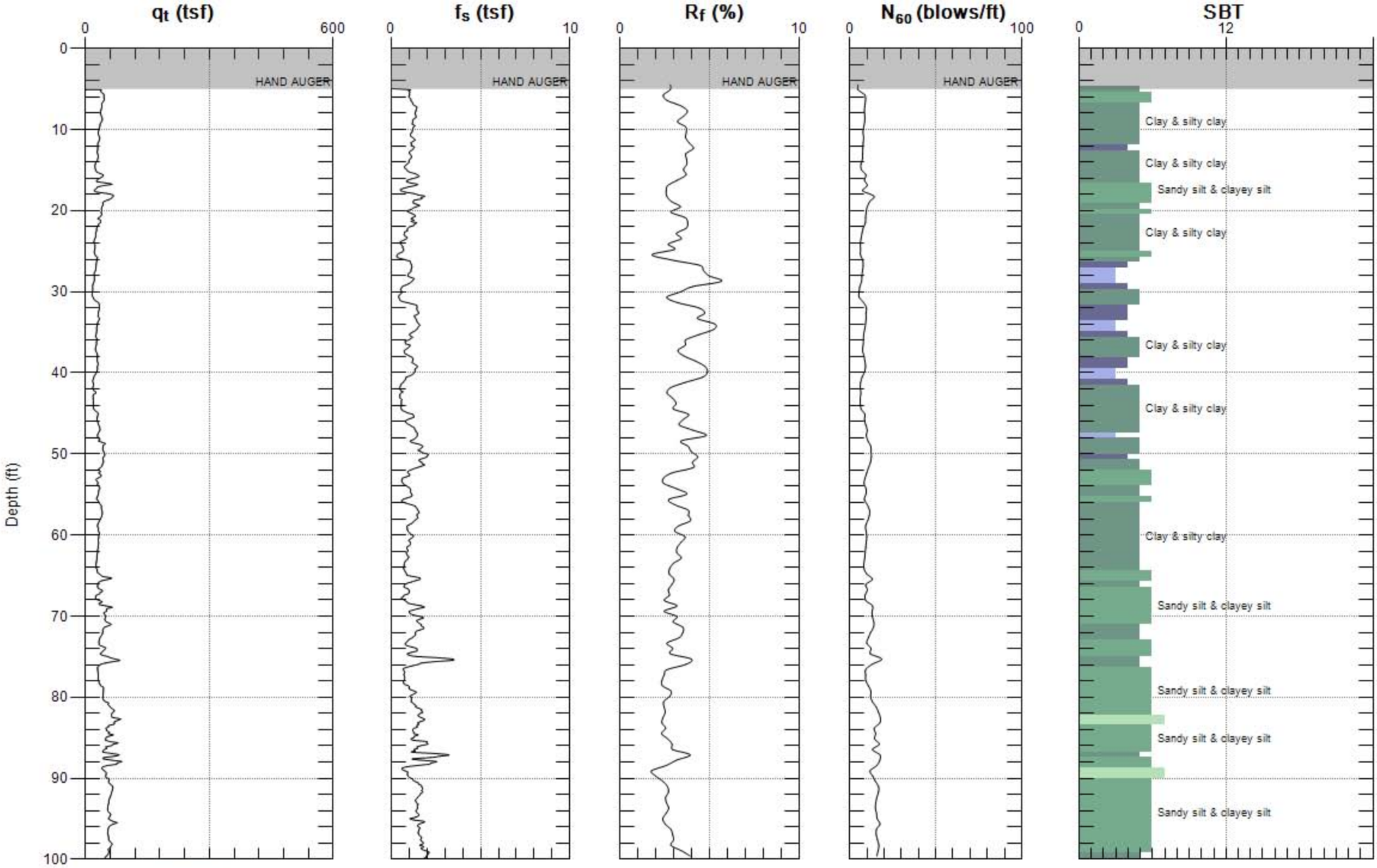
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-08

Engineer: F.WANG
Date: 10/26/2009 09:19



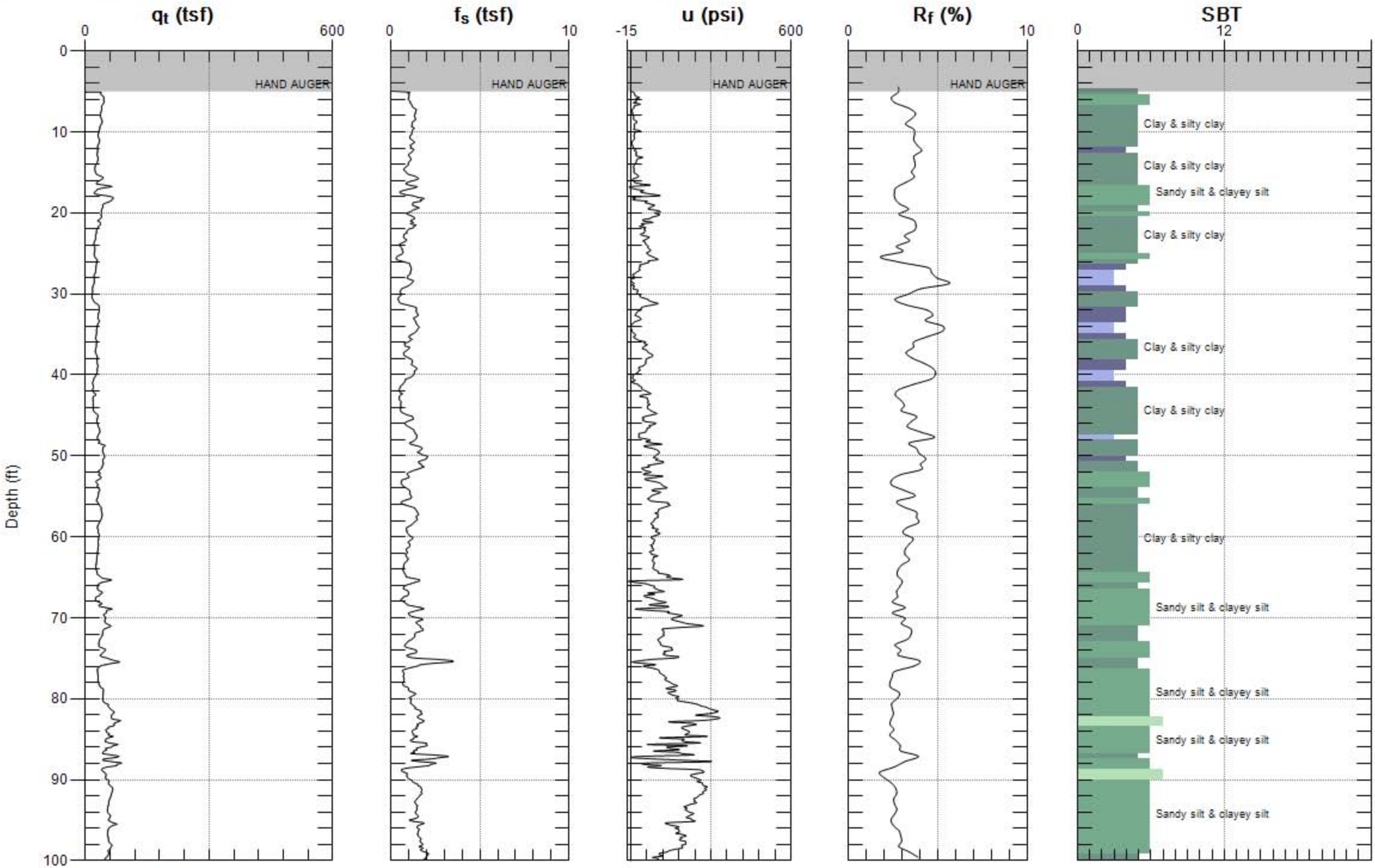
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-08

Engineer: F.WANG
Date: 10/26/2009 09:19

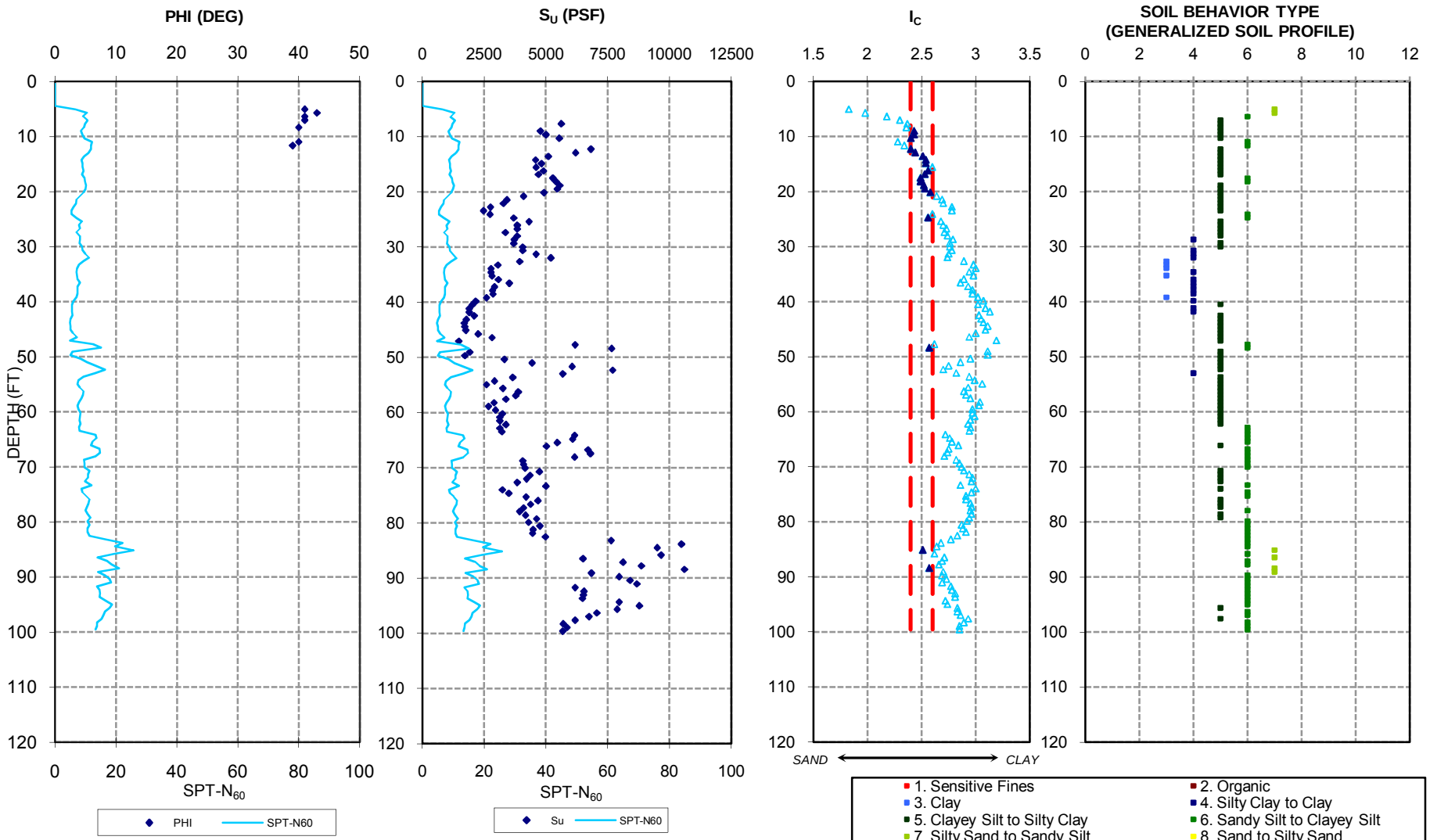


Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

CPT DATA CORRELATION

CPT-09-007



Reference: CPT data and correlation provided by Gregg Drilling and Testing, Inc.

PARIKH

Practicing in the Geosciences

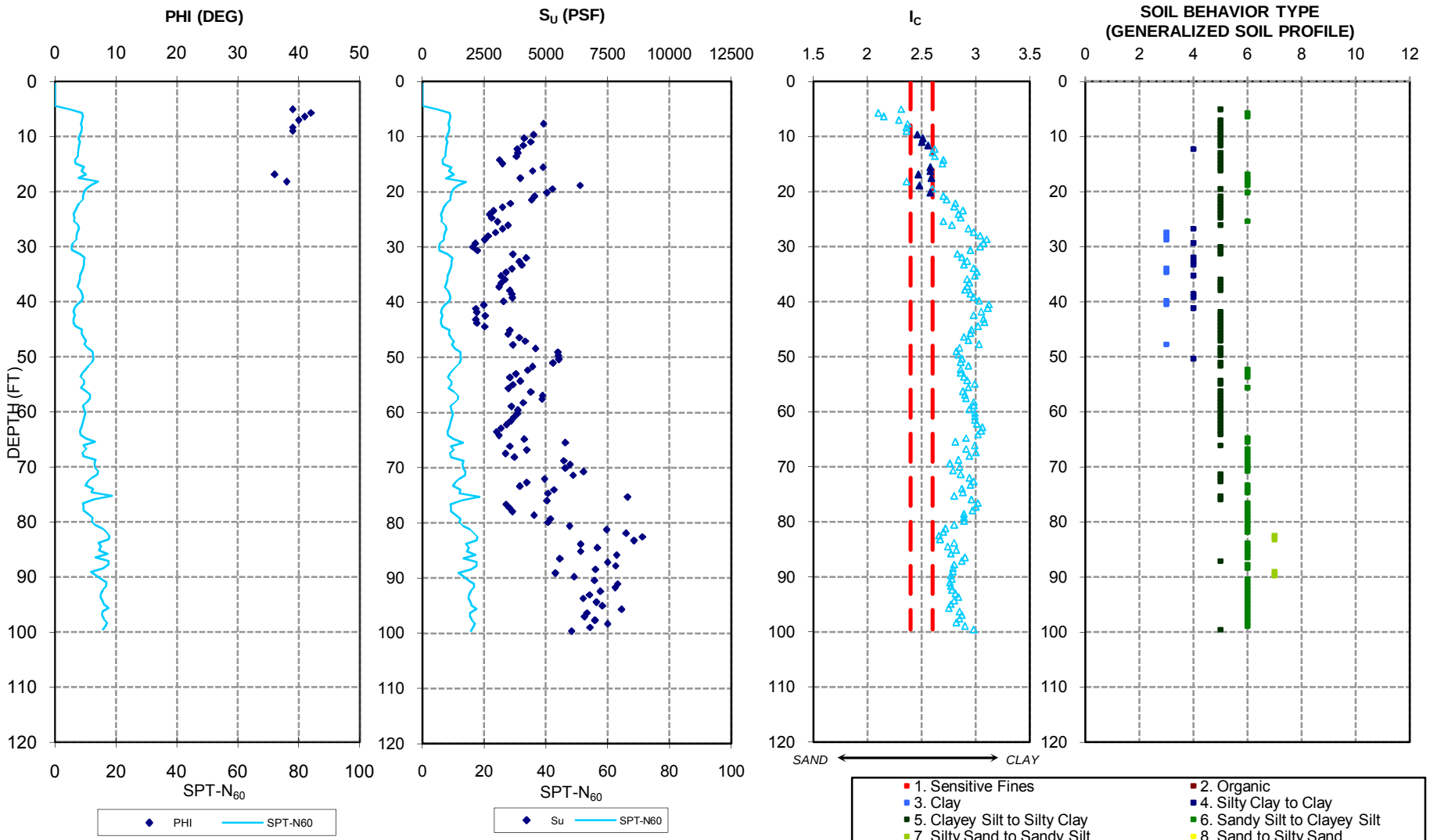
WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.:

CPT DATA CORRELATION

CPT-09-008



Reference: CPT data and correlation provided by Gregg Drilling and Testing, Inc.

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WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.:

APPENDIX IV

APPENDIX IV
LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System (ASTM Test Method D 2488, Visual-Manual Procedure). The classification has been verified with laboratory data as necessary. The classification tests are presented on “Log of Test Borings”, Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented on Plate IV-2A thru IV-2C.

Unconfined Compression Tests

Strength tests were performed on selected undisturbed sample using unconfined compression machine. Unconfined compression test was performed in general accordance with California Test Method T 221. The results are presented on Plate IV-2A thru IV-2C.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate IV-3, “Plasticity Chart”.

Grain Size Classification

Grain size classification tests (ASTM Test Method D 422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates IV-4A and IV-4B, "Grain Size Distribution Curves".

Corrosion Tests

Corrosion tests were performed on selected samples to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643 by Parikh Consultants, Inc. The test results are presented on Plates IV-5A and IV-5B.

Consolidation Tests

Consolidation tests were performed on selected samples in accordance with ASTM Test Method D 2435. The test resulrs are presented on the Plates IV-6A thru IV-6F.

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-006	1	6.5	CL				48	19	29		108.7	17.7	Corr. - See Plate No.: IV-5A
	2	9.5	CL								111.7	15.8	
	3	14.5	CL								109.5	18.2	
	4	19.5	CL				36	19	17	1.8	94.8	28.7	
	5	24.5	CL								95.1	30.0	
	6	29.5	CL								89.9	32.5	C. - See Plate No.: IV-6A thru IV-6C
	7	34.5	CL								100.9	25.1	
	8	39.5	CL	0.0	13.9	86.1					94.5	29.3	
	9	44.5	CH				56	19	37	2.3	90.6	32.1	
	10	49.5	CL								100.7	24.5	
	11	54.5	SM	3.0	77.4	19.6					103.7	23.3	
	12	59.5	CL								104.6	24.5	
	13	69.5	SC			40.1				1.6	103.9	22.2	
	14	79.5	CL								101.4	26.0	
	15	89.5	SP-SM	0.0	88.0	12.0					104.3	23.3	
	16	99.5	CL								105.4	21.7	

SUMMARY OF LABORATORY TEST RESULTS

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
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Notes:
* Unified Soil Classification System
C. = Consolidation
D.S. = Direct Shear
G. = Gradation
P.I. = Plasticity Index
R. = R-Value
U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: IV-2A

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-009	1	4.5	CL								105.5	21.8	Corr.: IV-5B & C.: IV-6D to IV-6E
	2	9.5	CL								101.5	19.4	
	3	14.5	SC			34.9					98.2	26.6	
	4	19.5	CL	0.0	29.7	70.3	39	19	20	7.6	107.7	21.0	
	5	24.5	SC			46.1					110.5	19.1	
	6	29.5	CL								109.4	19.6	
	7	34.5	CH				59	27	32	2.4	90.3	31.4	
	8	39.5	CL								90.4	31.5	
	9	44.5	CL								99.8	23.8	
	10	49.5	CL								110.0	18.1	
	11	54.5	CL								101.1	25.6	
	12	59.5	CL				38	20	18	2.8	93.6	29.4	
	13	69.5	CL								100.5	24.6	
	14	79.5	CL								109.9	21.1	
	15	89.5	CL								107.4	21.1	
	16	99.5	CL								98.6	27.4	

SUMMARY OF LABORATORY TEST RESULTS

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
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Notes:
* Unified Soil Classification System
C. = Consolidation
D.S. = Direct Shear
G. = Gradation
P.I. = Plasticity Index
R. = R-Value
U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: IV-2B

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-009A	1	6.5	CL								-	-	
	2	11.0	CL								-	-	
	3	13.0	CL				34	19	15		-	26.8	
	4	16.0	SC	0.5	67.0	32.6	30	21	9		-	28.4	
	5	19.0	SM	0.6	73.7	25.7					-	28.1	
	6	23.0	CL								-	-	
	7	26.0	CL								-	-	
	8	29.0	CL								-	-	
	9	36.0	CL								-	-	

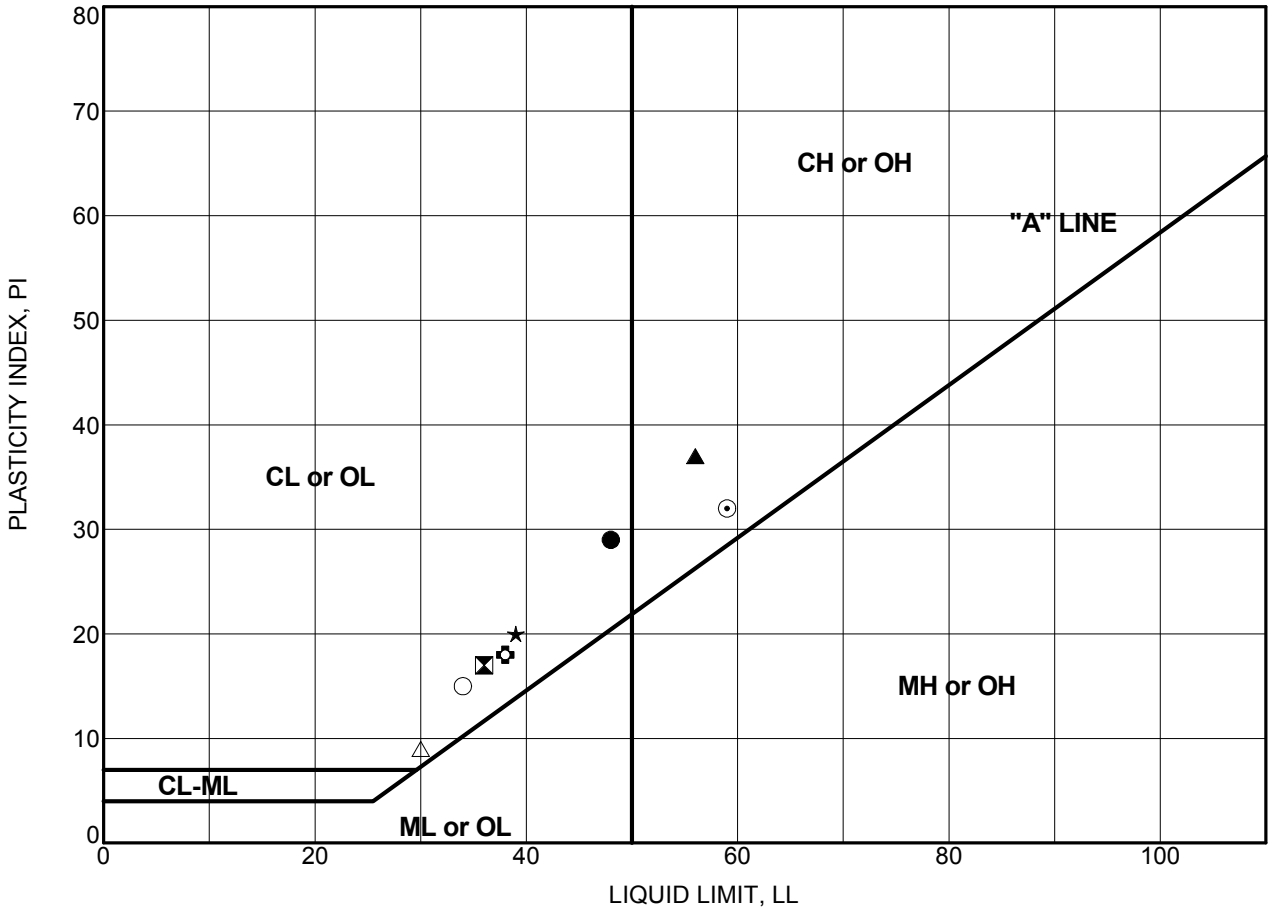
SUMMARY OF LABORATORY TEST RESULTS

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
ROUTE 80-680-12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

PARIKH
Practicing in the Geosciences

Notes:
* Unified Soil Classification System
C. = Consolidation
D.S. = Direct Shear
G. = Gradation
P.I. = Plasticity Index
R. = R-Value
U.C. = Unconf. Compression
Corr. = Corrosion

Job No.: 2009-130-GDR
Plate No.: IV-2C



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-006	MC-1	6.5	●	18	48	19	29	SANDY LEAN CLAY (CL)
A-09-006	MC-4	19.5	⧗	29	36	19	17	LEAN CLAY WITH SAND (CL)
A-09-006	MC-9	44.5	▲	32	56	19	37	FAT CLAY (CH)
A-09-009	MC-4	19.5	★	21	39	19	20	LEAN CLAY WITH SAND (CL)
A-09-009	MC-7	34.5	⊙	31	59	27	32	FAT CLAY (CH)
A-09-009	MC-12	59.5	✿	29	38	20	18	LEAN CLAY (CL)
R-10-009A	MC-3	14.0	○	27	34	19	15	LEAN CLAY (CL)
R-10-009A	MC-4	17.0	△	28	30	21	9	CLAYEY SAND (SC)

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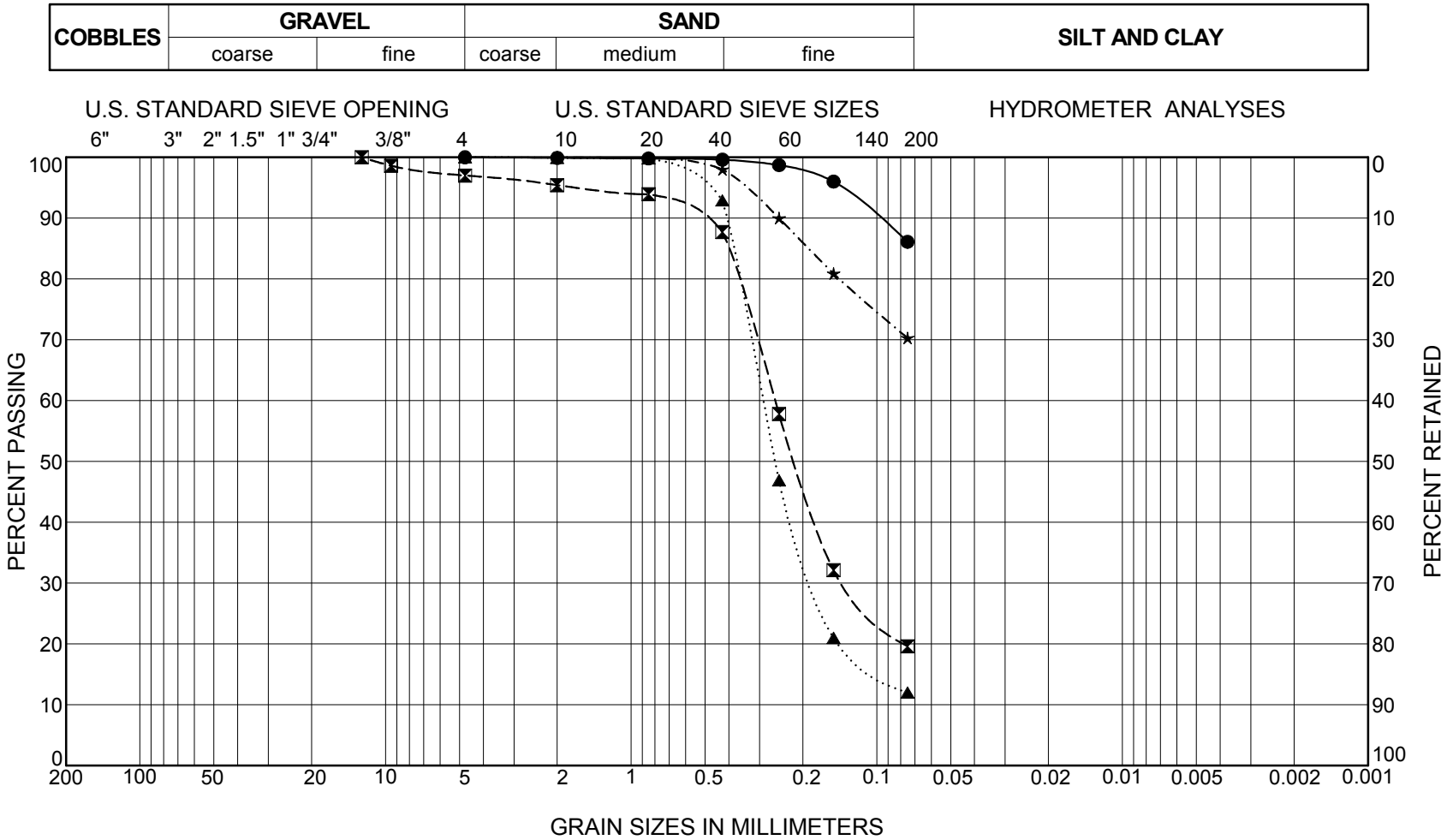
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

WB 80 TO WB 12 (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: IV-3

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-006	MC-8	39.5	●			LEAN CLAY WITH SAND (CL)
A-09-006	MC-11	54.5	⊠			SILTY SAND (SM)
A-09-006	MC-15	89.5	▲			POORLY GRADED SAND WITH SILT (SP-SM)
A-09-009	MC-4	19.5	★	39	20	LEAN CLAY WITH SAND (CL)

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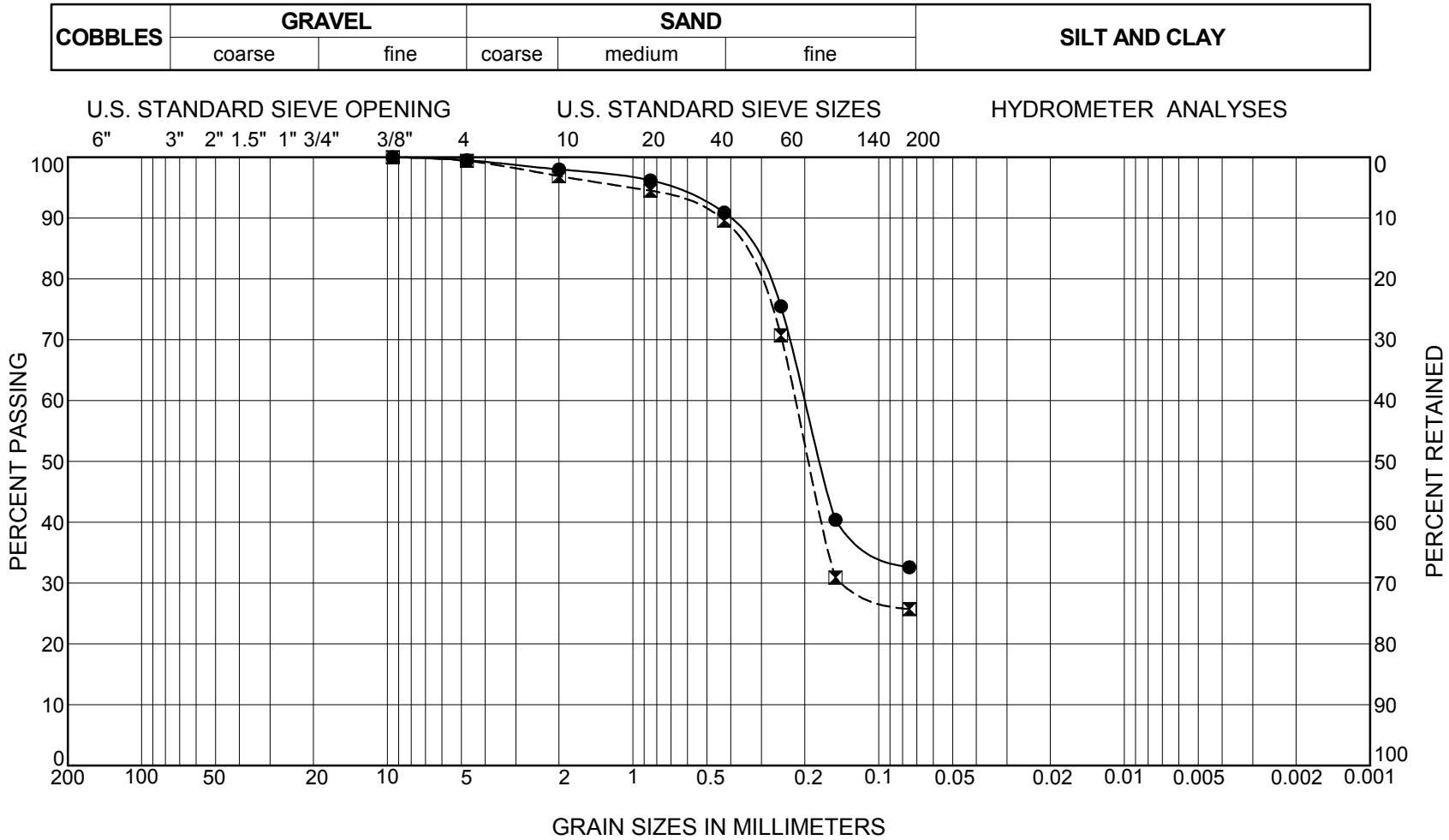
MATERIALS ENGINEERING

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: IV-4A

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-009A	MC-4	17.0	●	30	9	CLAYEY SAND (SC)
R-10-009A	SPT-5	19.0	⧗			SILTY SAND (SM)

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MATERIALS ENGINEERING

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR

PLATE NO: IV-4B

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID A-09-006 #1 @ 6.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115374.

EVALUATION FOR SOIL CORROSION

Soil pH	6.76		
Minimum Resistivity	0.56 ohm-cm (x1000)		
Chloride	377.6 ppm	00.03776	%
Sulfate	188.9 ppm	00.01889	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
NOV 18 2009
BY

PLATE NO. IV-5A

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID A-09-009 #1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115375.

EVALUATION FOR SOIL CORROSION

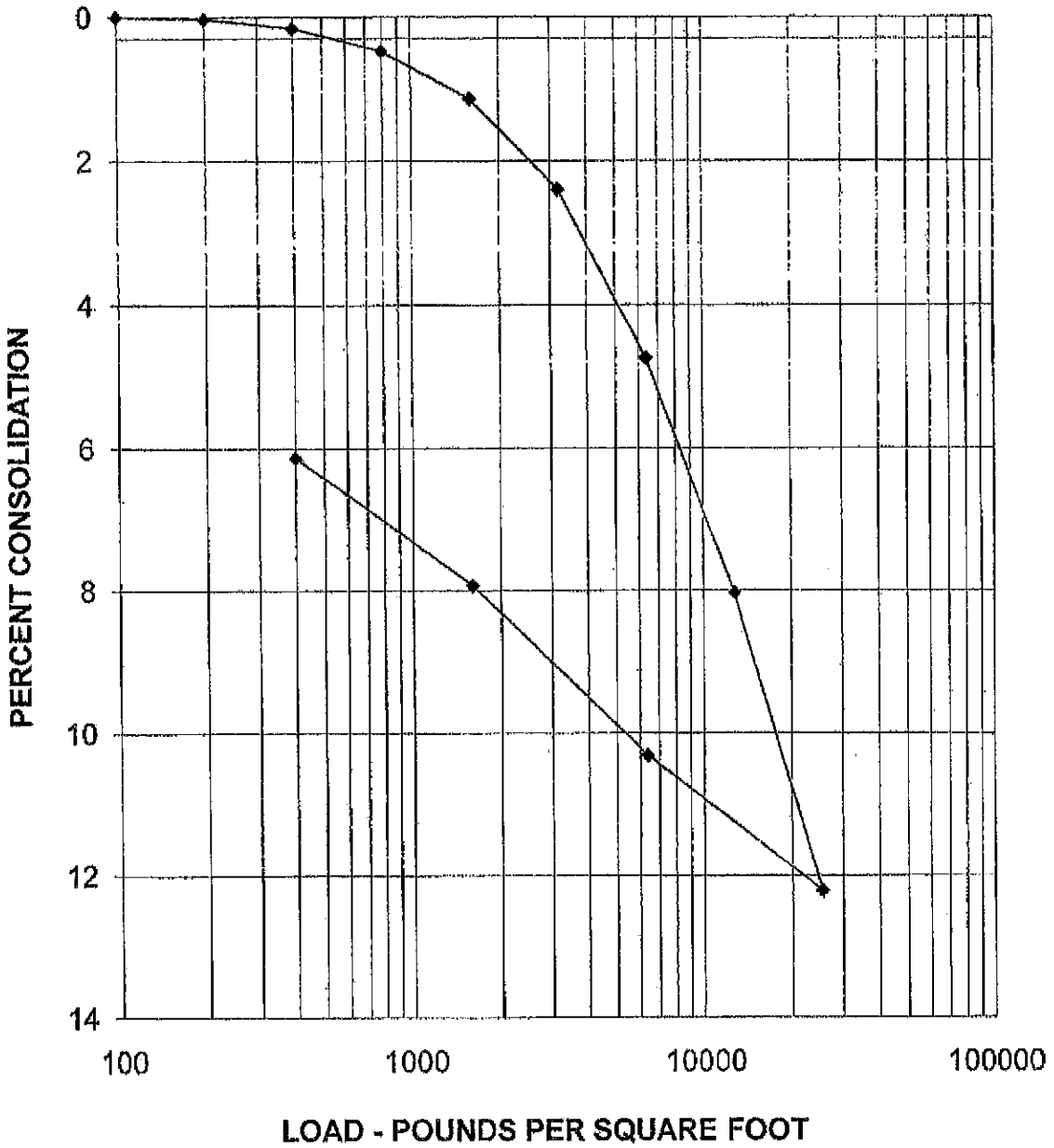
Soil pH	7.72	
Minimum Resistivity	0.56 ohm-cm (x1000)	
Chloride	176.1 ppm	00.01761 %
Sulfate	60.8 ppm	00.00608 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
NOV 16
By

PLATE NO. IV-5B

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	32.5	89.9	1.0000	2.416
FINAL	29.4	95.7	0.9387	2.416

BORING NO.	A-09-006	SAMPLE NO.	6	ELEV. OR DEPTH	29.5'
DESCRIPTION	Lean clay, yellowish brown				

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GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/10/2009	209130.GDR

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

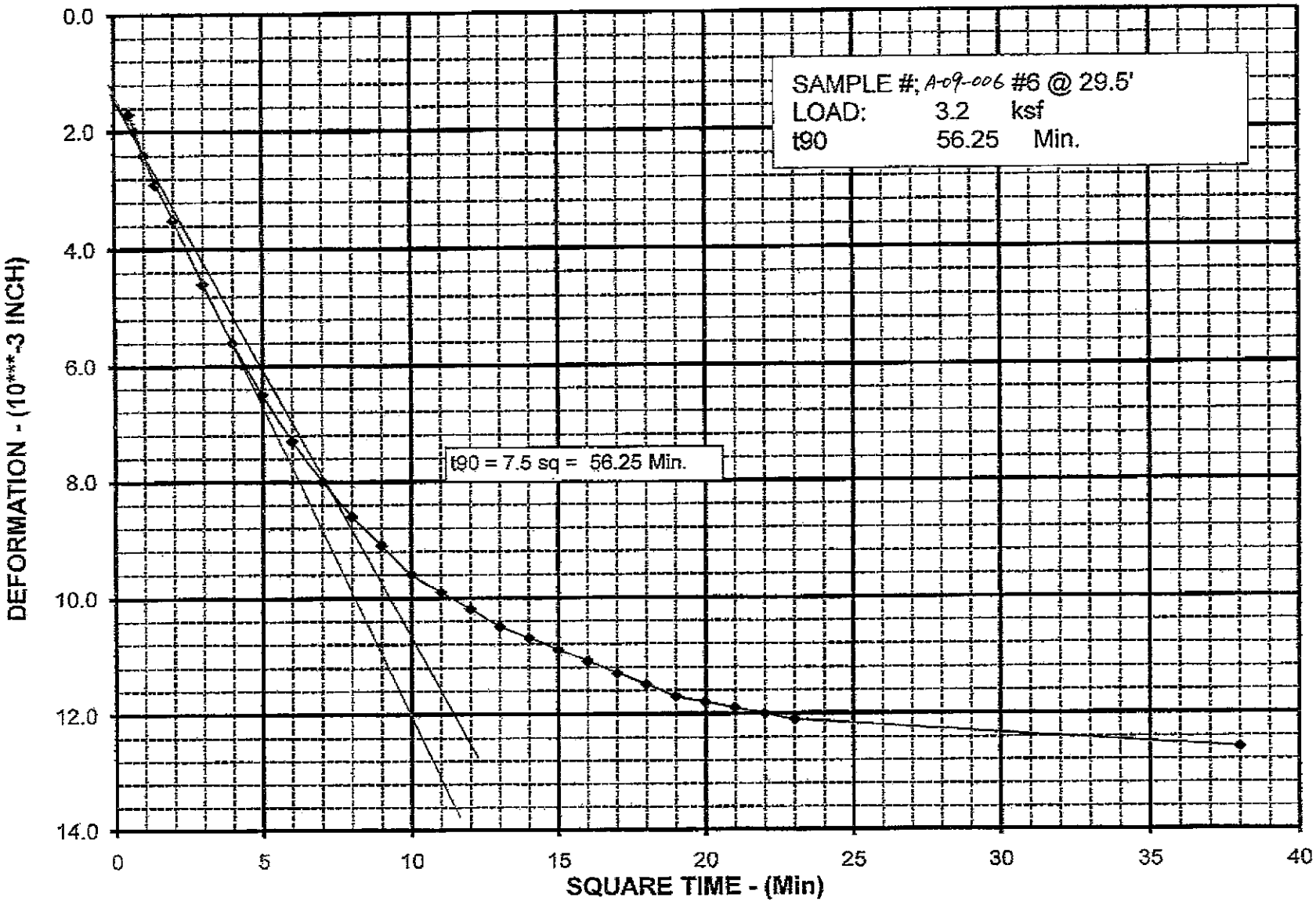


PLATE NO. IV-6B

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

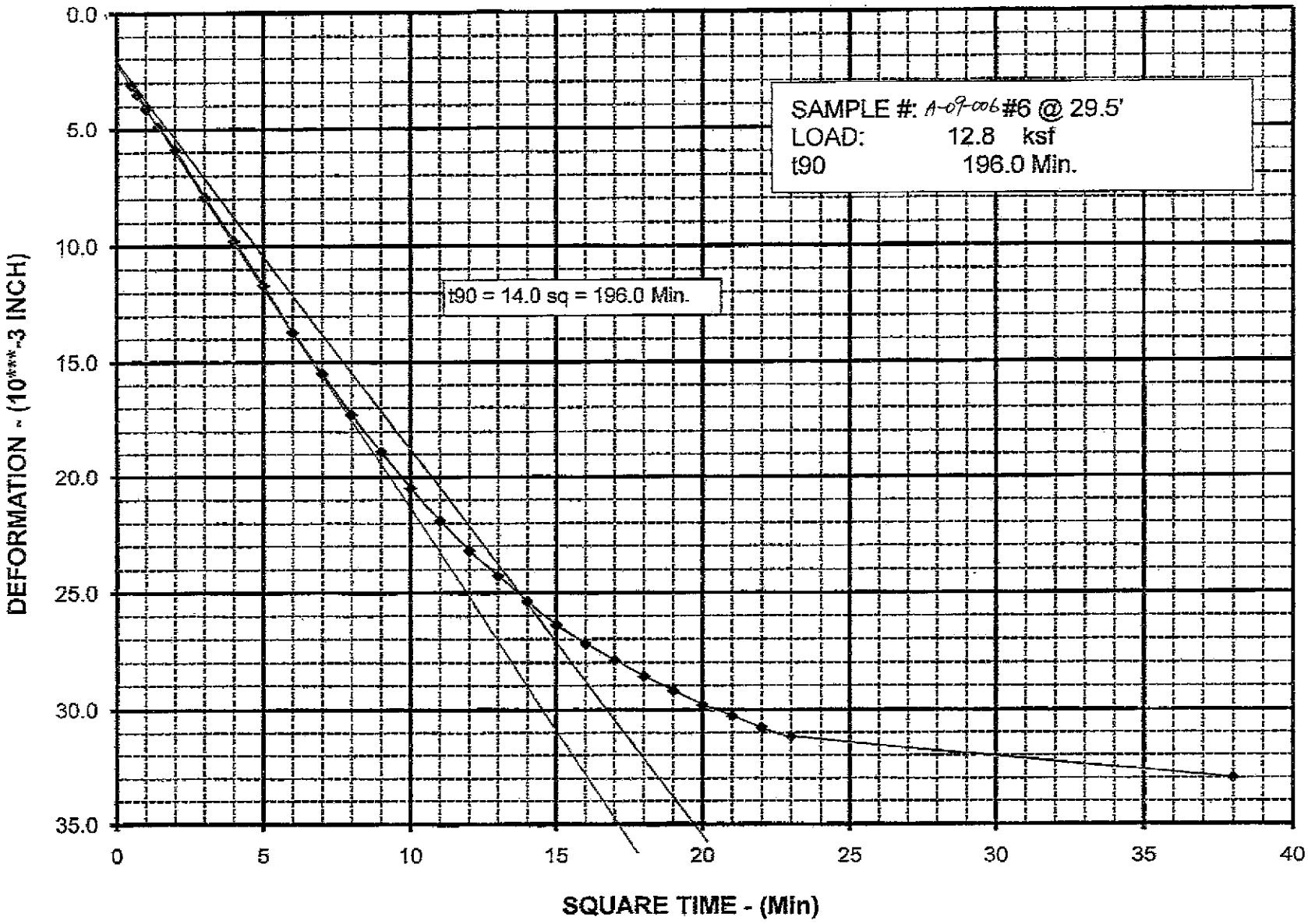
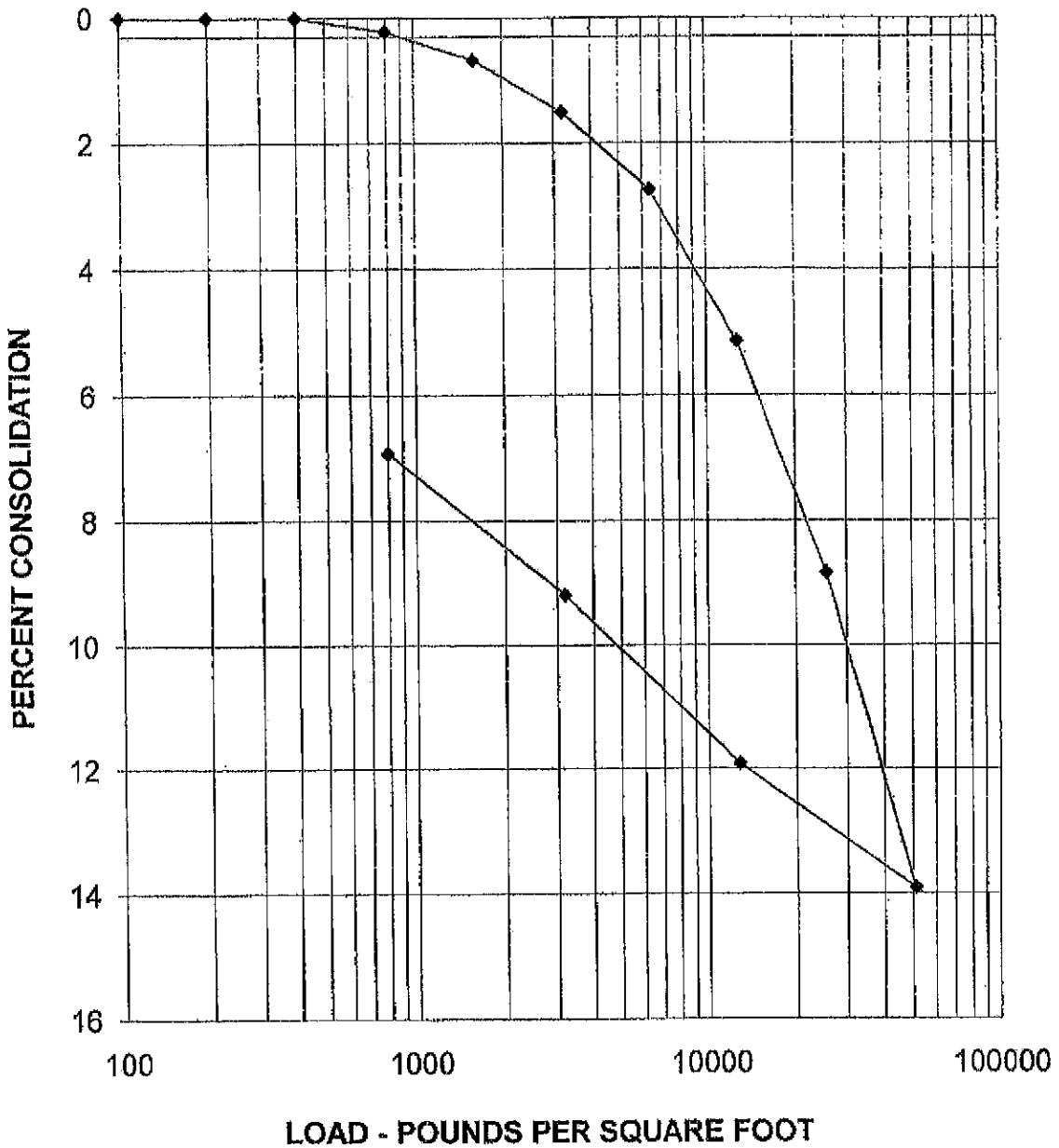


PLATE NO. IV-6C

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	21.8	105.5	1.0000	2.416
FINAL	19.3	113.4	0.9308	2.416

BORING NO.	A-09-009	SAMPLE NO.	I	ELEV. OR DEPTH	4.5'
DESCRIPTION	Sandy lean clay, reddish brown				

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GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/10/2009	209130.GDR

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

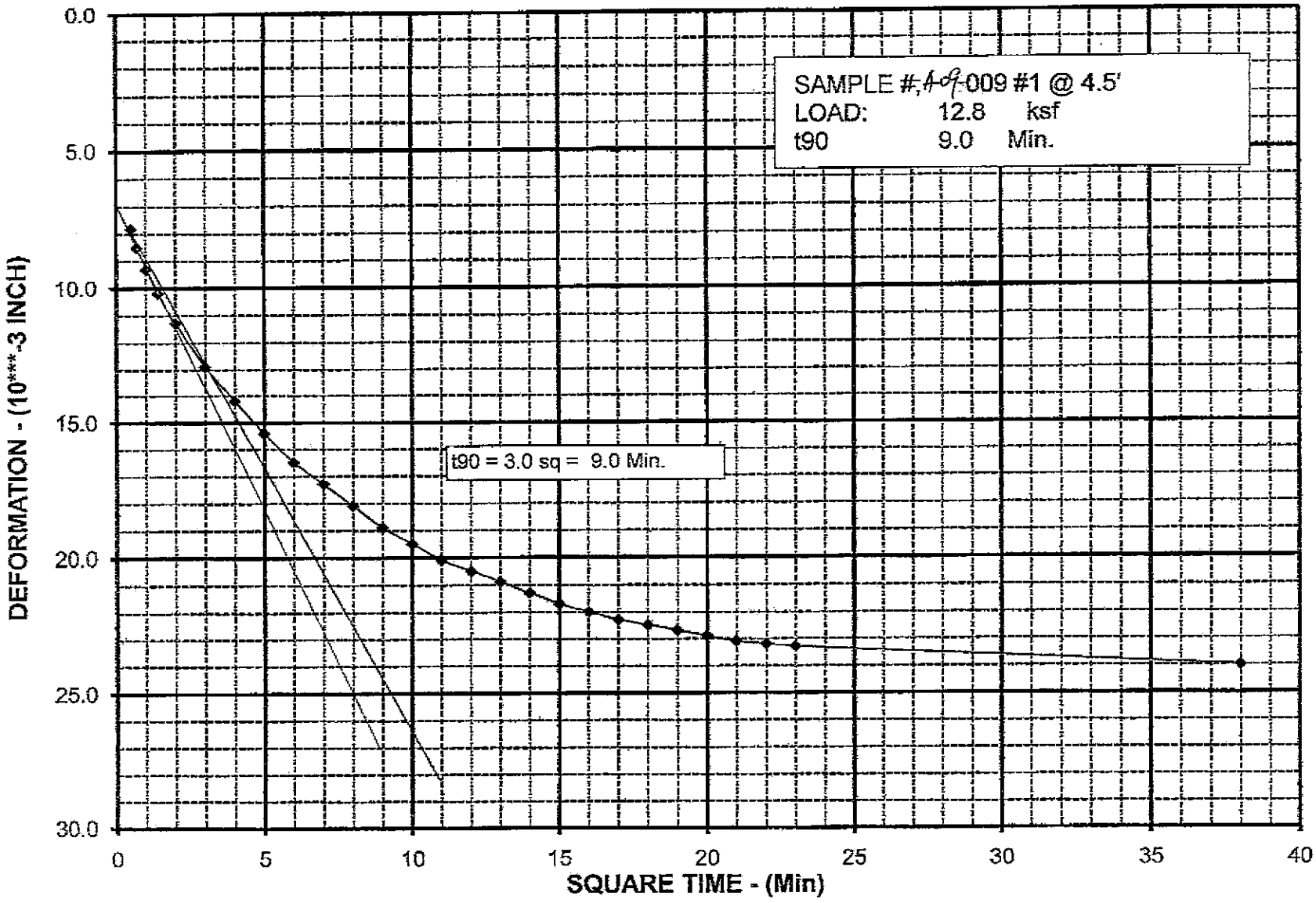
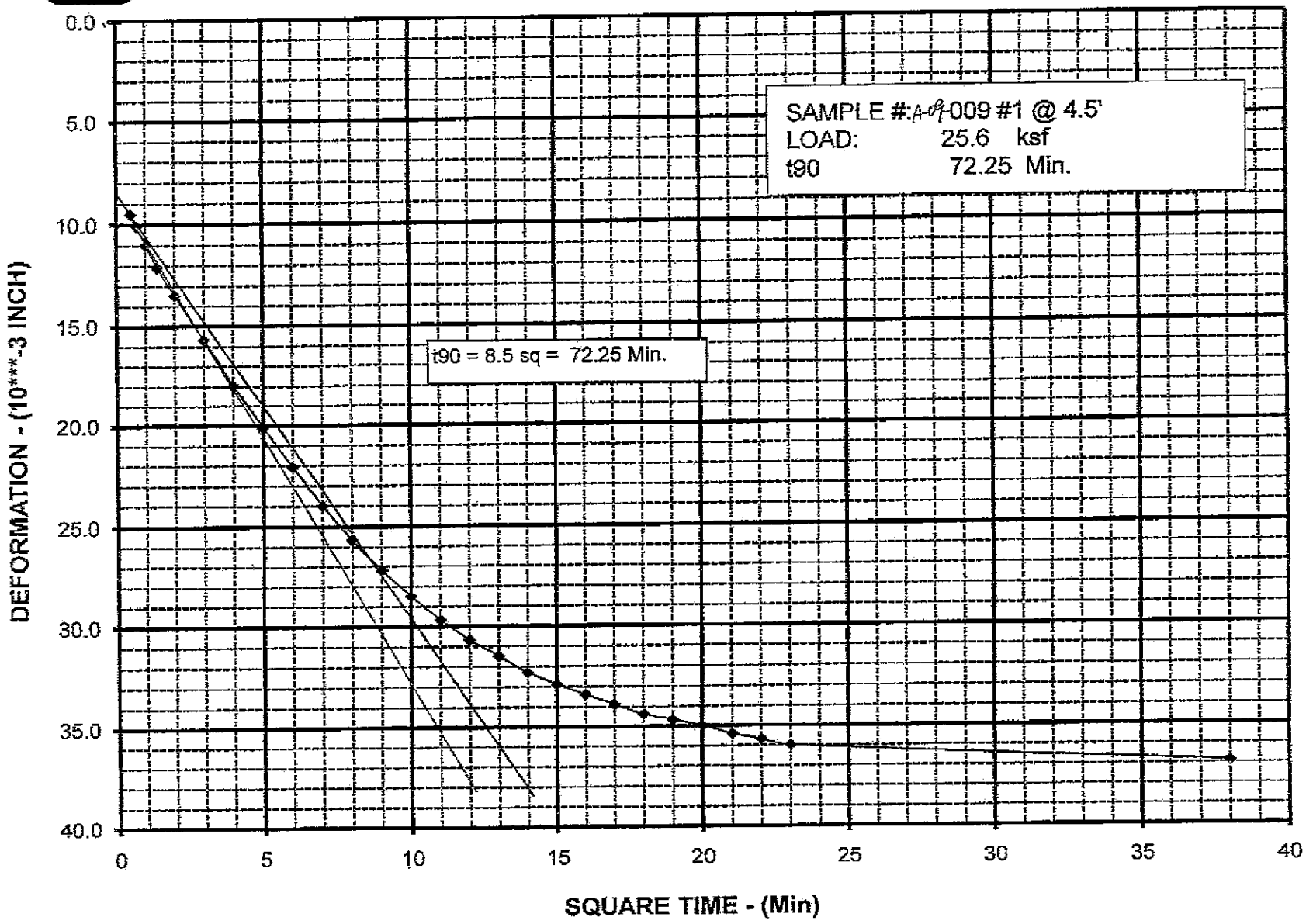


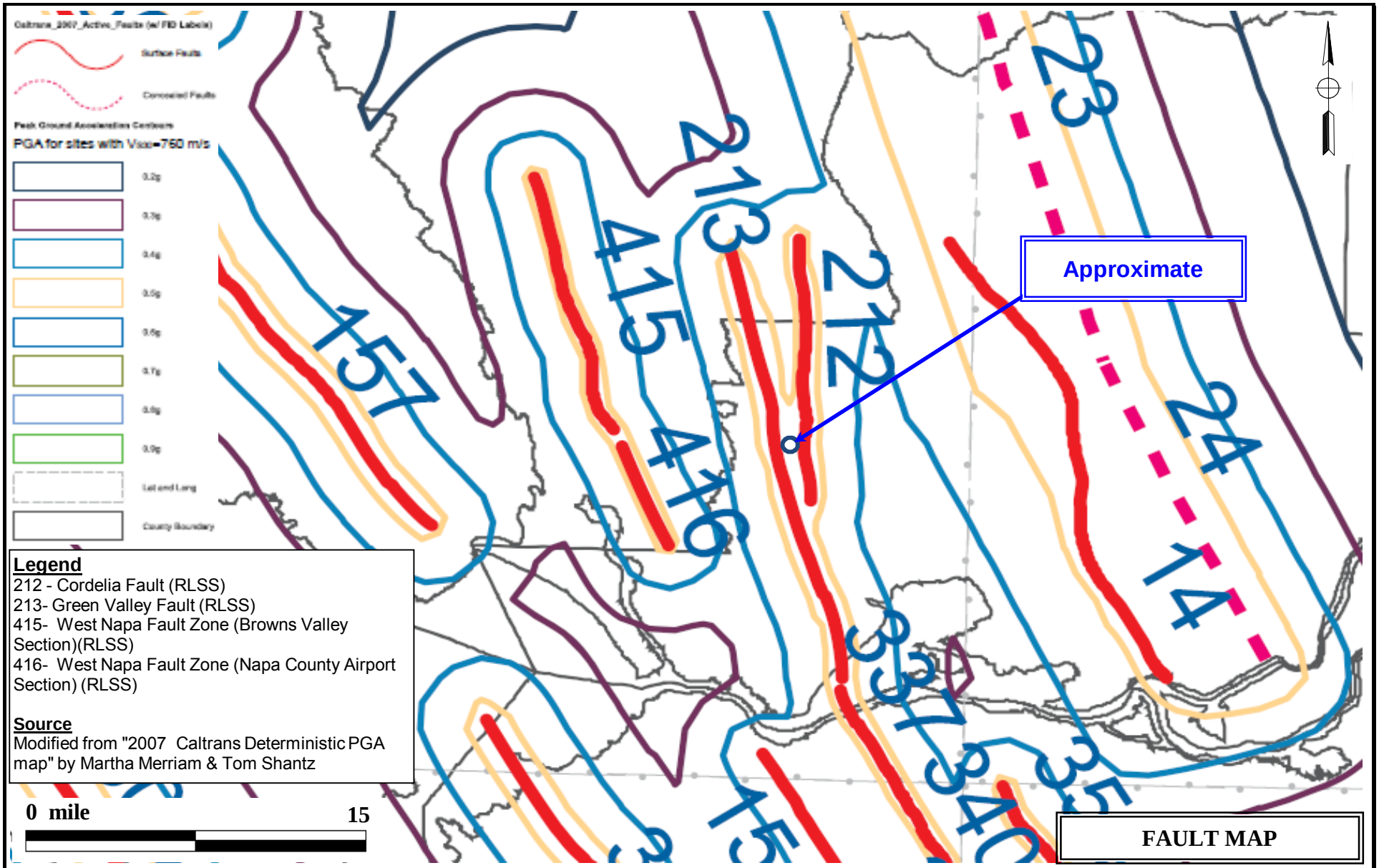
PLATE NO. IV-6E

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR



APPENDIX V



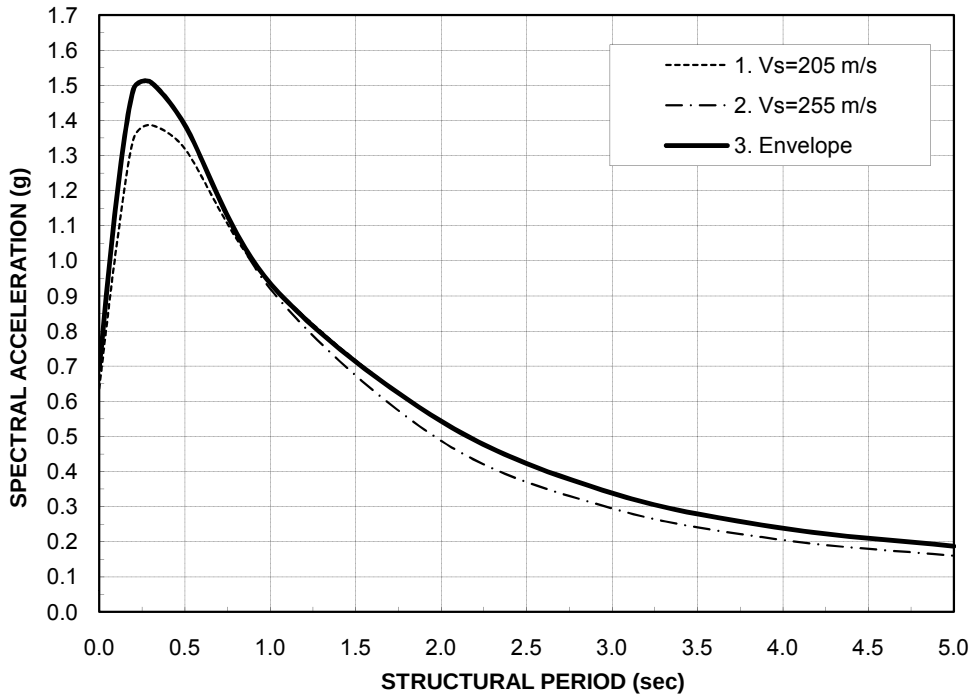
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.: V-1

ARS DESIGN CURVE
WB 80 TO WB 12 GRADE SEPARATION
SOLANO COUNTY, CALIFORNIA



Period (sec)	Spectral Accel. (g)	
	1. Vs=205 m/s	2. Vs=255 m/s
0.000	0.636	0.692
0.100	1.036	1.170
0.200	1.347	1.488
0.300	1.387	1.509
0.500	1.320	1.388
1.000	0.937	0.921
2.000	0.544	0.488
3.000	0.339	0.295
4.000	0.239	0.205
5.000	0.188	0.160

Site Location: 38.21141977 N/122.1468437 W
Seismic design criteria is governed by USGS 2008 Deaggregation (beta)
1. Vs=205 m/s (liquefiable soils modeled as clay with residual strength per Seed & Harder (1990)
2. Vs=255 m/s (non-liquefied case)
3. Recommended Design Curve = Envelope of above two curves

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

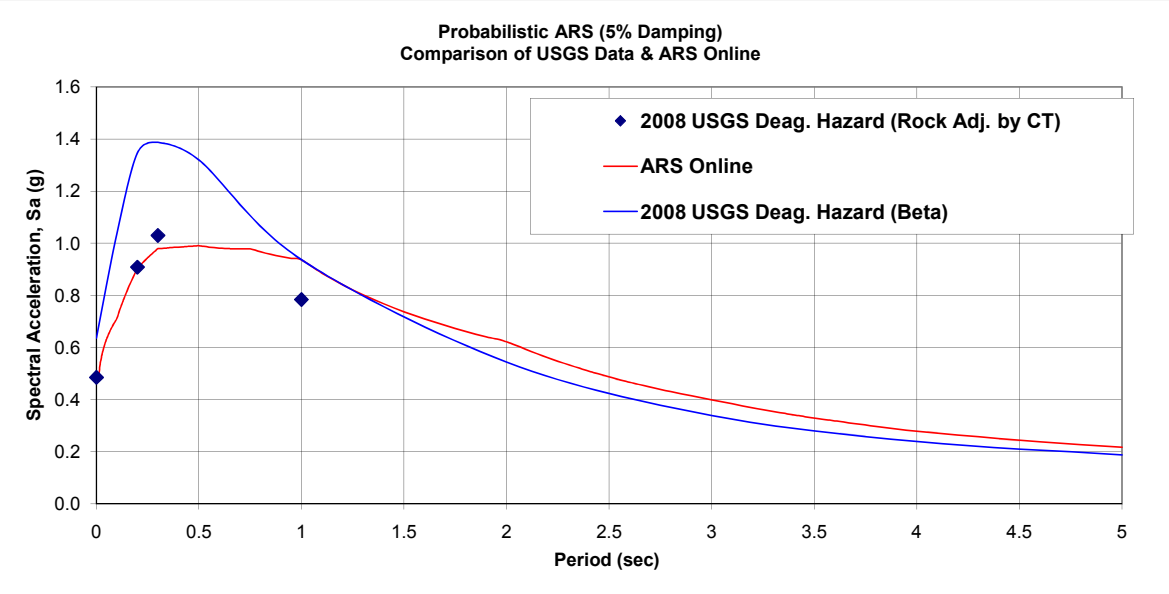
JOB NO.: 2009-130-GDR

PLATE NO.: V-2

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
38.2114	-122.1468
V_{S30} (m/s) =	205
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	25
$Z_{1.0}$ (m) =	0
$Z_{2.5}$ (km) =	0



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.482	1	1	0.482
0.02	0.542	1	1	0.542
0.022	0.551	1	1	0.551
0.025	0.563	1	1	0.563
0.029	0.577	1	1	0.577
0.03	0.58	1	1	0.58
0.032	0.586	1	1	0.586
0.035	0.595	1	1	0.595
0.036	0.598	1	1	0.598
0.04	0.609	1	1	0.609
0.042	0.614	1	1	0.614
0.044	0.619	1	1	0.619
0.045	0.621	1	1	0.621
0.046	0.623	1	1	0.623
0.048	0.628	1	1	0.628
0.05	0.632	1	1	0.632
0.055	0.642	1	1	0.642
0.06	0.652	1	1	0.652
0.065	0.66	1	1	0.66
0.067	0.664	1	1	0.664
0.07	0.669	1	1	0.669
0.075	0.676	1	1	0.676
0.08	0.684	1	1	0.684
0.085	0.691	1	1	0.691
0.09	0.697	1	1	0.697
0.095	0.704	1	1	0.704
0.1	0.71	1	1	0.71
0.11	0.734	1	1	0.734
0.12	0.756	1	1	0.756
0.13	0.777	1	1	0.777
0.133	0.784	1	1	0.784
0.14	0.798	1	1	0.798
0.15	0.817	1	1	0.817
0.16	0.836	1	1	0.836
0.17	0.853	1	1	0.853
0.18	0.87	1	1	0.87
0.19	0.887	1	1	0.887
0.2	0.903	1	1	0.903
0.22	0.92	1	1	0.92
0.24	0.936	1	1	0.936
0.25	0.944	1	1	0.944

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.698	1.000	0.696	1.000	0.485	0.482	0.7%
0.2	1.725	1.000	0.527	1.000	0.908	0.903	0.6%
0.3	1.449	1.000	0.711	1.000	1.030	0.979	5.0%
1	0.512	1.000	1.531	1.000	0.784	0.936	-19.4%

Max % Difference = 19.4%

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

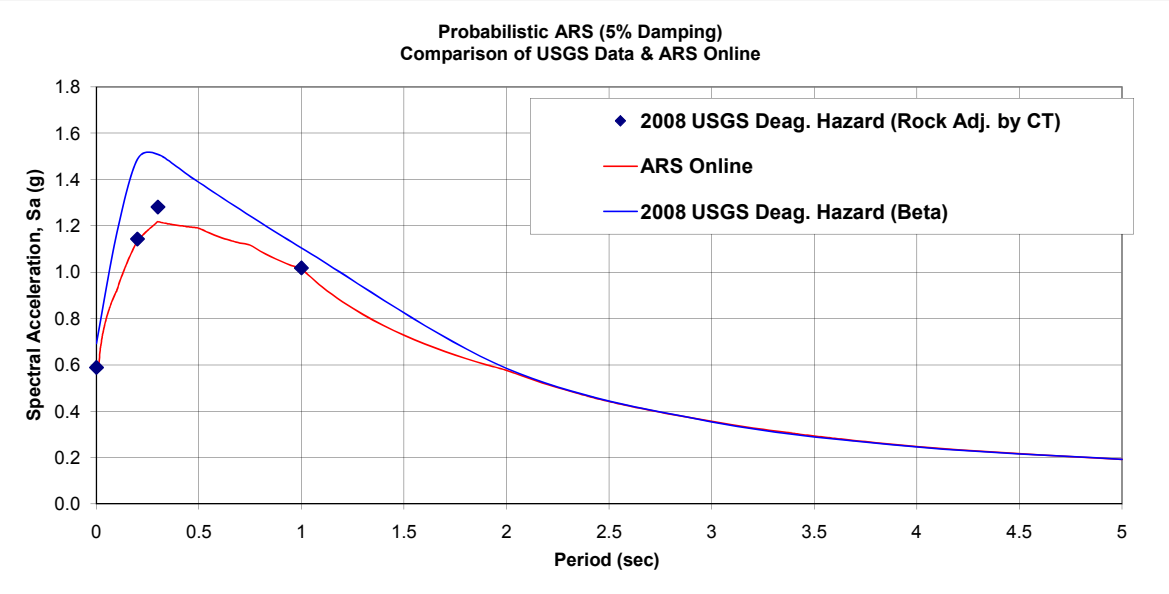
Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.6364	1.000	1.000	0.636	0.482	24.3%
0.1	1.0364	1.000	1.000	1.036	0.71	31.5%
0.2	1.3465	1.000	1.000	1.347	0.903	32.9%
0.3	1.387	1.000	1.000	1.387	0.979	29.4%
0.5	1.3199	1.000	1.000	1.320	0.99	25.0%
1	0.9368	1.000	1.000	0.937	0.936	0.1%
2	0.5439	1.000	1.000	0.544	0.622	14.4%
3	0.3389	1.000	1.000	0.339	0.4	18.0%
4	0.2389	1.000	1.000	0.239	0.279	16.8%
5	0.1876	1.000	1.000	0.188	0.218	16.2%

Max % Difference = 25.0%

Comparison spreadsheet of the 2008 USGS Probabilistic Seismic Hazard Data and ARS Online Probabilistic Data (unlock spreadsheet "shmi")
Spectral Accelerations Points from USGS Website at http://earthquake.usgs.gov/research/hazmaps/products_data/2008/data/

*** Note: This spreadsheet uses the given latitude and longitude data provided by the user to estimate spectral acceleration values with a probability of exceedence 5% in 50 yrs (or 975 yr return period). The four spectral acceleration data points plotted on the graph are from the USGS website and are based on a 0.05 degree grid. Basic interpolation is used to estimate intermediate values inside each grid. Raw Data points are provided in the tabs of this spreadsheet. Corner grid spectral acceleration data are shown in the "calculation" tab.**

Input Site Information	
Latitude	Longitude
38.2114	-122.1468
V_{S30} (m/s) =	255
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	4.2
$Z_{1.0}$ (m) =	0
$Z_{2.5}$ (km) =	0



Place ARS Online Probabilistic Data Here "Paste"

T (sec)	Base Spectrum S(a)	Basin Factor	Near Fault Factor	Final Adj. Spectrum S(a)
0.01	0.585	1	1	0.585
0.02	0.671	1	1	0.671
0.022	0.683	1	1	0.683
0.025	0.701	1	1	0.701
0.029	0.722	1	1	0.722
0.03	0.727	1	1	0.727
0.032	0.736	1	1	0.736
0.035	0.749	1	1	0.749
0.036	0.753	1	1	0.753
0.04	0.769	1	1	0.769
0.042	0.776	1	1	0.776
0.044	0.784	1	1	0.784
0.045	0.787	1	1	0.787
0.046	0.79	1	1	0.79
0.048	0.797	1	1	0.797
0.05	0.804	1	1	0.804
0.055	0.819	1	1	0.819
0.06	0.833	1	1	0.833
0.065	0.846	1	1	0.846
0.067	0.851	1	1	0.851
0.07	0.859	1	1	0.859
0.075	0.871	1	1	0.871
0.08	0.882	1	1	0.882
0.085	0.892	1	1	0.892
0.09	0.902	1	1	0.902
0.095	0.912	1	1	0.912
0.1	0.921	1	1	0.921
0.11	0.948	1	1	0.948
0.12	0.973	1	1	0.973
0.13	0.997	1	1	0.997
0.133	1.004	1	1	1.004
0.14	1.02	1	1	1.02
0.15	1.041	1	1	1.041
0.16	1.062	1	1	1.062
0.17	1.081	1	1	1.081
0.18	1.1	1	1	1.1
0.19	1.118	1	1	1.118
0.2	1.135	1	1	1.135
0.22	1.154	1	1	1.154
0.24	1.172	1	1	1.172
0.25	1.18	1	1	1.18

Analysis of ARS Online Results vs USGS Deaggregation Hazard (Adj. By CT)

Period (sec)	USGS Interpolated Spectral Accel.	Adj. for Near Fault Effect	Adj. for Soil Amplification	Adj. For Basin Effect	Final Adj. USGS Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.698	1.000	0.843	1.000	0.588	0.585	0.6%
0.2	1.725	1.000	0.663	1.000	1.143	1.135	0.7%
0.3	1.449	1.000	0.885	1.000	1.282	1.218	5.0%
1	0.512	1.200	1.657	1.000	1.018	1.013	0.5%

Max % Difference = 5.0%

USGS Deaggregation Hazard (Beta) with Near Field and Basin Factors

Period (sec)	INPUT USGS Deagg. Spec Accel	Adj. for Near Fault Effect	Adj. For Basin Effect	Final Adj. USGS Deagg Spec Accel	ARS Online Final Adj. Spect. Accel.	% Difference (bet. USGS & ARS Online)
0	0.6919	1.000	1.000	0.692	0.585	15.5%
0.1	1.1697	1.000	1.000	1.170	0.921	21.3%
0.2	1.4877	1.000	1.000	1.488	1.135	23.7%
0.3	1.5092	1.000	1.000	1.509	1.218	19.3%
0.5	1.3878	1.000	1.000	1.388	1.19	14.3%
1	0.9208	1.200	1.000	1.105	1.013	8.3%
2	0.4875	1.200	1.000	0.585	0.576	1.5%
3	0.2951	1.200	1.000	0.354	0.356	0.5%
4	0.2049	1.200	1.000	0.246	0.247	0.5%
5	0.1599	1.200	1.000	0.192	0.192	0.1%

Max % Difference = 14.3%

Liquefaction Analysis Results

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-006***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 12

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	39	MC	562.5	563	0.99		25.4	0.92	1.00	1.0	1.05	24.4	1.49	36.2				1.00	1	
2	9.5	2	40	MC	1187.5	1188	0.98		26.0	0.92	1.00	1.0	1.05	25.0	1.23	30.7				1.00	1	
3	14.5	2	43	MC	1812.5	1656	0.97		28.0	0.92	1.00	1.0	1.05	26.9	1.08	29.2				1.00	1	
4	19.5	2	20	MC	2437.5	1969	0.96		13.0	0.92	1.00	1.0	1.05	12.5	1.01	12.6				1.00	1	
5	24.5	2	27	MC	3062.5	2281	0.94		17.6	0.92	1.00	1.0	1.05	16.9	0.94	15.9				0.95	1	
6	29.5	2	15	MC	3687.5	2594	0.92		9.8	0.92	1.00	1.0	1.05	9.4	0.88	8.3				0.93	1	
7	34.5	2	26	MC	4312.5	2906	0.89		16.9	0.92	1.00	1.0	1.05	16.3	0.83	13.5				0.88	1	
8	39.5	2	22	MC	4937.5	3219	0.86		14.3	0.92	1.00	1.0	1.05	13.8	0.78	10.8				0.86	1	
9	44.5	2	19	MC	5562.5	3531	0.81		12.4	0.92	1.00	1.0	1.05	11.9	0.74	8.8				0.85	1	
10	49.5	2	28	MC	6187.5	3844	0.76		18.2	0.92	1.00	1.0	1.05	17.5	0.70	12.3				0.80	1	
11	54.5	1	27	MC	6812.5	4156	0.71	0.53	17.6	0.92	1.00	1.0	1.05	16.9	0.67	11.3	19%	15.6	0.17	0.79	1	(0.31)
12	59.5	2	22	MC	7437.5	4469	0.66		14.3	0.92	1.00	1.0	1.05	13.8	0.64	8.8				0.79	1	
13	69.5	1	27	MC	8687.5	5094	0.59	0.46	17.6	0.92	1.00	1.0	1.05	16.9	0.59	9.9	40%	16.9	0.18	0.75	1	(0.36)
14	79.5	2	19	MC	9937.5	5719	0.55		12.4	0.92	1.00	1.0	1.05	11.9	0.54	6.4				0.76	1	
15	89.5	1	34	MC	11188	6344	0.52	0.42	22.1	0.92	1.00	1.0	1.05	21.3	0.50	10.7	12%	12.6	0.14	0.69	1	(0.28)
16	99.5	2	76	MC	12438	6969	0.50		49.4	0.92	1.00	1.0	1.05	47.5	0.47	22.3				0.61	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-009***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 12

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	31	MC	562.5	563	0.99		20.2	0.92	1.00	1.0	1.05	19.4	1.49	28.8				1.00	1	
2	9.5	2	36	MC	1187.5	1188	0.98		23.4	0.92	1.00	1.0	1.05	22.5	1.23	27.6				1.00	1	
3	14.5	1	24	MC	1812.5	1656	0.97	0.48	15.6	0.92	1.00	1.0	1.05	15.0	1.08	16.3	35%	24.5	0.28	1.00	1	(0.73)
4	19.5	2	45	MC	2437.5	1969	0.96		29.3	0.92	1.00	1.0	1.05	28.2	1.01	28.4				1.00	1	
5	24.5	1	25	MC	3062.5	2281	0.94	0.58	16.3	0.92	1.00	1.0	1.05	15.6	0.94	14.7	46%	22.6	0.25	0.95	1	(0.52)
6	29.5	2	35	MC	3687.5	2594	0.92		22.8	0.92	1.00	1.0	1.05	21.9	0.88	19.3				0.90	1	
7	34.5	2	31	MC	4312.5	2906	0.89		20.2	0.92	1.00	1.0	1.05	19.4	0.83	16.1				0.87	1	
8	39.5	2	22	MC	4937.5	3219	0.86		14.3	0.92	1.00	1.0	1.05	13.8	0.78	10.8				0.86	1	
9	44.5	2	66	MC	5562.5	3531	0.81		42.9	0.92	1.00	1.0	1.05	41.3	0.74	30.6				0.80	1	
10	49.5	2	48	MC	6187.5	3844	0.76		31.2	0.92	1.00	1.0	1.05	30.0	0.70	21.2				0.77	1	
11	54.5	2	47	MC	6812.5	4156	0.71		30.6	0.92	1.00	1.0	1.05	29.4	0.67	19.7				0.75	1	
12	59.5	2	32	MC	7437.5	4469	0.66		20.8	0.92	1.00	1.0	1.05	20.0	0.64	12.8				0.76	1	
13	69.5	2	55	MC	8687.5	5094	0.59		35.8	0.92	1.00	1.0	1.05	34.4	0.59	20.2				0.69	1	
14	79.5	2	50	MC	9937.5	5719	0.55		32.5	0.92	1.00	1.0	1.05	31.3	0.54	17.0				0.67	1	
15	89.5	2	47	MC	11188	6344	0.52		30.6	0.92	1.00	1.0	1.05	29.4	0.50	14.8				0.66	1	
16	99.5	2	49	MC	12438	6969	0.50		31.9	0.92	1.00	1.0	1.05	30.7	0.47	14.4				0.64	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-10-009A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 12

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6.5	2	15	SPT	812.5	813	0.99		15.0	1.42	0.75	1.2	1.05	20.1	1.37	27.5				1.00	1	
2	11	2	11	SPT	1375	1375	0.98		11.0	1.42	0.80	1.2	1.05	15.7	1.17	18.3				1.00	1	
3	14	2	4	SPT	1750	1625	0.97		4.0	1.42	0.85	1.2	1.05	6.1	1.09	6.6				1.00	1	
4	17	1	5	SPT	2125	1813	0.96	0.51	5.0	1.42	0.85	1.2	1.05	7.6	1.04	7.9	33%	14.2	0.15	1.00	1	(0.37)
5	20	1	9	SPT	2500	2000	0.96	0.54	9.0	1.42	0.95	1.2	1.05	15.3	1.00	15.3	26%	21.5	0.24	1.00	1	(0.53)
6	23	2	7	SPT	2875	2188	0.95		7.0	1.42	0.95	1.2	1.05	11.9	0.96	11.4				0.98	1	
7	26	2	12	SPT	3250	2375	0.94		12.0	1.42	0.95	1.2	1.05	20.3	0.92	18.8				0.95	1	
8	29	2	14	SPT	3625	2563	0.93		14.0	1.42	0.95	1.2	1.05	23.7	0.89	21.0				0.92	1	
9	36	2	9	SPT	4500	3000	0.88		9.0	1.42	1.00	1.2	1.05	16.1	0.81	13.1				0.90	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***				
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*			
CPT NO.	***CPT-09-007***	*FAULT M_w =* 6.9	*MSF =* 1.24	*a_{max} (g)=* 0.7	

			CPT RESULT INPUT							***CSR***			***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
0.492																				
1.148																				
1.804																				
2.461																				
3.117																				
3.773																				
4.429																				
5.085	7	Silty Sand to Sandy Silt	35.657	0.339	0.299		0.299	1.83	1.4676	0.99	0.450	1.830	1.47	52.33	1.129	59.09	0.10	1.00	1	
5.741	7	Silty Sand to Sandy Silt	53.357	1.058	0.338		0.338	1.98	1.4304	0.99	0.450	1.980	1.43	76.32	1.275	97.29	0.17	1.00	1	
6.398	6	Sandy Silt to Clayey Silt	43.467	1.201	0.376		0.376	2.18	1.3959	0.99	0.449	2.180	1.40	60.68	1.619	98.25	0.17	1.00	1	
7.054	5	Clayey Silt to Silty Clay	47.728	1.868	0.413		0.413	2.3	1.3639	0.99	0.448	2.300	1.36	65.10	1.949	126.86	0.27	1.00	1	
7.71	5	Clayey Silt to Silty Clay	42.543	1.737	0.451		0.451	2.37	1.3325	0.98	0.448	2.370	1.33	56.69	2.194	124.38	0.26	1.00	1	
8.366	5	Clayey Silt to Silty Clay	41.392	1.507	0.488		0.488	2.36	1.3033	0.98	0.447	2.360	1.30	53.95	2.156	116.33	0.23	1.00	1	
9.022	5	Clayey Silt to Silty Clay	35.979	1.339	0.526		0.526	2.43	1.2746	0.98	0.446	2.430	1.27	45.86	2.439	111.85	0.21	1.00	1	
9.678	5	Clayey Silt to Silty Clay	37.514	1.398	0.564		0.564	2.43	1.2472	0.98	0.446	2.430	1.25	46.79	2.439	114.11	0.22	1.00	1	
10.335	5	Clayey Silt to Silty Clay	41.264	1.452	0.601		0.601	2.4	1.2215	0.98	0.445	2.400	1.22	50.41	2.312	116.56	0.23	1.00	1	
10.991	6	Sandy Silt to Clayey Silt	54.803	1.644	0.639		0.639	2.28	1.1963	0.98	0.445	2.280	1.20	65.56	1.886	123.66	0.26	1.00	1	
11.647	6	Sandy Silt to Clayey Silt	52.372	1.696	0.676		0.676	2.34	1.1727	0.98	0.444	2.340	1.17	61.42	2.084	127.98	0.27	1.00	1	
12.303	5	Clayey Silt to Silty Clay	50.966	1.811	0.714	0.001	0.714	2.4	1.1494	0.97	0.443	2.400	1.15	58.58	2.312	135.46	0.31	1.00	1	(0.87)
12.959	5	Clayey Silt to Silty Clay	46.287	1.654	0.752	0.014	0.737	2.44	1.1358	0.97	0.452	2.440	1.14	52.57	2.483	130.54	0.29	1.00	1	(0.79)
13.615	5	Clayey Silt to Silty Clay	38.482	1.399	0.789	0.035	0.755	2.51	1.1253	0.97	0.462	2.510	1.13	43.30	2.820	122.10	0.25	1.00	1	(0.67)
14.272	5	Clayey Silt to Silty Clay	34.633	1.227	0.827	0.055	0.772	2.54	1.1156	0.97	0.473	2.540	1.12	38.64	2.979	115.10	0.22	1.00	1	(0.58)
14.928	5	Clayey Silt to Silty Clay	36.229	1.329	0.864	0.076	0.789	2.54	1.1061	0.97	0.483	2.540	1.11	40.07	2.979	119.37	0.24	1.00	1	(0.61)
15.584	5	Clayey Silt to Silty Clay	34.839	1.44	0.902	0.096	0.806	2.6	1.0967	0.97	0.493							1.00	1	
16.24	5	Clayey Silt to Silty Clay	36.986	1.376	0.94	0.117	0.823	2.56	1.0875	0.97	0.502	2.560	1.09	40.22	3.091	124.31	0.26	1.00	1	(0.64)
16.896	5	Clayey Silt to Silty Clay	35.401	1.147	0.977	0.137	0.84	2.53	1.0784	0.96	0.510	2.530	1.08	38.18	2.925	111.66	0.21	1.00	1	(0.51)
17.552	6	Sandy Silt to Clayey Silt	39.539	1.23	1.015	0.158	0.857	2.49	1.0695	0.96	0.519	2.490	1.07	42.29	2.718	114.95	0.22	1.00	1	(0.53)
18.209	6	Sandy Silt to Clayey Silt	40.613	1.275	1.052	0.178	0.874	2.49	1.0608	0.96	0.526	2.490	1.06	43.08	2.718	117.11	0.23	1.00	1	(0.54)
18.865	5	Clayey Silt to Silty Clay	41.442	1.473	1.09	0.198	0.891	2.52	1.0521	0.96	0.534	2.520	1.05	43.60	2.872	125.21	0.26	1.00	1	(0.61)
19.521	5	Clayey Silt to Silty Clay	40.39	1.427	1.128	0.219	0.909	2.53	1.0431	0.96	0.541	2.530	1.04	42.13	2.925	123.23	0.25	1.00	1	(0.58)
20.177	5	Clayey Silt to Silty Clay	36.691	1.316	1.165	0.239	0.926	2.58	1.0348	0.96	0.547	2.580	1.03	37.97	3.206	121.74	0.25	1.00	1	(0.56)
20.833	5	Clayey Silt to Silty Clay	31.034	1.108	1.203	0.26	0.943	2.64	1.0266	0.95	0.554							1.00	1	
21.49	5	Clayey Silt to Silty Clay	26.106	0.873	1.24	0.28	0.96	2.69	1.0185	0.95	0.560							1.00	1	
22.146	5	Clayey Silt to Silty Clay	25.282	0.793	1.278	0.301	0.977	2.7	1.0106	0.95	0.566							1.00	1	
22.802	5	Clayey Silt to Silty Clay	21.394	0.721	1.316	0.321	0.994	2.78	1.0027	0.95	0.572							1.00	1	
23.458	5	Clayey Silt to Silty Clay	19.269	0.563	1.353	0.342	1.011	2.78	0.995	0.95	0.577							1.00	1	
24.114	6	Sandy Silt to Clayey Silt	20.888	0.338	1.391	0.362	1.028	2.6	0.9874	0.94	0.582							0.99	1	
24.77	6	Sandy Silt to Clayey Silt	27.947	0.588	1.428	0.383	1.046	2.56	0.9795	0.94	0.586	2.560	0.98	27.37	3.091	84.60	0.14	0.99	1	(0.29)
25.427	5	Clayey Silt to Silty Clay	32.909	1.245	1.466	0.403	1.063	2.68	0.9722	0.94	0.590							0.99	1	
26.083	5	Clayey Silt to Silty Clay	29.343	1.002	1.503	0.424	1.08	2.7	0.9649	0.94	0.594							0.98	1	
26.739	5	Clayey Silt to Silty Clay	29.654	1.117	1.541	0.444	1.097	2.73	0.9578	0.94	0.598							0.98	1	
27.395	5	Clayey Silt to Silty Clay	25.983	0.749	1.579	0.465	1.114	2.71	0.9507	0.93	0.601							0.98	1	
28.051	5	Clayey Silt to Silty Clay	29.549	1.095	1.616	0.485	1.131	2.74	0.9438	0.93	0.604							0.98	1	
28.707	4	Silty Clay to Clay	28.825	1.178	1.654	0.506	1.148	2.79	0.937	0.93	0.608							0.97	1	
29.364	5	Clayey Silt to Silty Clay	28.748	1.058	1.691	0.526	1.165	2.76	0.9302	0.92	0.610							0.97	1	
30.02	5	Clayey Silt to Silty Clay	31.485	1.277	1.729	0.547	1.183	2.76	0.9232	0.92	0.612							0.97	1	
30.676	4	Silty Clay to Clay	31.562	1.313	1.767	0.567	1.2	2.78	0.9167	0.92	0.614							0.96	1	
31.332	4	Silty Clay to Clay	35.823	1.538	1.804	0.587	1.217	2.75	0.9102	0.91	0.616							0.96	1	
31.988	4	Silty Clay to Clay	40.318	1.86	1.842	0.608	1.234	2.74	0.9039	0.91	0.618							0.96	1	
32.644	3	Clay	31.179	1.75	1.878	0.628	1.25	2.89	0.898	0.91	0.619							0.96	1	
33.301	3	Clay	24.815	1.376	1.915	0.649	1.266	2.98	0.8921	0.90	0.621							0.95	1	
33.957	3	Clay	22.696	1.173	1.951	0.669	1.282	3	0.8864	0.90	0.622							0.95	1	
34.613	4	Silty Clay to Clay	22.645	0.945	1.989	0.69	1.299	2.94	0.8804	0.89	0.622							0.95	1	
35.269	3	Clay	22.968	1.088	2.026	0.71	1.315	2.98	0.8748	0.89	0.623							0.95	1	
35.925	4	Silty Clay to Clay	24.843	0.974	2.063	0.731	1.332	2.89	0.8689	0.88	0.623							0.94	1	
36.581	4	Silty Clay to Clay	27.958	1.118	2.101	0.751	1.35	2.86	0.8627	0.88	0.623							0.94	1	
37.238	4	Silty Clay to Clay	23.68	0.958	2.138	0.772	1.367	2.93	0.857	0.87	0.622							0.94	1	
37.894	4	Silty Clay to Clay	23.168	1.019	2.176	0.792	1.384	2.97	0.8514	0.87	0.622							0.94	1	
38.55	4	Silty Clay to Clay	23.285	1.011	2.214	0.813	1.401	2.97	0.8458	0.86	0.621							0.93	1	
39.206	3	Clay	21.478	0.991	2.25	0.833	1.417	3.02	0.8407	0.86	0.620							0.93	1	
39.862	4	Silty Clay to Clay	18.346	0.752	2.288	0.854	1.434	3.07	0.8352	0.85	0.619							0.93	1	
40.518	5	Clayey Silt to Silty Clay	17.311	0.527	2.325	0.874	1.451	3.02	0.8299	0.85	0.617							0.93	1	
41.175	4	Silty Clay to Clay	16.198	0.585	2.363	0.895	1.468	3.09	0.8246	0.84	0.616							0.93	1	
41.831	4	Silty Clay to Clay	16.198	0.667	2.401	0.915	1.486	3.13	0.8191	0.83	0.613							0.92	1	
42.487	5	Clayey Silt to Silty Clay	17.472	0.575	2.438	0.935	1.503	3.03	0.8139	0.83	0.611							0.92	1	
43.143	5	Clayey Silt to Silty Clay	15.13	0.421	2.476	0.956	1.52	3.05	0.8088	0.82	0.609							0.92	1	
43.799	5	Clayey Silt to Silty Clay	14.435	0.4	2.513	0.976	1.537	3.07	0.8038	0.82	0.607							0.92	1	
44.455	5	Clayey Silt to Silty Clay	14.63	0.475	2.551	0.997	1.554	3.11	0.7988	0.81	0.604							0.92	1	
45.112	5	Clayey Silt to Silty Clay	14.969	0.441	2.588	1.017	1.571	3.09	0.7939	0.80	0.602							0.91	1	
45.768	5	Clayey Silt to Silty Clay	18.357	0.558	2.626	1.038	1.588	3	0.7891	0.80	0.599							0.91	1	
46.424	5	Clayey Silt to Silty Clay	23.335	0.761	2.664	1.058	1.605	2.94	0.7843	0.79	0.596							0.91	1	
47.08	5	Clayey Silt to Silty Clay	13.256	0.412	2.701	1.079	1.622	3.19	0.7796	0.78	0.593							0.91	1	
47.736	6	Sandy Silt to Clayey Silt	48.256	1.293	2.739	1.099	1.64	2.62	0.7746	0.78	0.590							0.91	1	
48.392	6	Sandy Silt to Clayey Silt	60.149	1.706	2.776	1.12	1.657	2.57	0.77	0.77	0.586	2.570	0.77	46.32	3.148	145.80	0.37	0.90	1	(0.70)
49.049	5	Clayey Silt to Silty Clay	16.76	0.534	2.814	1.14	1.674	3.11	0.7655	0.76	0.583							0.90	1	
49.705	5	Clayey Silt to Silty Clay	14.958	0.416	2.852	1.161	1.691	3.11	0.761	0.76	0.580							0.90	1	
50.361	5	Clayey Silt to Silty Clay	27.218	1.04	2.889	1.181	1.708	2.95	0.7565	0.75	0.576							0.90	1	
51.017	5	Clayey Silt to Silty Clay	35.857	1.393	2.927	1.202	1.725	2.86	0.7521	0.74	0.573							0.90	1	
51.673	5	Clayey Silt to Silty Clay	47.833	1.873	2.964	1.222	1.742	2.75	0.7478	0.74	0.570							0.89	1	
52.329	5	Clayey Silt to Silty Clay	60.533	2.56	3.002	1.243	1.759	2.7	0.7435	0.73	0.566							0.89	1	
52.986	4	Silty Clay to Clay	45.486	1.999	3.04	1.263	1.777	2.82	0.739	0.72	0.563							0.89	1	
53.642	5	Clayey Silt to Silty Clay	30.066	1.182	3.077	1.284	1.794	2.94	0.7348	0.72	0.559							0.89	1	
54.298	5	Clayey Silt to Silty Clay	24.348	0.823	3.115	1.304	1.811	2.99	0.7307	0.71	0.556							0.89	1	
54.954	5	Clayey Silt to Silty Clay	21.978	0.812	3.152	1.324	1.828	3.06	0.7266	0.70	0.552							0.89	1	
55.61	5	Clayey Silt to Silty Clay	26.322	0.847	3.19	1.345	1.845	2.93	0.7225	0.70	0.549							0.88	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***				
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*			
CPT NO.	***CPT-09-007***	*FAULT M_w =*	6.9	*MSF =* 1.24	*a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***		***CRR $_{7.5}$***						***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
56.266	5	Clayey Silt to Silty Clay	31.034	1.075	3.228	1.365	1.862	2.89	0.7185	0.69	0.545							0.88	1	
56.923	5	Clayey Silt to Silty Clay	30.45	1.061	3.265	1.386	1.879	2.91	0.7145	0.69	0.542							0.88	1	
57.579	5	Clayey Silt to Silty Clay	27.58	0.956	3.303	1.406	1.896	2.95	0.7106	0.68	0.539							0.88	1	
58.235	5	Clayey Silt to Silty Clay	24.181	0.915	3.34	1.427	1.914	3.04	0.7065	0.67	0.535							0.88	1	
58.891	5	Clayey Silt to Silty Clay	22.318	0.738	3.378	1.447	1.931	3.03	0.7027	0.67	0.532							0.88	1	
59.547	5	Clayey Silt to Silty Clay	24.253	0.731	3.416	1.468	1.948	2.97	0.6989	0.66	0.529							0.88	1	
60.203	5	Clayey Silt to Silty Clay	26.311	0.883	3.453	1.488	1.965	2.97	0.6951	0.66	0.526							0.87	1	
60.86	5	Clayey Silt to Silty Clay	25.816	0.886	3.491	1.509	1.982	2.99	0.6914	0.65	0.523							0.87	1	
61.516	5	Clayey Silt to Silty Clay	25.622	0.745	3.528	1.529	1.999	2.95	0.6877	0.65	0.520							0.87	1	
62.172	5	Clayey Silt to Silty Clay	27.318	0.813	3.566	1.55	2.016	2.93	0.6841	0.64	0.517							0.87	1	
62.828	6	Sandy Silt to Clayey Silt	25.555	0.721	3.604	1.57	2.033	2.95	0.6805	0.64	0.514							0.87	1	
63.484	6	Sandy Silt to Clayey Silt	26.005	0.718	3.641	1.591	2.051	2.94	0.6767	0.63	0.511							0.87	1	
64.14	6	Sandy Silt to Clayey Silt	48.462	1.4	3.679	1.611	2.068	2.72	0.6732	0.63	0.508							0.86	1	
64.797	6	Sandy Silt to Clayey Silt	48.829	1.592	3.716	1.632	2.085	2.76	0.6697	0.62	0.506							0.86	1	
65.453	6	Sandy Silt to Clayey Silt	43.439	1.318	3.754	1.652	2.102	2.78	0.6663	0.62	0.503							0.86	1	
66.109	5	Clayey Silt to Silty Clay	40.24	1.325	3.792	1.672	2.119	2.84	0.6629	0.61	0.501							0.86	1	
66.765	6	Sandy Silt to Clayey Silt	52.873	1.834	3.829	1.693	2.136	2.75	0.6595	0.61	0.498							0.86	1	
67.421	6	Sandy Silt to Clayey Silt	53.78	1.795	3.867	1.713	2.153	2.74	0.6561	0.61	0.496							0.86	1	
68.077	6	Sandy Silt to Clayey Silt	49.14	1.259	3.904	1.734	2.17	2.71	0.6528	0.60	0.493							0.86	1	
68.734	6	Sandy Silt to Clayey Silt	32.525	0.725	3.942	1.754	2.187	2.82	0.6495	0.60	0.491							0.86	1	
69.39	6	Sandy Silt to Clayey Silt	32.614	0.836	3.979	1.775	2.205	2.85	0.6461	0.60	0.489							0.85	1	
70.046	6	Sandy Silt to Clayey Silt	32.697	0.891	4.017	1.795	2.222	2.87	0.6429	0.59	0.487							0.85	1	
70.702	5	Clayey Silt to Silty Clay	37.726	1.325	4.055	1.816	2.239	2.89	0.6397	0.59	0.485							0.85	1	
71.358	5	Clayey Silt to Silty Clay	35.206	1.289	4.092	1.836	2.256	2.94	0.6366	0.58	0.483							0.85	1	
72.014	5	Clayey Silt to Silty Clay	34.299	1.352	4.13	1.857	2.273	2.97	0.6335	0.58	0.481							0.85	1	
72.671	5	Clayey Silt to Silty Clay	31.334	1.029	4.167	1.877	2.29	2.96	0.6304	0.58	0.479							0.85	1	
73.327	6	Sandy Silt to Clayey Silt	40.379	1.285	4.205	1.898	2.307	2.86	0.6273	0.58	0.477							0.85	1	
73.983	5	Clayey Silt to Silty Clay	27.096	0.797	4.243	1.918	2.324	3	0.6243	0.57	0.475							0.84	1	
74.639	6	Sandy Silt to Clayey Silt	28.486	0.804	4.28	1.939	2.342	2.96	0.6211	0.57	0.473							0.84	1	
75.295	6	Sandy Silt to Clayey Silt	33.704	1.021	4.318	1.959	2.359	2.91	0.6182	0.57	0.472							0.84	1	
75.951	5	Clayey Silt to Silty Clay	37.481	1.279	4.355	1.98	2.376	2.91	0.6152	0.56	0.470							0.84	1	
76.608	5	Clayey Silt to Silty Clay	35.567	1.244	4.393	2	2.393	2.95	0.6123	0.56	0.469							0.84	1	
77.264	5	Clayey Silt to Silty Clay	33.643	1.103	4.431	2.021	2.41	2.96	0.6094	0.56	0.467							0.84	1	
77.92	6	Sandy Silt to Clayey Silt	32.263	0.979	4.468	2.041	2.427	2.95	0.6066	0.56	0.466							0.84	1	
78.576	5	Clayey Silt to Silty Clay	33.899	1.149	4.506	2.061	2.444	2.96	0.6037	0.55	0.464							0.84	1	
79.232	5	Clayey Silt to Silty Clay	37.748	1.321	4.543	2.082	2.461	2.94	0.6009	0.55	0.463							0.84	1	
79.888	6	Sandy Silt to Clayey Silt	34.884	1.029	4.581	2.102	2.479	2.92	0.598	0.55	0.461							0.83	1	
80.545	6	Sandy Silt to Clayey Silt	38.121	1.07	4.619	2.123	2.496	2.87	0.5952	0.55	0.460							0.83	1	
81.201	6	Sandy Silt to Clayey Silt	35.896	0.978	4.656	2.143	2.513	2.88	0.5925	0.54	0.459							0.83	1	
81.857	6	Sandy Silt to Clayey Silt	35.501	1.028	4.694	2.164	2.53	2.91	0.5898	0.54	0.458							0.83	1	
82.513	6	Sandy Silt to Clayey Silt	38.961	1.001	4.731	2.184	2.547	2.83	0.5871	0.54	0.456							0.83	1	
83.169	6	Sandy Silt to Clayey Silt	59.403	2.075	4.769	2.205	2.564	2.77	0.5845	0.54	0.455							0.83	1	
83.825	6	Sandy Silt to Clayey Silt	82.955	2.995	4.807	2.225	2.581	2.68	0.5819	0.54	0.454							0.83	1	
84.482	6	Sandy Silt to Clayey Silt	75.051	2.103	4.844	2.246	2.598	2.64	0.5793	0.53	0.453							0.83	1	
85.138	7	Silty Sand to Sandy Silt	105.57	2.813	4.883	2.266	2.617	2.51	0.5764	0.53	0.452	2.510	0.58	60.85	2.820	171.56		0.82	1	
85.794	6	Sandy Silt to Clayey Silt	74.995	2.002	4.92	2.287	2.634	2.62	0.5738	0.53	0.451							0.82	1	
86.45	7	Silty Sand to Sandy Silt	51.187	1.123	4.959	2.307	2.652	2.71	0.5711	0.53	0.450							0.82	1	
87.106	6	Sandy Silt to Clayey Silt	64.109	1.681	4.997	2.328	2.669	2.69	0.5686	0.53	0.449							0.82	1	
87.762	6	Sandy Silt to Clayey Silt	70.078	1.843	5.034	2.348	2.686	2.66	0.5661	0.52	0.448							0.82	1	
88.419	7	Silty Sand to Sandy Silt	83.173	1.945	5.073	2.369	2.704	2.57	0.5635	0.52	0.447	2.570	0.56	46.87	3.148	147.55	0.38	0.82	1	(0.86)
89.075	7	Silty Sand to Sandy Silt	52.178	1.136	5.111	2.389	2.722	2.7	0.5609	0.52	0.446							0.82	1	
89.731	6	Sandy Silt to Clayey Silt	61.078	1.598	5.149	2.41	2.74	2.69	0.5584	0.52	0.445							0.82	1	
90.387	6	Sandy Silt to Clayey Silt	65.389	2.083	5.187	2.43	2.757	2.73	0.556	0.52	0.444							0.82	1	
91.043	6	Sandy Silt to Clayey Silt	68.231	1.878	5.224	2.45	2.774	2.69	0.5536	0.52	0.443							0.82	1	
91.699	6	Sandy Silt to Clayey Silt	49.252	1.137	5.262	2.471	2.791	2.77	0.5512	0.52	0.442							0.81	1	
92.356	6	Sandy Silt to Clayey Silt	51.966	1.384	5.299	2.491	2.808	2.78	0.5489	0.51	0.441							0.81	1	
93.012	6	Sandy Silt to Clayey Silt	51.599	1.512	5.337	2.512	2.825	2.81	0.5466	0.51	0.440							0.81	1	
93.668	6	Sandy Silt to Clayey Silt	51.082	1.458	5.375	2.532	2.842	2.81	0.5443	0.51	0.440							0.81	1	
94.324	6	Sandy Silt to Clayey Silt	61.612	1.654	5.412	2.553	2.859	2.72	0.542	0.51	0.439							0.81	1	
94.98	6	Sandy Silt to Clayey Silt	67.931	2.236	5.45	2.573	2.877	2.74	0.5396	0.51	0.438							0.81	1	
95.636	5	Clayey Silt to Silty Clay	62.046	2.375	5.487	2.594	2.894	2.83	0.5374	0.51	0.437							0.81	1	
96.293	6	Sandy Silt to Clayey Silt	56.088	1.903	5.525	2.614	2.911	2.83	0.5351	0.51	0.437							0.81	1	
96.949	6	Sandy Silt to Clayey Silt	54.113	1.86	5.563	2.635	2.928	2.86	0.5329	0.50	0.436							0.81	1	
97.605	5	Clayey Silt to Silty Clay	50.225	1.943	5.6	2.655	2.945	2.93	0.5308	0.50	0.435							0.81	1	
98.261	6	Sandy Silt to Clayey Silt	46.17	1.382	5.638	2.676	2.962	2.89	0.5286	0.50	0.435							0.80	1	
98.917	6	Sandy Silt to Clayey Silt	47.026	1.254	5.675	2.696	2.979	2.85	0.5264	0.50	0.434							0.80	1	
99.573	6	Sandy Silt to Clayey Silt	45.622	1.181	5.713	2.717	2.996	2.85	0.5243	0.50	0.433							0.80	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

PROJECT NAME	***80-680-12 INTERCHAGNE***				
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*			
CPT NO.	***CPT-09-008***	*FAULT M_w =*	6.9	*MSF =* 1.24	*a_{max} (g)=* 0.7

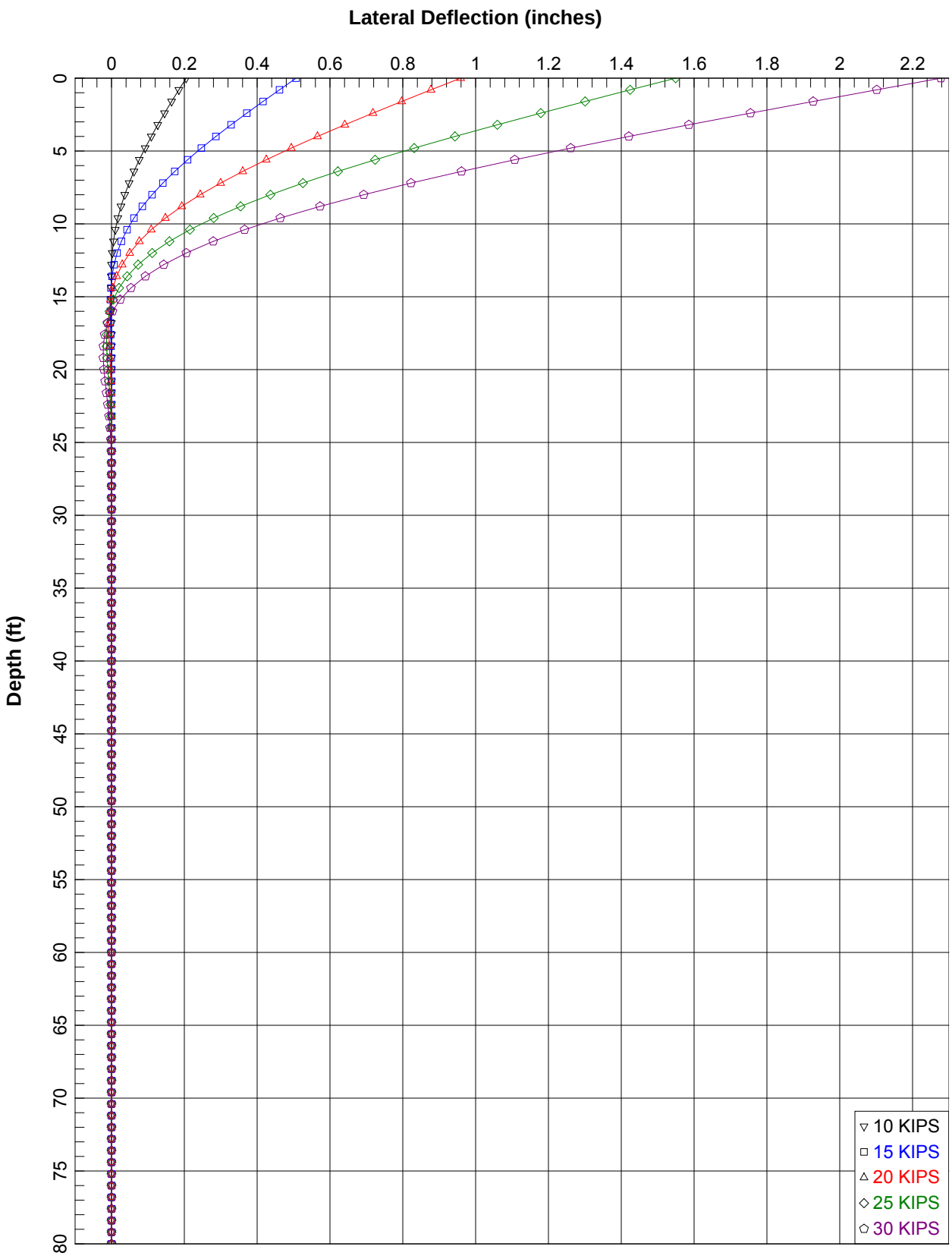
			CPT RESULT INPUT							***CSR***			***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
0.492																				
1.148																				
1.804																				
2.461																				
3.117																				
3.773																				
4.429																				
5.085	5	Clayey Silt to Silty Clay	22.161	0.622	0.291		0.291	2.31	1.4755	0.99	0.450	2.310	1.48	32.70	1.981	64.78	0.11	1.00	1	
5.741	6	Sandy Silt to Clayey Silt	42.966	1.036	0.329		0.329	2.1	1.4388	0.99	0.450	2.100	1.44	61.82	1.455	89.94	0.15	1.00	1	
6.398	6	Sandy Silt to Clayey Silt	43.272	1.134	0.367		0.367	2.15	1.404	0.99	0.449	2.150	1.40	60.75	1.553	94.34	0.16	1.00	1	
7.054	5	Clayey Silt to Silty Clay	39.523	1.333	0.404		0.404	2.29	1.3716	0.99	0.448	2.290	1.37	54.21	1.917	103.92	0.18	1.00	1	
7.71	5	Clayey Silt to Silty Clay	37.103	1.391	0.442		0.442	2.37	1.3398	0.98	0.448	2.370	1.34	49.71	2.194	109.07	0.20	1.00	1	
8.366	5	Clayey Silt to Silty Clay	38.666	1.366	0.479		0.479	2.36	1.3103	0.98	0.447	2.360	1.31	50.66	2.156	109.25	0.20	1.00	1	
9.022	5	Clayey Silt to Silty Clay	38.171	1.223	0.517		0.517	2.36	1.2813	0.98	0.446	2.360	1.28	48.91	2.156	105.47	0.19	1.00	1	
9.678	5	Clayey Silt to Silty Clay	34.01	1.252	0.555		0.555	2.46	1.2536	0.98	0.446	2.460	1.25	42.63	2.574	109.75	0.20	1.00	1	
10.335	5	Clayey Silt to Silty Clay	31.301	1.158	0.592		0.592	2.51	1.2277	0.98	0.445	2.510	1.23	38.43	2.820	108.35	0.20	1.00	1	
10.991	5	Clayey Silt to Silty Clay	33.342	1.218	0.63		0.63	2.5	1.2022	0.98	0.445	2.500	1.20	40.08	2.768	110.97	0.21	1.00	1	
11.647	5	Clayey Silt to Silty Clay	31.112	1.199	0.667		0.667	2.56	1.1784	0.98	0.444	2.560	1.18	36.66	3.091	113.30	0.22	1.00	1	
12.303	4	Silty Clay to Clay	29.337	1.206	0.705	0.001	0.705	2.62	1.1549	0.97	0.443							1.00	1	
12.959	5	Clayey Silt to Silty Clay	29.271	1.086	0.742	0.001	0.742	2.6	1.1329	0.97	0.443							1.00	1	
13.615	5	Clayey Silt to Silty Clay	29.015	1.083	0.78	0.001	0.78	2.62	1.1111	0.97	0.442							1.00	1	
14.272	5	Clayey Silt to Silty Clay	23.992	0.897	0.818	0.001	0.818	2.7	1.0902	0.97	0.441							1.00	1	
14.928	5	Clayey Silt to Silty Clay	24.893	0.883	0.855	0.001	0.855	2.69	1.0706	0.97	0.441							1.00	1	
15.584	5	Clayey Silt to Silty Clay	37.192	1.376	0.893	0.001	0.893	2.58	1.0511	0.97	0.440	2.580	1.05	39.09	3.206	125.35	0.26	1.00	1	(0.74)
16.24	5	Clayey Silt to Silty Clay	34.027	1.094	0.93	0.001	0.93	2.58	1.0329	0.97	0.439	2.580	1.03	35.15	3.206	112.69	0.21	1.00	1	(0.60)
16.896	6	Sandy Silt to Clayey Silt	42.61	1.134	0.968	0.001	0.968	2.47	1.0148	0.96	0.439	2.470	1.01	43.24	2.621	113.34	0.22	1.00	1	(0.61)
17.552	6	Sandy Silt to Clayey Silt	29.727	0.784	1.006	0.001	1.006	2.59	0.9973	0.96	0.438	2.590	1.00	29.65	3.266	96.83	0.16	1.00	1	(0.46)
18.209	6	Sandy Silt to Clayey Silt	61.734	1.616	1.043	0.001	1.043	2.36	0.9808	0.96	0.437	2.360	0.98	60.55	2.156	130.57	0.29	0.99	1	(0.81)
18.865	6	Sandy Silt to Clayey Silt	47.967	1.392	1.081	0.001	1.081	2.48	0.9645	0.96	0.437	2.480	0.96	46.26	2.669	123.49	0.26	0.98	1	(0.71)
19.521	5	Clayey Silt to Silty Clay	39.372	1.358	1.118	0.001	1.118	2.6	0.9491	0.96	0.436							0.98	1	
20.177	6	Sandy Silt to Clayey Silt	37.587	1.098	1.156	0.001	1.156	2.58	0.9338	0.96	0.435	2.580	0.93	35.10	3.206	112.54	0.21	0.97	1	(0.59)
20.833	5	Clayey Silt to Silty Clay	34.277	1.267	1.194	0.001	1.194	2.7	0.919	0.95	0.434							0.97	1	
21.49	5	Clayey Silt to Silty Clay	33.609	1.292	1.231	0.001	1.231	2.73	0.905	0.95	0.434							0.96	1	
22.146	5	Clayey Silt to Silty Clay	27.224	1.029	1.269	0.001	1.269	2.81	0.891	0.95	0.433							0.95	1	
22.802	5	Clayey Silt to Silty Clay	24.876	0.802	1.306	0.001	1.306	2.8	0.8779	0.95	0.432							0.95	1	
23.458	5	Clayey Silt to Silty Clay	22.117	0.779	1.344	0.014	1.33	2.88	0.8696	0.95	0.435							0.94	1	
24.114	5	Clayey Silt to Silty Clay	20.949	0.584	1.382	0.035	1.347	2.84	0.8638	0.94	0.441							0.94	1	
24.77	5	Clayey Silt to Silty Clay	21.46	0.677	1.419	0.055	1.364	2.86	0.858	0.94	0.446							0.94	1	
25.427	6	Sandy Silt to Clayey Silt	23.018	0.429	1.457	0.076	1.381	2.7	0.8524	0.94	0.451							0.94	1	
26.083	5	Clayey Silt to Silty Clay	26.595	0.788	1.494	0.096	1.398	2.78	0.8468	0.94	0.456							0.94	1	
26.739	4	Silty Clay to Clay	25.388	1.145	1.532	0.116	1.415	2.93	0.8413	0.94	0.461							0.93	1	
27.395	3	Clay	23.563	1.105	1.569	0.137	1.432	2.98	0.8359	0.93	0.465							0.93	1	
28.051	3	Clay	21.411	1.067	1.605	0.157	1.448	3.04	0.8308	0.93	0.469							0.93	1	
28.707	3	Clay	20.498	1.161	1.642	0.178	1.464	3.1	0.8258	0.93	0.473							0.93	1	
29.364	4	Silty Clay to Clay	17.428	0.712	1.679	0.198	1.481	3.07	0.8206	0.92	0.476							0.92	1	
30.02	5	Clayey Silt to Silty Clay	16.543	0.567	1.717	0.219	1.498	3.04	0.8154	0.92	0.480							0.92	1	
30.676	5	Clayey Silt to Silty Clay	17.572	0.477	1.754	0.239	1.515	2.95	0.8103	0.92	0.483							0.92	1	
31.332	5	Clayey Silt to Silty Clay	28.13	0.932	1.792	0.26	1.532	2.83	0.8053	0.91	0.486							0.92	1	
31.988	4	Silty Clay to Clay	32.803	1.459	1.83	0.28	1.549	2.87	0.8003	0.91	0.489							0.92	1	
32.644	4	Silty Clay to Clay	30.867	1.468	1.867	0.301	1.566	2.92	0.7954	0.91	0.491							0.91	1	
33.301	4	Silty Clay to Clay	31.774	1.382	1.905	0.321	1.584	2.89	0.7902	0.90	0.494							0.91	1	
33.957	3	Clay	29.132	1.534	1.941	0.342	1.6	2.98	0.7857	0.90	0.495							0.91	1	
34.613	3	Clay	27.19	1.426	1.978	0.362	1.616	3.01	0.7813	0.89	0.497							0.91	1	
35.269	4	Silty Clay to Clay	25.677	1.144	2.015	0.383	1.633	2.99	0.7766	0.89	0.499							0.91	1	
35.925	5	Clayey Silt to Silty Clay	26.517	0.99	2.053	0.403	1.65	2.92	0.7719	0.88	0.500							0.90	1	
36.581	5	Clayey Silt to Silty Clay	25.204	0.943	2.091	0.424	1.667	2.94	0.7674	0.88	0.502							0.90	1	
37.238	5	Clayey Silt to Silty Clay	24.431	0.816	2.128	0.444	1.684	2.92	0.7628	0.87	0.503							0.90	1	
37.894	5	Clayey Silt to Silty Clay	27.685	1.011	2.166	0.464	1.701	2.9	0.7584	0.87	0.503							0.90	1	
38.55	4	Silty Clay to Clay	28.586	1.233	2.203	0.485	1.718	2.95	0.7539	0.86	0.504							0.90	1	
39.206	4	Silty Clay to Clay	29.065	1.396	2.241	0.505	1.736	2.98	0.7493	0.86	0.504							0.90	1	
39.862	3	Clay	26.606	1.306	2.278	0.526	1.752	3.03	0.7453	0.85	0.504							0.89	1	
40.518	3	Clay	20.726	0.959	2.314	0.546	1.768	3.12	0.7412	0.85	0.504							0.89	1	
41.175	4	Silty Clay to Clay	18.262	0.674	2.352	0.567	1.785	3.11	0.737	0.84	0.504							0.89	1	
41.831	5	Clayey Silt to Silty Clay	18.117	0.527	2.389	0.587	1.802	3.05	0.7328	0.83	0.503							0.89	1	
42.487	5	Clayey Silt to Silty Clay	20.704	0.562	2.427	0.608	1.819	2.98	0.7287	0.83	0.503							0.89	1	
43.143	5	Clayey Silt to Silty Clay	17.817	0.549	2.464	0.628	1.836	3.07	0.7246	0.82	0.502							0.89	1	
43.799	5	Clayey Silt to Silty Clay	18.051	0.589	2.502	0.649	1.853	3.08	0.7206	0.82	0.501							0.88	1	
44.455	5	Clayey Silt to Silty Clay	20.337	0.635	2.54	0.669	1.87	3.02	0.7166	0.81	0.500							0.88	1	
45.112	5	Clayey Silt to Silty Clay	28.152	1.104	2.577	0.69	1.888	2.96	0.7124	0.80	0.498							0.88	1	
45.768	5	Clayey Silt to Silty Clay	27.652	1.001	2.615	0.71	1.905	2.95	0.7085	0.80	0.497							0.88	1	
46.424	5	Clayey Silt to Silty Clay	31.073	1.055	2.652	0.731	1.922	2.89	0.7047	0.79	0.496							0.88	1	
47.08	5	Clayey Silt to Silty Clay	33.198	1.379	2.69	0.751	1.939	2.93	0.7009	0.78	0.494							0.88	1	
47.736	3	Clay	29.577	1.448	2.727	0.772	1.955	3.03	0.6973	0.78	0.492							0.87	1	
48.392	5	Clayey Silt to Silty Clay	36.085	1.259	2.764	0.792	1.972	2.85	0.6936	0.77	0.491							0.87	1	
49.049	5	Clayey Silt to Silty Clay	42.727	1.655	2.802	0.813	1.989	2.82	0.6899	0.76	0.489							0.87	1	
49.705	5	Clayey Silt to Silty Clay	42.666	1.742	2.839	0.833	2.006	2.84	0.6862	0.76	0.487							0.87	1	
50.361	4	Silty Clay to Clay	42.888	1.912	2.877	0.853	2.024	2.87	0.6824	0.75	0.484							0.87	1	
51.017	5	Clayey Silt to Silty Clay	41.108	1.704	2.915	0.874	2.041	2.86	0.6788	0.74	0.482							0.87	1	
51.673	5	Clayey Silt to Silty Clay	35.523	1.48	2.952	0.894	2.058	2.93	0.6753	0.74	0.480							0.87	1	
52.329	6	Sandy Silt to Clayey Silt	33.843	1.013	2.99	0.915	2.075	2.86	0.6718	0.73	0.478							0.86	1	
52.986	6	Sandy Silt to Clayey Silt	30.183	0.756	3.027	0.935	2.092	2.86	0.6683	0.72	0.476							0.86	1	
53.642	6	Sandy Silt to Clayey Silt	27.824	0.718	3.065	0.956	2.109	2.89	0.6649	0.72	0.474							0.86	1	
54.298	5	Clayey Silt to Silty Clay	31.39	1.039	3.103	0.976	2.126	2.92	0.6615	0.71	0.472							0.86	1	
54.954	5	Clayey Silt to Silty Clay	29.437	1.135	3.14	0.997	2.143	2.99	0.6581	0.70	0.469							0.86	1	
55.61	6	Sandy Silt to Clayey Silt	27.847	0.792	3.178	1.017	2.16	2.93	0.6548	0.70	0.467							0.86	1	

LIQUEFACTION POTENTIAL ANALYSIS (per Youd et al., 2001)

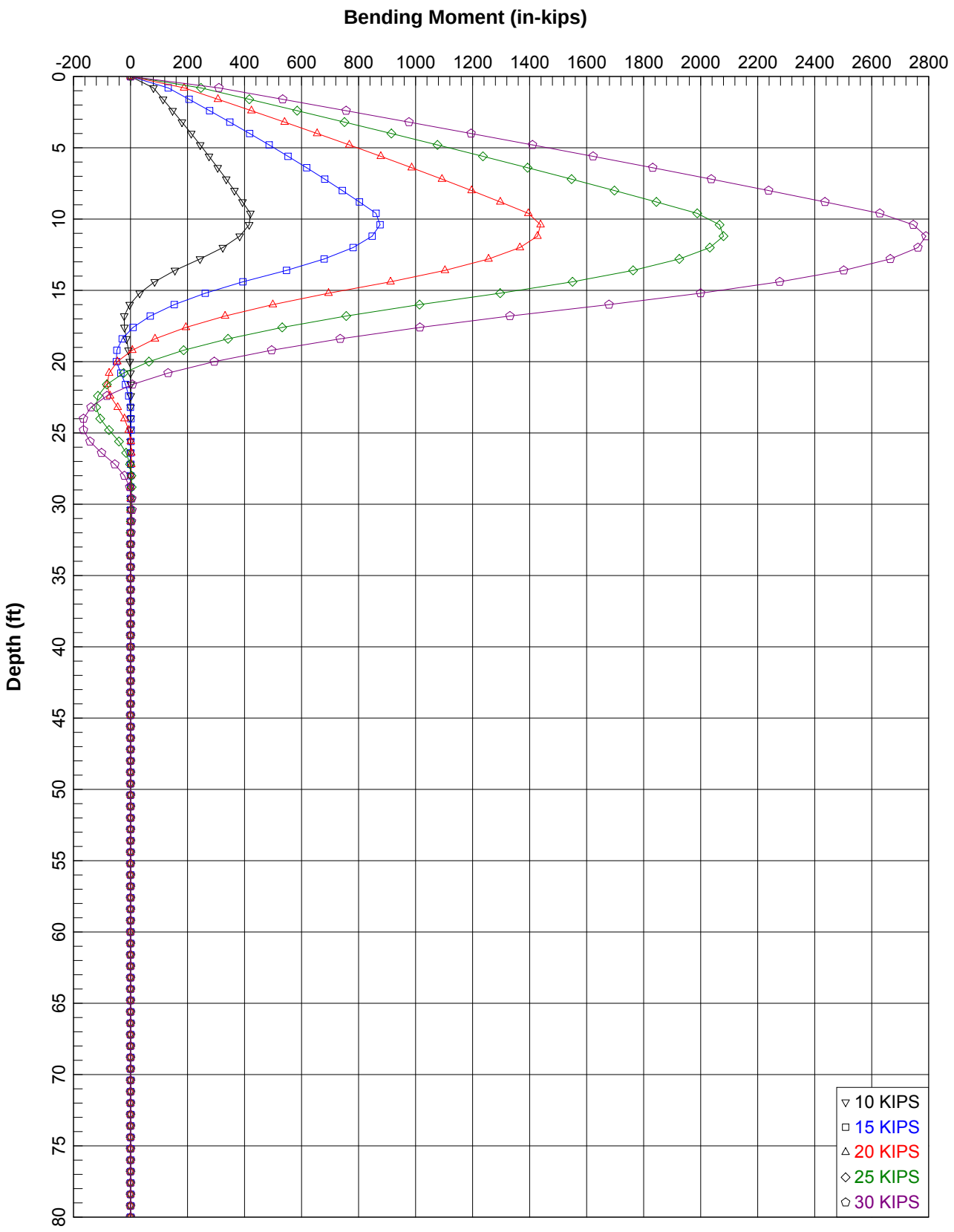
PROJECT NAME	***80-680-12 INTERCHAGNE***				
PROJECT NO.	***2009-130-GDR***	*FAULT INFO*			
CPT NO.	***CPT-09-008***	*FAULT M_w =*	6.9	*MSF =* 1.24	*a_{max} (g)=* 0.7

			CPT RESULT INPUT							***CSR***				***CRR $_{7.5}$***					***F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α***		
Depth (ft)		Soil Behavior Type	qc (tsf)	fs (tsf)	σ_v (tsf)	u (tsf)	σ_v' (tsf)	Ic*	C_N*	γ_d	CSR	Ic	C_Q	q_{c1N}	K_C	$(q_{c1N})_{cs}$	$CRR_{7.5}$	Kσ	Kα	F.S.
56.266	5	Clayey Silt to Silty Clay	34.266	1.098	3.215	1.038	2.178	2.88	0.6513	0.69	0.464							0.86	1	
56.923	5	Clayey Silt to Silty Clay	38.193	1.499	3.253	1.058	2.195	2.9	0.648	0.69	0.462							0.85	1	
57.579	5	Clayey Silt to Silty Clay	38.154	1.501	3.291	1.079	2.212	2.91	0.6448	0.68	0.460							0.85	1	
58.235	5	Clayey Silt to Silty Clay	32.786	1.33	3.328	1.099	2.229	2.98	0.6416	0.67	0.458							0.85	1	
58.891	5	Clayey Silt to Silty Clay	29.026	0.983	3.366	1.12	2.246	2.98	0.6384	0.67	0.456							0.85	1	
59.547	5	Clayey Silt to Silty Clay	30.912	0.986	3.403	1.14	2.263	2.94	0.6353	0.66	0.454							0.85	1	
60.203	5	Clayey Silt to Silty Clay	30.978	1.162	3.441	1.161	2.28	2.99	0.6322	0.66	0.452							0.85	1	
60.86	5	Clayey Silt to Silty Clay	30.027	1.063	3.478	1.181	2.297	2.99	0.6291	0.65	0.449							0.85	1	
61.516	5	Clayey Silt to Silty Clay	29.243	0.963	3.516	1.202	2.315	2.99	0.6259	0.65	0.447							0.85	1	
62.172	5	Clayey Silt to Silty Clay	27.83	0.914	3.554	1.222	2.332	3.01	0.6229	0.64	0.445							0.84	1	
62.828	5	Clayey Silt to Silty Clay	26.3	0.935	3.591	1.242	2.349	3.06	0.6199	0.64	0.443							0.84	1	
63.484	5	Clayey Silt to Silty Clay	24.859	0.772	3.629	1.263	2.366	3.05	0.6169	0.63	0.441							0.84	1	
64.14	5	Clayey Silt to Silty Clay	25.572	0.739	3.666	1.283	2.383	3.02	0.614	0.63	0.440							0.84	1	
64.797	6	Sandy Silt to Clayey Silt	32.619	0.944	3.704	1.304	2.4	2.91	0.6111	0.62	0.438							0.84	1	
65.453	6	Sandy Silt to Clayey Silt	45.903	1.414	3.742	1.324	2.417	2.81	0.6082	0.62	0.436							0.84	1	
66.109	5	Clayey Silt to Silty Clay	29.204	0.87	3.779	1.345	2.434	2.99	0.6054	0.61	0.434							0.84	1	
66.765	6	Sandy Silt to Clayey Silt	34.077	0.949	3.817	1.365	2.452	2.91	0.6024	0.61	0.433							0.84	1	
67.421	6	Sandy Silt to Clayey Silt	28.03	0.799	3.854	1.386	2.469	3	0.5996	0.61	0.431							0.83	1	
68.077	6	Sandy Silt to Clayey Silt	30.377	0.782	3.892	1.406	2.486	2.94	0.5969	0.60	0.429							0.83	1	
68.734	6	Sandy Silt to Clayey Silt	45.686	1.479	3.93	1.427	2.503	2.84	0.5941	0.60	0.428							0.83	1	
69.39	6	Sandy Silt to Clayey Silt	46.838	1.197	3.967	1.447	2.52	2.76	0.5914	0.60	0.426							0.83	1	
70.046	6	Sandy Silt to Clayey Silt	44.969	1.499	4.005	1.468	2.537	2.85	0.5887	0.59	0.425							0.83	1	
70.702	6	Sandy Silt to Clayey Silt	49.769	1.563	4.042	1.488	2.554	2.79	0.586	0.59	0.424							0.83	1	
71.358	5	Clayey Silt to Silty Clay	47.549	1.736	4.08	1.509	2.571	2.86	0.5834	0.58	0.422							0.83	1	
72.014	5	Clayey Silt to Silty Clay	39.467	1.44	4.118	1.529	2.589	2.94	0.5806	0.58	0.421							0.83	1	
72.671	5	Clayey Silt to Silty Clay	34.221	1.171	4.155	1.55	2.606	2.98	0.578	0.58	0.420							0.83	1	
73.327	6	Sandy Silt to Clayey Silt	32.052	0.879	4.193	1.57	2.623	2.95	0.5755	0.58	0.418							0.82	1	
73.983	6	Sandy Silt to Clayey Silt	42.059	1.289	4.23	1.59	2.64	2.87	0.5729	0.57	0.417							0.82	1	
74.639	6	Sandy Silt to Clayey Silt	40.218	1.182	4.268	1.611	2.657	2.88	0.5704	0.57	0.416							0.82	1	
75.295	5	Clayey Silt to Silty Clay	65.639	2.638	4.306	1.631	2.674	2.8	0.5679	0.57	0.415							0.82	1	
75.951	5	Clayey Silt to Silty Clay	41.186	1.545	4.343	1.652	2.691	2.96	0.5654	0.56	0.414							0.82	1	
76.608	6	Sandy Silt to Clayey Silt	28.208	0.77	4.381	1.672	2.708	3.02	0.5629	0.56	0.413							0.82	1	
77.264	6	Sandy Silt to Clayey Silt	29.009	0.755	4.418	1.693	2.725	3	0.5605	0.56	0.412							0.82	1	
77.92	6	Sandy Silt to Clayey Silt	29.666	0.736	4.456	1.713	2.743	2.97	0.558	0.56	0.411							0.82	1	
78.576	6	Sandy Silt to Clayey Silt	36.118	0.897	4.494	1.734	2.76	2.89	0.5556	0.55	0.410							0.82	1	
79.232	6	Sandy Silt to Clayey Silt	41.197	1.23	4.531	1.754	2.777	2.89	0.5532	0.55	0.409							0.82	1	
79.888	6	Sandy Silt to Clayey Silt	40.262	1.174	4.569	1.775	2.794	2.89	0.5508	0.55	0.408							0.81	1	
80.545	6	Sandy Silt to Clayey Silt	46.025	1.192	4.606	1.795	2.811	2.8	0.5485	0.55	0.407							0.81	1	
81.201	6	Sandy Silt to Clayey Silt	56.36	1.477	4.644	1.816	2.828	2.72	0.5462	0.54	0.407							0.81	1	
81.857	6	Sandy Silt to Clayey Silt	62.173	1.669	4.681	1.836	2.845	2.7	0.5439	0.54	0.406							0.81	1	
82.513	7	Silty Sand to Sandy Silt	67.597	1.699	4.72	1.857	2.863	2.66	0.5415	0.54	0.405							0.81	1	
83.169	7	Silty Sand to Sandy Silt	66.034	1.601	4.759	1.877	2.882	2.67	0.539	0.54	0.404							0.81	1	
83.825	6	Sandy Silt to Clayey Silt	49.875	1.335	4.796	1.898	2.899	2.8	0.5367	0.54	0.403							0.81	1	
84.482	6	Sandy Silt to Clayey Silt	54.898	1.33	4.834	1.918	2.916	2.74	0.5345	0.53	0.403							0.81	1	
85.138	6	Sandy Silt to Clayey Silt	50.136	1.401	4.872	1.939	2.933	2.82	0.5323	0.53	0.402							0.81	1	
85.794	6	Sandy Silt to Clayey Silt	61.534	1.844	4.909	1.959	2.95	2.77	0.5301	0.53	0.401							0.81	1	
86.45	6	Sandy Silt to Clayey Silt	44.368	1.361	4.947	1.979	2.967	2.9	0.528	0.53	0.401							0.80	1	
87.106	5	Clayey Silt to Silty Clay	59.587	2.385	4.984	2	2.984	2.87	0.5258	0.53	0.400							0.80	1	
87.762	6	Sandy Silt to Clayey Silt	61.584	1.992	5.022	2.02	3.002	2.8	0.5236	0.52	0.399							0.80	1	
88.419	6	Sandy Silt to Clayey Silt	55.827	1.476	5.06	2.041	3.019	2.79	0.5215	0.52	0.399							0.80	1	
89.075	7	Silty Sand to Sandy Silt	41.764	0.791	5.098	2.061	3.037	2.79	0.5192	0.52	0.398							0.80	1	
89.731	7	Silty Sand to Sandy Silt	47.672	1.013	5.137	2.082	3.055	2.77	0.517	0.52	0.398							0.80	1	
90.387	6	Sandy Silt to Clayey Silt	53.585	1.373	5.174	2.102	3.072	2.78	0.515	0.52	0.397							0.80	1	
91.043	6	Sandy Silt to Clayey Silt	60.505	1.701	5.212	2.123	3.089	2.76	0.5129	0.52	0.397							0.80	1	
91.699	6	Sandy Silt to Clayey Silt	59.899	1.712	5.25	2.143	3.106	2.77	0.5109	0.52	0.396							0.80	1	
92.356	6	Sandy Silt to Clayey Silt	55.826	1.497	5.287	2.164	3.123	2.78	0.5089	0.51	0.396							0.80	1	
93.012	6	Sandy Silt to Clayey Silt	52.85	1.438	5.325	2.184	3.141	2.81	0.5068	0.51	0.395							0.80	1	
93.668	6	Sandy Silt to Clayey Silt	51.137	1.463	5.362	2.205	3.158	2.84	0.5048	0.51	0.395							0.79	1	
94.324	6	Sandy Silt to Clayey Silt	54.976	1.486	5.4	2.225	3.175	2.8	0.5029	0.51	0.394							0.79	1	
94.98	6	Sandy Silt to Clayey Silt	57.134	1.426	5.438	2.246	3.192	2.77	0.5009	0.51	0.394							0.79	1	
95.636	6	Sandy Silt to Clayey Silt	63.687	1.651	5.475	2.266	3.209	2.75	0.499	0.51	0.393							0.79	1	
96.293	6	Sandy Silt to Clayey Silt	52.879	1.564	5.513	2.287	3.226	2.85	0.4971	0.51	0.393							0.79	1	
96.949	6	Sandy Silt to Clayey Silt	52.088	1.599	5.55	2.307	3.243	2.87	0.4952	0.50	0.393							0.79	1	
97.605	6	Sandy Silt to Clayey Silt	55.142	1.723	5.588	2.327	3.26	2.85	0.4933	0.50	0.392							0.79	1	
98.261	6	Sandy Silt to Clayey Silt	59.164	1.745	5.626	2.348	3.278	2.82	0.4913	0.50	0.392							0.79	1	
98.917	6	Sandy Silt to Clayey Silt	54.581	1.918	5.663	2.368	3.295	2.9	0.4894	0.50	0.391							0.79	1	
99.573	5	Clayey Silt to Silty Clay	49.552	1.983	5.701	2.389	3.312	2.98	0.4876	0.50	0.391							0.79	1	

L-PILE Analysis Results



WB 80 TO WB 12 GRADE SEPARATION, BENT 2, CLASS 200 ALT "W"



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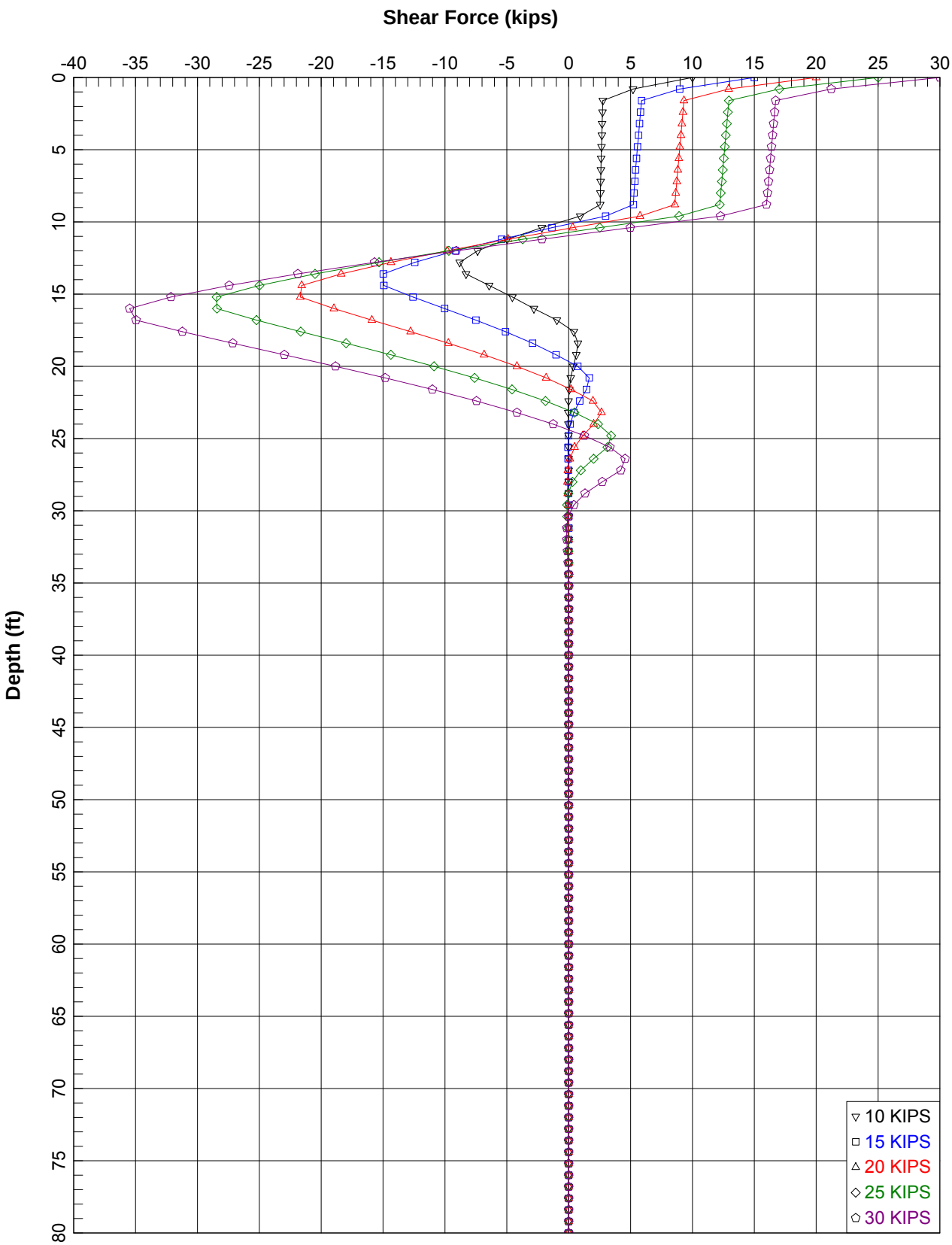

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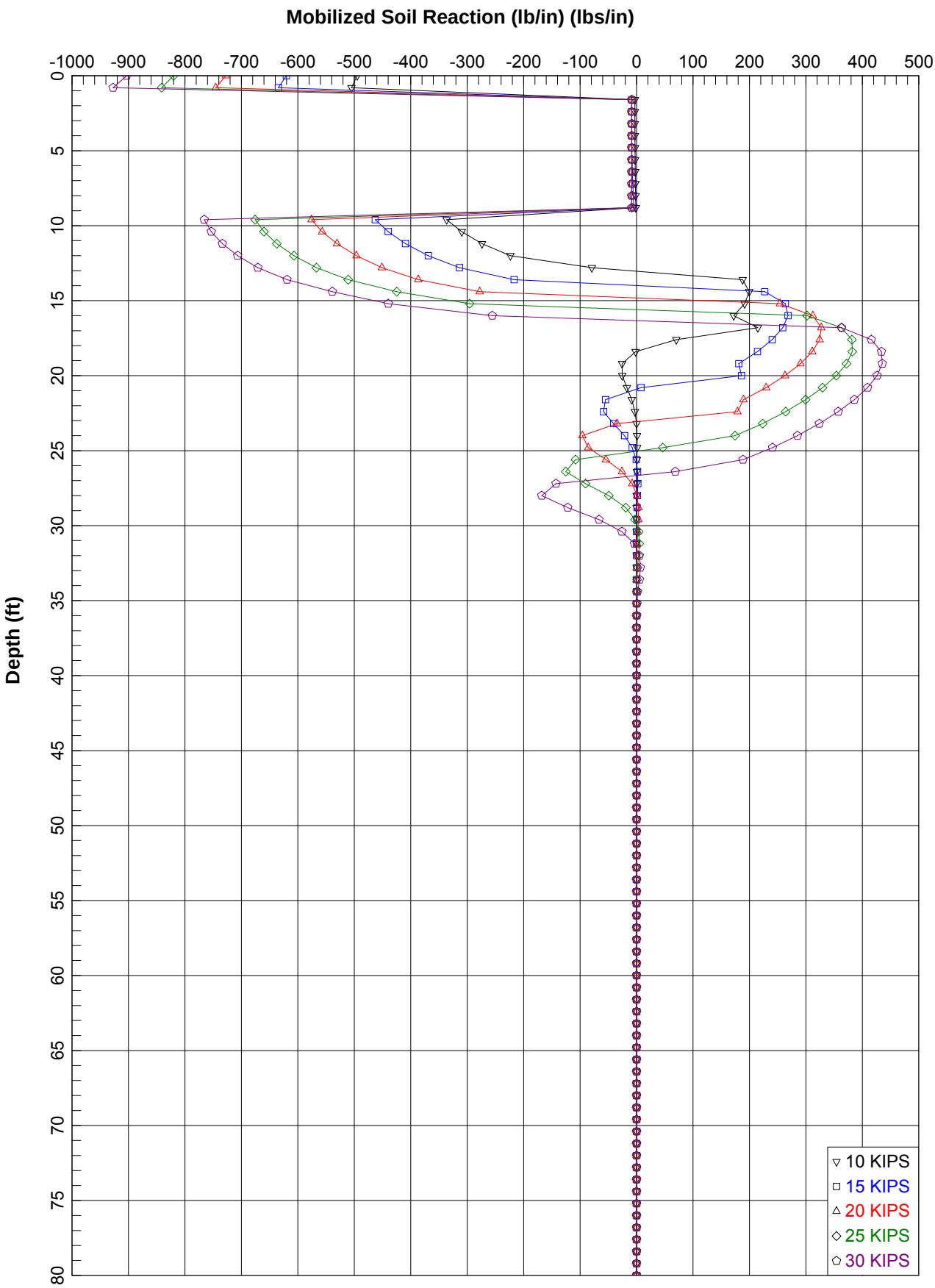
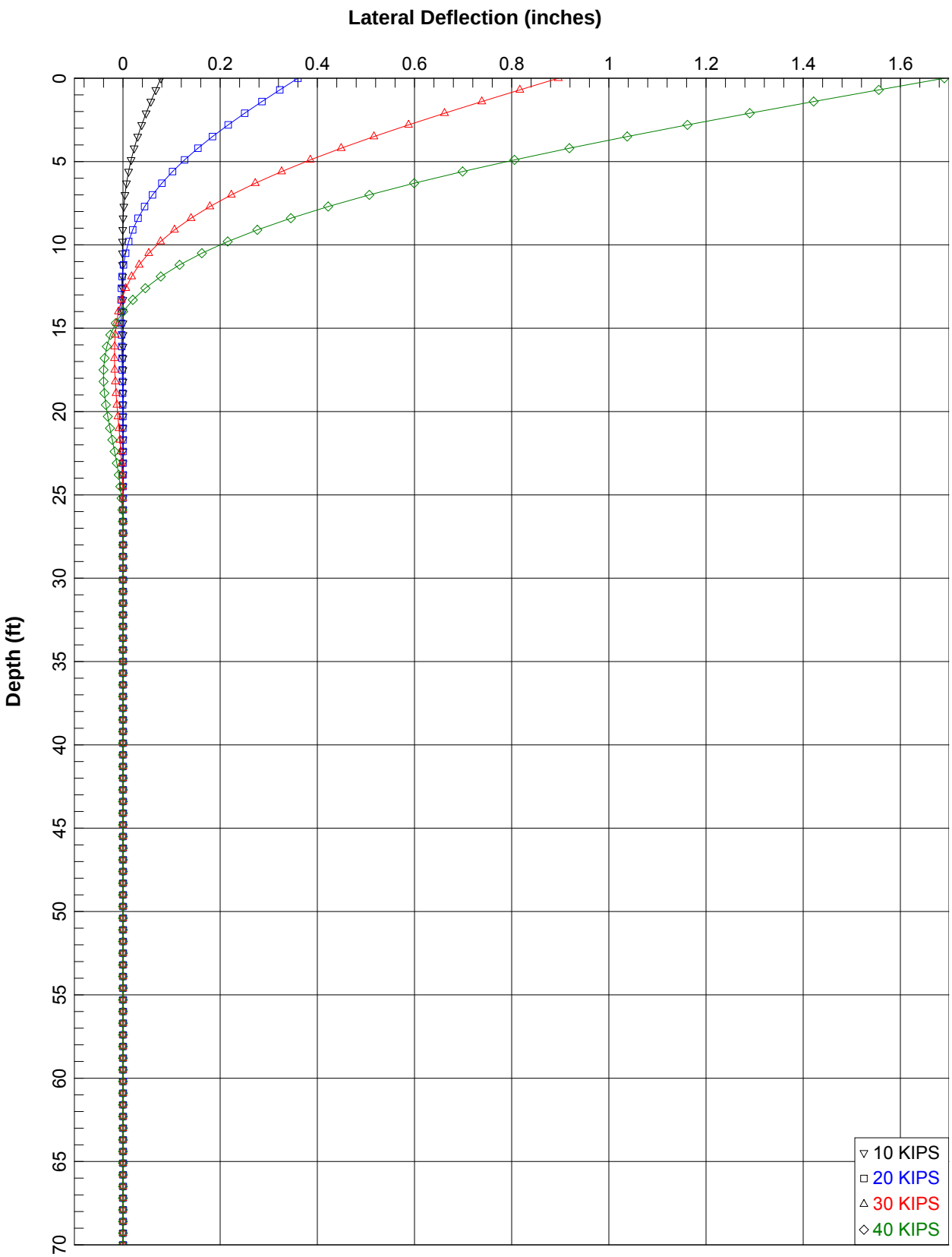
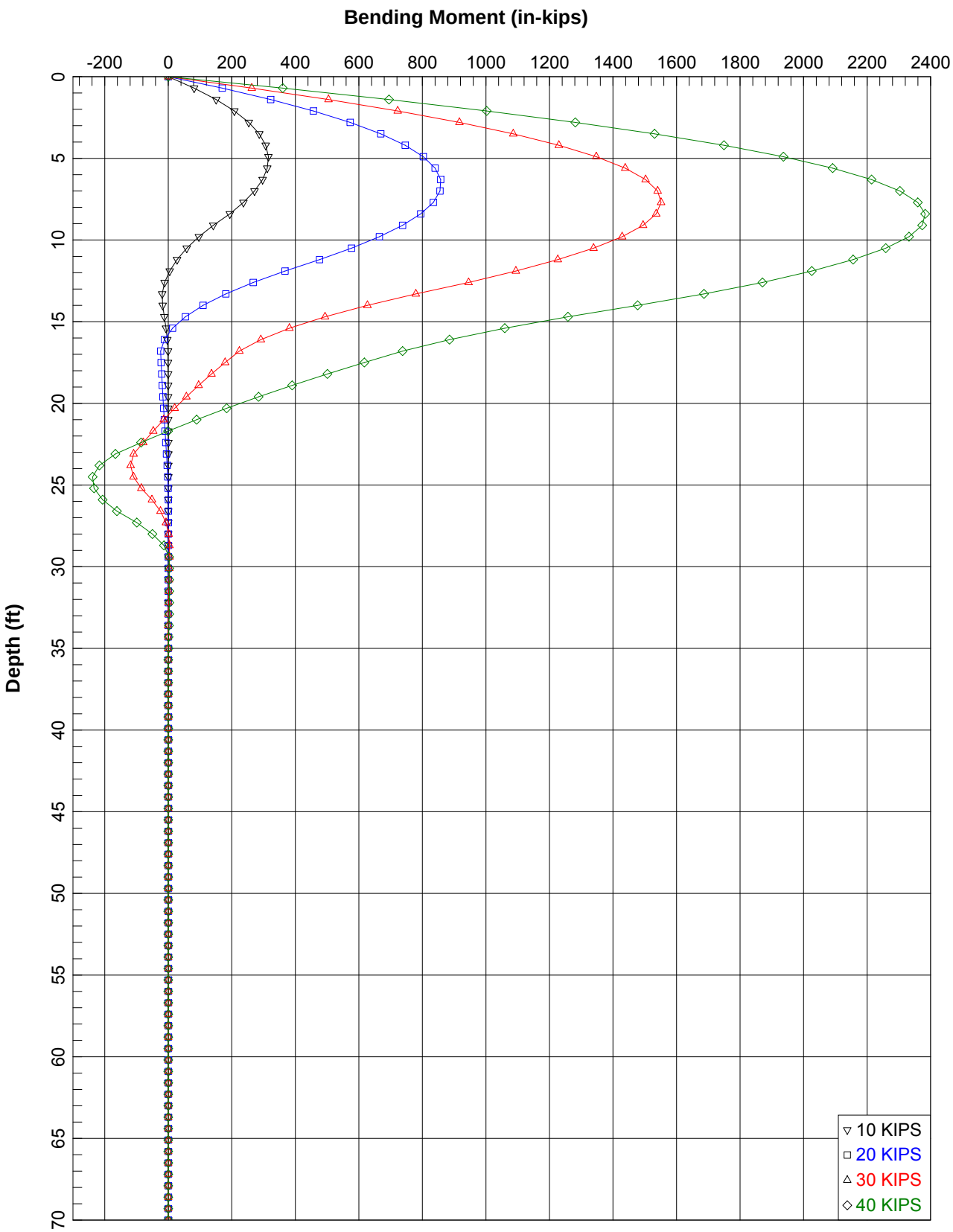


WB 80 TO WB 12 GRADE SEPARATION, BENT 2, CLASS 200 ALT "W"



WB 80 TO WB 12 SEPARATION, ABUTMENT 4, CLASS 200 ALT. "W" (16" DIA.)



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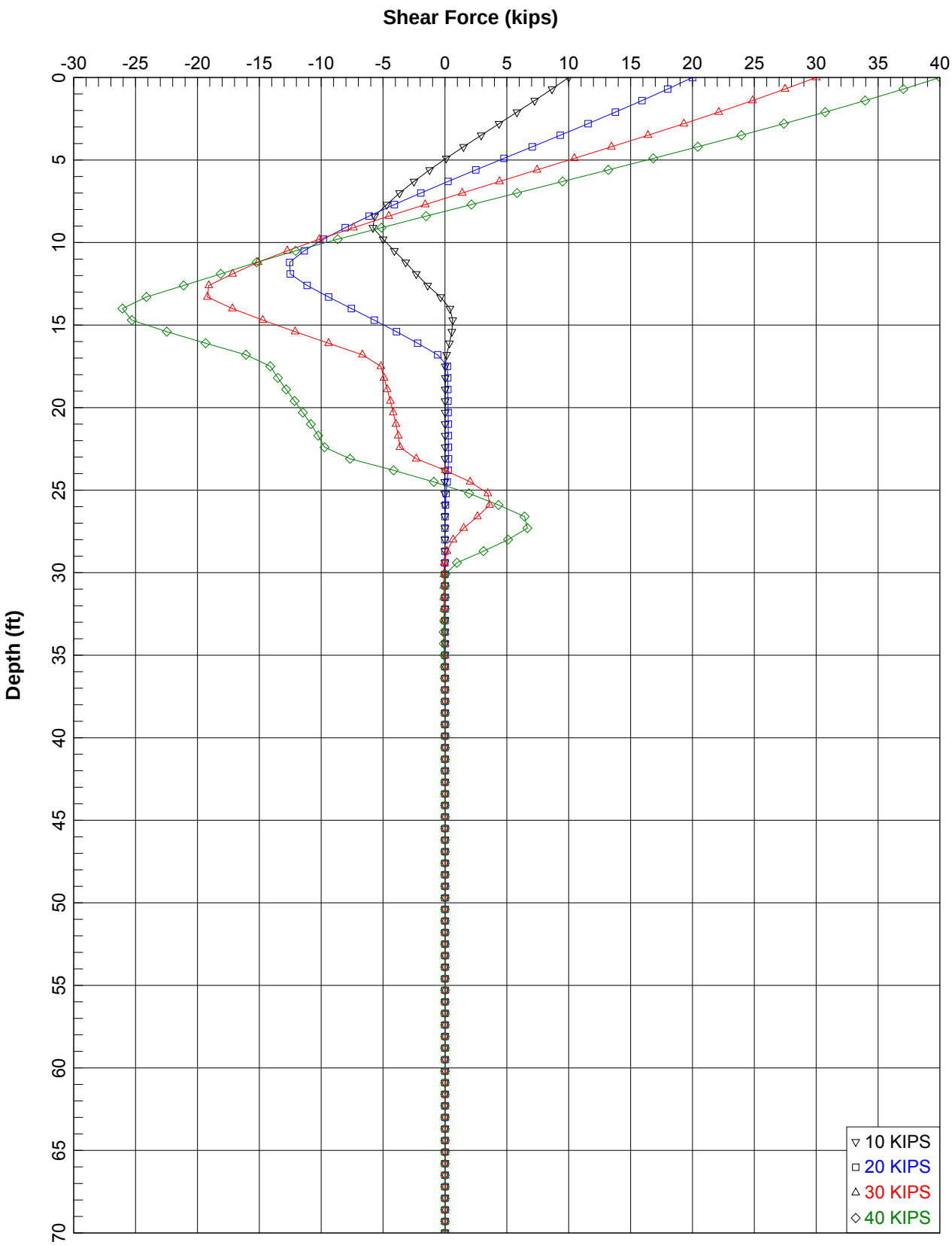
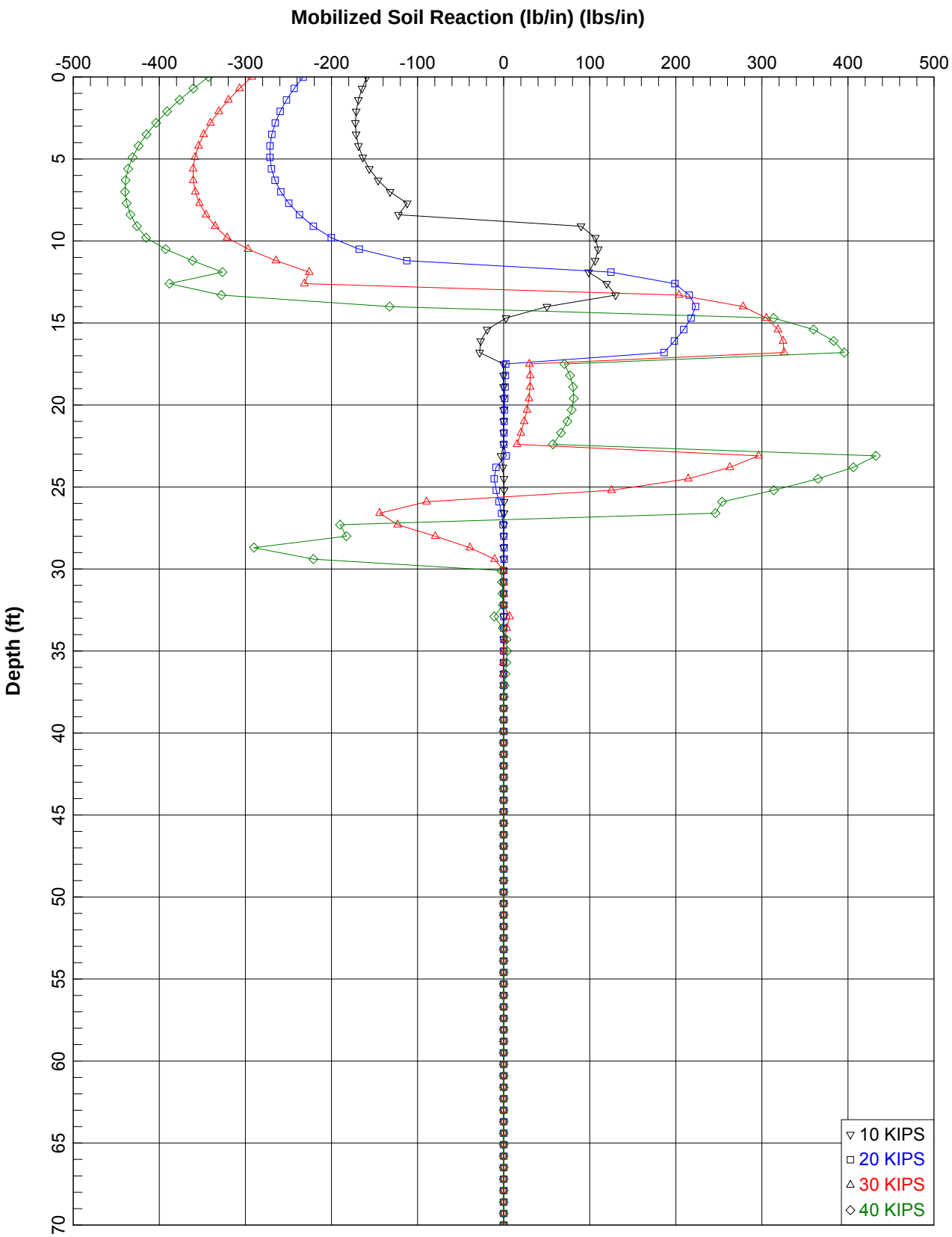


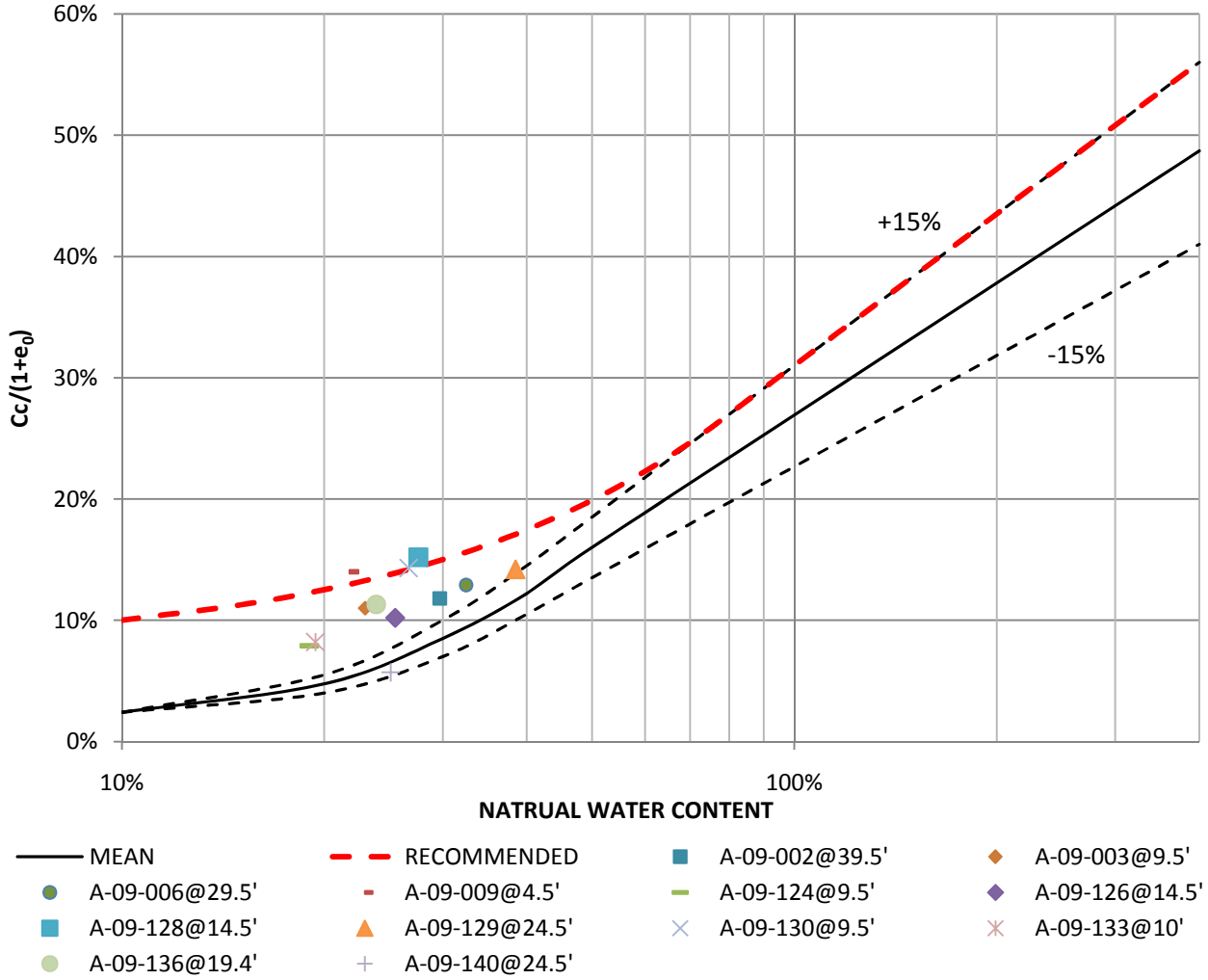
WB 80 TO WB 12 SEPARATION, ABUTMENT 4, CLASS 200 ALT. "W" (16" DIA.)



WB 80 TO WB 12 SEPARATION, ABUTMENT 4, CLASS 200 ALT. "W" (16" DIA.)

Settlement Analysis Results

Modified Compression Index v.s. Natural Moisture Content



Boring	Sample No.	Depth	Moisture Content	Cc/(1+e0)	Cr/(1+e0)	Cr/Cc
A-09-002	8	39.5	29.7%	11.8%	1.6%	13.6%
A-09-003	2	9.5	23.0%	11.0%	2.6%	23.6%
A-09-006	6	29.5	32.5%	12.9%	1.7%	13.2%
A-09-009	1	4.5	21.8%	14.0%	4.1%	29.3%
A-09-124	3	9.5	19.0%	7.9%	1.4%	17.7%
A-09-126	3	14.5	25.5%	10.2%	3.2%	31.4%
A-09-128	4	14.5	27.6%	15.2%	3.0%	19.7%
A-09-129	6	24.5	38.5%	14.2%	2.5%	17.6%
A-09-130	2	9.5	26.7%	14.3%	3.0%	21.0%
A-09-133	3	10.0	19.4%	8.2%	1.8%	22.0%
A-09-136	5	19.4	23.9%	11.3%	2.3%	20.4%
A-09-140	5	24.5	25.1%	5.7%	1.0%	17.5%

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Practicing in the Geosciences

I-80/680/12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR | PLATE NO.:

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-006*** *(ABUTMENT 1 OF WB80 TO WB12/RW#2)*

Embankment H (ft)= 35 *Contact Pressure (psf)=* 4375 *Contact Area, B (ft)=* 100 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 18 *Contact Area, L (ft)=*
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	NC	Sum
2	0	8	14	SPT	14	125.0	125.0	17.7%	500	4206.7	7202	0.0239	0.1194	2.233		2.233
2	8	13	20	SPT	20	125.0	125.0	15.8%	1313	3959.3	10029	0.0229	0.1146	0.831		0.831
2	13	16.5	21	SPT	21	125.0	125.0	18.2%	1844	3812.6	10644	0.0241	0.1207	0.493		0.493
2	16.5	23	12	SPT	12	125.0	62.6	28.7%	2266	3653.4	6148	0.0294	0.1468	0.955		0.955
2	23	28	15	SPT	15	125.0	62.6	30.0%	2626	3486.1	7558	0.0300	0.1500	0.661		0.661
2	28	33	9	SPT	9	125.0	62.6	32.5%	2939	3352.5	4312	0.0312	0.1562	0.312	1.538	1.850
2	33	38	15	SPT	15	125.0	62.6	25.1%	3252	3228.8	7583	0.0276	0.1379	0.496		0.496
2	38	40	15	SPT	15	125.0	62.6	29.3%	3471	3147.5	7437	0.0297	0.1483	0.200		0.200
2	40	48.5	13	SPT	13	125.0	62.6	32.1%	3800	3032.9	6453	0.0310	0.1552	0.728	0.393	1.121
2	48.5	52	19	SPT	19	125.0	62.6	24.5%	4175	2911.8	9543	0.0273	0.1364	0.263		0.263
1	52	57	18	SPT	18	125.0	62.6	23.3%	4441	2831.7						
2	57	65	15	SPT	15	125.0	62.6	24.5%	4848	2717.4	7540	0.0273	0.1364	0.502	0.020	0.522
2	65	74	19	SPT	19	125.0	62.6	22.2%	5380	2581.1	9250	0.0261	0.1307	0.480		0.480
2	74	84	13	SPT	13	125.0	62.6	26.0%	5975	2444.1	6509	0.0280	0.1401	0.125	1.878	2.004
1	84	94	23	SPT	23	125.0	62.6	23.3%	6601	2314.8						
2	94	100	52	SPT	52	125.0	62.6	21.7%	7102	2220.8	26038	0.0259	0.1294	0.220		0.220
													Estimated Settlement (in)=	*8.5*	*3.8*	***12.3***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-009*** *(ABUTMENT 4 OF WB80 TO WB 12/RW#4)*

Embankment H (ft)= 25 *Contact Pressure (psf)=* 3125 *Contact Area, B (ft)=* 100 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 15 *Contact Area, L (ft)=*
Plane Strain? (Y/N)= Y

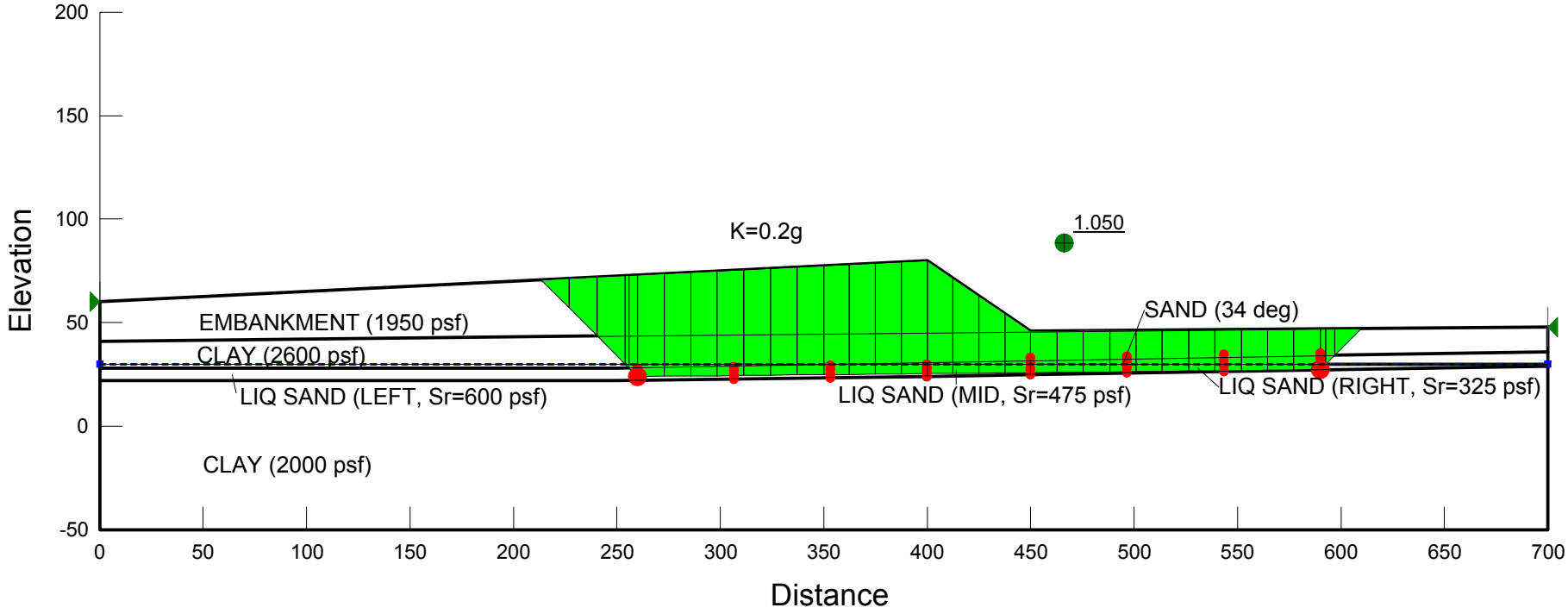
GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	8	11	SPT	11	125.0	125.0	21.8%	500	3004.8	5725	0.0259	0.1297	2.105		2.105
2	8	12	18	SPT	18	125.0	125.0	19.4%	1250	2840.9	9026	0.0247	0.1237	0.611		0.611
1	12	16.5	12	SPT	12	125.0	62.6	26.6%	1641	2735.2						
2	16.5	24.5	28	SPT	28	125.0	62.6	21.0%	2032	2593.4	13834	0.0255	0.1277	0.876		0.876
1	24.5	28	14	SPT	14	125.0	62.6	19.1%	2392	2475.2						
2	28	32	20	SPT	20	125.0	62.6	19.6%	2627	2403.8	10060	0.0248	0.1242	0.336		0.336
2	32	37	18	SPT	18	125.0	62.6	31.4%	2909	2323.4	9042	0.0307	0.1535	0.470		0.470
2	37	42	15	SPT	15	125.0	62.6	31.5%	3222	2240.1	7437	0.0307	0.1537	0.423		0.423
2	42	47	45	SPT	45	125.0	62.6	23.8%	3535	2162.6	22416	0.0269	0.1346	0.335		0.335
2	47	52	33	SPT	33	125.0	62.6	18.1%	3848	2090.3	16360	0.0241	0.1204	0.272		0.272
2	52	57	32	SPT	32	125.0	62.6	25.6%	4161	2022.7	16070	0.0278	0.1391	0.287		0.287
2	57	65	22	SPT	22	125.0	62.6	29.4%	4567	1941.0	10967	0.0297	0.1485	0.439		0.439
2	65	75	38	SPT	38	125.0	62.6	24.6%	5131	1838.2	18843	0.0273	0.1366	0.436		0.436
2	75	85	34	SPT	34	125.0	62.6	21.1%	5757	1736.1	17130	0.0256	0.1279	0.351		0.351
2	85	95	32	SPT	32	125.0	62.6	21.1%	6383	1644.7	16102	0.0256	0.1279	0.306		0.306
2	95	100	34	SPT	34	125.0	62.6	27.4%	6852	1582.3	16788	0.0287	0.1436	0.155		0.155
													Estimated Settlement (in)=	*7.4*	*0.0*	***7.4***

Slope Stability Analysis Results

WB 80 TO WB 12 GRADE SEPARATION
ABUTMENT 4

(SEISMIC CONDITION, PSEUDO-STATIC+RESIDUAL SHEAR STRENGTH)

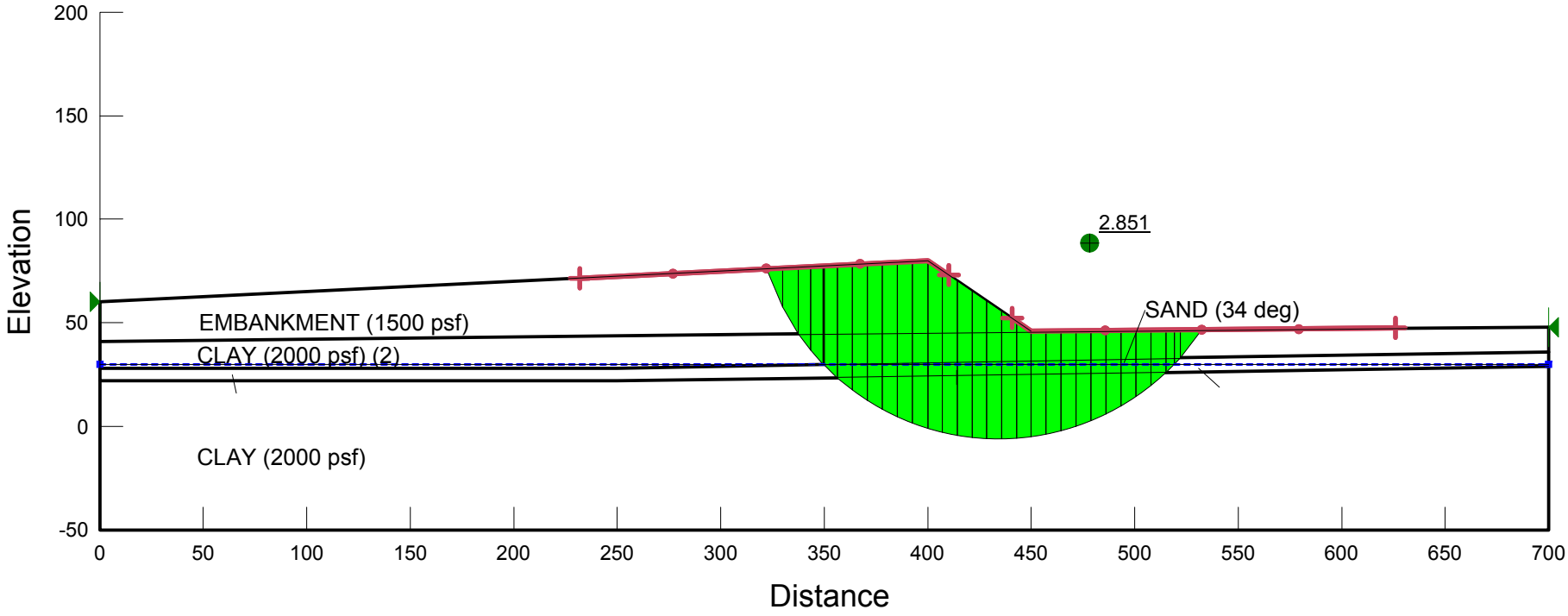


C:\Users\fwang\Desktop\ICP new\SLOPE W\NEW\WB 80_WB 12 ABUTMENT 4 (SEISMIC).gsz

6/28/2011 9:46:55 PM

WB 80 TO WB 12 GRADE SEPARATION
ABUTMENT 4

(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUCTION)



C:\Users\fwang\Desktop\ICP new\SLOPE W\NEW\WB 80_WB 12 ABUTMENT 4 (STATIC).gsz

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APPENDIX VI

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 0A5341 Project Name: I-80/I-680/SR-12 ICP OSFP Liaison: Tracy Bertram Phone: (916)227-8397 e-mail:_____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection	☐ 65% PS&E Unchecked Details ☒ PS&E (Review No. 1) ☐ Construction Support ☐ Other: Foundation Report Parikh- Dated 05-11-12	Reviewer Name: A. Suja/R. Nashed/Sunny Yang Functional Unit: GS-GDW Phone Number: (510) 286-4752/ (510)266-1773/(510)286-4808 e-mail: _____ Date of Review: 06-29-2012
	Structure Information (Use when necessary to document comments by individual structure) Structure Name: WB 80 to WB 12 Seperation (Over WB 80 On-Ramp) Br No: 23-0248		

Consultant Information (to be filled in by Consultant)				
Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	_____	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1		Section 9.4, Seismic Design Criteria (Page 10)	Mention the "Seismic Design Criteria". Make sure it does match with Bridge Plan SDC (Version 1.6, November 2010).	The texts have been revised and SDC Ver. 1.6 (dated November 2010) is mentioned in the report.	
2		Table 3.5-Pile Data Table (Page 14)	Specific Tip Elevation for Bent-3 in Table 3.4 & Table 3.5 should be same. Correct the typing mistake in Table 3.5. Both Bents are mentioned as "Bent 2"	The typo has been corrected. The pile tip elevations have been revised based on the latest design load provided by the structural engineer.	
	Geologic comments by R. Nashed		See Attached Sheet		

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

	Seismic Comments by Sunny Yang		In Tables 3.2 through 3.5 in the Report dated 5/11/12 (pages 13-14): At the abutments, the loads per pile don't match the loads per support. The nominal resistance per pile should be 2170/16*2=272 kips at Abutment 1 and 2140/16*2=268 kips at Abutment 4. Actually, we only need 2170/200 ~= 11 piles at the abutments. At Bents 2 and 3, The Extreme Event compression loads (440 kips and 450 kips) are exceeding the ultimate capacity of Class 200 pile. More piles should be used. Further, the Design Tip Elev. and Specified Tip Elev. in Tables 3.4 and 3.5 are either totally wrong or don't match one another. The Pile Data Table in Foundation Plans also needs to be modified accordingly.	Per our discussion with the structural engineer, load does not equally distribute to all the piles. Based on the calculations, the loads at the toe and heel piles are different. The load per pile shown in Table 3.4 and 3.5 is the maximum load.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
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✓= Comment Resolved
(for Reviewer's use)

GEOLOGIC COMMENTS

OSFP Review Comment & Response Form

General Project Information	Review Phase	Reviewer Information
Dist: 04 EA: 0A5341 Project Name: I-80/I- 680/SR-12 ICP OSFP Liaison: _____ Phone: _____ e-mail: _____	☐ PSR/PDS (Review No. _) ☐ APS/PSR (Review No. _) ☐ APS/PR (Review No. _) ☐ Type Selection ☐ 65% PS&E Unchecked Details ☒ PS&E (Review No. 1) ☐ Construction Support ☐ Other: Foundation Report **Structure Information** (Use when necessary to document comments by individual structure) Structure Name: WB 80 to WB 12 Separation Br No: 23-0248	Reviewer Name: R. Nashed/A.Suja Functional Unit: GS-GDW Phone Number: (510) 622-1773 e-mail: _____ Date of Review: 6/20/2012

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date
_____	_____	_____	_____	_____

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	Caltrans Responses
1	FR	N/A	Foundation Report prepared by Parikh Consultant, Inc., dated July 11, 2011.		Foundation Report prepared by Parikh Consultant, Inc., dated May 11, 2012.
2	FR	6.2 Subsurface Conditions Page 5	The soil profile and subsurface conditions should be described in detail: For abutment 1- use Boring A-09-006, including the fat clay layer. For Bent 2&3 and Abutment 4- use Borings A-09-009, R-10-009A, CPT-09-007, CPT-09-008 including the soft clay and loose sand layers.	Concur. More discussion has been included in the report. Response: We have provided a more detailed description of the loose sand layer encountered in Boring R-10-009A. Response: This paragraph has been removed.	For Bent 2&3 and Abutment 4. 1- Our comment dated 08/09/11 should be discussed in more details with mentioning loose sand. 2- The 4th paragraph "Boring A-09-006.....and 84-to 94.5-foot depth" is misplaced and includes repeated information, should be removed.

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

3		**Appendix II**	All the LOTB's does not include the bench mark for the borings location as the Soil/Rock classification Manual stated	Concur. Bench marks have been included.	1- Our comment dated 08/09/11 has been addressed. 2- In the LOTB of boring R-10-009A. The descriptor "firm" no longer be used and should be replaced by "medium dense". Response: We have replaced this with "medium stiff"

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

OSFP Review Comment & Response Form

General Project Information	Review Phase		Reviewer Information
Dist: 04 EA: 0A5341 **Project Name: WB 80 to WB 12 Seperation (Over WB 80 On-Ramp)** **OSFP Liaison: Tracy Bertram** **Phone: (916)227-8397** **e-mail:_____**	☐ **PSR/PDS (Review No. _)** ☐ **APS/PSR (Review No. _)** ☐ **APS/PR (Review No. _)** ☐ **Type Selection**	☐ **65% PS&E Unchecked Details** ☐ **PS&E (Review No. _)** ☐ **Construction Support** ☒ **Other: Foundation Report (65% Submittal) Parikh- 07-11-2011**	**Reviewer Name: A. Suja/R. Nashed/Sunny Yang** **Functional Unit: GS-GDW** **Phone Number: (510) 286-4752/ (510)266-1773/(510)286-4808** **e-mail: _____** **Date of Review: 08/09/2011**
	Structure Information (Use when necessary to document comments by individual structure) **Structure Name:_____** **Br No: _____**		

Consultant Information (to be filled in by Consultant)

Consultant Structure Lead (First and Last Name)	Structure Consultant Firm	Phone Number	e-mail	Response Date

#	Doc. (See Note 1)	Page, Section, or SSP	Review Comments	Consultant Responses	
1	FR	Page-2, Line 9	Mention Pile Class such as "Class 200 Alt. W Pile"	Concur. The text has been revised.	
2	FR	Page-2, Line 11	Mention RW number in parenthesis.	Concur. The text has been revised.	
3	FR	Page-3, Section 5	*Laboratory Test Results are attached in Appendix IV not Appendix III * CTM 226 determine only "Moisture Content" of soil/aggregate not the Density- correct this. * For Consolidation Test, the test number is 219 not T219	Concur. The text has been revised.	
4	FR	Page-2, 5th Paragraph	Mention "CPT results are shown in Appendix III"	Concur. The text has been included.	
5	FR	Page-5, Sec 8	Corrosion Results are presented in Appendix IV not Appendix III	Concur. The text has been revised.	
6	FR	Appendix-III, Plate:IV-6A to Plate IV-6F	Address the Boring Number in the same format that addressed before.	Concur. The boring numbers have been revised accordingly.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved (for Reviewer's use)

	Seismic Comments by Sunny Yang	No comments			
	Geologic comments by R. Nashed				
	FR	N/A	Foundation Report prepared by Parikh Consultant, Inc., dated July 11, 2011.		
7	FR	6.2 Subsurface Conditions Page 5	The soil profile and subsurface conditions should be described in detail: For abutment 1- use Boring A-09-006, including the fat clay layer. For Bent 2&3 and Abutment 4- use Borings A-09-009, R-10-009A, CPT-09-007, CPT-09-008 including the soft clay and loose sand layers.	Concur. More discussion has been included in the report.	
8		Appendix II	All the LOTB's does not include the bench mark for the borings location as the Soil/Rock classification Manual stated	Concur. Bench marks have been included.	

Note 1: Abbreviations for Typical Documents (if Abbr. is not below, type in the document type)					
P=Structure Plans	SP=Special Provisions	FR=Foundation Rpt	DC=Design Calcs	TS=Type Sel. Report	QCC=Quant. Check Calcs
RP=Road Plans	E=Estimate	H=Hydraulics Rpt	CC=Check Calcs	QC=Quant. Calcs	

✓= Comment Resolved
(for Reviewer's use)

GEOTECHNICAL DESIGN & MATERIALS REPORT
I-80/I-680/SR 12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA
04-SOL-80 PM 12.2/12.9

For

Mark Thomas & Company, Inc./Nolte Vertical Five, A Joint Venture
3000 Oak Road, Suite 650
Walnut Creek, California 94597

PARIKH CONSULTANTS, INC.
1243 Alpine Road, Suite 210
Walnut Creek, CA 94596
(925)933-6336

December 5, 2012 Job No. 2009-130-GDR

PARIKH

Practicing in the Geosciences

Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

Mark Thomas & Co., Inc./Nolte Associates, Inc. JV
3000 Oak Road, Suite 650
Walnut Creek, CA 94596

Job No.: 2009-130-GDR
December 5, 2012

Attn: Mr. Michael Lohman

Sub: Geotechnical Design & Materials Report
I-80/I-680/SR 12 Interchange Project
Solano County, California
04-SOL-80 PM 12.2/12.9

Dear Mr. Lohman:

Transmitted herewith is the Geotechnical Materials Report for the subject project. The report was prepared in accordance with the scope of work outlined in our proposal.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning our findings or conclusions, please feel free to contact this office at (925) 933-6336.

Very truly yours,
PARIKH Consultants, Inc.

Gary Parikh, P.E., G.E.
President

Attachment: Geotechnical Design & Materials Reports

"Approved as to impact on State facilities and conformance with applicable State standards and practices, and the technical oversight were performed as described in the California Department of Transportation A&E Consultant Services Manual."

Caltrans_____

Title_____

Date_____

Caltrans_____

Title_____

Date_____

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GEOTECHNICAL DESIGN & MATERIALS REPORT
I-80/I-680/SR 12 INTERCHANGE
WB I-80 CONNECTOR TO WB SR 12W PROJECT
SOLANO COUNTY, CALIFORNIA
04-SOL-12, 80 PM 2.5/11.3/12.9

1. INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed I-80/I-680/SR 12 Interchange – WB I-80 Connector to WB SR 12W Project in Solano County, California. The general location of the project site and its limits are shown in Plate 1, Project Location Map.

This report addresses the design of embankments and retaining walls, structural pavement sections, and corrosion investigation recommendations. The investigation included review of readily available soils and geologic literature pertaining to the site including as-built information and "Log of Test Borings" (LOTB), site reconnaissance, conducting Cone Penetration Tests (CPT), obtaining representative samples and logging soil materials encountered in exploratory borings, laboratory testing of the representative samples, performing engineering analyses, and preparation of this report.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend design and construction criteria for the project. This report also establishes a geotechnical baseline to be used in assessing the existence and scope of changed site conditions, if any.

The report is intended for use by the project civil and roadway design engineers for information and reference purposes only and should not be construed directly as project specifications.

2. EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

The I-80/I-680/SR 12 interchange is located in Solano County, California and primarily within the City of Fairfield. The existing I-80/I-680/SR 12 interchange connects 3 separate highways: Route 80 (interstate highway) running southwest-northeast; State Route 12 (state highway) running east-west; and Route 680 running north-south. State Route 12 crosses Route 80 on a skew and then runs concurrent with Route 80 for approximately 3.0 miles. The segment of State Route 12 extending to the west of Route 80 is "State Route 12W" and the segment of State Route 12 extending to the east of Route 80 is "State Route 12E". Route 680 begins at Route 80 between the two divergence points of State Route (SR) 12 and extends south from Route 80. Route 80 (I-80), Route 680 (I-680) and SR 12 within the project limit consists of the following:

1. I-80 is an 8-lane freeway with auxiliary lanes between I-680 connectors and the SR 12 (East) connectors;
2. Existing I-680 and SR 12E are 4-lane freeway;
3. Existing SR 12W (also known as Jameson Canyon Road) through the project limits is a

2-lane highway;
4. I-80/Red Top Road interchange;
5. I-80/SR 12W interchange;
6. SR 12W/Red Top Road intersection;
7. I-80/Green Valley Road interchange;
8. I-80/I-680 interchange;

The proposed improvement will construct braided ramps on westbound I-80 between the Green Valley Road Overcrossing and SR 12 and replace the Green Valley Road Overcrossing to improve traffic flow, pedestrian access and safety on the overcrossing. The improvements include the following:

- Reconstruct the Interstate 80 (I-80) / Green Valley Road (GVR) interchange, consisting of constructing the southbound (SB) portion of the ultimate GVR overcrossing with an interim connection to Lopes Road. The new bridge will provide a single through- lane in each direction, including single lane northbound (NB) left turn lanes at the two ramp terminus intersections, standard 8-foot outside shoulders in each direction and a sidewalk on the west side of the bridge. Alignment of Green Valley Road will follow an interim alignment located across the existing gas valve lot between Green Valley Road/Lopes Road and existing Interstate 680 (I-680). A retaining wall will be used to support the interim alignment adjacent to the existing I-680 edge of shoulder.

- Reconstruct the westbound (WB) on-ramp to I-80 as a single lane on-ramp with ramp metering and HOV bypass and including a connection from the on-ramp to the proposed WB I-80 /State Route 12 (SR12) W connector and retaining walls.

- Reconstruct the eastbound (EB) off-ramp from I-80 to the reconstructed Green Valley Road.

- Reconstruct the EB on-ramp, including ramp metering, reconnecting to the existing collector-distributor (CD) connector from EB I-80 to SB I-680 and NB I-680 to EB I-80.

- Construct an interim overcrossing to carry Green Valley Road over the existing EB I-80 to SB I-680 connector. This structure will be removed in future phases when Green Valley Road is realigned to utilize the existing I-680 right of way later in the overall interchange project.

- Access driveway from Green Valley Road into the loop defined by the on ramp to EB I-80 and SB I-680. This loop area is currently outside the access control line of the freeway. The driveway is for utility owners to access existing and relocated facilities within the loop.

- Construct a two lane WB I-80 / WB SR12W connector (Connector) with a bridge crossing over the WB I-80 Green Valley Road on ramp. There will be retaining walls supporting the connector adjacent to this bridge. The connector exit from I-80 would begin immediately west of the existing I-80/I-680 connector and would conform to SR 12W near the existing SR12W / Red Top Road intersection.

- The EB SR12W / EB I-80 connector will be reconstructed between Red Top Road and the existing bridge over I-80, including a retaining wall will to separate the two directions of SR12

- The westbound acceleration lane on SR12W after Red Top Road will be lengthened. The left turn from westbound SR12W to Red Top Road will be closed.

- Relocation of bike and pedestrian trail along I-80 between Green Valley Road IC and the SR 12W / Red Top Road intersection to be from the ends of Mangels Blvd and Business Center Drive, adjacent to the new westbound connector to SR12 (West) to Jameson Canyon Road, opposite Red Top Road.

3. PERTINENT REPORTS AND INVESTIGATION

The following as-built LOTB were also reviewed to supplement the subsurface information obtained for the project during this study (from west to east).

TABLE 1 – LIST OF AS-BUILT LOTB

No.	Structure Name	Bridge No.
1	Red Top Road UC	23-165 R/L
2	Cordelia Underpass	23-25
3	Route 12/80 Separation (Ramp B)	23-16 L
4	Cordelia Overhead	23-142 R/L
5	Green Valley Road Overcrossing	23-138
6	Route 680/80 Separation	23-139 E

4. PHYSICAL SETTING

4.1 Climate

The project site is located in the southwest part of Solano County, California. The climate of the project site is influenced by the Pacific Ocean and has a warm, Mediterranean climate in the summer and drops to cool winter temperature. Based on the information from the Western Regional Climate Center, the temperature ranges in the project vicinity are from 55° F to 87° F in summer and from 40° F to 55° F in winter. The average annual precipitation is 22.8 inches

and the average monthly precipitation from October through April is 3.1 inches. About 95% of the total precipitation falls between October and April.

4.2 Topography and drainage

The general terrain in the vicinity of the project limits consists of hills on the north and northwest sides near Red Top Road and relatively level area near Green Valley Road. Based on the plans provided by the designer, the topography along I-80 is relatively flat with slight grade decrease from approximate Elevation of 180 to 25 feet from west to east within our project limits. The topography along SR 12 is relatively flat and decreases from Elevation 115 feet to 50 feet from west to east within our project limits.

Solano County is divided into two drainage provinces. They are San Francisco Bay Province and Sacramento River Province. The project site is located within the San Francisco Bay Province. There are two primary drainage patterns in Solano County. The drainages in the western third, which includes the project site, drains south into San Francisco Bay through Suisun Bay. The eastern two-third of Solano County drains east and southeast into Sacramento River. The main drainage within the project limits include Green Valley Creek, which drains into San Francisco Bay through Suisun Bay.

4.3 Man-Made and Natural Features of Engineering and Construction Significance

The subject was considered and was determined to be not significant for the project.

4.4 Regional Geology and Seismicity

The project area is located on the boundary between the central Coast Range and the Great Valley Geomorphic Provinces. The San Francisco Bay Area block lies between the mountains of the Coast Range. The Project site is located within the northern portion of the Diablo Range northeast of San Francisco Bay. The Mesozoic sediments (Great Valley Sediments) mainly greywacke and shales accumulated along the south western margin of Sacramento Valley, where they are now tilted up and exposed by uplift of the Coast Range. The Mesozoic rocks include the Coast Range Ophiolite, Franciscan Complex, and the Great Valley Sequence.

In Pliocene time on the western side of the Sacramento Valley, alluvial deposits eroded from Coast Range were deposited as Thema Formation; it contains distinctive widespread ash layers.

Today rivers and streams flowing from the surrounding mountains and hills continue to carry sediments to the valley. The two chief types of surface sediments in the Central Valley are

flood plain deposits, mud that settle out of floor waters, and stream deposits, which form alluvial fans at base of the range on either sides of the valley.

Significant earthquakes, which have occurred in this area, are generally associated with crustal movements along well-defined active fault zones that cross through the region. Active faults in the vicinity of the site with a moderate to high potential for generating earthquakes include the Green Valley and Cordelia faults to the east of the project site and the Napa fault to the west.

5. EXPLORATION

5.1 Drilling and Sampling

Based on the preliminary plans, discussions with the design team, and readily available geotechnical and geologic data in the area, 20 bulk samples and 37 borings were drilled at selected locations to depths ranging from 5 feet to 161.5 feet below the existing ground surface. Six Cone Penetration Tests (CPTs) were also performed to obtain continuous soil data in the vicinity of the proposed Green Valley Road Overcrossing, Green Valley Road Overcrossing (Over SB 680 On-Ramp) and the WB 80 to WB 12 Grade Separation structures.

- Twenty bulk samples for pavement design were collected at relatively shallow depths (approximately 5 feet) from Borings A-09-005, A-09-110 thru A-09-113, A-09-119, A-09-120, A-09-121, A-10-131, A-10-132, A-10-141 thru A-09-150;

- Thirty-seven borings, namely A-09-001 thru A-09-003, R-10-003A, R-10-004A, A-09-005, A-09-006, A-09-009, R-10-009A, A-09-111, A-09-112, A-09-114, A-09-119 thru A-09-130, A-09-133 thru A-09-140, R-12-151, R-12-M001 and R-12-M002 were drilled within the project limits for the design of the ramp connections and separation, embankments, retaining walls, and three proposed bridge structures. These borings were drilled to approximate depths of 30 feet to 161.5 feet;

- Six CPT, namely CPT-10-003A, CPT-09-004, CPT-10-005A, CPT-09-007, CPT-09-008, and CPT-10-129A, were conducted in the vicinity of the proposed Green Valley Road OC, Green Valley Road Temporary OC, and the WB 80 to WB 12 Grade Separation. The CPTs were advanced to approximate depths of 60 feet to 120 feet;

Selected samples were obtained from 2.5-inch I.D. (Modified California, MC) and 1.4-inch I.D. (Standard Penetration Test, SPT) samplers at various depths. The samplers were driven into subsurface soils under the impact of a 140-pound hammer having a free fall of 30 inches. The blow counts are presented on the Log of Test Boring (LOTB) in Appendix A. When

correlating standard penetration data, the blow counts for the Modified California Sampler may be converted to equivalent SPT blow counts by multiplying a conversion factor of 0.65. The samples were sealed and transported to our laboratory for further evaluation and testing. The field investigation was conducted under the supervision of our field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation.

Gregg Drilling & In Situ, Inc. of Martinez, CA, performed the CPTs on October 26, 2009 and January 28, 2010. The CPTs were conducted by using a 20-Ton capacity cone with a 60-degree cone attached to a 1.7-inch diameter (tip area of 15 cm^2) rod. The soil resistance exerted to the tip and side of the cone were recorded and correlated to "Soil Behavior Type", classification and strength characteristics. The following table summarizes the boring program.

TABLE 2 – EXPLORATION PROGRAM

Boring No.	Purpose	Boring No.	Purpose
A-09-001	Green Valley Road OC (Over SB 680 On-Ramp)/Retaining Wall No. 7	A-09-122	Retaining Walls No. 1 & 3
A-09-002	Green Valley Road OC (Over SB 680 On-Ramp)/Retaining Walls No. 8 & 9	A-09-123	Retaining Wall No. 1 & 3
A-09-003	Green Valley Road OC/ Retaining Walls No. 8 & 9	A-09-124	Embankment/ Retaining Wall No. 4
CPT-10-003A	Green Valley Road OC/ Retaining Walls No. 8 & 9	A-09-125	Embankment/ Retaining Wall No. 4
R-10-003A	Green Valley Road OC/ Retaining Walls No. 8 & 9	A-09-126	Embankment/ Retaining Walls No. 5 & 6
R-10-004A	Green Valley Road OC/ Retaining Wall No. 6	A-09-127	Embankment/ Retaining Walls No. 5 & 6
CPT-09-004	Green Valley Road OC/ Retaining Wall No. 6	A-09-128	Embankment/ Retaining Walls No. 5 & 6
A-09-005	Green Valley Road OC	R-10-128A	Embankment/Retaining Walls No. 5 & 6
CPT-10-005A	Green Valley Road OC	CPT-10-129A	Embankment/ Retaining Walls No. 5 & 6
A-09-006	WB 80 to WB 12 Separation (Over WB 80 On-Ramp)/Retaining Walls No. 1 & 2	A-09-129	Embankment/ Retaining Walls No. 5 & 6
CPT-09-007	WB 80 to WB 12 Separation (Over WB 80 On-Ramp)	A-09-130	Embankment/ Retaining Wall No. 10
CPT-09-008	WB 80 to WB 12 Separation (Over WB 80 On-Ramp)	A-09-133	Embankment/ Retaining Wall No. 7
A-09-009	WB 80 to WB 12 Separation (Over WB 80 On-Ramp)/Retaining Wall No. 4	R-10-133A	Embankment/ Retaining Wall No. 7
R-10-009A	WB 80 to WB 12 Separation (Over WB 80 On-Ramp)/Retaining Wall No. 4	A-09-134	Embankment/ Retaining Wall No. 7
A-09-111	WB 80 to WB 12 Grade Separation	A-09-135	-*

Boring No.	Purpose	Boring No.	Purpose
A-09-112	WB 80 to WB 12 Grade Separation	A-09-136	-*
A-09-114	Cut	A-09-137	-*
A-09-119	Embankment	A-09-138	-*
A-09-120	Embankment/Retaining Wall No. 2	A-09-139	-*
A-09-121	Embankment/Retaining Walls No. 1 & 2	A-09-140	-*
R-12-151	Embankment/ Retaining Wall No. 10	R-12-M001	Cut
R-12-M002	Cut		

*Note: Borings A-09-135 to A-09-140 were initially drilled for a proposed retaining wall, which has been removed from the scope.

The approximate locations of these explorations are presented in Appendix A (Log of Test Borings, Sheets No. 1 to 5).

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

5.2 Geologic Mapping

According to the State Earthquake Fault Zone Map of the Cordelia Quadrangle (1993), portions of the project are located within the Earthquake Fault Zone. William Lettis and Associates, Inc. (WLA) was contracted by Solano Transportation Authority (STA) to perform fault rupture hazard characterization study. Detail geologic mapping was conducted as part of their study. We have referred to their draft report, “Assessment of Fault Rupture and Analysis of Displacement Hazard”, dated January 2009 as the primary basis of our study for the proposed interchange project.

Within the project limit, the majority of the project site generally consists of native alluvium and roadway fill. However, there are rock outcrops along SR 12, located west of I-80. The area studied by WLA, depicted as “Green Valley Project Site” in their report, is located directly west of the interchange of SR 12 and I-80 and east of Red Top Road.

The geologic mapping in this area was conducted primarily by observing the exposures from cuts produced by past quarrying operations along the margin of the Quarry Hill and cuts along the railroad corridor south of SR 12. WLA used the compiled available geologic data, coupled with aerial photography, historic topographic maps, high-resolution topographic data (shaded relief of DEM from LiDAR) to develop a base map.

5.3 Geophysical Studies

Two seismic refraction profiles were collected and interpreted by NORCAL Geophysical Consultants, Inc. at the location of the planned cut slopes after receiving the right-of-entry in September 2012. The purpose of the seismic refraction surveys was to measure seismic p-wave velocities to aid in characterizing the underlying rock and to quantify seismic compressional wave velocities as they pertain to rippability. The report prepared by NORCAL Geophysical Consultants, Inc. (dated November 14, 2012) is attached in Appendix E of this report.

The interpreted cross sections indicate the velocities of the underlying layers. In general, the seismic refraction surveys revealed that the upper 5 to 15 feet consists of very weathered, soil-like materials with velocities ranging from 1,000 to 4,000 ft/sec. Beneath that, weathered rock to fresh hard rock (above 5,000 ft/sec) is indicated. We have also reviewed the results of the geophysical surveys that were previously conducted by WLA adjacent to Route 12, including seismic refraction survey and electrical resistivity profiles. Detailed discussions regarding the rippability are presented in Section 8.2.2.

5.4 Instrumentation

The subject was considered and was determined to be not applicable to the project.

5.5 Exploration Notes

The exploratory borings mainly encountered undivided surficial deposits. Drilling conditions using hollow stem augers/rotary wash drilling method with rock coring were considered normal for this site.

6. GEOTECHNICAL TESTING

6.1 In-Situ Testing

In-situ testing consists of recording blow counts during sampling (using both Modified California sampler and Standard Penetration Test sampler) and performing CPTs in the field. Based on our previous experience, when correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler may be converted equivalent SPT blow

counts by multiplying a conversion factor of 0.65. Based on the average values of the SPT-N values for the soil materials encountered in the field exploration, the subsurface soils are classified generally as stiff to hard cohesive soils with lenses of loose to very dense cohesionless soils.

The CPTs were conducted using a 60-degree cone attached to a 1.7-inch diameter (tip area of 15 cm^2) rod pushed into the subsurface. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil behavior type and strength characteristics. The in-situ test results are presented on the LOTB attached in Appendix A.

6.2 Laboratory Testing

Laboratory tests performed for the study include the following: Laboratory determination of Moisture (California Test Method 226), Unit Weight (California Test Method 212), Atterberg Limits (California Test Method 204), Grain Size Analysis (California Test Method 202), R-value Test (California Test Method 301), Consolidation Test (California Test Method 219), Resistivity and pH Test (California Test Method 643), Sulfate Content (California Test Method 417), and Chloride Content (California Test Method 422). The laboratory test results are attached in Appendix B.

7. GEOTECHNICAL CONDITIONS

7.1 Site Geology

The Jameson Canyon area and to the north is largely underlain by broadly folded Eocene Markley Formation and flat or gently tilted Pliocene Sonoma Volcanics. The Sonoma Volcanics are mostly andesitic tuff and breccias, but there is also some basalt and rhyolite. The area east of the Green Valley Fault is largely underlain by late Pleistocene to Holocene alluvial fan deposits.

The Green Valley Fault, which intersects the project area, separates the Sonoma Volcanics from the Cretaceous. Great Valley Sequence on the east. (CGS 2002, Bezore, S.P., Wagner, D.L, and Sowers, J.M., Geologic Map of Cordelia 7.5' Quadrangle, Solano and Napa Counties, California).

General geologic conditions at the site were evaluated by reference to the Geologic Map of the Cordelia 7.5’ Quadrangle, Solano and Napa Counties, California by Bezore, S.P., Wagner, D.L., and Somers, J.M., 1998. Descriptions of the main geologic units are presented as follows:

af - Artificial fill

Qhc - Modern stream channel deposits. Channel bed and bank deposits of the major present-day creeks and streams. Deposits are late Holocene to modern in age and consist of loose fluvial sand, gravel, and silt.

Qhf - Holocene fan deposits. Holocene alluvial fan sediments, deposited by streams emanating from the mountains as debris flows, hyper-concentrated mudflows, or braided stream flows. Sediments include sand, gravel, silt, and clay that are moderately to poorly sorted, and moderately to poorly bedded.

Qf - Late Pleistocene to Holocene fan deposits. Gently sloping, fan-shaped, relatively undissected alluvial surfaces where late Pleistocene or Holocene age was uncertain or where the deposits of different age interfinger such that they could not be delineated at the map scale. Sediments include sand, gravel, silt, and clay that were moderately to poorly sorted, and moderately to poorly bedded.

Qa - Late Pleistocene to Holocene alluvium, undivided. Alluvium deposited in small valleys where separate fan, basin, and terrace units could not be delineated at the map scale, and where Holocene or Pleistocene age was uncertain. The unit includes flat, relatively undissected fan, terrace, and basin deposits, and small active stream channels.

Qpf - Late Pleistocene alluvium, undivided. Gently sloping, fan-shaped, alluvial surfaces where late Pleistocene age is indicated by slight dissection and/or development of alfisols.

<u>Sonoma Volcanics</u>

Tss - Sandstone and volcanic gravel (Pliocene). Poorly consolidated tan sandstone and tuffaceous sandstone with lenses of volcanic conglomerate. The sandstone contains sparse flakes of white mica, probably derived from the Markley sandstone.

Tst - Ash-flow tuff (Pliocene). Pumicitic, locally welded, with bedded agglomeritic tuff.

Tsa - Andesites (Pliocene). Andesitic flows, breccias, and agglomerates. Agglomerate composed of fine gravel to cobble-size clasts of andesite, ruff and vitrophyre.

Tmk - Markley Formation (Eocene). Gray to yellow-brown, micaceous marine arkosic sandstone. Massive to well-bedded; contains abundant muscovite.

The portion of the published geologic map that includes the project area is shown on Plates 2A and 2B. Subsequent investigation has identified more fault traces that are not shown on this publication.

The draft report done by WLA (dated January 2009) includes a local geologic map (Figure 7 of WLA report) that delineates the distribution of bedrock and surficial materials with observed bedding orientations shown in the area west of the intersection of SR12 and I-80.

7.1.1 **Lithology**

The majority of the project site generally consists of native alluvium and roadway fill. However, rock formations were observed and mapped in the area west of the intersection of SR 12 and I-80, where the cut slopes north of SR 12 are planned. Based on the published geologic map, the area is generally underlain by Pliocene Sonoma Volcanics (tuffaceous sandstones, siltstone, agglomerate, andesites, and ash-flow tuff) on the east juxtaposed against Eocene Markley Formation to the west.

7.1.2 **Structure**

Based on the published geologic map (Bezore, 1998), there is no bedding strike and dip symbol within the proposed cut slope. According to the draft report prepared by WLA (dated January 2009), the bedding orientations within this area generally dip steeply toward the west and strike northward.

After visiting the site and reviewing the aerial photos, we determined that historic quarrying has left several large pits in the hillsides north of the planned cut that expose various volcanic rock types. The "beds" of the various rock types strike 10 to 20 degrees northeast and dip steeply (75 to 80 degrees below horizontal) toward the west. As a result, the planned cut slope will cross the geologic structure at nearly a right angle which should expose the various beds as nearly vertical "stripes".

The site of the planned cut slopes is underlain by andesite agglomerate and tuffaceous sandstone (welded pebbly ashfall deposits) of the Sonoma Volcanics formation. The andesite consists of light to dark gray, vesicular semi-rounded blocks (4 inches to several feet in diameter) of very hard volcanic rock. The agglomerate consists of smaller (1 to 6 inch diameter) very rounded pebbles and cobbles of andesite in a sandy matrix. The tuffaceous sandstone consists of light buff-colored rounded pebbles of volcanic tuff in a sandy matrix that appears to have been thermally welded together when it was deposited as an ashfall.

Based on the above, an adverse bedding condition in Sonoma Volcanic is not expected for the proposed excavation. However, localized joint planes may dip toward the proposed cut face.

7.1.3 **Existing Slope Stability**

The slopes within the project vicinity consist of man-made embankment slopes at the existing bridge abutments of the interchanges. These existing slopes, typically having

gradients of 2H:1V or flatter, are covered with vegetation, and generally appear to be in good condition.

Our engineering geologist observed the existing slope located south of SR 12, along the north side of the railroad corridor. The existing slope is steeper than 2H:1V and appears to be stable, except for localized erosion of raveling of gravels.

7.2 Subsurface Soil Conditions

As mentioned in the previous section, majority of the project site generally consists of native alluvial and roadway fill. Based on the boring data and the as-built LOTB, the subsurface soil conditions of the site generally consist of varying thickness of stiff to hard clay/silt interbedded with medium dense to very dense sand layers to the maximum depth explored (161.5 feet below existing grade). Loose, submerged silty sand/clayey sand layers, which are subject to liquefaction, were encountered in some borings.

Based on the proposed improvements along the project, we have subcategorized the project into several segments. The following paragraphs summarize the subsurface conditions at each area.

- ***Cut Slope between Sta. 61+00 and 75+00 ("JW" Line)***
  This area is generally underlain by Sonoma Volcanics (Ash-flow tuff and Andesites, Pliocene) and Markley Formation (Eocene). Two borings (Boring A-09-111 and A-09-112) were drilled from the roadway level in this area, which are located on the south side of SR 12, about 550 and 850 feet west of Red Top Road, respectively. The borings generally encountered predominantly granular materials, consisting of medium dense to very dense clayey and silty sand.

  The site of the planned cut slopes is underlain by andesite agglomerate and tuffaceous sandstone (welded pebbly ashfall deposits) of the Sonoma Volcanics formation. Two additional borings were drilled recently after receiving the right-of-entry. Boring R-12-M001 encountered hard tuffaceous sandstone very near the ground surface. That material was present to the total depth drilled (61.5 feet). Except for a few joints, the only remarkable feature was the distinctive bright red color below a depth of 35 feet. Boring R-12-M002 encountered blocky andesite and agglomerate in the first 8.5 feet. Below that depth, tuffaceous sandstone (essentially the same character as that encountered in Boring R-12-M001) was found to the total depth drilled (31.0 feet). However, the weathered tuff is relatively weak above 20 feet.

- ***Embankment between Sta. 75+00 to 100+00, "JW" Line, including WB 80 to WB 12 Grade Separation and RW02 thru RW04***
  Based on the borings, the subsurface conditions consist of stiff to hard fine-grained material (lean clay/sandy lean clay) with interbedded medium dense sand layers (silty/clayey sand) at various depths.

  The sand layer appears to be at shallower depth west of the proposed grade separation structure. Borings A-09-120 and A-09-121, located west of the proposed grade separation structure, encountered silty sand layer at about 20- to 30-foot depths below existing grade. Based on Borings A-09-009, R-10-009A, A-09-124 and CPT-09-007 & CPT-09-008, located east of the proposed grade separation structure, an approximately 5-foot-thick silty/clayey sand layer, was encountered at about 15- to 20-foot depth in all locations. Boring A-09-124 encountered another thicker sand layer between 20- and 30-foot depths.

- ***Embankment at North Abutment of Green Valley Road OC/RW05, RW06 & RW10***
  In general, the subsoils consist of interbedded very stiff to hard silt/clay in the upper depths overlying medium dense to dense sand. It appears that granular materials are more prominent toward the northeast and the clay thicknesses appear to be thicker on the southwest.

  Up to 40 feet of sandy lean clay was encountered on the southwest side of RW05 and RW06 (per Boring A-09-126). The thickness of the clay layer decreases to about 30 feet toward the proposed Green Valley Road Overcrossing. Based on the boring/CPT data (CPT-09-004 & R-10-004A), located at the planned location of Abutment 3 of Green Valley Road OC, the upper sandy lean clay is underlain by 20 feet of silty sand. Below 50-foot depth, the boring/CPT generally encountered another 20 feet of silt and 20 feet of sand layer to about 100 feet, underlain by very stiff to hard silt to 160 feet, the maximum depth explored.

  According to the boring data (A-09-130 & R-12-151), the subsoils consist of about 25 to 30 feet of lean clay overlying 25 to 50 feet of dense to very dense silty sand along the approach embankment at Abutment 3 of the proposed Green Valley Road OC. The sand formation is generally underlain by stiff to hard fine grained materials. Boring R-12-151 encountered very dense poorly-graded sand between 75- and 95-foot depths.

- ***Green Valley Road OC, Green Valley Road Temporary OC/RW07 thru RW09***
  The proposed RW08 and RW09 will support the embankment between Green Valley Road OC and Green Valley Road Temporary OC, and RW07 is located along the northeast side of the approach embankment at Abutment 1 of Green Valley Road Temporary OC.

Based on the boring data (A-09-002, A-09-003 & R-10-003A), the planned location of RW08 & RW09 are underlain by interbedded silty sand and low plasticity silt. Granular materials are more prominent toward north. The subsoils generally consist of about 15 feet of lean clay, 10 feet of silty sand and about 10 to 20 feet of sandy silt. Below previous depth, the borings encountered silty sand, and the thickness ranges from 20 to 30 feet on the north end to about 5 feet on the south end. Below the sand layer, the borings encountered another 15 to 25 feet of sandy silt, overlying very dense silty sand. Hard silt was encountered below the silty sand layer in Borings A-09-003 and A-09-002 to about 100 feet, the maximum depth drilled.

Along the planned location of RW07, the borings encountered about 30 to 40 feet of sandy lean clay, and the clay appears to be thicker toward southeast. Below the clay layer, the borings encountered about 25 feet of silty sand. Boring A-09-001 encountered stiff to hard sandy silty/sandy lean clay to approx. 95-foot depth, overlying very dense silty sand to 100 feet, the maximum depth drilled.

Detailed descriptions of the materials encountered in the exploratory borings are presented in the LOTB in Appendix A "Log of Test Borings". It should be noted that these descriptions and related information depict subsurface conditions only at the locations indicated and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface soil conditions at other locations may differ from conditions occurring at the locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted due to field limitations. Also, the passage of time may result in a change in the soil conditions at the locations due to environmental changes.

7.3 Water

7.3.1 Surface Water

The terrain along I-80 and SR-12 slightly slopes downward from west to east within the project vicinity. The surface water/drainage generally follows the ground topography and is collected in local storm drainage system.

7.3.1.1 Scour

The subject was considered and was determined to be not applicable for the roadway project.

7.3.1.2 Erosion

The existing slopes have established landscaping to help control erosion. Erosion within the project limits is minimal. Localized erosion and raveling may occur within some poorly cemented rock layers exposed by excavation in the cut slopes, while soils within the flatter regions of the project area are classified as no hazard to slight hazard of erosion. This project should not adversely affect erosion within or outside the project limits.

7.3.2 Groundwater

Groundwater was encountered in most of the borings during drilling at approximate elevations ranging from Elev. -2.1 feet (Boring A-09-005) to 92 feet (Boring A-09-111). It was also encountered as shallow as 8.5 feet to 26.0 feet below grade. A summary of the groundwater data is presented in the following table for at each location.

TABLE 3 – SUMMARY OF GROUNDWATER

Location	Groundwater Elevation (ft)	Groundwater Depth (ft)	Design Groundwater Elevation (ft)
Area west of Sta. 65+00 “JW” Line	92.0 (A-09-111)	18.0	95.0
Cut Slope from Sta. 65+00 to 75+00 "JW" Line	Not encountered	Not encountered	80.0
Embankment from Sta. 75+00 to 100+00 "JW" Line/WB 80 to WB 12 Separation (Over WB 80 On-Ramp)/RW02 thru RW04	24.0 (A-09-009) to 34.5 (A-09-120)	8.5 to 21.0	27.5 to 35.0
Green Valley Road OC/Green Valley Road OC (Over SB 680 On-Ramp)/RW05 thru RW09/Approach Embankment	-2.1 (A-09-005) to 12.0 (A-09-126)	12.0 to 26.0	15.0

Between Sta. 65+00 and 75+00, two more borings were recently drilled. However, the explorations were advanced by rotary drilling method in order to collect rock core samples. Two borings in the vicinity were advanced by hollow stem augers, but groundwater was not encountered during drilling (Boring A-09-112 and A-09-119). According to the site condition, geologic settings and the topography, groundwater level is expected to be relatively low within this area. Perched water may be expected between soil and rock interface. We have assumed groundwater at Elev. 80 feet for design purpose. It is anticipated that groundwater level will vary with the passage of time due to seasonal runoff, groundwater fluctuations, surface and subsurface flow, ground surface run-off, and other factors that were not existent at the time of investigation.

7.4 Project Site Seismicity

7.4.1 Ground Motions

The project is located in a seismically active part of northern California. Many faults that exist in the San Francisco Bay Area are capable of producing earthquakes that may cause strong ground shaking at the site. The proposed project is generally located between Cordelia Fault and Green Valley Fault. The attached Fault Map (Plate 3) presents the locations of the fault systems relative to the project site.

Maximum magnitudes for the two major faults in the area are determined by Caltrans' 2007 Deterministic PGA Map. These maximum moment magnitudes represent the largest earthquakes that a fault is capable of generating and is related to the seismic moment. The Green Valley fault is crossed by the western portion of the project. The information of the faults within close proximity of the project is summarized below.

TABLE 4 – FAULT DATA

Fault (Fault I.D.)	Maximum Magnitude (M_{max})	Fault Type	Fault distance	
			Green Valley Rd OC & Green Valley Rd OC (Over 680 On-Ramp)	WB 80 to WB 12 Separation (Over WB 80 On-Ramp)
Green Valley fault (213)	6.9	RLSS*	Approx. 1.0 mi.	Approx. 0.5 mi.
Cordelia fault (212)	6.7	RLSS*	Approx. 0.15 mi	Approx. 0.7 mi.

*Note: RLSS=Right Lateral Strike Slip

7.4.2 Ground Rupture

The State Alquist-Priolo Earthquake Fault Zones Map of the Cordelia Quadrangle shows the extent of the zone established by the State Geologist along the Green Valley Fault where it was mapped through the project area. STA contracted with William Lettis and Associates, Inc. (WLA) to perform site-specific fault study. Caltrans is currently reviewing the report for final acceptance.

All proposed retaining walls and the structures, including Green Valley Road Overcrossing, Green Valley Road Overcrossing (Over SB 680 On-Ramp), and WB 80 to WB 12 Separation (Over WB 80 On-Ramp) structure, are not located within the State Alquist-Priolo Earthquake Fault Zones. The potential for fault rupture is expected to be relatively low since no active faults are known to pass through.

8. GEOTECHNICAL ANALYSIS AND DESIGN

8.1 Dynamic Analysis

8.1.1 Parameter Selection

Caltrans has updated the 1996 Seismic Hazard map with the new Caltrans Deterministic PGA Map (2008) and the Caltrans ARS Online (V1.0.4) design spectrum for the development of response spectra for design. The new design methods incorporate both deterministic and probabilistic seismic hazards to produce the Design Response Spectrum. Since the V_{s30m} at the project site is less than 300 m/s, we have compared the data to the 2008 USGS Deaggregation per the design guideline. Consequently, the probabilistic response spectrum to be used for design of the bridge structures is governed by the data from the 2008 USGS Deaggregation. The ARS curves are presented in Appendix C of the report.

According to the response spectra, we have assumed an average Peak Ground Acceleration of 0.7g for evaluating liquefaction potential and retaining wall design within the project limit. The seismic design criteria for the three main structures are summarized in the following table:

TABLE 5 – SUMMARY OF SEISMIC DESIGN

Structure	Location	V_{s30m} (m/s)	Peak Ground Acceleration
Green Valley Road OC	38.2161°N 122.1387°W	200 m/s (liquefaction case); 225 m/s (non-liquefaction case)	0.669g
Green Valley Road OC (Over SB 680 On-Ramp)	38.2154 °N 122.1383°W	205 m/s (liquefaction case); 285 m/s (non-liquefaction case)	0.748g
WB 80 to WB 12 Separation (Over WB 80 On-Ramp)	38.2114°N 122.1468°W	205 m/s (liquefaction case); 255 m/s (non-liquefaction case)	0.692g

8.1.2 Analysis

As mentioned above, an average PGA of 0.7g was used for liquefaction analysis. Per Caltrans design guidelines (Guidelines for Structures Foundation Reports manual, Ver. 2.0, 2006), the slope stability under seismic loading condition should be analyzed by using a seismic factor, k, equals to one third of the horizontal peak acceleration and not exceeding 0.2g. Therefore, the pseudo-static analysis should be conducted with k of 0.2g.

According to the latest revised standard plans and the standard detail sheets, the standard walls are designed according to a seismic acceleration coefficient (k_h) of 0.2. Per the discussion between the design team and the Caltrans representative, it is our understanding

that the seismic acceleration coefficient equals to one-third of peak acceleration per Section 5.2.2.3 of the Caltrans Bridge Design Specifications (BDS, August 2004). For the proposed retaining walls within the project limit, we have assumed an average PGA of 0.7g for retaining wall design, and the seismic acceleration coefficient (k_h) of 0.23 is recommended. Based on our discussions with the structure engineers, the increase of k_h does not appear to govern the wall design. Standard plans and standard detail sheets are considered adequate and will be adopted for the proposed retaining walls (both cantilever and MSE) within the project limit.

8.1.3 **Liquefaction Potential**

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils, which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

Based on The Susceptibility Map of the San Francisco Bay Area by (USGS Open-File Report 2006-1037, 2006) by Robert C. Witter, Keith L. Knudsen, Janet M. Sowers, Carl M. Wentworth, Richard D. Koehler, and Carolyn E. Randolph, the project vicinity is generally exposed to moderate liquefaction.

Site-specific liquefaction analyses were performed for the project. The liquefaction potential was evaluated in accordance with the methods proposed by Youd, et al. (2001) using the boring and CPT data. As indicated by recent advances in soil liquefaction engineering (Bray, 2006), for soils with sufficient fines content so as to separate the coarser particles and control behavior, liquefaction appears to occur primarily in soils where these fines are either non-plastic or are low plasticity silts and/or silty clays (PI<12%, and LL<37%), and with high water content relative to their LL (W%> 0.85LL).

An average PGA of 0.7g was adopted for liquefaction analysis. With the high PGA, submerged granular materials with $N_{1,60,CS}$ less than 30 are generally found to be potentially liquefiable. Submerged soils with CPT data showing I_C<2.6 (most likely granular) and $q_{C1N,CS}$ less than 160 tons/ft^2 are also considered liquefiable, unless sampling and laboratory data from neighboring borings suggested otherwise.

Based on our analysis, potentially liquefiable soils were identified at various locations and depths. We have reviewed and compared all the available data from the borings and CPTs. Per our discussion with the Caltrans Geotechnical Engineers, boring data is the preferred source for liquefaction analysis, particularly the ones conducted with rotary wash drilling

method, when available. In general, liquefaction potential is considered moderate to high within the project limit.

The corrected $N_{1,60,CS}$ in some of the liquefiable soils are relatively high and close to 30. The laboratory test results also indicate that the fines contents are generally high (greater than 35%) for some of the sand layers encountered. The anticipated 100% development of pore pressure in such materials (i.e. high $N_{1,60,CS}$, high fines content) may be more correctly ascribed to "cyclic mobility", which results in limited soil deformations without liquid-like flow. In our opinion, the engineering consequences of such phenomenon in those layers may be limited to temporarily loss of strength. Volumetric strain induced by liquefaction, i.e. post-liquefaction settlement, is considered relatively small.

In general, liquefaction hazards are most severe in the upper 50 feet of the surface as mentioned in Special Publication 117A (CGS, 2008). In our opinion, the impact due to the potential liquefiable soils below 50 feet is considered insignificant, especially when the layer is relatively thin and discontinuous.

Based on the analysis, surface manifestation of ground failure might not be anticipated, and the extent and consequences of this liquefaction is limited to some post-liquefaction settlements of the ground surface. Detail discussions regarding the liquefaction potential at each location are summarized as follows:

- ***Cut Slope between Sta. 61+00 and 75+00 ("JW" Line)***
  Based on the available boring and geologic data, the area is underlain by volcanic and sedimentary rock. The liquefaction potential is deemed low and is not considered for foundation design.

- ***Embankment between Sta. 75+00 to 100+00, "JW" Line, including WB 80 to WB 12 Separation (Over WB 80 On-Ramp) and RW01 thru RW04***
  New embankment, between approx. Sta. 83+40 and Sta. 100+20, is planned along the future alignment of WB 80 to WB 12 connector. Within this section, four retaining walls (RW01 thru RW04) and one grade separation structure are proposed. Based on the subsoil condition and our analysis, liquefaction potential is considered moderate to high. The liquefaction analysis results are sub-categorized into three sections and are summarized in the following paragraphs:

  West of Sta. 90+00 "JW" Line. Borings A-09-120 & A-09-121 encountered about 10 feet of medium dense to dense silty sand at 20-foot depth, which may be subject to liquefaction during earthquake. However, the fines contents and the corrected $N_{1,60,CS}$ are relatively high. The analysis results are summarized in the following table:

Boring No.	Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in) (1)
A-09-120	19.0' to 32.0'	19.5	SM	0.60	24.3	30% (2)	- (3)
		24.5	SM	0.38	18.1	47%	- (3)
		29.5	SM	0.29	14.8	25%	1.5±
	Below 42.5'	44.5	SM	0.46	23.9	27%	- (3)
A-09-121	22.0' to 33.0'	24.5	SM	0.91	29.9	33%	- (3)
		29.5	SM	-	40.9	30%	-

Notes:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992)
(2) Fines contents estimated from laboratory test results in similar soil strata.
(3) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was neglected.

Boring A-09-006 indicates that granular materials were encountered at greater depth, approx. at 52- to 56.5-foot depth, 65.5- to 74-foot depth and 84- to 94.5-foot depth. Based on the site geology (Qpf, late Pleistocene) and the depths of these strata (greater than 50 feet), the impact to foundation design of these layers is considered low.

Between Sta. 90+00 and 95+50 "JW" Line. Within this segment, the boring and CPT data indicate that an approximately 5-foot-thick sand layer was encountered at approximately 15 to 20 feet deep in CPT-09-007, CPT-09-008, A-09-123, A-09-009 and R-10-009A. According to our analysis, this submerged and loose sand layer may be subject to liquefaction during a strong earthquake event. Liquefaction potential and its engineering consequences were estimated mainly based on the data from Boring R-10-009A, which was recently conducted by rotary wash drilling method. The analysis results are summarized in the following table:

Boring No.	Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
R-10-009A	15.0' to 21.0'	17	SM	0.37	14.2	33%	1.0~1.5 (1)
		20	SM	0.53	21.5	26%	

Note:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992)

East of Sta. 95+50 "JW" Line. Boring A-09-124 also encountered a 5-foot-thick silty sand layer at about 12 feet below grade, which is consistent with the soil strata between Sta. 90+00 and 95+50. In addition, the boring also encountered another sand layer between 21.5- and 32-foot depths, which is also considered liquefiable.

Boring A-09-125 encountered medium dense silty sand layer from 22 to 31.5 feet and below 41 feet deep. Based on the analysis results, the sand layer between approximately 26.5- and 31.5-foot depths is considered liquefiable. The sand layer encountered below 41 feet is relatively deep, and its fines content is relatively high. Therefore, the impact to the foundation design of the proposed retaining walls is considered minor. The analysis results are summarized in the following table:

Boring No.	Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in) (1)
A-09-124	12' to 17'	14.5	SM	0.39	15.6	33%	1± (1)
	21.5' to 32.0'	24.5	SP-SM	0.46	21.5	7% (2)	3~3.5 (1)
		29.5	SM	0.33	16.9	19%	
A-09-125	22.0' to 31.5'	24.5	SM	-	33.9	19%	-
		29.5	SM	0.39	19.5	29%	1.5± (1)
	Below 41'	44.5	SM	0.39	20.9	40%	- (3)
		49.5	SM	0.77	29.8	40% (2)	- (3)

Notes:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992)
(2) Fines contents estimated from laboratory test results in similar soil strata.
(3) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was neglected.

- ***Embankment at North Abutment of Green Valley Road OC/RW05, RW06 & RW 10***

Based on the boring/CPT data, the potentially liquefiable soils were identified at various depths. We have used the data from Boring R-10-004A and R-10-128A as the prime source for liquefaction evaluation. Liquefiable soils were identified in the following layers:

Boring No.	Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
R-10-004A	30.0' to 36.0'	31	SM	0.38	19.6	16%	2.0(1)
		36	SM	0.29	15.3	16%	
	45.0' to 50.0'	45	SM	0.62	27.8	18%	2.0(1)
		48	SM	0.30	15.6	2%	
	60.0' to 67.5'	61	ML	0.65	27.2	30%	- (2)(3)
		66	ML	0.68	27.5	30%	
R-10-128A	28.0' to 33.0'	31	SP-SM	0.57	26.0	12%	- (2)
	33.0' to 38.0'	36	SP-SM	0.23	11.7	20% (2)	2.5
	38.0' to 45.0'	39~42	SM	0.6±	27~28	24%	- (3)
	45.0' to 47.0	45	SM	0.35	18.6	13%	0.5
	53.5' to 62.0'	57~65	SM	0.5±	21~26	17%~52%	- (3) (4)

Notes:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992)
(2) Fines contents estimated from laboratory test results in similar soil strata.
(3) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was neglected.
(4) The depth of the liquefiable soils is greater than 50 feet below existing grade. The impact is considered insignificant.

The post-liquefaction settlement is expected to be on the order of 3 to 4 inches at Abutment 3 of Green Valley Road Overcrossing, which is considered as the worst-case-scenario. Based on the other borings and CPT, the post-liquefaction settlement is expected to be random and localized.

At the planned location of Retaining Wall No.10, the liquefaction potential was primarily evaluated according to the recent boring data (Boring R-12-151), which was advanced by rotary wash drilling method. Based on the boring data, the liquefaction potential is considered low. However, a layer of loose silty sand was encountered in the nearby boring, Boring A-09-130 (advanced by hollow stem augers), between about Elev. 0 and -10 feet. Based on the laboratory test result, the fines contents are relatively high (F.C.=49%). Based on the Atterberg limits from R-12-151 at the similar depth, the plasticity index (PI) is about 15, which is greater than 12 (Bray 2006). Therefore, liquefaction potential is not considered for foundation design.

- ***Green Valley Road OC, Green Valley Road OC (Over WB 80 On-Ramp)/RW07 thru RW09***

  Within this area, the potentially liquefiable soils were identified at various depths. We have used the data from Boring A-09-002, R-10-003A and R-10-133A as the main data for liquefaction evaluation. Liquefiable soils were identified in the following layers:

Boring No.	Soil Layer	Sample Depth (ft)	Soil Type	F.S.	$N_{1,60,CS}$	Fines Contents (-#200)	Approx. Post-Liq. Settlement (in)
R-10-003A	12.5' to 15.0'	14	SM	0.46	18.1	19%	0.75 (1)
	15.0' to 22.5'	17	ML/SM	0.73	26.6	35%	- (3)
		21	ML/SM	0.86	29.0	10%	- (3)
		26	ML/SM	0.72	28.1	35%	- (3)
	32.5' to 40.0'	36	ML/SM	0.57	26.4	49%	- (3)
		39	ML/SM	0.54	25.7	49%	- (3)
A-09-002	14.0' to 18.0'	14.5	SC	0.63	23.5	>35%	- (3)
	18.0' to 22.5'	19.5	SM	0.71	26.8	37%	- (3)
	38.5' to 42.0'	39.5	ML	0.45	23.6	>50%	- (3)
	42.0' to 47.0'	44.5	SM	0.50	25.3	20%	- (3)
R-10-133A	42.5' to 50.0'	43	SM	0.65	28.1	40%	- (3)
		46	SM	0.61	27.4	35% (2)	

Notes:
(1) The post-liquefaction settlement was estimated per Ishihara and Yoshimine (1992)
(2) Fines contents estimated from laboratory test results in similar soil strata.
(3) Due to the high $N_{1,60,CS}$ and/or high fines contents, the mechanism was considered as "Cyclic Mobility" where post-liquefaction settlement was neglected.

The low plasticity silt was encountered in Boring R-10-003A between about 67- and 70-foot depths. However, this is relatively deep with high fines content. Therefore, the impact to the foundation design of this liquefiable layer is considered low. An additional boring was drilled in February 2012 for RW10, located north of the intersection of I-80 and Green Valley Road. Based on the liquefaction analysis, the liquefaction potential is considered low as the $N_{1,60,CS}$ of the submerged sand are greater than 30. Therefore, liquefaction is not considered for foundation design of RW10.

8.1.4 Liquefaction Mitigation

Due to the high liquefaction potential at the project site, we have evaluated the potential of lateral spreading per Caltrans latest guideline (February 2011). As a result, the liquefaction induced lateral spreading will be a design issue for the embankment and Retaining Wall No. 8 (MSE wall) and Retaining Wall No. 9 (Caltrans Standard Type 1) at Abutment 1. Consequently, ground improvement is proposed to mitigate the potential hazard.

Several ground improvement methods, such as dynamic compaction, stone columns, cement deep soil mixing (CDSM) and Controlled Low Strength Material (CLSM) columns are commonly used in California. However, based on the subsurface condition, CLSM column ground improvement method is deemed more appropriate and cost-effective for the proposed project. CLSM columns may be a proprietary method and its applicability

should be verified with the contract requirement. We engaged Acacia Consultants & Engineers (Acacia CE) to perform the design of the CLSM system.

The CLSM columns are formed in drilled or displaced soil cavity. The columns replace or displace the compressible or liquefiable soil with cemented CLSM. It is recommended that these ground improvement columns be separated from the bottom of the footings using a layer of compacted Aggregate Base (AB). No connectivity of the ground improvement columns and overlying structural element should be anticipated. Lateral resistance is provided by the friction at the footing/concrete to crushed rock interface and passive resistance of the side of the footing. In addition, CLSM ground improvement columns provide enhanced engineering properties for the matrix soil/CLSM column composite. The composite improved ground provides increased density and shear capacity to resist liquefaction and increased shear resistance for global stability of supported structures.

The target strengths of the CLSM backfill material are generally on the order of 200 to 750 psi at 28 days, depending on load demands. The CLSM strength is tested using standard sampling and loading methods. The settlement properties of the improved soil/CLSM composite can be verified using a full scale modulus load test.

The CLSM columns generally are constructed with a minimum 18 inch diameter and maximum 36 inch diameter displacement barrels above a short section of standard auger. For Drill Displacement CLSM columns the expanded cavities are filled with CLSM under pressure as the displacement auger is withdrawn.

8.2 Cuts and Excavations

As part of the project, the area west of the intersection of I-80 and SR 12 will be excavated to accommodate the new alignment from WB 80 to WB SR 12. A major cut is proposed on the north side of SR 12 in the vicinity west of I-80, cutting through the existing hill. Based on the plans provided by the designer, the cut slope will be up to about 70 feet high with a gradient of 2(H):1(V) or flatter on both sides.

According to the draft report prepared by WLA (dated January 2009), the bedding orientations within this area generally dip steeply towards west, which were measured from locations approximately 300 to 500 feet north of the proposed alignment. Based on the available data, adverse bedding condition should not be expected within the proposed southeast-facing cut slopes. Various rock layers may be exposed by the excavation; consequently, localized erosion and raveling may occur within some poorly cemented rock layers exposed in the cut slopes.

The colluvium deposits that have filled in the graben immediately west of Fault C (per WLA report at about Sta. 73+80) may be more erodible than the Sonoma Volcanic bedrock. The portion of the planned cut slope up to 100 feet west of Fault C should be considered as highly erodible. Unless otherwise determined after it is exposed by excavation, erosion protection measures should be considered.

8.2.1 **Stability**

Based on the boring data and the geologic mapping presented in WLA's draft report, the area of planned excavation is mostly underlain by Sonoma Volcanic rock formation, including ash-fall tuff (Tst), Andesites (Tsa) and agglomerate (Tag). In addition, the bedding planes dip steeply towards the west. Consequently, an adverse bedding condition is not anticipated to be present in the proposed cut slopes.

In our opinion, the global stability of the proposed cut slopes should not pose a significant constraint on the design of cuts with slopes less than 2H:1V. However, the blocky nature of the Sonoma Volcanics and the presence of localized shears within fault zones may lead to wedge-type failures, which is expected to be localized and relatively insignificant. It may be necessary to over-excavate and re-compact areas where shears or joints are exposed in the cuts.

8.2.2 **Rippability**

Based on the publication "Repeatability of Pre- and Post-Excavation Seismic Refraction Data at the New Benicia-Martinez Bridge Toll Plaza, Northern California", by Mr. Dennison Leeds (undated), we understand that Caltrans uses their own chart to correlate seismic velocity with rippability in lieu of other commonly-cited references (e.g. Caterpillar Handbooks). The standard Caltrans rippability correlation is as follows:

TABLE 6 – CALTRANS RIPPABILITY CORRELATION

Velocity (m/s)	Velocity (ft/s)	Rippability
<1050	<3445	Easily Ripped
1050 – 1500	3445 – 4920	Moderately Difficult
1500 – 2000	4920 – 6560	Difficult Ripping/Light Blasting
> 2000	>6560	Blasting Required

We have first reviewed the seismic refraction surveys performed by NORCAL Geophysical Consultants, Inc. that are included in the fault assessment report prepared by WLA. Three seismic velocity survey lines were conducted in the vicinity south of the

proposed excavation. The p-wave velocity profiles indicate that the area is generally underlain by materials with low seismic velocity (<5,000 ft/sec) at the shallow depths, and the thickness range from 5 to 30 feet. The underlying materials have higher seismic velocity and are considered "Difficult Ripping" per Caltrans rippability chart where light blasting may be anticipated.

Two seismic refraction surveys were recently conducted after the right-of-entry was granted. The maximum depths of exploration for both surveys are approximately 50 feet below the existing ground surface. Line SR-1 shows a near-surface moderate-velocity (less than 4,500 ft/s) zone that correlates well with exposures in the dirt road on site. At depths of approximately 30 feet seismic velocities increase to a maximum value near 5,000 ft/s. Line SR-2 shows a relatively thick layer of low-velocity material from ground surface to depths of 15 to 20 feet. The thicker low-velocity zone on SR-2 suggests a thicker layer of soil and very weathered rock in that location. Below this layer, velocities gradually increase with depth to a maximum value greater than 5,000 ft/s at depths of 25 to 30 feet below the existing ground surface.

Based upon currently available data, the excavations for the new ramp from WB 80 to WB 12 will generally cut into rock formations. From Sta. 68+75 and 72+75 (north side, "BP" Line) and Sta. 73+50 to 75+00 (south side, "JW" Line), materials with p-wave velocities greater than 5,000 ft/sec were identified, which are considered difficult to rip per Caltrans rippability criteria and light blasting may be necessary. The cut slope should expose ash-fall tuff and andesites. Based on our understanding of the typical character of such formations and our previous experiences with similar cases, extra effort may be necessary during construction to break up localized areas containing thermally welded materials due to their volcanic origin. This appears to be consistent with the results of the seismic refraction survey.

The information described above is only a general guideline. The actual rippability of earth materials depends not only on p-wave velocity, but also on the degree of fracturing of the rock and the skill and experience of the equipment operator. The contractors should evaluate the site condition, review the test data, and make their own judgments regarding the selection of equipment and construction method best suited to the anticipated conditions.

8.2.3 **Grading Factor**

The on-site native soil meeting the project specifications may be used as engineered fill. For preliminary estimate, a grading factor of 0.9 may be assumed for the import materials and 1.0 for rock materials based on our previous experience.

8.3 Embankments

8.3.1 Embankment Settlements & Settlement Monitoring

New embankments are planned within the project limits, mainly along the alignment of WB 80 to WB 12, and the approach embankments at the abutments of the overcrossing structures. The height of the embankment is up to about 40 feet. Consequently, consolidation settlement is expected from the additional load exerted from the embankment.

In order to estimate the amount of settlement, consolidation tests were conducted on selected samples obtained from the borings. We have reviewed and adopted correlations from various references with revision to the site-specific laboratory test results for estimating the indexes for settlement calculation.

The estimation of pre-consolidation pressure is based Su/p per Skempton (1957) and NAVFAC D.M. 7.1. The modified compression index ($C_c/(1+e_0)$) and the modified recompression index ($C_r/(1+e_0)$) were obtained from the laboratory test results. The modified compression indices were compared to the correlation with natural moisture contents suggested by Lambe and Whitman (1969). After reviewing the laboratory data and the correlation, we have revised the correlation for estimating the modified compression index accordingly. For the recompression index (Cr, in the over-consolidated range), it is typically 10% of the compression index (per Holtz and Kovacs, 1982). According to the test data, the ratio of Cr/Cc range from 13% to 30%, which is in general accordance with the suggested value. Therefore, we have assumed a ratio of 20% (Cr/Cc) for estimating the modified recompression index ($C_r/(1+e_0)$).

Based on the available boring information and the proposed embankment dimensions, the estimated ground settlements are discussed in the following section:

- ***Embankment between Sta. 75+00 to 100+00, "JW" Line, including WB 80 to WB 12 Grade Separation and RW01 thru RW04***
  New embankments are anticipated along the new alignment of the WB80 to WB12 connector. Based on the profile and superelevation diagram plans provided by the designer, the maximum height of the new embankment is on the order of 35 feet. The boring/CPT data in the vicinity indicates that the subsurface soil conditions consist of predominantly clay. Some interbedded sand layers were encountered at various depths. The subsurface conditions are generally uniform along the proposed structure.

Based on the results of the settlement analyses, the amount of consolidation settlement is estimated to be up to 12 inches. The anticipated settlement is generally in the over-consolidated (OC) range and should occur relatively fast. However, the calculation based on A-09-006 shows that about 40% of the consolidation settlement is expected to occur in the normally-consolidated (NC) range. Based on our analysis, a waiting period of 90 days is recommended prior to the foundation construction (including piles for the proposed connector structure and the spread footings for the standard retaining walls in the vicinity of RW01 and RW03) and the construction of the pavement. This should help reduce potential down drag load on abutment piles due to consolidation settlement. The settlement monitoring is recommended and should be performed as per Caltrans Standard Test Method 112.

As mentioned in the previous section, the potential post-liquefaction settlement may be up to 6 inches at some locations. Typically, differential settlement may on the order of 50% of the total settlement. This settlement is expected to be local and random.

- ***Embankment at North Abutment of Green Valley Road OC/RW05, RW06 & RW10***
  New embankments up to about 40 feet are anticipated at the north abutment of the Green Valley Road OC. Retaining Wall No. 10, located along the northeast side of the embankment, was recently added into the project scope to reduce the impact to the environmentally sensitive area north of the I-80 and Green Valley Road. Another two retaining walls, RW05 and RW06, are planned to support the embankment along Green Valley Road On-Ramp.

  In general, the subsoils consist of interbedded very stiff to hard silt/clay in the upper depths overlying medium dense to dense sand. It appears that granular materials are more prominent toward the northeast and the clay thicknesses appear to be thicker on the southwest.

  Based on the results of the settlement analyses, the amount of consolidation settlements is estimated to be on the order of 6 inches. The settlement magnitude should be tolerable for Caltrans standard MSE walls provided the panels for the wall system are constructed after the settlement has completed. Alternative design of the panel system is also feasible as long as it can accommodate the potential settlement. The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast. A waiting period of 60 days is recommended for the embankment within this section prior to the foundation and pavement construction, such as:

- Spread footing for Retaining Wall No. 5,
- Pile construction at the abutment of the new overcrossing structure and the proposed Retaining Wall No. 10, and
- Construction of the pavement such as HMA sections.

The surcharge and the recommended waiting period will reduce potential down drag load on the piles due to consolidation settlement and lessen the ground deformation for the retaining wall on spread footings.

The settlement monitoring is recommended and should be performed as per Caltrans Standard Test Method 112. In addition, the method of constructing the concrete facing (panels) for the MSE walls might have to be delayed. Special details would be required to allow for the settlement of the panels or to attach them after the settlement has occurred.

- ***Green Valley Road OC, Green Valley Road OC(Over SB 680 On-Ramp)/RW07, RW08 & RW09***
  New embankments are planned between the Green Valley Road OC and Green Valley Road OC (Over SB 680 On-Ramp) and at the south abutment of the Green Valley Road OC (Over SB 680 On-Ramp). The embankment between the two structures will be up to 40 feet high and will be supported by RW08 (MSE wall) and RW09 (Caltrans Standard Type 1) on both sides. Granular materials are more prominent toward north, and the clay appears to be thicker toward southeast. The embankment at the Abutment 1 of Green Valley Road OC (Over SB 680 On-Ramp) is up to about 35 feet high, and RW07 (MSE wall) is planned along the east side.

  - *Abutment 1 at Green Valley Road OC (Over SB 680 On-Ramp)/RW07*
    Based on the results of the settlement analyses, the amount of consolidation settlements is estimated to be on the order of 6 inches. The settlement magnitude should be tolerable for Caltrans standard MSE walls.

    The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast. A waiting period of 60 days is recommended after the construction of the embankment and RW07 within this section, prior to pile construction at the abutment of the new structure and the construction of the pavement. It will reduce potential down drag load on abutment piles due to consolidation settlement. The settlement monitoring is recommended and should be performed as per Caltrans Standard Test Method 112. In addition, the method of

constructing the concrete facing (panels) might have to be delayed. Special details would be required to allow for the settlement of the panels or to attach them after the settlement has occurred.

- *Abutment 1 at Green Valley Road OC/Abutment 2 at Green Valley OC (Over SB 680 On-Ramp)/RW08 and RW09*
  Ground improvement with CLSM columns are recommended under the footprint of the retaining walls and the embankment to mitigate the potential lateral spreading. Based on the analyses provided by Acacia CE, the amount of settlements is estimated to be on the order of 3 inches with the CLSM columns. The settlement magnitude should be tolerable for Caltrans standard MSE walls.

  The anticipated settlements are generally in the elastic range and should occur relatively fast. With the planned ground improvement, the settlement is expected to be relatively uniform. Per our discussion with the designer, the amount of settlement is considered tolerable for the planned MSE wall (RW08) and the cantilever retaining wall (RW09).

  Consequently, a waiting period of 30 days is recommended after the construction of the embankment, including the construction of RW08 and RW09, but prior to pile construction at the abutment of the new structures and the construction of the pavement. It will reduce potential down drag load on abutment piles due to consolidation settlement. The settlement monitoring is recommended and should be performed as per Caltrans Standard Test Method 112. In addition, the method of constructing the concrete facing (panels) might have to be delayed. Special details would be required to allow for the settlement of the panels or to attach them after the settlement has occurred.

8.3.2 **Evaluation of Embankment Stability**

Caltrans issued a new publication regarding lateral spreading, "Guidelines on Foundation Loading and Deformation Due to Liquefaction Induced Lateral Spreading" in February 2011. Consequently, we have re-visited the analyses that were performed in the previous design phase.

Previously (during the 35% design phase), due to the presence of liquefiable soils on site, the stability of the embankment was evaluated under three different scenarios: 1) Static Condition (short-term, immediately after construction); 2) Seismic Condition (pseudo-static with seismic coefficient, k); and 3) Post-Liquefaction Condition. Per our

previous discussion with Caltrans engineer, short-term, un-drained shear strength (non-liquefied) parameters were used for seismic condition, since liquefaction generally is not expected to occur in conjunction with the peak ground acceleration. Residual shear strengths (Sr) were adopted only for the post-liquefaction condition without seismic coefficient.

According to the latest Caltrans guideline of lateral spreading, we have revised our pseudo-static analysis with the use of residual shear strengths (Sr, estimated based on Kramer and Wang (2007) as cited in Caltrans guideline) for liquefiable soils. As mentioned previously, liquefaction is generally not expected to occur in conjunction with peak ground acceleration. Therefore, this approach (pseudo-static analysis coupled with residual shear strengths) appears relatively conservative.

In our opinion, if the derived factor of safety is greater than unity, the design seismic coefficient is considered less than the yield acceleration (ky), and the ground deformation under the design earthquake event should be relatively insignificant. On the other hand, if the derived factor of safety is less than unity, the ground deformation can be excessive and lateral spreading should be considered.

For the seismic coefficient (k), we have referenced to Caltrans guidelines (Guidelines for Structures Foundation Reports manual, Ver. 2.0, 2006), which recommends that the seismic factor equal to one third of the horizontal peak acceleration and not exceeding 0.2g. An average PGA of 0.7g was assumed for design at the project site. Therefore, a seismic coefficient (k) of 0.2g was used for pseudo-static analysis. In addition, the strengths of the non-liquefiable fine-grained materials were increased by 30% due to the effect of rapid loading (per Ishihara, 1985) and strength increase from the consolidation under the embankment/retaining walls.

Based on the preliminary plans provided, several representative sections were selected for evaluating the slope stability of the new embankments and retaining walls. The analysis results are presented in Appendix C. The analysis results are summarized in the following table.

TABLE 7 – SUMMARY OF SLOPE STABILITY ANALYSIS

Location	Factor of Safety	
	Static Condition – Short term (immediately after construction)	**Pseudo-Static Analysis (k=0.2+residual shear strength)**
Retaining Wall No. 2	3.34	1.17
Retaining Wall No. 4	3.29	1.44
Retaining Walls No. 5 & 6	5.30	1.75
Retaining Wall No. 7	2.65	1.55
Retaining Wall No. 8 & 9	2.71	0.70(1)
Retaining Wall No. 10	2.42	1.03(2)

Notes:

(1) For most of the embankments and the proposed retaining walls, the stability appears satisfactory. However, based on our analysis, the stability of the embankment supported by RW08 and RW09 is not satisfactory (F.S. less than 1 under pseudo-static analysis with residual shear strengths). The results indicate that the potential deformation during the design seismic event can be excessive. Per Bray and Travasarou (2007) as cited in Caltrans guideline, the anticipated deformation is estimated on the order of 12 inches (with a yield acceleration, ky, of 0.145g). Therefore, the potential of lateral spreading is considered high, and it will impose additional loads onto the abutment wall and the foundations at Abutment 1. This will complicate the design considerably.

Consequently, as mentioned in the previous section (Section 8.1.4), ground treatment by using CLSM columns is recommended. We have engaged Acacia CE to perform the design of the CLSM system. According to their preliminary evaluation, the planned ground treatment will consist of 24-inch diameter Drill Displacement Column (DDC) with an average spacing of 4’-10” on center. The proposed treatment ratio is about 17% under the footprint of Retaining Wall No. 9 (Type 1) and about 15.5% under the embankment and Retaining Wall No. 8 (MSE wall). The CLSM columns will extend to Elev. -15 feet (approximate 39 feet below grade). It is recommended that the CLSM have an average 28-day unconfined compressive strength of at least 750 psi.

Based on the assumptions, a composite shear strength of 9,800 psf is recommended under Retaining Wall No. 9 and 9,000 psf under Retaining Wall No. 8 and embankment are recommended. The composite strength is calculated based on a residual shear strength of 750 psf for the liquefiable soils.

We have performed pseudo-static slope stability analysis with an improved composite shear strength of 9 ksf. The results indicate the stability to be satisfactory.

(2) For RW10, the stability analysis was performed based on Boring A-09-130, where liquefiable materials were identified between Elev. -1.5 and -11.5 feet, and the factor of safety was relatively low. However, the additional boring (R-12-151) drilled in February 2012 indicate low liquefaction potential. In our opinion, the potential of lateral spreading is considered low for RW10, and it should not have significant impact on the foundation design.

8.4 Earth Retaining Systems

It is our understanding that ten retaining walls are proposed as part of the proposed improvements to the interchange project. Retaining walls are proposed behind the entrance ramp, the slip ramp connecting the entrance ramp and branch connector, as well as on the north and south approach to the overcrossing.

According to the memorandum issued by Caltrans (dated September 20, 2011, attached), it is our understanding that the 2010 Standards shall be used on all projects with scheduled Ready to List dates after September 30, 2012. According to the schedule of the project, the recommendations provided in this report have been updated per 2010 standards (LRFD).

The heights of the retaining walls range from about 6 feet to 40 feet. For the walls, where the design wall heights are greater than 7.5 feet, it is generally planned to use Mechanically Stabilized Embankment (MSE) walls to support the new embankments. Cantilevered Cast-In-Place (CIP) concrete retaining walls are planned at several locations where there is utility conflict or requires shorter walls with maximum design wall height up to 12 feet. Caltrans standard retaining walls (Type 1/1A) are planned for Retaining Walls No. 1, 3, 5, 9, 10 and southwest portion of Retaining Wall No. 6. The configurations of the retaining walls are summarized in the following table.

According to the latest revised standard plans and the standard detail sheets, the standard walls are designed according to a seismic acceleration coefficient (k_h) of 0.2. Per the discussion between the design team and the Caltrans representative, it is our understanding that the seismic acceleration coefficient equals to one-third of peak acceleration per Section 5.2.2.3 of the Caltrans Bridge Design Specifications (BDS, August 2004). For the proposed retaining walls within the project limit, we have assumed an average PGA of 0.7g for retaining wall design, and the seismic acceleration coefficient (k_h) of 0.23 is recommended. Based on our discussions with the structure engineers, the increase of k_h does not appear to govern the wall design. Standard plans and standard detail sheets are considered adequate and will be adopted for the proposed retaining walls (both cantilever and MSE) within the project limit.

TABLE 8 – SUMMARY OF RETAINING WALLS

Wall No.	Approx. Location	Wall Type	Wall Height (ft)	Approx. Length (ft)
RW01	"S" Line, 86+54 to 88+10	Caltrans Standard Type 1A	6 – 12	157±
RW02	"JW" Line, 82+40 to 88+37	MSE Wall	7.5 – 25	595±
RW03	"S" Line, 92+19 to 94+21	Caltrans Standard Type 1A	6 – 8	208±
RW04	"JW" Line, 92+94 to 98+58	MSE Wall	10 – 30	565±
RW05	"GL2" Line, 114+43 to 117+99	Caltrans Standard Type 1	4 – 14	355±
RW06	"GL2" Line, 114+79 to 115+94	Caltrans Standard Type 1	6 – 8	115±
	"GL2" Line, 115+94 to 119+78	MSE Wall	12.5 – 22.5	385±
RW07	"G" Line, 64+00 to 68+70	MSE Wall	15 – 32.5	475±
RW08	"G" Line, 70+48 to 71+34	MSE Wall	40	95±
RW09	"G" Line, 70+76 to 71+15	Caltrans Standard Type 1	36	40±
RW10	"G" Line, 76+43 to 79+55	Caltrans Standard Type 1	16 – 28	316±

8.4.1 Standard Retaining Walls

Caltrans recently issued the Revised Standard Plans (RSP) on April 20th, 2012. The standard retaining wall design has been revised/updated with Extreme Limit State. The bearing stresses demands are shown in the RSP under Service Limit State, Strength Limit State, and Extreme Limit State (I & II) with the associated effective footing widths.

– ***Retaining Wall No. 1, 45.5' Lt. "S" Line Sta. 86+53 to 60.8' Lt. "S" Line Sta. 88+10 (Type 1A, Case 1)***

Retaining Wall No. 1 (RW01) is located along the northwest side of the Green Valley Road westbound ramp and is approximately 157 feet long. Per plans provided by the designer, the maximum design wall height is 12 feet and the proposed footing bottom elevation range from Elev. 45.8 feet to 55.8 feet. It is planned to use Caltrans standard Type 1A retaining wall to support the new fill embankment. Based on the boring data (A-09-006 & A-09-122), it is expected that the footing subgrade consist of stiff to hard lean clay. For design purposes, we have assumed groundwater at Elev. 35 feet.

Liquefiable soils were encountered in Boring A-09-006. However, these layers are relatively deep (greater than 50 feet below ground surface) and are considered discontinuous. Therefore, the impact due to liquefaction is considered minimal.

- For LRFD Service Limit State, we have verified that the footing settlement under the service bearing stress and the effective footing widths. The estimated

settlement is on the order of 1.5 inches for design wall height of 10 and 12 feet. In general, the permissible settlement is typically 1 inch. Therefore, it is recommended that the bottom of the footing be over-excavated 2 feet for the wall portion with design height of 10 feet and 3 feet for the wall portion with design height of 12 feet, and replace with compacted AB or LCB. This should reduce the consolidation settlement to about 1 inch.

- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 4.5 ksf (with a resistance factor of 0.45 per Table 10.5.5.2.2-1, Caltrans Amendment, December 2008), which exceeds the demands at Strength Limit State for walls up to 12 feet.
- For LRFD Extreme Limit State (I & II), the recommended ultimate bearing capacity is 10 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for walls up to 12 feet.

Therefore, standard Type 1A wall on spread footing (Caltrans 2010 RSP, Sheet B3-3A) with design wall height up to 12 feet is considered feasible for the proposed Retaining Wall No. 1 with the implementation of the over-excavation recommendations.

However, according to the proposed profile, the grade increases toward west along "S" Line, which is the new alignment that connects the traffic from westbound I-80 to westbound SR-12. The height of the fill in the vicinity of RW01 is up to about 25 feet. Significant settlement is expected from the new embankment. Therefore, it is recommended that the planned location of RW01 be preloaded to reduce the consolidation settlement.

– ***Retaining Wall No. 3, 35' Lt. "S" Line 92+19 to 34' Lt. "S" Line 94+21 (Type 1A, Case 1)***

Retaining Wall No. 3 is located along the north side of the Green Valley Road westbound ramp and is approximately 208 feet long. Per plans provided by the designer, the design wall heights are 6 to 8 feet and the proposed elevations of footing bottom are at Elev. 42 feet and 40.5 feet. It is planned to use Caltrans standard Type 1A retaining wall to support the new fill embankment.

Based on the boring data (A-09-122 & A-09-123), it is expected that the footing subgrade consists of stiff to very stiff clay. Groundwater level was not encountered during drilling in these two boreholes. For design purposes, we have assumed groundwater at Elev. 35 feet (approximately 10 feet below existing grade), which is similar to the assumptions for RW01.

- For LRFD Service Limit State, the footing settlement was estimated with the service bearing stress and the effective footing width for wall height of 8 feet, and the amount of settlement is about 1 inch, which is considered tolerable for the wall.
- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 3.4 ksf (with a resistance factor of 0.45 per Table 10.5.5.2.2-1, Caltrans Amendment, December 2008), which exceeds the demands at Strength Limit State for wall heights of 6 and 8 feet.
- For LRFD Extreme Limit State (I & II), the recommended ultimate bearing capacity is 7.5 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for wall heights of 6 and 8 feet.

Therefore, standard Type 1A wall on spread footing (Caltrans 2010 RSP, Sheet B3-3A) with design wall height of 6 and 8 feet is considered feasible for the proposed Retaining Wall No. 3.

– ***Retaining Wall No. 5, 29' Lt. "GL2" Line 114+43 to 33' Lt. "GL2" Line 117+99 (Type 1, Case 1)***

Retaining Wall No. 5 is located along the northwest side of the Green Valley Road westbound ramp and is approximately 355 feet long. Per plans provided by the designer, it is planned to use Caltrans standard Type 1 retaining wall to support the embankment due to utility conflict. The design wall heights range from 4 to 14 feet, and the proposed elevations of footing bottom range from Elev. 23.5 to 35.8 feet.

According to the boring and CPT data in the wall vicinity (A-09-126, A-09-127, R-10-128A, A-09-128, A-09-129 and CPT-10-129), it is expected that the footing subgrade consists of stiff to very stiff clay. Groundwater level was encountered at about Elev. 12 feet in Boring A-09-126 and A-09-128, about Elev. 9 feet in Boring A-09-127 and about Elev. 5 feet in Boring A-09-129 during drilling. For design purposes, we have assumed groundwater at Elev. 15 feet.

- For LRFD Service Limit State, the footing settlement was estimated with the service bearing stress and the effective footing width for wall height of 8 feet, and the amount of settlement is about 1 inch, which is considered tolerable for the wall.
- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 4.1 ksf (with a resistance factor of 0.45 per Table 10.5.5.2.2-1, Caltrans Amendment, December 2008), which exceeds the demands at Strength Limit State for wall heights of 6 and 8 feet.

- For LRFD Extreme Limit State, the recommended ultimate bearing capacity is 9 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for wall heights of 6 and 8 feet.

Liquefaction potential is considered high at the planned location of the retaining wall. The liquefiable soils were encountered at Elev. 0 feet, which is about 25 feet below the bottom of the footings. In our opinion, the 25-foot-thick clay layer should bridge over and provide sufficient bearing capacity if liquefaction occurs. The impact due to the potential liquefaction is considered minor, which may be limited to post-liquefaction settlement. It is estimated that the post-liquefaction settlements may be on the order of 2 to 4 inches, and probably would be random and localized. Therefore, it is recommended that more joints be designed along the wall.

In addition, it is recommended that the subgrade be over-excavated 2 feet below the bottom of the footing and replace with compacted AB or LCB with a layer of geofabric underneath. This pad should serve as a "load distribution bridge" for reducing loads and differential settlements.

The amount of consolidation settlements due to the new embankment is estimated to be on the order of 6 inches, and a waiting period of 60 days is recommended prior to the foundation construction for Retaining Wall No. 5.

Therefore, standard Type 1 wall on spread footing is considered feasible for the planned portion of Retaining Wall No. 5 with implementation of the above stated recommendations (i.e. more joints, over-excavation and the recommended waiting period).

– ***Retaining Wall No. 6, 7' Rt. "GL2" Line 114+79 to 14' Rt. "GL2" Line 115+94 (Type 1, Case 2)***

Retaining Wall No. 6 is located along the southeast side of the Green Valley Road westbound ramp and is approximately 500 feet long. Per plans provided by the designer, it is planned to use Caltrans standard Type 1 retaining wall for the portion on the southwestern end of the wall (approx. 115 feet long). The design wall height is 6 and 8 feet and the proposed elevations of footing bottom are at about Elev. 25 feet.

According to the boring data (A-09-126 & A-09-127), it is expected that the footing subgrade consists of stiff to very stiff clay. Groundwater level was encountered at Elev. 12 feet in Boring A-09-126 and Elev. 9 feet in Boring A-09-127 during drilling. For design purposes, we have assumed groundwater at Elev. 15 feet (approximately 10 feet below existing grade).

- For LRFD Service Limit State, the footing settlement was estimated with the service bearing stress and the effective footing width for wall height of 8 feet. The amount of settlement is on the order of 1 inch, which is considered tolerable for the wall.
- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 4.1 ksf (with a resistance factor of 0.45 per Table 10.5.5.2.2-1, Caltrans Amendment, December 2008), which exceeds the demands at Strength Limit State for wall heights up to 8 feet.
- For LRFD Extreme Limit State (I & II), the recommended ultimate bearing capacity is 9 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 8 feet.

Liquefaction potential is considered high at the planned location of the retaining wall. The liquefiable soils were encountered at Elev. 0 feet, which is about 25 feet below the bottom of the footings. In our opinion, the 25-foot-thick clay layer should bridge over and provide sufficient bearing capacity if liquefaction occurs. The impact due to the potential liquefaction is considered minor, which may be limited to post-liquefaction settlement. It is estimated that the post-liquefaction settlements may be on the order of 2 to 4 inches, and probably would be random and localized. Therefore, it is recommended that more joints be designed along the wall. In addition, it is recommended that the subgrade be over-excavated 2 feet below the bottom of the footing and replace with compacted AB or LCB and a layer of geofabric underneath. This pad should serve as a "load distribution bridge" for reducing loads and differential settlements.

The amount of consolidation settlements due to the new embankment is estimated to be on the order of 6 inches, and a waiting period of 60 days is recommended prior to the foundation construction for Retaining Wall No. 6. Therefore, standard Type 1 wall on spread footing is considered feasible for the planned portion of Retaining Wall No. 6 with implementation of the above stated recommendations (i.e. more joints, over-excavation and the recommended waiting period).

– ***Retaining Wall No. 9, 27' Lt. "G" Line 70+76 to 27' Lt. "G" Line 71+17 (Type 1, Loading Case I)***

A large joint utility trench with 8-inch and 16-inch water lines will be constructed along the future Green Valley Road. The utility trench cannot be placed under the reinforcement of the MSE wall since access to the utilities will be necessary.

Therefore, it is planned to use Caltrans standard Type 1 wall along the southwest side of the embankment for RW09. The design wall height is 36 feet.

Due to the potential lateral spreading, ground treatment with CLSM columns is recommended to mitigate the hazard. With such improvement, the composite improved ground provides increased density and shear capacity to resist liquefaction and provide increased shear resistance for global stability of supported structures. Therefore, it is our opinion that the proposed Caltrans standard Type 1 retaining wall supported on spread footing should be feasible provided the ground is improved as stated above. It is recommended that the bottom of the footing be over-excavated 2 feet and replaced with compacted Aggregate Base (AB). This layer should act as a "raft" to provide uniform support.

According to the recommendations by Acacia CE (dated July 2001, revised September 2011), the recommended ultimate bearing capacity is 18 ksf. The bearing capacity was calculated based on CLSM columns with an average unconfined compressive strength of 750 psi (at 28 days) with 17% treatment ratio. The CLSM columns should extend to Elev. -15 feet (approximate 39 feet below grade).

- According to the recommendations provided by Acacia CE, the anticipated settlement under the entire embankment is on the order of 3 inches. However, the wall section is relatively short (less than 40 feet long). With the implementation of the proposed ground improvement, it is expected that the settlement should be relatively uniform and shout not have significant impact to the wall. In our opinion, the Service Limit State should not govern the wall design.
- For LRFD Strength Limit State, the estimated available bearing capacity under Strength Limit design is about 8.1 ksf (with a resistance factor of 0.45 per Table 10.5.5.2.2-1, Caltrans Amendment, December 2008), which exceeds the demands at Strength Limit State for wall height of 36 feet.
- For LRFD Extreme Limit State (I & II), the recommended ultimate bearing capacity is 18 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008) as mentioned above, which exceeds the demands for wall height of 36 feet.

Based on the above, in our opinion, standard Type 1 wall on spread footing is considered feasible for Retaining Wall No. 9 with proposed ground improvement.

– ***Retaining Wall No. 10, 62' Rt. "G" Line 76+51 to 71' Rt. "GU" Line 79+50 (Type 1, Case I)***

Retaining Wall No. 10 was added into the project scope during 65% design phase. The wall is located along the northeast side of the approach embankment at Abutment 3 of the proposed Green Valley Road OC. The purpose of the wall is to reduce the impact to the environmentally sensitive area north of the I-80 and Green Valley Road. In order to accommodate staging and traffic handling, the water mains will have to be constructed along the east side of Green Valley Road. Consequently, MSE wall is not considered feasible due to the utility conflict, and it is planned to use Caltrans standard Type 1 retaining wall to support the embankment. Per plans provided by the designer, the wall is approximately 303 feet long and the design wall heights range from 16 to 28 feet.

According to the boring and CPT data in the wall vicinity (CPT-09-004, R-10-004A and A-09-130), it is expected that the footing subgrade consists of stiff to very stiff clay. A medium dense to very dense sand layer was encountered between approximate Elev. 0 and -30 feet. Groundwater level was encountered at about Elev. -1 foot in Boring A-09-130. For design purposes, we have assumed groundwater at Elev. 15 feet, which is consistent with the design for Retaining Wall No. 5 and 6 and the abutment of the proposed overcrossing.

Additional boring (R-12-151) was drilled in February 2012 in the vicinity of the proposed wall location. Based on the boring data, the bearing capacity is much less than the required footing pressure shown on the revised standard plan (RSP B3-1A). Therefore, it is planned to use piles for foundation support. Due to the presence of dense sand formation, concrete driven piles are not recommended. Per our discussion with the designer, open ended steel pipe piles will be (Caltrans standard Alt. "W", Class 140, 14-inch diameter).

Liquefaction potential is considered low at the planned location of the retaining wall, according to Boring R-12-151. Liquefaction was not considered when estimating the pile capacities. Based on the foundation design loads provided by the designer, the pile design is summarized in the following tables.

TABLE 9 – FOUNDATION DESIGN SUMMARY

TABLE 9.1 – FOUNDATION DESIGN DATA

Wall Segment	Design Method	Pile Type	Finish Grade Elev. (ft)	Pile Cut-off Elev.(ft)	Pile Cap Size (ft)		Permissible Settlement – Service Load (in)	Number of Piles per Support
					B	L		
0+00 to 0+36	LRFD	Class 140 Alt. "W"	24	20.75	17.08	36	1	24
0+36 to 0+76	LRFD	Class 140 Alt. "W"	23	16.34	18.42	40	1	32
0+76 to 1+12	LRFD	Class 140 Alt. "W"	22	16.75	17.08	36	1	24
1+12 to 1+52	LRFD	Class 140 Alt. "W"	22	17.00	15.75	40	1	24
1+52 to 1+98	LRFD	Class 140 Alt. "W"	22	17.25	14.50	46	1	23
1+98 to 2+40	LRFD	Class 140 Alt. "W"	22	17.42	13.25	42	1	17
2+40 to 2+84	LRFD	Class 140 Alt. "W"	22	17.42	12.00	44	1	15
2+84 to 3+16	LRFD	Class 140 Alt. "W"	22	17.50	10.75	32	1	11

TABLE 9.2 – FOUNDATION DESIGN LOADS

Wall Segment	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Limit State (Controlling Group, kips)			
	Total Load		Perma-nent Loads	Compression		Tension		Compression		Tension	
	Per Support	Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
0+00 to 0+36	1559	89	1478	2090	150	0	0	1690	95	160	32
0+36 to 0+76	2119	73	2022	2831	137	0	0	2330	120	438	73
0+76 to 1+12	1559	89	1478	2090	150	0	0	1690	95	160	32
1+12 to 1+52	1566	95	1482	2100	164	0	0	1709	90	235	47
1+52 to 1+98	1522	89	1434	2045	155	0	0	1653	85	255	51
1+98 to 2+40	1176	89	1101	1581	153	0	0	1267	81	168	42
2+40 to 2+84	1040	81	970	1397	139	0	0	1109	86	124	31
2+84 to 3+16	623	69	578	838	99	0	0	659	90	36	9

TABLE 9.3 – PILE DATA TABLE

Wall Segment	Pile Type	Nominal Resistance		Design Tip Elevation (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension			
0+00 – 0+36	Class 140 Alt. "W"	220 kips	40 kips	-35.3 (a), -1.8 (b), -9.3 (c), -9.3 (d)	-35.3	220
0+36 – 0+76	Class 140 Alt. "W"	200 kips	80 kips	-35.7 (a), -21.2 (b), -13.7 (c), -13.7 (d)	-35.7	200
0+76 – 1+12	Class 140 Alt. "W"	220 kips	40 kips	-39.3 (a), -5.8 (b), -13.3 (c), -13.3 (d)	-39.3	220
1+12 – 1+52	Class 140 Alt. "W"	240 kips	50 kips	-43.0 (a), -13.0 (b), -13.0 (c), -13.0 (d)	-43.0	240
1+52 – 1+98	Class 140 Alt. "W"	230 kips	60 kips	-40.8 (a), -15.3 (b), -12.8 (c), -12.8 (d)	-40.8	230
1+98 – 2+40	Class 140 Alt. "W"	220 kips	50 kips	-38.6 (a), -7.6 (b), -12.6 (c), -12.6 (d)	-38.6	220
2+40 – 2+84	Class 140 Alt. "W"	200 kips	40 kips	-34.6 (a), -5.1 (b), -12.6 (c), -12.6 (d)	-34.6	200
2+84 – 3+16	Class 140 Alt. "W"	150 kips	10 kips	-27.5 (a), 5.0 (b), -12.5 (c), -12.5 (d)	-27.5	150

Design tip elevations are controlled by (a) compression, (b) tension, (c) settlement, (d) lateral

The axial pile capacities of the open end steel pipe piles (Caltrans Standard Class Alt. "W") were estimated based on procedures published by American Petroleum Institute (API) from "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design" (API RP 2A-WSD, 2002). We have utilized computer program "APILE Plus" (ENSOFT, v5.0) for calculation purpose.

Lateral load analyses were performed for the proposed steel open-ended pipe piles using the LPILE program (ENSOFT, v6.0). An average "p-y Curve Modification Factor" of 0.6 was adopted for non-liquefiable soils in the lateral pile analysis for pile spacing of 3 times the pile diameter. In addition, due to the corrosive potential (see Section 8.0), a corrosive allowance of 0.05 inch (a corrosion rate of 0.001 inch per year with a design life of 50 years) was assumed for the shell thickness above Elev. -13 feet per Caltrans Memo-To-Designer 3-1. The results of lateral pile analyses, with the plots of the pile deflection, moment, shear and soil reaction along the pile length and the input files are included in the Appendix C.

The new embankment is up to about 30 feet high in the wall vicinity and the north abutment of the proposed overcrossing. Based on available boring information, the estimated ground settlement at the north abutment is expected to be on the order of 8 inches. The settlement is expected mainly within the over-consolidated (OC) range, which should occur relatively fast and probably during earthwork construction. To reduce potential down drag load on abutment piles, a waiting period of 60 days is

recommended after embankment construction and prior to the pile construction at abutments. Based on the loads provided by the structural engineer and the proposed waiting period, pile group settlement does not appear to be an issue and a minimum pile length of 30 feet is recommended.

8.4.2 **MSE Retaining Walls**

Mechanically Stabilized Embankment (MSE) walls may be used to support the fill and to accommodate right-of-way and geometric constraints. The MSE wall system is generally considered more economical particularly in fill situations, and it is popular for its high-load capacity, speedy installation, durability, relatively low maintenance, and cost efficiency. For the proposed project, a total of five MSE walls are proposed.

The Caltrans standard MSE wall design for the welded wire mat soil reinforcement corresponding to the 5 by 5 panel are presented in Section 3-8 of the latest Caltrans Bridge Design Aids (October 2011). The latest publication indicates that the design is based on AASHTO LRFD Bridge Design Specifications with Caltrans Amendments. Bearing stresses under different Limit States (Service, Strength and Extreme) and the associated effective base width (B') are provided for various wall heights.

According to BDA 3-8, the base width must be a minimum of 70% of the height for loading condition 1 and not less than 8 feet. Under loading condition 2, the base width must be increased to at least equal to the height and also not less than 8 feet. The detail wall design and its assumption are available on Bridge Standard Detail Sheets XS 13-020-1 through 6. Per Sheet XS13-020-2e, the design assumptions of the Caltrans standard MSE walls are summarized as follows:

- *Internal Design:* $\gamma = 120\ lb/ft^3$, $\phi = 34^o$,
- *External Design:* $\gamma = 120\ lb/ft^3$, $\phi_{(backfill)} = 34^o$, $\phi_{(foundation)} = 30^o$, $k_h = 0.2$

Waiting period should be expected before construction of the structures and pavement to minimize the impact due to consolidation settlement. Since ground settlement is expected, we have adopted long-term drained shear strengths for the wall design, which are discussed in the subsequent sections. The drained shear strengths were estimated according to the soil types and the laboratory test data.

According to the plans provided, most of the MSE walls will be constructed on the original grade. RW02 will be constructed above a new embankment of 15 feet and above. The boring/CPT data indicated that the native subgrade materials within the project limits

generally consist of fine-grained materials with low plasticity at shallow depth (upper 20 feet). Based on the boring data and the laboratory test results, the recommended shear strength parameters are assumed for each wall:

TABLE 10 – SUMMARY OF STRENGTH PARAMETER FOR MSE WALL DESIGN

Location	Subgrade Materials (within depth of B)	Strength Parameters
RW02	New embankment (Fill)	c' = 250 psf, ϕ' = 28º
RW04	Lean Clay (PI=9~24)	c' = 250 psf, ϕ' = 28º
RW06	Lean Clay/Sandy Lean Clay (PI=10~29)	c' = 250 psf, ϕ' = 28º
RW07	Lean Clay (PI=12~24)	c' = 200 psf, ϕ' = 30º
RW08	Lean Clay(PI=24)/Silty sand	c' = 200 psf, ϕ' = 30º

Per Caltrans comments and past experience with the MSE walls, for the areas where the shoulder is PCC and a concrete barrier will be mounted on the MSE wall, Caltrans recommends (regardless of the height of the wall) the length of the reinforcement of the top panel be about 20% to 30% longer than the rest of the reinforcements. This is because the top reinforcement may not have sufficient overburden to withstand the weight of the concrete barrier and the top panel tends to lean outwards.

In our opinion, Caltrans standard MSE walls are generally considered feasible for the proposed project. Detailed discussions of each wall are summarized as follows:

– ***Retaining Wall No. 2, 35' Lt. "JW" Line 82+40 to 35' Lt. "JW" Line 88+37 (Load Case 1)***

  Based on the plans provided, RW02 is located on the northwest side of the approach embankment at Abutment 1 of WB 80 to WB 12 Separation (Over WB 80 On-Ramp) structure. RW02 will be constructed on the new embankment, and wall is about 595 feet long with design wall heights vary from 7.5 to 25 feet.

  According to the plans, RW02 is expected to be underlain by about 12.5 to 30 feet of new embankment. The long-term drained shear strength parameters of c' = 250 psf and ϕ' = 28º are assumed for evaluating bearing capacity. The consolidation settlement under entire embankment (up to 35 to 40 feet tall) is estimated on the order of 12 inches and in the over-consolidated/elastic range. The settlement magnitude appears tolerable for Caltrans standard MSE walls. In Caltrans District 4, we have seen previous MSE wall settlement data (Route 87, between Hedding Street and I-880 in Santa Clara County, California) on the order of 2 to 3 feet.

The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast. However, the calculation based on A-09-006 shows that about 40% of the consolidation settlement is expected to occur in the normally-consolidated (NC) range. Based on our analysis, a waiting period of 90 days is recommended prior to pile construction and the construction of the pavement.

- For LRFD Service Limit State, we have estimated the bearing capacity of 5 ksf with a F.S. of 2.0 (per Section 5.9.2.3 of Caltrans BDS), which exceeds the demands as shown in BDA 3-8 for walls up to 25 feet.
- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 7.6 ksf (with a resistance factor of 0.65 per Table 11.5.6-1, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 25 feet.
- For LRFD Extreme Limit State, the recommended ultimate bearing capacity is 10 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 25 feet.

The potential post-liquefaction settlement is approximately 1.5 inches, which should be localized and random. This settlement magnitude is considered tolerable for Caltrans standard MSE walls.

The stability of the MSE wall was evaluated under 1) Static condition with short-term un-drained shear strength (immediately after construction), and 2) Pseudo-static with residual shear strength (Sr) for the liquefiable soils, which were estimated per Kramer and Wang (2007) as cited in Caltrans guideline (2011). Based on the evaluation, the stability of the MSE wall is acceptable. See Section 8.3.2 for more discussions.

Based on the above, Caltrans standard design per BDA 3-8 (Load Case 1) is considered feasible for the proposed MSE wall.

– ***Retaining Wall No. 4, 35' Lt. "JW" Line 92+94 to 35' Lt. "JW" Line 98+20 (Load Case 1)***

Based on the plans provided, RW04 is located on the northwest side of the approach embankment at Abutment 4 of WB 80 to WB 12 Separation (Over WB 80 On-Ramp) structure. Majority of the wall will be constructed from the original grade, and wall is about 565 feet long with design wall heights vary from 10 to 30 feet.

Based on the boring data, the RW04 is expected to be underlain by predominantly lean clay with interbedded sand layers. Long-term drained shear strength parameters of c' = 250 psf and ϕ' = 28º are assumed for evaluating bearing capacity.

The consolidation settlement under entire embankment is estimated on the order of 8 inches and in the over-consolidated/elastic range. The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast. The potential post-liquefaction settlement is approximately on the order of 1.5 inches (west of Sta. 95+50 "JW" Line) to 3 to 3.5 inches (east of Sta. 95+50 "JW" Line), which should be localized and random. This settlement magnitude is considered tolerable for Caltrans standard MSE walls.

- For LRFD Service Limit State, we have estimated the bearing capacity of 7.5 ksf with a F.S. of 2.0 (per Section 5.9.2.3 of Caltrans BDS), which exceeds the demands as shown in BDA 3-8 for walls up to 30 feet.
- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 9.8 ksf (with a resistance factor of 0.65 per Table 11.5.6-1, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 25 feet.
- For LRFD Extreme Limit State, the recommended ultimate bearing capacity is 14 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 25 feet.

The stability of the MSE wall was evaluated under 1) Static condition with short-term un-drained shear strength (immediately after construction), and 2) Pseudo-static with residual shear strength (Sr) for the liquefiable soils, which were estimated per Kramer and Wang (2007) as cited in Caltrans guideline (2011). Based on the evaluation, the stability of the MSE wall is acceptable. See Section 8.3.2 for more discussions.

Based on the above, Caltrans standard design per BDA 3-8 (Load Case 1) is considered feasible for the proposed MSE wall.

– ***Retaining Wall No. 6, 14' Rt. "GL2" Line 115+94 to 37' Rt. "G" Line 119+78 (Load Case 2)***

Based on the plans provided, RW06 is located on the southeast side of the Green Valley Road On-Ramp. Majority of the wall will be constructed from the original grade. The MSE portion of the wall is about 385 feet long with design wall heights varying from 12.5 to 22.5 feet.

Based on the boring data, the planned location of RW06 is expected to be underlain by lean clay/silt, ranging from 15 to 25 feet in thickness, overlying silty sand/sandy silt. Long-term drained shear strength parameters of c' = 250 psf and ϕ' = 28º are assumed for evaluating bearing capacity.

The consolidation settlement under entire embankment is estimated on the order of 6 inches and in the over-consolidated/elastic range. The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast. The potential post-liquefaction settlement is approximately on the order of 3 to 4 inches, which should be localized and random. This settlement magnitude is considered tolerable for Caltrans standard MSE walls.

- For LRFD Service Limit State, we have estimated the bearing capacity of 7.5 ksf with a F.S. of 2.0 (per Section 5.9.2.3 of Caltrans BDS), which exceeds the demands as shown in BDA 3-8 for walls up to 22.5 feet.
- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 9.8 ksf (with a resistance factor of 0.65 per Table 11.5.6-1, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 22.5 feet.
- For LRFD Extreme Limit State, the recommended ultimate bearing capacity is 14 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 22.5 feet.

The stability of the MSE wall was evaluated under 1) Static condition with short-term un-drained shear strength (immediately after construction), and 2) Pseudo-static with residual shear strength (Sr) for the liquefiable soils, which were estimated per Kramer and Wang (2007) as cited in Caltrans guideline (2011). Based on the evaluation, the stability of the MSE wall is acceptable. See Section 8.3.2 for more discussions.

Based on the above, Caltrans standard design per BDA 3-8 (Load Case 2) is considered feasible for the proposed MSE wall.

– ***Retaining Wall No. 7, 33' Rt. "G" Line 64+00 to 21' Rt. "G" Line 68+70 (Load Case 1)***

Based on the plans provided, RW07 is located along the east side of the approach embankment at the Abutment 1 of Green Valley Road Overcrossing (Over SB 680 On-Ramp). Majority of the wall will be constructed from the original grade. The wall is about 480 feet long with design wall heights varying from 15 to 32.5 feet.

Based on the boring data, the planned location of RW07 is expected to be underlain by about 40 feet of lean clay, overlying silty sand/sandy silt. Long-term drained shear strength parameters of c' = 200 psf and ϕ' = 30° are assumed for evaluating bearing capacity.

The consolidation settlement under entire embankment is estimated on the order of 6 inches and in the over-consolidated/elastic range. The anticipated settlements are generally in the over-consolidated (OC) range and should occur relatively fast. This settlement magnitude is considered tolerable for Caltrans standard MSE walls.

- For LRFD Service Limit State, we have estimated the bearing capacity of 7.5 ksf with a F.S. of 2.0 (per Section 5.9.2.3 of Caltrans BDS), which exceeds the demands as shown in BDA 3-8 for walls up to 32.5 feet.
- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 9.8 ksf (with a resistance factor of 0.65 per Table 11.5.6-1, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 32.5 feet.
- For LRFD Extreme Limit State, the recommended ultimate bearing capacity is 15 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for wall heights up to 32.5 feet.

Liquefiable soils were encountered at the proposed wall location, however these layers are relatively deep and the impact is considered minor. The stability of the MSE wall was evaluated under 1) Static condition with short-term un-drained shear strength (immediately after construction), and 2) Pseudo-static with residual shear strength (Sr) for the liquefiable soils, which were estimated per Kramer and Wang (2007) as cited in Caltrans guideline (2011). Based on the evaluation, the stability of the MSE wall is acceptable. See Section 8.3.2 for more discussions.

Based on the above, Caltrans standard design per BDA 3-8 (Load Case 1) is considered feasible for the proposed MSE wall.

– ***Retaining Wall No. 8, 25' Rt. "G" Line 70+54 to 48' Lt. "G" Line 71+42 (Loading Case 1)***

Based on the plans provided, RW08 is located along the east side of the approach embankment between Green Valley Road OC and Green Valley Road OC (Over SB 680 On-Ramp). The wall is about 100 feet long with a design wall height of 40 feet.

Based on the assumed native soil strength parameters of c' = 200 psf and ϕ' = 30º, the bearing capacity should be adequate. However, due to the potential of liquefaction and the lateral spreading, ground treatment with CLSM columns is recommended to mitigate the hazard. With such improvement, the composite improved ground provides increased density and shear capacity to resist liquefaction and provide increased shear resistance for global stability of supported structures.

According to the recommendations by Acacia CE, an ultimate bearing capacity of 16.5 ksf was estimated based on CLSM columns with an average unconfined compressive strength of 750 psi (at 28 days) with 15.5% treatment ratio. The CLSM columns should extend to Elev. -15 feet (approximate 39 feet below grade). The contribution from the non-treated portion is conservatively neglected. According to the report provided by Acacia CE, the anticipated settlement is on the order of 3 inches.

- For LRFD Service Limit State, we have estimated the bearing capacity of 8.25 ksf with a F.S. of 2.0 (per Section 5.9.2.3 of Caltrans BDS), which exceeds the demands as shown in BDA 3-8 for wall height of 40 feet.
- For LRFD Strength Limit State, the recommended available bearing capacity under Strength Limit design is about 10.7 ksf (with a resistance factor of 0.65 per Table 11.5.6-1, Caltrans Amendment, December 2008), which exceeds the demands for wall height of 40 feet.
- For LRFD Extreme Limit State, the recommended ultimate bearing capacity is 16.5 ksf (with a resistance factor of 1.0 per Section 10.5.5.3.3, Caltrans Amendment, December 2008), which exceeds the demands for wall height of 40 feet.

Based on the above, Caltrans standard design per BDA 3-8 (Load Case 1) is considered feasible for the proposed MSE wall.

8.5 Culverts

8.5.1 Corrosion Investigation

The corrosion investigation for this project was performed in general accordance with the provisions of California Test Method 643. Chemical tests were performed on fourteen soil samples to evaluate the corrosion potential of the subsurface soil. A summary of the corrosion test results is presented in the following table.

TABLE 11 – SUMMARY OF CORROSION TEST RESULTS

Boring No.	Station (ft)	Depth (ft)	pH	Min. Resistivity (ohm-cm)	Sulfate (ppm)	Chloride (ppm)
R-10-003A	71+45 "G" Line	11	7.90	1550	50.1	98.8
R-10-004A	77+60 "G" Line	11	8.37	1660	64.1	102.2
A-09-005	74+00 "G" Line	4.5	8.67	190	142.3	2114.8
A-09-006	88+40 "JW" Line	6.5	6.76	560	188.9	377.6
A-09-009	93+20 "JR" Line	4.5	7.72	560	60.8	176.1
A-09-119	79+80 "JW" Line	2	6.49	940	27.8	87.4
A-09-123	92+30 "JW" Line	2	7.22	800	0.3	24.2
A-09-125	98+00 "JW" Line	4.5	8.29	260	606.1	718.5
A-09-127	114+40 "GL2" Line	2	5.64	780	80.2	70.9
A-09-128	116+00 "GL2" Line	2	7.93	1230	87.8	18.0
R-10-133A	64+40 "G" Line	5	7.79	480	165.4	317.6
A-09-135	14+30 "GR1" Line	10	7.55	960	168.9	71.9
A-09-137	9+00 "GR1" Line	4.5	7.52	220	576.4	1167.3
A-09-140	14+10 "GR1" Line	4.5	7.38	480	390.5	190.5
R-12-151	79+00 "GU" Line	5	8.22	560	167.6	158.8

For selection of pipe material for culvert and storm drain applications, it is our understanding that the AltPipe computer program is used by Caltrans to assist designers. AltPipe program is a web-based tool (http://dap1.dot.ca.gov/design/altpipe/) and updates and supersedes the previous CULVERT 4 program. The computations performed by AltPipe are based on the procedures and California Test Methods described in Chapter 850 of the Caltrans Highway Design Manual (HDM). AltPipe incorporates current requirements from the HDM supplemented by Caltrans Design Information Bulletin No. 83 (D.I.B. No. 83, June 30, 2003) for abrasion potential for material selection.

Based on the test results, the pH values, minimum resistivities and sulfate/chloride concentrations are expected to vary from location to location. It appears that the resistivities along the project limit are relatively low. After reviewing the test results, we have sub-divided the project limit into several zones, and the following parameters are recommended for AltPipe analysis:

TABLE 12 – SUMMARY OF STRENGTH PARAMETER FOR ALTPIPE ANALYSIS

Area	Reference Borings	Recommended Input Parameters for AltPipe			
		pH	Min. Resistivity (ohm-cm)	Sulfate (ppm)	Chloride (ppm)
West of Sta. 80+00 "JW" Line	A-09-119	6.5	940	27.8	87.4
Sta. 80+00 to 95+00 "JW" Line	A-09-006, A-09-009	7.0	560	200	400
East of Sta. 95+00 "JW" Line	A-09-005, A-09-125, A-09-137	8.0	200	600	2000

The AltPipe analyses are based on a design life of 50 years, abrasion level of 2, and a flow velocity of 12 fps, which were provided by the designer. Based on these parameters, the selected Alternative Pipes consist of Steel Pipes, Plastic Pipes, and Reinforced Concrete Pipes. Minimum soil resistivities are too low (<1500) for Aluminum or Aluminized Pipe along the project alignment.

Based on the results, Steel Spiral Rib Pipes are ¾"×¾" Ribs At 7½" Pitch and are recommended for pipe diameters of 30 inches or greater within the project limit. The minimum steel thickness for structure overfill requirement is 0.064 inches. Corrugated Steel Pipe may be used between Sta. 80+00 and 95+00 for pipe diameters of 48 inches or greater, and the minimum steel thickness for structure overfill requirement is 0.168 inches.

Plastic Pipes consist of PVC Corrugated, PVC Ribbed, and HDPE Corrugated – Type S, HDPE Ribbed, HDPE Corrugated – Type C. The plastic pipes will vary depending on the diameter size. For pipe diameters of 18 and 24 inches, PVC Corrugated, PVC Ribbed, and HDPE Corrugated – Type S, HDPE Ribbed, HDPE Corrugated – Type C are acceptable. For pipe diameters of 30 and 36 inches, PVC Corrugated, PVC Ribbed, and HDPE Corrugated – Type S are acceptable. For pipe diameters of 42 and 48 inches, PVC Ribbed and HDPE Corrugated – Type S are allowed. Based on the AltPipe results, Reinforced Concrete are acceptable for all pipe diameters and should use 5 sacks of cement, 10% of water, and a minimum steel cover of 1 inch.

This information is intended only to assist the civil or hydraulic designer. AltPipe is not a substitute for the appropriate use of engineering judgment as conditions and experience would warrant. Implementation of the results and output of this program is solely at the discretion of the civil or hydraulic designer. It is recommended that the civil or hydraulic engineer verify the design based on the corrosion test results provided in the above table.

The recommended Alternative Pipes and the minimum thicknesses for structural overfill requirements are presented in Appendix C.

9. STRUCTURAL PAVEMENT

New pavement will be constructed on existing grade and on import borrow materials. For designing the proposed pavement sections, we have conducted R-value tests on representative samples collected at proposed subgrade level.

Based on the test results, the R-value of the native materials appears to be relatively low. Chemical treatment may be considered to improve the native subgrade and also serve as a cost-saving measure. Therefore, R-value tests and unconfined compressive strength tests were performed on treated samples to provide design basis for lime treated materials. The percentage of lime admixtures used for treatment was determined according to the pH test results (ASTM C977). Per the test results, the samples were treated with 6% quick lime by dry weight of the soil for R-value tests and Unconfined Compression tests (California Test Method No. 373). The sample description and the test results are summarized in the following table.

TABLE 13 – SUMMARY OF R-VALUE TEST RESULTS

Boring No.	Boring Depth (ft)	Soil Type	R-Value Test Results		Unconfined Compressive Strength (psi)*
			Original	Treated*	
A-09-110	0-5	Fat Clay	<5	-	368
A-09-112	0-5	Sandy Fat Clay with gravel	15	-	-
A-10-132	0-5	Clayey Sand with some gravel	37	-	-
A-09-119	0-5	Fat Clay	-	-	352
A-10-141	0-5	Lean Clay with some gravel	11	-	-
A-10-143	0-5	Lean Clay	6	-	-
A-09-147	0-5	Fat Clay	<5	-	-
A-09-148	0-5	Fat Clay	<5	79	-
A-09-149	0-5	Fat Clay	<5	-	-
A-09-150	0-5	Fat Clay	-	-	316

*Note: The samples were treated with 6% lime (by dry weight)

The design of the pavement sections are in accordance with the State of California Department of Transportation design procedures (Highway Design Manual, July 2008). Based on the test results and the subgrade conditions, relatively low R-values are expected for the majority portion of the project. A lower R-value of 5 was used for the pavement design to account for the subgrade variation throughout the alignment.

Areas where the pavement section will be constructed with minimum 4 feet of fill underneath, such as the proposed alignment of WB 80 to WB 12 and the embankments at the abutments of the proposed structures, an R-value of 15 was assumed for design for the borrow materials. Per our

previous local experience with Caltrans District 4, we have assumed R-value of 78 for Aggregate Base (AB, Class 3) and 50 for Aggregate Subbase (AS, Class 4).

As discussed above, the native soils may be treated with 6% of quick lime to increase the strength, reduce its expansive potential to reduce the overall structural pavement thickness. Based on the test results, the unconfined compressive strength (UCS) for lime stabilized materials ranged from 316 to 368 psi, which meet the minimum test threshold of 300 psi per Caltrans design guideline.

We have assumed the minimum required UCS of 300 psi for the Lime-Treated-Subbase (LTS) design to account for the subgrade variation throughout the alignment. The Gravel Factor (Gf) of the LTS should be 1.2 per Highway Design Manual. It is recommended to use 18-inch thick lime-treated-subbase (LTS) to reduce the AC/Base thickness on the top. Based on our experience, 18 inches is about the maximum thickness that the contractor can treat in one lift.

It is recommended that the specifications require the determinations of the percent lime content for the required minimum UCS for the LTS during construction. The pavement structural section has been designed based on this strength as provided in the HDM. All treatment operations should be performed in accordance with the project specifications and Caltrans standards.

Bike path is planned from the future WB 80 to WB 12 connector to the intersection of Roberts Road and Mangels Blvd. The total length of the bike path is approximately 3000 feet. We have provided the pavement section design of two different options (Option 1: Full depth HMA (FDHMA), Option 2: HMA/AB) with various TI value. The pavement sections are relatively thin because of low TIs. Additional ASB (Class 4) of 1.0 and 0.5 foot is recommended underneath Option 1 and 2, respectively, to provide extra overburden since the native materials are considered expansive.

Per State of California Department of Transportation design procedures (Highway Design Manual - Section 600), the full design and the interim structural pavement section data are tabulated in the following tables.

TABLE 14 – RECOMMENDED STRUCTURAL PAVEMENT SECTIONS

TABLE 14A - RECOMMENDED (MINIMUM) STRUCTURAL PAVEMENT FOR BIKE LANES

Location	TI	R-Value	Flexible Pavement Section				
			Option 1		Option 2		
			FDHMA	ASB (Class 4)	HMA	AB	ASB (Class 4)
Bike Lanes	5	5 (native)	0.65'	1.0'	0.25'	0.85'	0.5'
	6		0.75'	1.0'	0.30'	1.05'	0.5'
	7		0.90'	1.0'	0.35'	1.25'	0.5'
	5	15 (import)	0.60'	-	0.25'	0.70'	-
	6		0.70'	-	0.30'	0.85'	-
	7		0.85'	-	0.35'	1.05'	-

Note: Additional ASB (Class 4) is recommended to provide extra overburden for pavement on native materials (where R-Value = 5).

TABLE 14B - RECOMMENDED (MINIMUM) STRUCTURAL PAVEMENT SECTIONS (20 YEARS)

Location	TI	R-Value	Flexible Pavement Section											
			Option 1		Option 2		Option 3				Option 4			
			FD HMA	AS*	HMA	AB	HMA	AB	LCB	AS	HMA	AB	LCB	LTS
I-80 West of I/C, Inside Shoulders/Lanes	11.5	5 (native)	1.55'	0.50’	0.70'	2.00'	0.60'	0.90'	-	1.50'	0.60'	0.60'	-	1.50'
I-80 West of I/C, Outside Shoulders/Lanes	13.5		1.85'	0.50’	-	-	0.65'	-	0.70'	1.70'	0.70'	-	0.60'	1.50'
I-80 East of I/C, Inside Shoulders/Lanes	12.5		1.70'	0.50’	-	-	0.60'	-	0.65'	1.60'	0.60'	-	0.55'	1.50'
I-80 East of I/C, Outside Shoulders/Lanes	14.5		2.00'	0.50’	-	-	0.70'	-	0.75'	1.85'	0.75'	-	0.75'	1.50'
SR 12 (W)	12.5		1.70'	0.50’	-	-	0.60'	-	0.65'	1.60'	0.60'	-	0.55'	1.50'
Green Valley Road Ramps	10	15 (import)	1.20'		0.55'	1.60'	0.55'	0.75'	-	0.90'	-	-	-	-
Green Valley Road	11		1.35'		0.60'	1.75'	0.60'	0.85'	-	1.00'	-	-	-	-

* For FDHMA, it is recommended to add 0.50’ of AS where R-value is less than 5 (native Fat Clay materials)

TABLE 14C - RECOMMENDED (MINIMUM) STRUCTURAL PAVEMENT SECTIONS (WITH PROJECTED TI OF 40 YEARS)

Location	TI	R-Value	20+ Year Flexible Pavement Section												Rigid Pavement Section			
			Option 1		Option 2		Option 3				Option 4				Option 5			
			FD HMA	AS*	HMA	AB	HMA	AB	LCB	AS	HMA	AB	LCB	LTS	JPCP	LCB/ HMA-A**	AS	LTS***
I-80 West of I/C, Inside Shoulders/Lanes	12.5	5 (native)	1.70'	0.50'	-	-	0.60'	-	0.65'	1.60'	0.60'	-	0.55'	1.50'	1.00'	0.35' (LCB) 0.25' (HMA)	0.70'	0.65'
I-80 West of I/C, Outside Shoulders/Lanes	15		2.05'	0.50'	-	-	0.75'	-	0.75'	1.90'	0.80'	-	0.75'	1.50'	1.15'	0.35' (LCB) 0.25' (HMA)	0.70'	0.65'
I-80 East of I/C, Inside Shoulders/Lanes	13.5		1.85'	0.50'	-	-	0.65'	-	0.70'	1.70'	0.70'	-	0.60'	1.50'	1.05'	0.35' (LCB) 0.25' (HMA)	0.70'	0.65'
I-80 East of I/C, Outside Shoulders/Lanes	16		2.20'	0.50'	-	-	0.80'	-	0.80'	2.05'	0.90'	-	0.85'	1.50'	1.20'	0.35' (LCB) 0.25' (HMA)	0.70'	0.65'
SR 12 (W)	14		1.90'	0.50'	-	-	0.70'	-	0.70'	1.80'	0.75'	-	0.65'	1.50'	1.05'	0.35' (LCB) 0.25' (HMA)	0.70'	0.65'
Green Valley Road Ramps	11	15 (import)	1.35'		0.60'	1.75'	0.60'	0.85'	-	1.00'	-	-	-	-	0.85	0.35' (LCB) 0.25' (HMA)	0.60'	-
Green Valley Road	11		1.35'		0.60'	1.75'	0.60'	0.85'	-	1.00'	-	-	-	-	0.85	0.35' (LCB) 0.25' (HMA)	0.60'	-

Notes:
(1) No empirical design method is available for 20+ year flexible pavement design. The projected TI of 40 years is provided by the designer and used for design per current HDM.
(2) Flexible Pavement: Gravel Equivalent Calculation (Table 633.1, Highway Design Manual, July 2008)
(3) Rigid Pavement Thickness: Table 623.1G (Inland Valley; Highway Design Manual, July 2008)
(4) HMA: Hot Mix Asphalt; AB: Aggregate Base (Class 2 or 3) with R-value equal to 78; AS: Aggregate Sub-base (Class 4) with the R-value equal to 50; LCB: Lean Concrete Base; LTS: Lime Treated Subbase; JPCP: Jointed Plain Concrete Pavement;
(5) FDHMA section are to be used for temporary pavement only and not for final pavement.

* For FDHMA, it is recommended to add 0.50' of AS where R-value is less than 5 (native Fat Clay materials)
** Revised per Caltrans Pavement Policy Bulletin PPB-09-01
*** R-value ≤ 5 cannot be used for the design Rigid Pavement Sections. Therefore, the R-value is increased to 10 for design by using 0.65' of Lime Treatment Subbase.

Additional notes for the pavement design:

1. LCB is recommended for TI greater than 12.
2. As an alternative, the upper portion of HMA can be replaced with equal thickness of RHMA-G up to 0.2 feet per Highway Design Manual, Section 631.3.
3. Rigid pavement section cannot be placed directly on materials having R-value of 5. Subgrade treatment is required.
4. Full depth HMA section is recommended to have additional 0.50 foot of Class 4 ASB underneath to provide adequate cover over the Fat Clay (R-value less than 5), i.e. native subgrade.
5. For bike lanes, adequate pavement cover is recommended over the Fat Clays. Therefore, a 0.5' to 1.0' of Class 4 ASB is proposed.

It is our understanding that the empirical method for "40-year" pavement design has not been developed by Caltrans. This is mainly because the asphalt binder and the aggregates have limited service life that is less than 40 years. A performance based analysis (PBA) is not in the current program. Therefore, in our opinion, rigid pavement should be considered as first priority when the design service life of the pavement is over 20 years.

The pavement sections provided in the above tables were calculated by using the empirical method per current Highway Design Manual with the projected TI value of 40 years, which was provided by the designer. This is provided for cost estimation as part of the Life-Cycle Cost Analysis (LCCA). However, the flexible pavement should require maintenance over the 40-year design life. Per the Caltrans Highway Design Manual (Section 633.1), the following enhancements shall be incorporated into all flexible pavements with a pavement design life greater than 20 years:

- Full depth hot mix asphalt should be considered
- Place a minimum 0.50 foot of Class 2 Aggregate base underneath the flexible pavement
- Use a non-structural wearing course (such as OGFC) above the surface layer (minimum 0.10 foot).
- Use rubberized hot mix asphalt (maximum 0.20 foot) or a PG-PM binder (minimum 0.20 foot) for the top of the surface layer.

Toe Drains. Based on the proposed improvement along the project corridor, excavation is proposed at between Sta. 65+00 and 75+00 ("JW" Line). Hillside seepage may be encountered from the adjacent uphill slopes. Such moisture penetrations in pavement layers, when combined with heavy traffic load, could compromise the service life of the pavement.

Therefore, toe drains are recommended where the cut slopes or walls toe into the roadway. This a permanent feature and it is installed between the toe of the slope and the pavement improvement

including shoulder and any future widening. It is recommended that the toe drains (underdrains) be installed where the cuts/slopes exceed 5 feet in height. This underdrain system is considered to be an interceptor drain to collect seepage from the uphill slopes before it reaches the pavement subgrade. The bottom of the trench is recommended to be minimum 12 inches below the pavement subgrade and 20 inches wide with an 8 inch diameter perforated pipe. The drain rock is to be wrapped in filter fabric. The design of the toe drains should conform to Caltrans standard plan (Sheet D102). Wherever applicable, pavement structural sections (beginning with the base layers) can be placed above the underdrain system.

10. MATERIAL SOURCES

There are several commercial sources of asphalt, concrete, and aggregate products in the area. The following table lists available commercial suppliers in the area.

TABLE 15 – SOURCES OF ASPHALT AND AGGREGATE MATERIAL

Source	Location	Approximate Haul Distance* (One Way, Mile)
Clark's Rock Material	650 Green Island Road, American Canyon, CA	12.5
A R Ready Mix	4969 Vanden Road, Vacaville, CA	13.5
Castle & King & Ready Mix	105 Aegean Way, Vacaville, CA	15.0

* Based on the approximate mid-point along the project alignment

11. MATERIAL DISPOSAL

Majority of the project will require fill for the proposed widening. Based on our understanding, the project will require minimal disposal of the excess materials.

12. CONSTRUCTION CONSIDERATIONS

12.1 Construction Advisories

These sections are written primarily for the engineer responsible for the preparation of plans and specifications. Since these sections identify potential construction issues related to the project, it may also be of use to the Agency's representatives involved in monitoring of construction activity. The field investigation performed by us primarily addresses design issues and was not planned specifically to identify construction issues.

The project site is located along the existing highways (I-80, I-680, SR 12) and city streets in the vicinity of the interchange. Therefore, traffic control is required to maintain traffic flow along the highways and the respective city streets. Several underground utilities exist at the site. The contractor should verify the utility lines, be aware of the existing conditions and plan the construction activities accordingly.

In our opinion, conventional equipment may be used to excavate the on-site soil materials. The materials to be excavated may consist of stiff to hard clay/silt at the shallow depths. Localized subgrade pumping may be encountered during earthwork construction depending on the weather, moisture condition of the subsurface soils, and surface drainage conditions. Equipment mobility may also be difficult if the subgrade is wet. In which case, the subgrade soils may require reworking, aeration, or over-excavation and replacing with dry granular fill to facilitate earthwork construction. It is possible that unknown old buried utilities or abandoned structures, concrete rubble etc. are located along the alignment. It might require special equipment and additional efforts to remove these buried objects.

Prospective contractors for the project must evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other localities, or on the basis of field investigation on the site performed by them, taking into account their proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and Stage regulatory agencies.

12.2 Construction Consideration that Influence Specifications

The contractor should verify the conditions of the existing utility lines. These locations should not be used for stockpiling of borrow materials. Any conflicts with proposed construction should also be reviewed prior to construction.

12.3 Hazardous Waste Considerations

The project environmental study report should be referred to for further details about any potential hazardous materials within the project site.

12.4 Differing Site Conditions

The soil conditions described in this report are based on available boring data. It should be noted that these borings depict subsurface conditions only at the locations drilled. Because of the variability from place to place within soils in general, and the nature of geologic depositions, subsurface conditions could change between the explored locations.

Early communication should be made between the Resident Engineer, the Contractor, and the Geotechnical Engineer as soon as conditions that differ from those established in this report are recognized by any of the parties. Additional recommendations could be provided if such conditions arise.

13. RECOMMENDATIONS AND SPECIFICATIONS

13.1 Summary of Recommendations

If the designer has questions or concerns with any of these recommendations, or, if conditions are found to be different during construction, the Geotechnical Engineer who prepared this report should be contacted. Additional fieldwork, analysis or changes in recommendations may be required. These services may be provided under a separate authorization, as necessary. A concise summary of the geotechnical recommendations is presented below:

- The subsurface conditions vary throughout the project vicinity. However, the subsoils generally consist of stiff to hard clay/silt and interbedded medium dense to dense silty sand/clayey sand of varying thickness to the maximum depth explored.
- Based on investigation, groundwater was encountered at Elev. -2.1 to 92 feet, which is approximately 8.5 to 33.8 feet below the existing ground surface within the project vicinity.
- The proposed modifications for the interchanges will require new embankments along the proposed alignment of WB 80 to WB 12 and at the abutments of the future structures. The estimated settlement is anticipated to be on the order of 5 to 12 inches.
- Pavement Sections (Ref: Section 9). Refer to the tables for the design structural pavement sections.

13.2 Recommended Materials Specifications

13.2.1 **Standard Specifications**

Unless otherwise stated in the special provisions, all materials specifications should conform to Caltrans Standard Specifications, May 2006 edition and Amendments dated April 2009, including but not limited to the following: Earthwork, Structure Backfill, Pervious Backfill Material, Reinforcing Geosynthetics, Thermoplastic Pipes, Hot Mix Asphalt, Aggregate Base, Aggregate Subbase, Lean Concrete Base, etc.

13.2.2 **Special Provisions**

<u>Imported Borrow:</u>
Imported material should be in accordance with the specifications set forth in Caltrans Section 19. In particular, for new embankment/roadway construction, the material placed within 4 feet of the finish pavement subgrade should meet the following requirements:

1. Free of organic or other deleterious materials.
2. An R-value of no less than 15.

Aggregate Subbase:

Aggregate Subbase shall be Class 4 and shall conform to the provisions in Section 25 of the Standard Specifications and to these Special Provisions. Class 4 aggregate subbase shall be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class 4 aggregate subbase shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing)

Sieve Sizes	Operating Range	Contract Compliance
2-1/2”	100	100
No. 4	30 – 65	25 – 70
No. 200	0 – 15	0 – 18

Class 4 aggregate subbase shall also conform to the quality requirements given in the following table:

Quality requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	21 Min.	18 Min.
Resistance (R-value) (301)	50	50 Min.

14. INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions.

No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our findings and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Frank Y. Wang, P.E, G.E. 2862
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

15. REFERENCES

Bezore, S.P., Wagner, D.L., and Sowers, J.M.; 1998; Geologic Map of the Cordelia 7.5' Quadrangle, Solano and Napa Counties, California, California Geological Survey; CD-2002-07.

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Department of Conservation; California Division of Mines and Geology, 2002, Official Revised Seismic Hazard Zones Map for the San Jose West, Santa Clara County, California.

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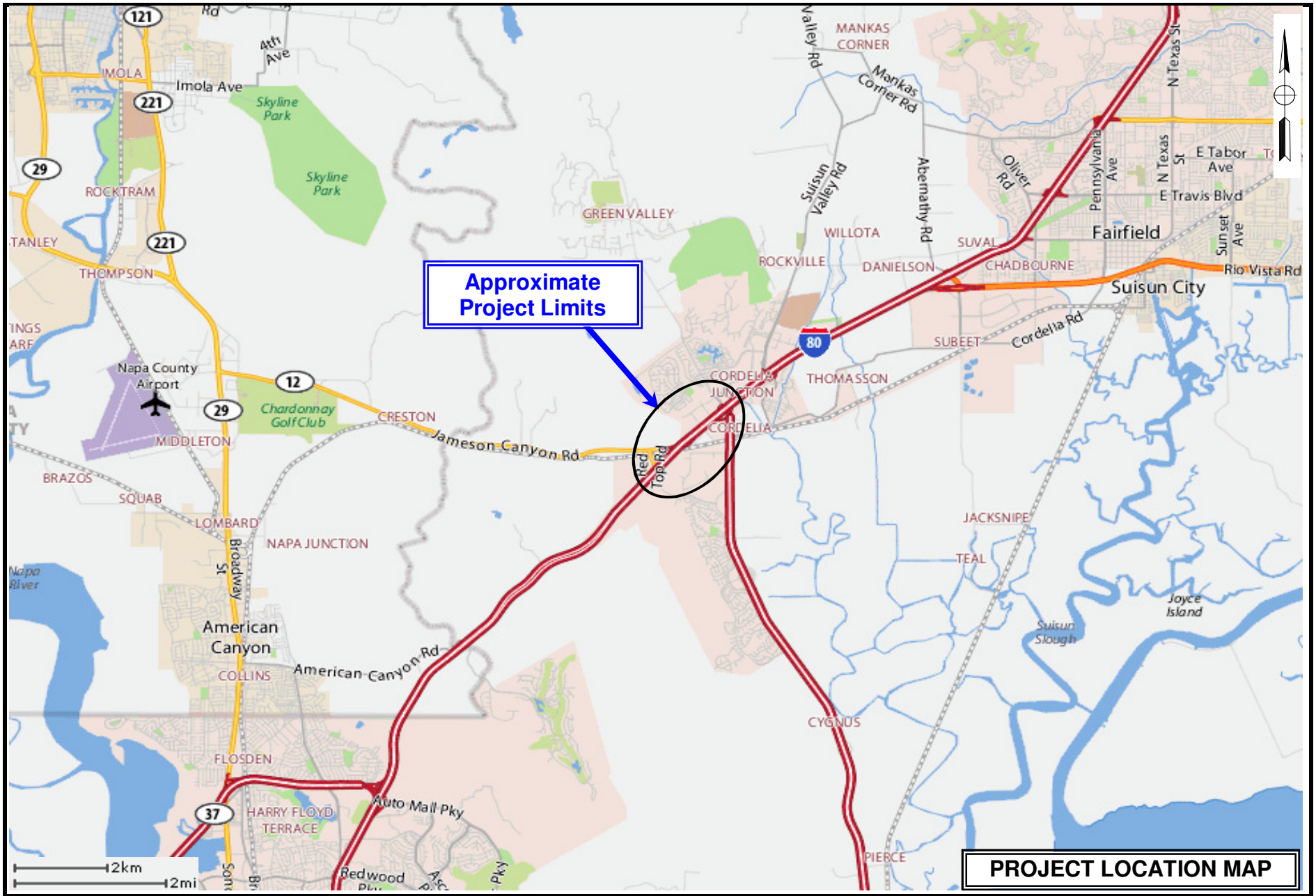

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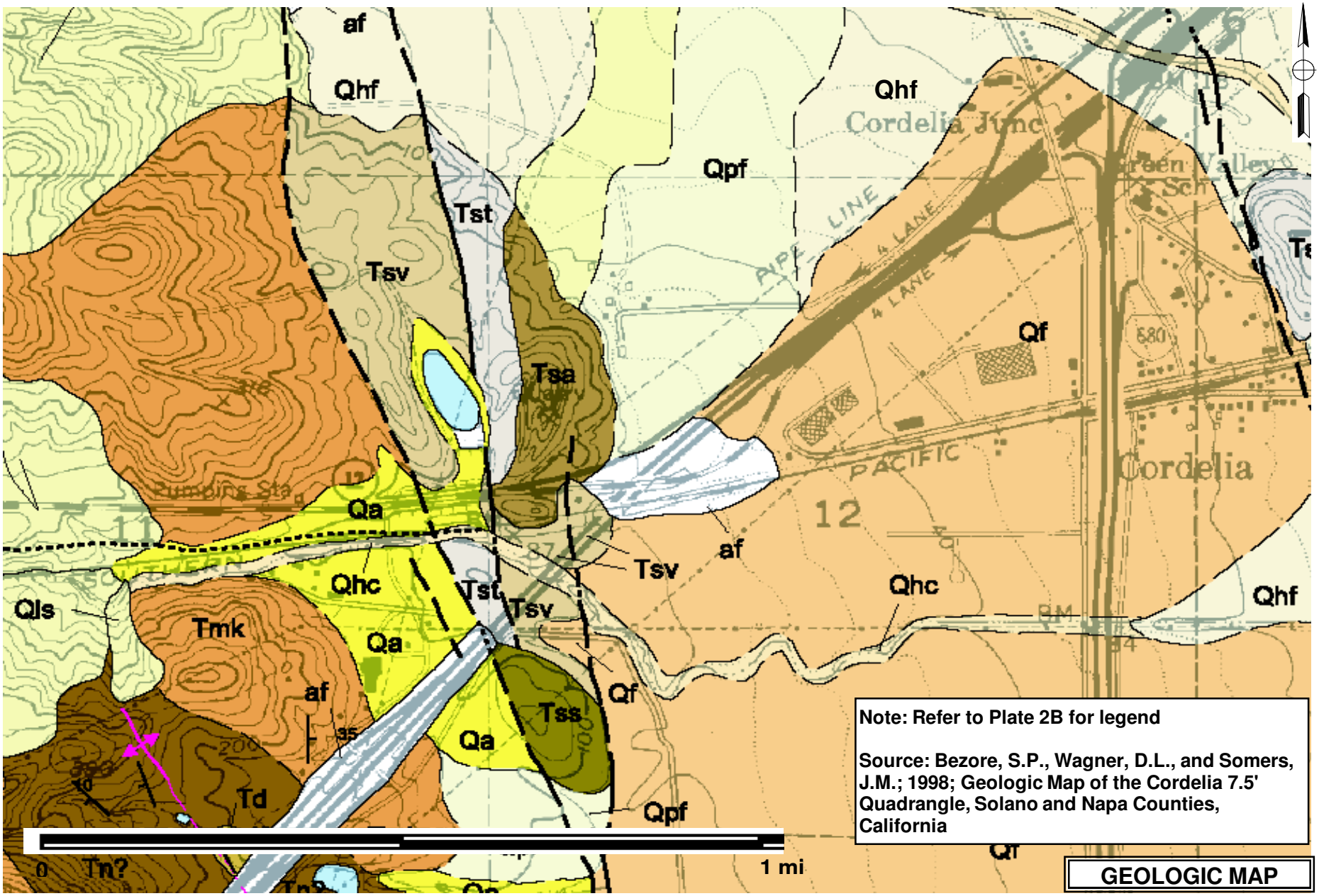
I-80/I-680/SR 12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

JOB NO.: 209130.GDR	PLATE NO.: 1



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JOB NO.: 209130.GDR	PLATE NO.: 2A

af	Artificial fill
Qhc	Modern stream channel deposits. Channel bed and bank deposits of the major present-day creeks and streams. Deposits are late Holocene to modern in age and consist of loose fluvial sand, gravel, and silt.
Qhf	Holocene fan deposits. Holocene alluvial fan sediments, deposited by streams eminating from the mountains as debris flows, hyperconcentrated mudflows, or braided stream flows. Sediments include sand, gravel, silt, and clay, that are moderatly to poorly sorted, and moderatly to poorly bedded.
Qf	Late Pleistocene to Holocene fan deposits. Gently sloping, fan-shaped, relatively undissected alluvial surfaces where late Pleistocene or Holocene age was uncertain or where the deposits of different age interfinger such that they could not be delineated at the map scale. Sediments include sand, gravel, silt, and clay, that were moderatly to poorly sorted, and moderately to poorly bedded.
Qa	Late Pleistocene to Hololcene alluvium, undivided. Alluvium deposited in small valleys where seperate fan, basin, and terrace units could not be delineated at the map scale, and where Holocene or Pleistocene age was uncertain. The unit includes flat, relatively undissected fan, terrace, and basin deposits, and small active stream channels.
Qpf	Late Pleistocene alluvium, undivided. Gently sloping, fan-shaped, alluvial surfaces where late Pleistocene age is indicated by slight dissection and/or development of alfisols.
Tss	Sandstone and volcanic gravel (Pliocene). Poorly consolidated tan sandstone and tuffaceous sandstone with lenses of volcanic conglomerate. The sandstone contains sparse flakes of white mica, probably derived from the Markley sandstone
Tst	Ash-flow tuff (Pliocene). Pumicitic, locally welded, with bedded agglomeritic tuff.
Tsa	Andesites (Pliocene). Andesitic flows, breccias, and agglomerates.

Note: Refer to Plate 2A for map

Source: Bezore, S.P., Wagner, D.L., and Somers, J.M.; 1998; Geologic Map of the Cordelia 7.5' Quadrangle, Solano and Napa Counties, California

GEOLOGIC MAP

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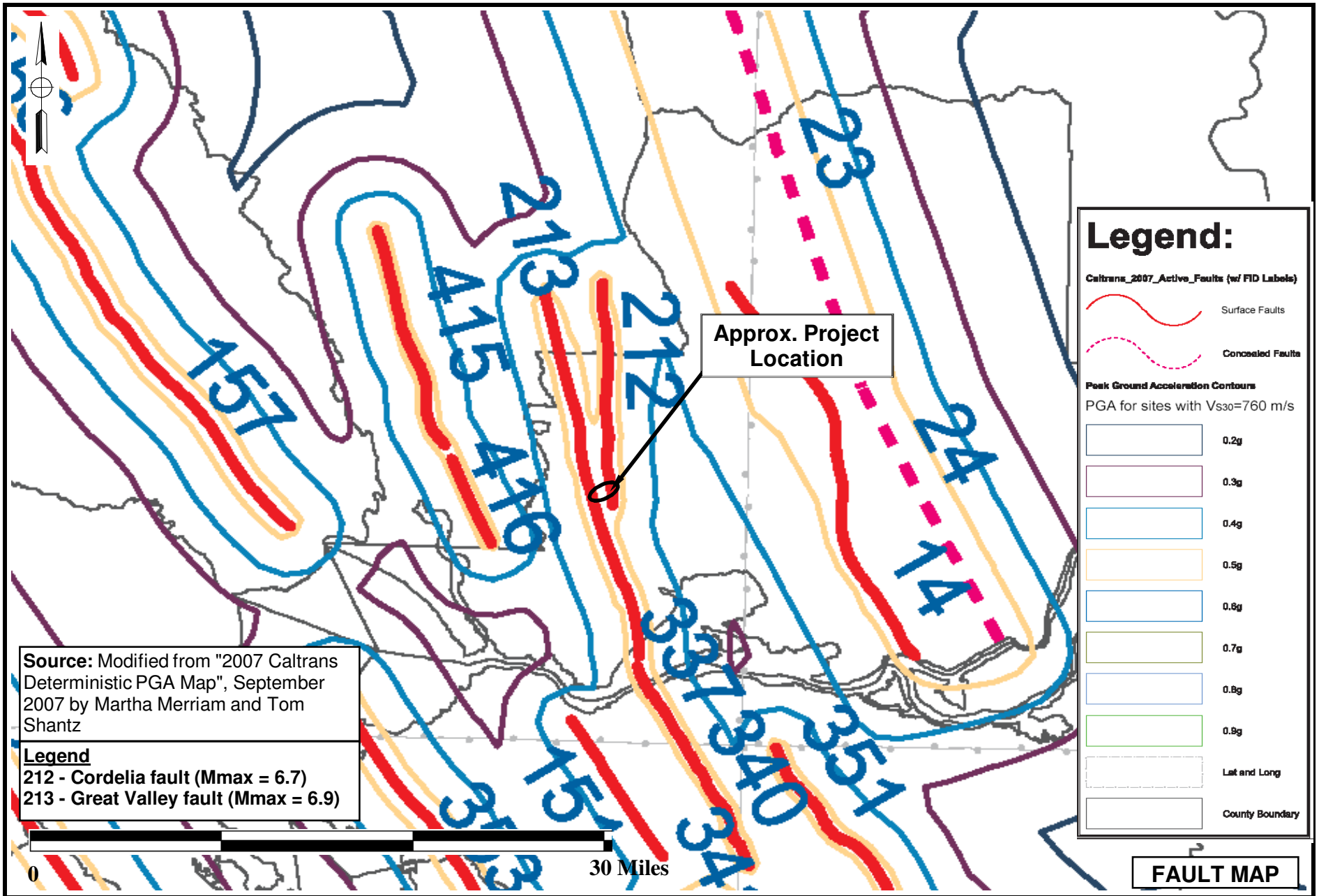
SOLANO COUNTY, CALIFORNIA

JOB NO.: 209130.GDR | **PLATE NO.: 2B**



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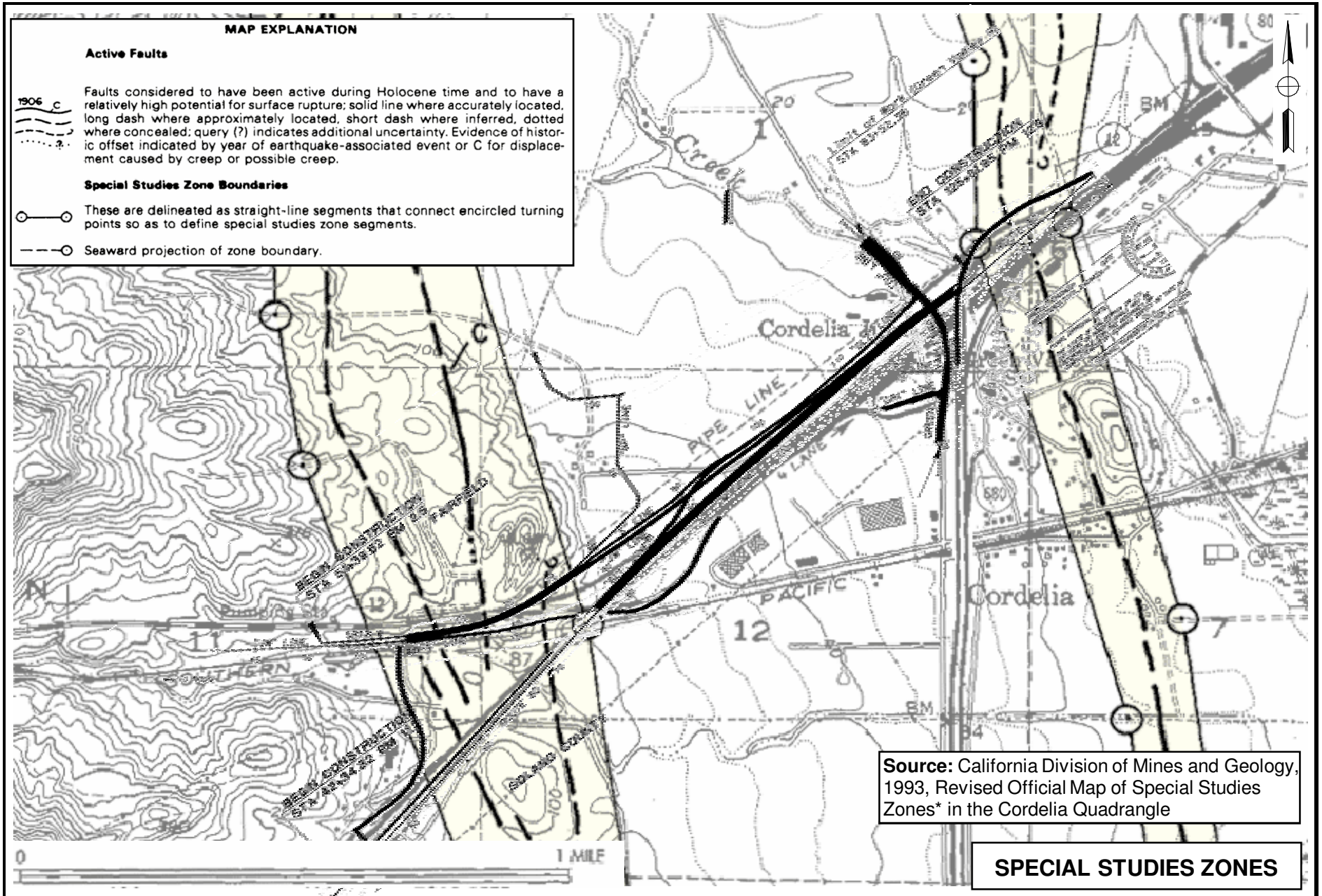
SOLANO COUNTY, CALIFORNIA

JOB NO.: 209130.GDR | PLATE NO.: 3



Source: California Division of Mines and Geology, 1993, Revised Official Map of Special Studies Zones* in the Cordelia Quadrangle

SPECIAL STUDIES ZONES

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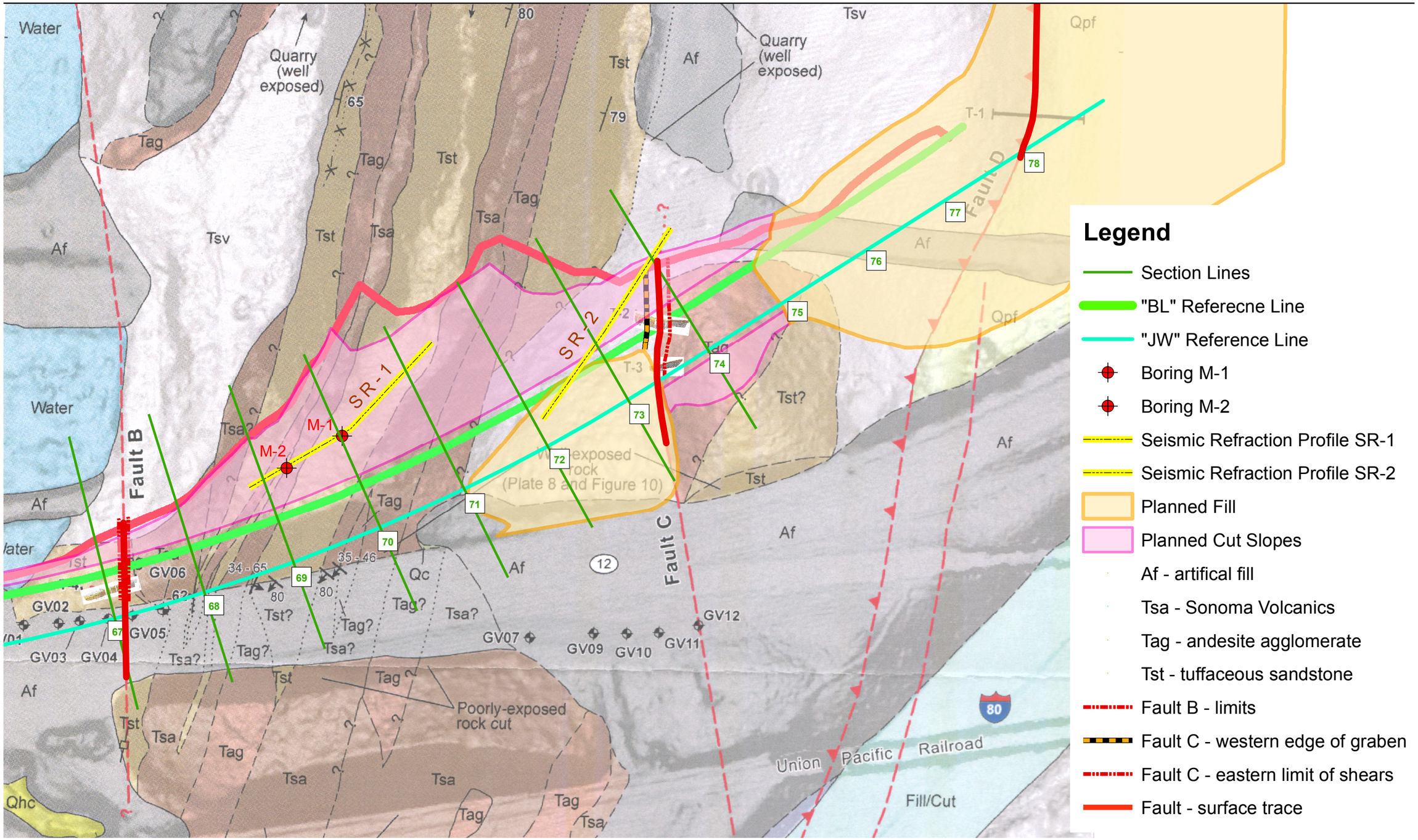
JOB NO.: 209130.GDR	PLATE NO.: 4



0 25 50 100 150 200 Feet

Site Geologic Map (per WLA, 2009)
(between Sta. 67+00 and Sta. 78+00)

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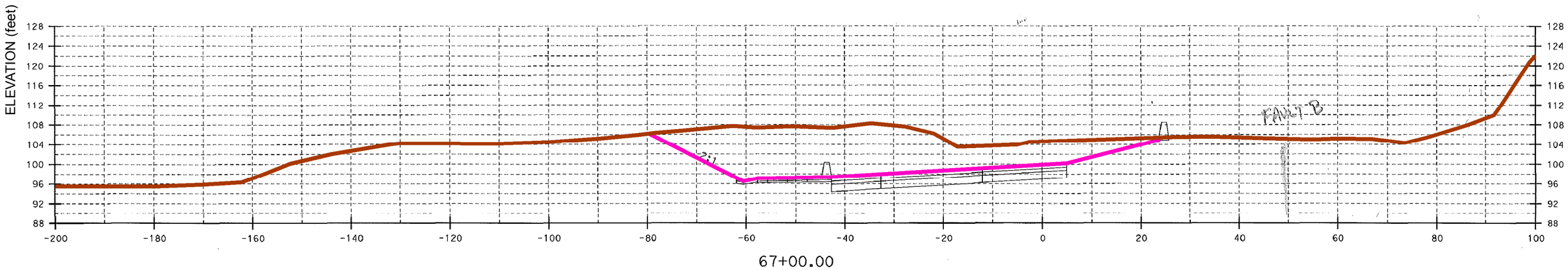
JOB NO.: 209130.GDR | PLATE NO.: 5



Legend

- ground surface
- planned cut

CROSS-SECTION 67+00

0 10 20 40 60 80 100 Feet

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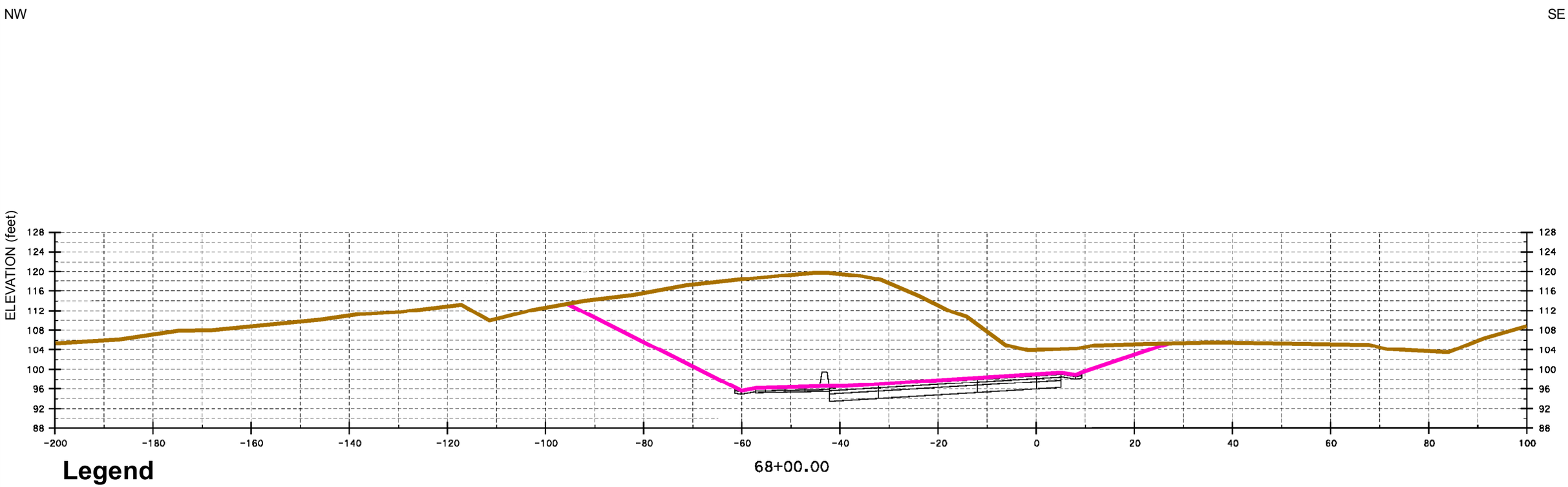
JOB NO.: 209130.GDR

PLATE NO.: 6A



Legend

- ground surface
- planned cut

CROSS-SECTION 68+00

0 10 20 40 60 80 100 Feet

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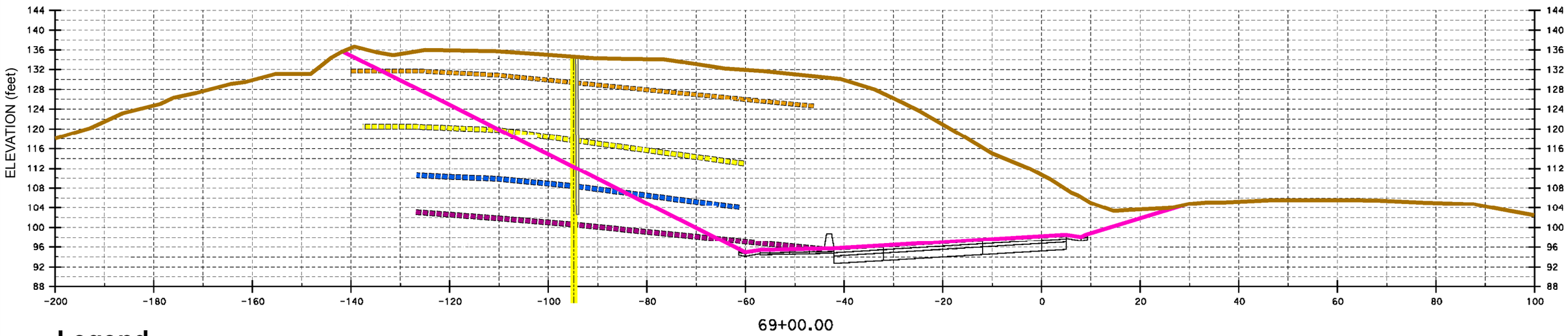
JOB NO.: 209130.GDR

PLATE NO.: 6B



Legend

- ground surface
- planned cut
- Boring M-2
- SR-1
- 2000fps
- 3000fps
- 4000fps
- 5000fps

CROSS-SECTION 69+00

0 10 20 40 60 80 100 Feet

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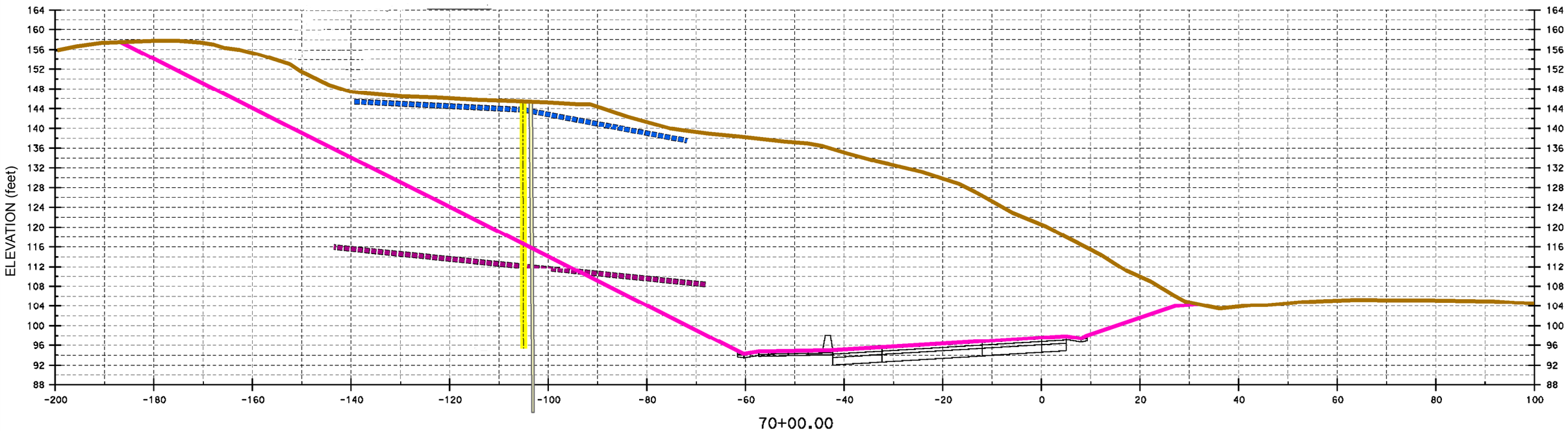
JOB NO.: 209130.GDR

PLATE NO.: 6C



Legend

- ground surface
- planned cut
- Boring M-1
- SR-1
- 4000-fps
- 5000fps

CROSS-SECTION 70+00

0 10 20 40 60 80 100 Feet

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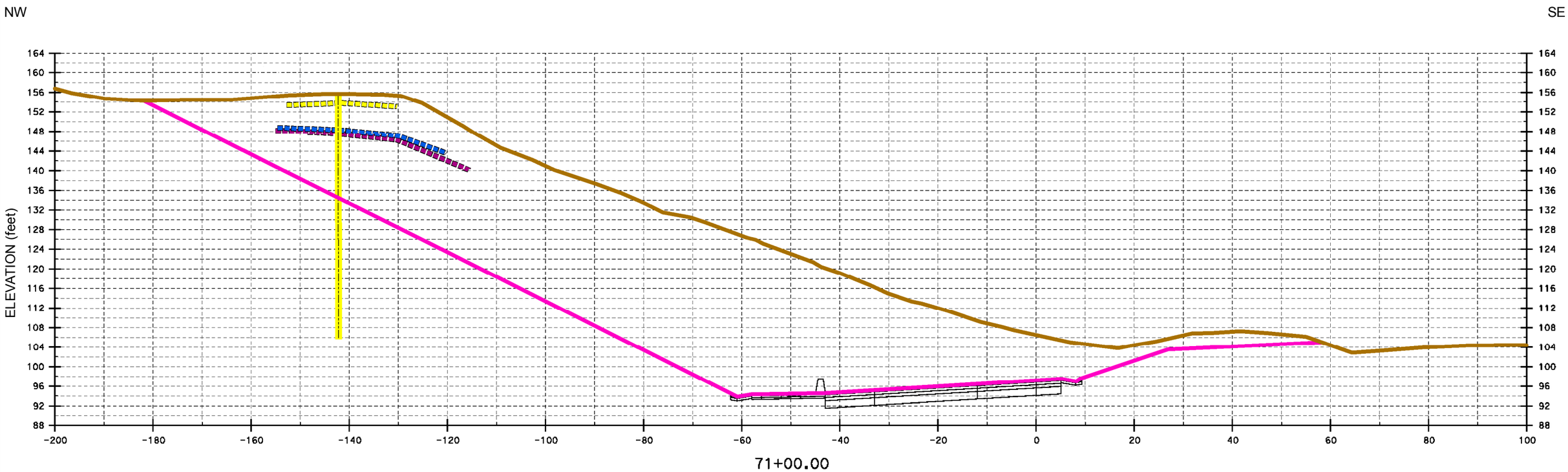
JOB NO.: 209130.GDR | PLATE NO.: 6D



Legend

- ground surface
- planned cut
- SR-1
- 3000fps
- 4000FPS
- 5000fps

CROSS-SECTION 71+00

0 10 20 40 60 80 100 Feet

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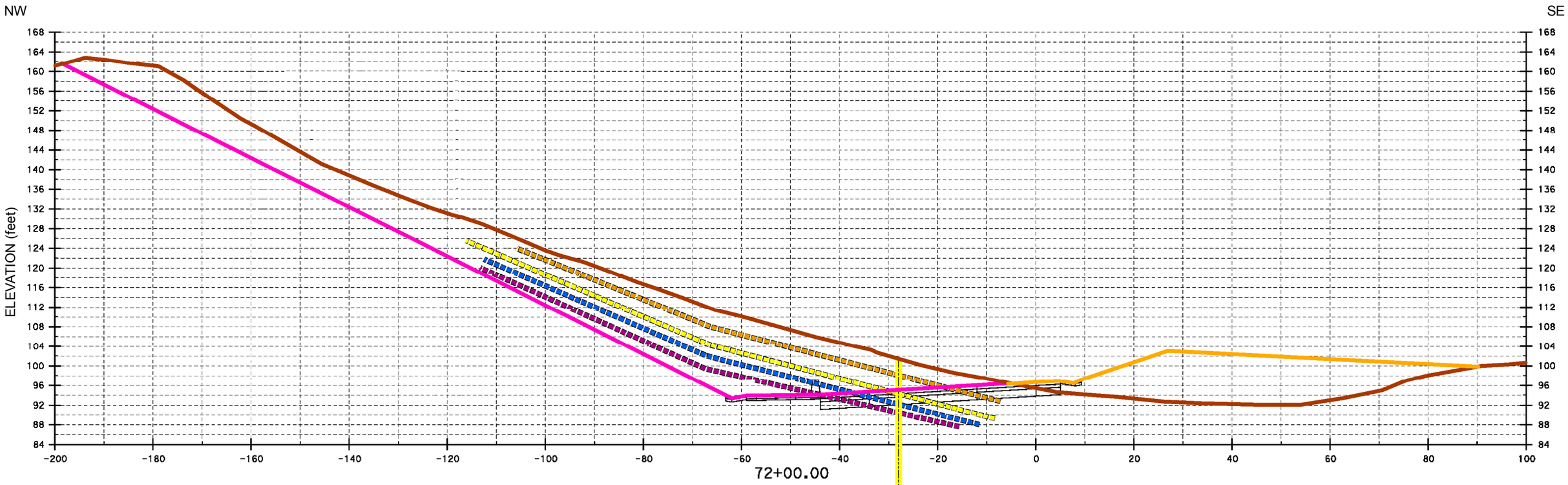
JOB NO.: 209130.GDR | PLATE NO.: 6E



Legend

- planned fill
- ground surface
- planned cut
- SR-2
- 2000fps
- 3000fps
- 4000fps
- 5000fps

CROSS-SECTION 72+00

0 10 20 40 60 80 100 Feet

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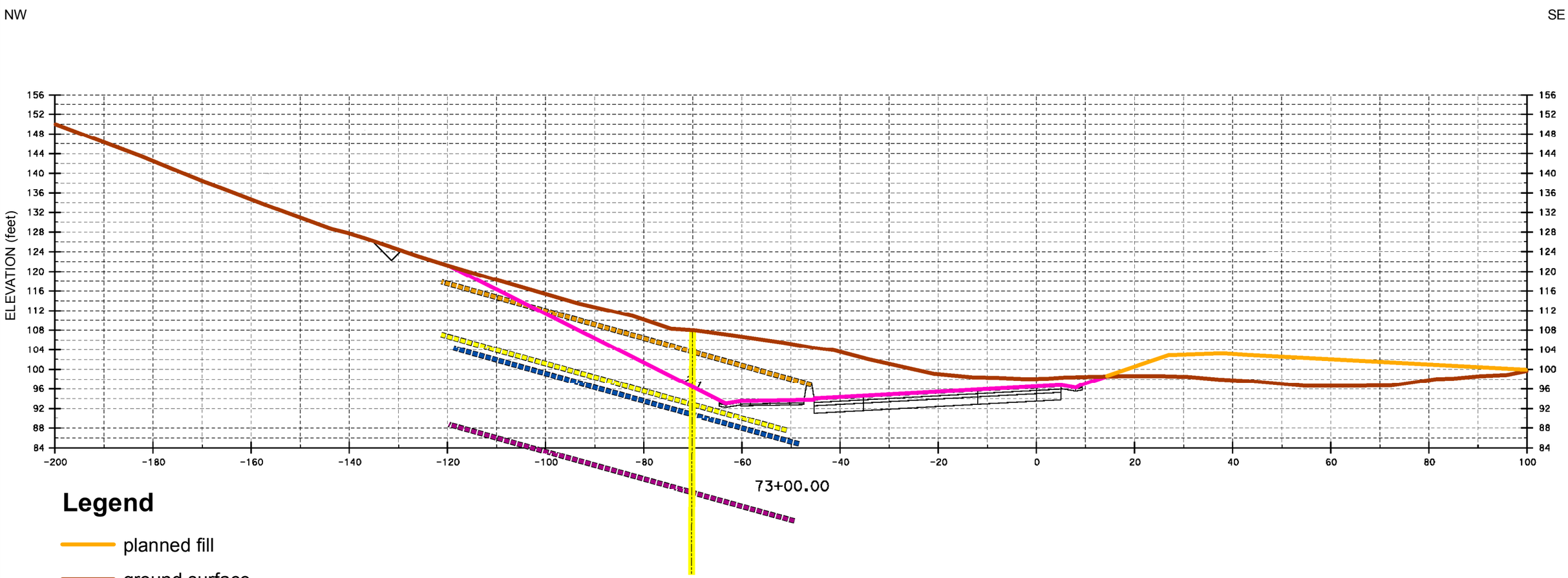
SOLANO COUNTY, CALIFORNIA

JOB NO.: 209130.GDR

PLATE NO.: 6F



Legend

- planned fill
- ground surface
- planned cut
- SR-2
- 2000fps
- 3000fps
- 4000fps
- 5000fps

CROSS-SECTION 73+00

0 10 20 40 60 80 100 Feet

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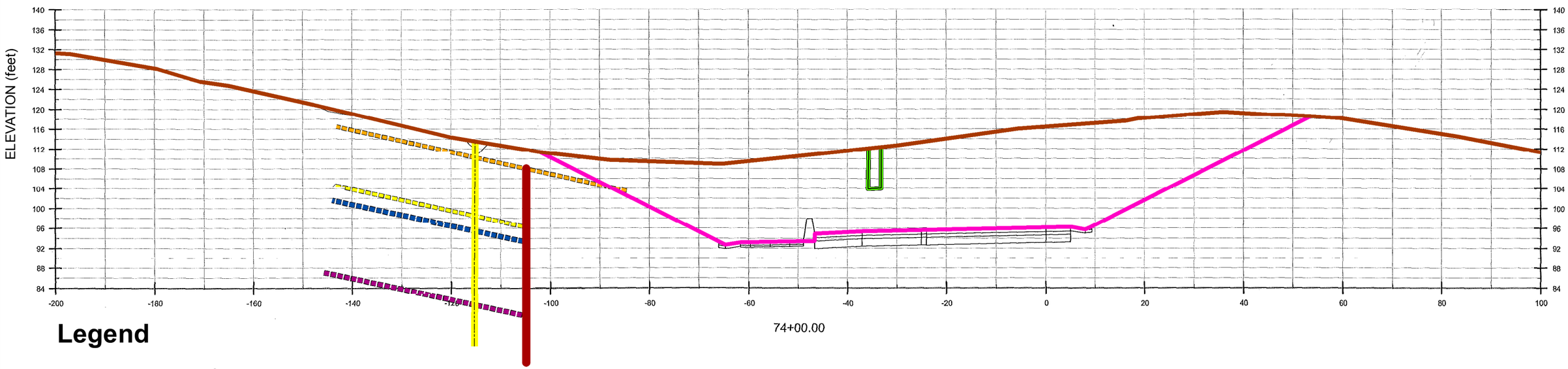
I-80/I-680/SR 12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

JOB NO.: 209130.GDR

PLATE NO.: 6G



Legend

- ground surface
- planned cut
- T-2
- Fault-C
- SR-2
- 2000fps
- 3000fps
- 4000fps
- 5000fps

CROSS-SECTION 74+00

0 10 20 40 60 80 100 Feet

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I-80/I-680/SR 12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

JOB NO.: 209130.GDR | **PLATE NO.:** 6H

APPENDIX A

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1	____	____

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
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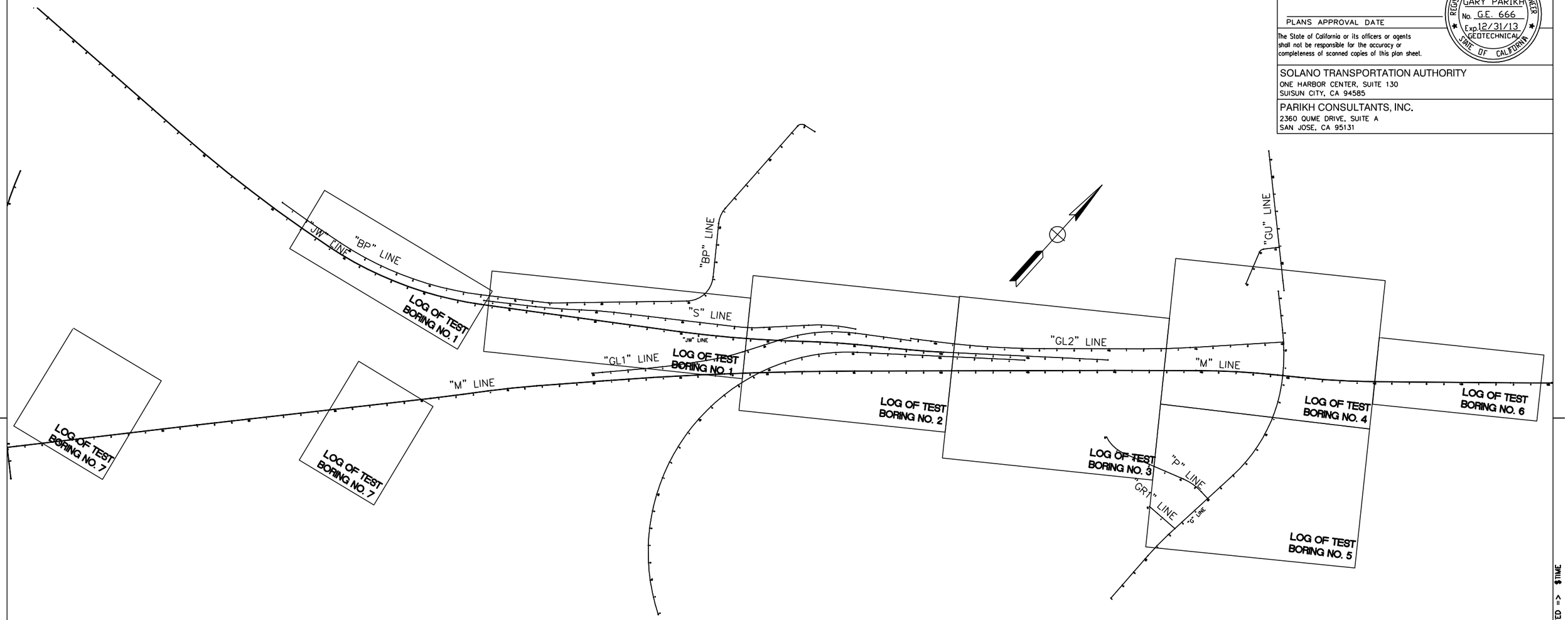
SAN JOSE, CA 95131



NO SCALE

Note: All units are in feet unless otherwise specified
Reference Map was provided by Mark Thomas & Co., Inc.

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		PROJECT ENGINEER

BRIDGE NO. — | POST MILES —

I-80/I-680/SR-12 ICP

KEY MAP

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

REVISION DATES | SHEET | OF

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

Oct 05, 2012 - 12:10pm S:\ACAD\209130.GDR\Key Map.dwg

ltran

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	SOL	80	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JULY 2010)

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

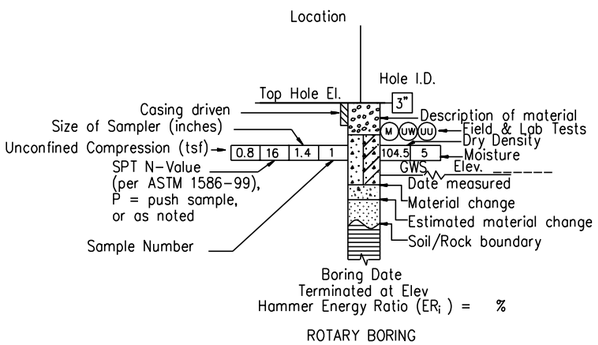
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

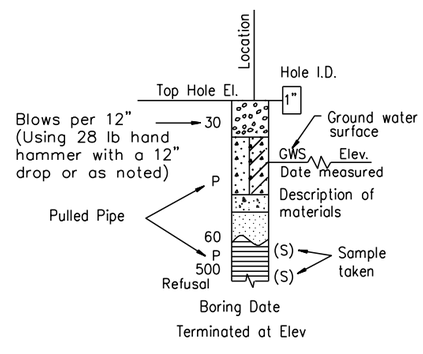
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

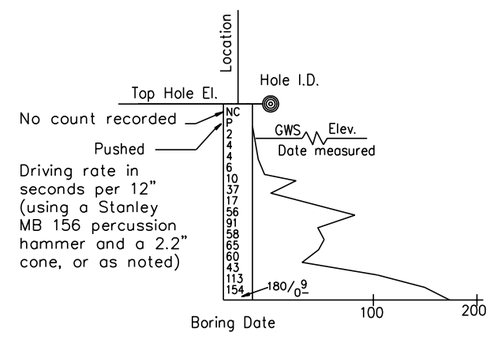
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.



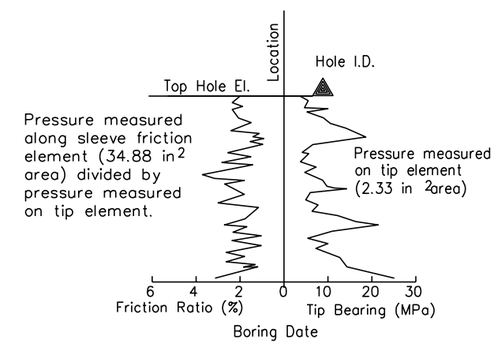
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG			

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

SOIL LEGEND NO. 1 OF 2

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

REVISION DATES | SHEET | OF

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

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GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY: L. TRAN

CHECKED BY: F. WANG

L.S. BHANGOO / A. BHARADWAJ / V. SANTOS
FIELD INVESTIGATION BY:
DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG
PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

SOIL LEGEND NO. 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

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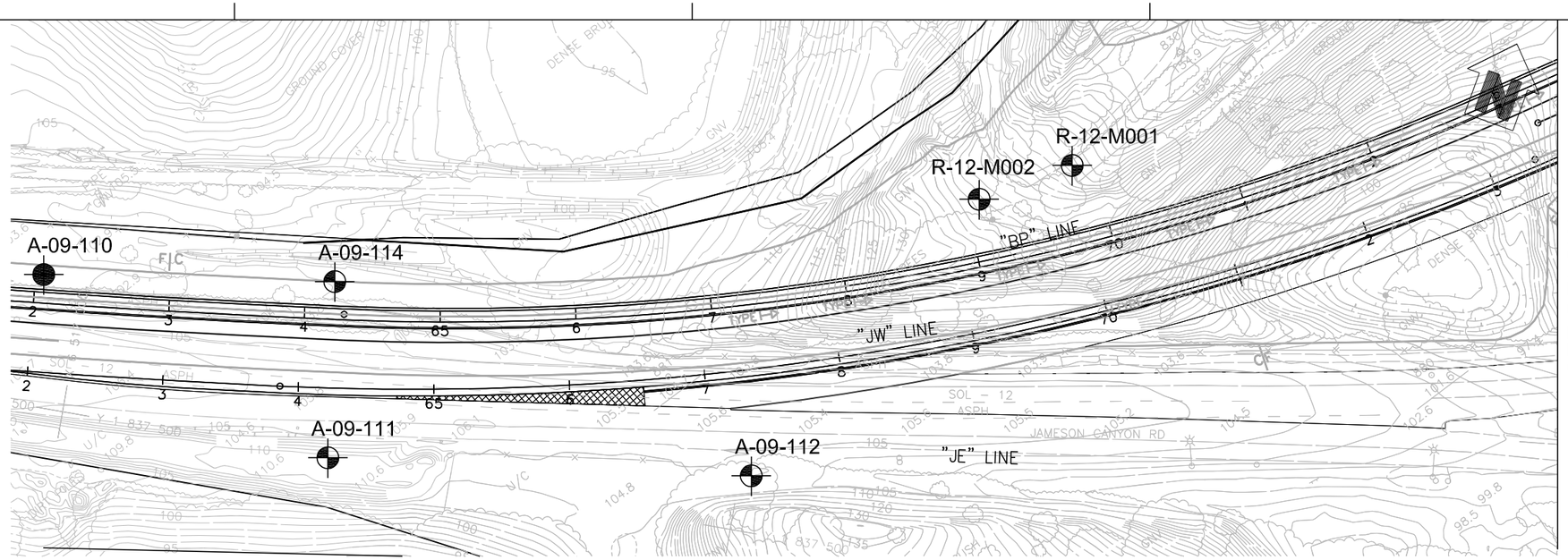
BENCH MARKS
BENCHMARK NO. A 1393 (NGS PID JT9519)
Brass disc set vertically in the east face at the first concrete pier east at the west abutment at the Union Pacific (formerly Southern Pacific) Railroad overcrossing at Interstate Highway 80, 21.7 feet northwest at the center at the most northwesterly westbound lane of the highway. The disc is stamped "A 1393 1987"
Northing: 1837422 Easting: 6518256
(NAD83, CCSII)
Elevation: 67.07 (NAVD 88)
Stability: B

HPGN D CA 10 LC (NGS PID AC9890)
Survey disc set on aluminum alloy rod encased in a PVC pipe with access cover set in concrete flush with the parking lot pavement in the Park and Ride Lot, 92 feet west at the center line at Green Valley Road and 48 feet southeast of the Green Valley Road onramp to westbound Interstate Highway 80. The disc is stamped "CADT 10 LC"
Northing: 1840653.06 Easting: 6521452.79
(HPGN 1991.35, CCSII)
Elevation: 26.35 (NAVD 88)
Stability: B



SEE BELOW

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
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LEGEND

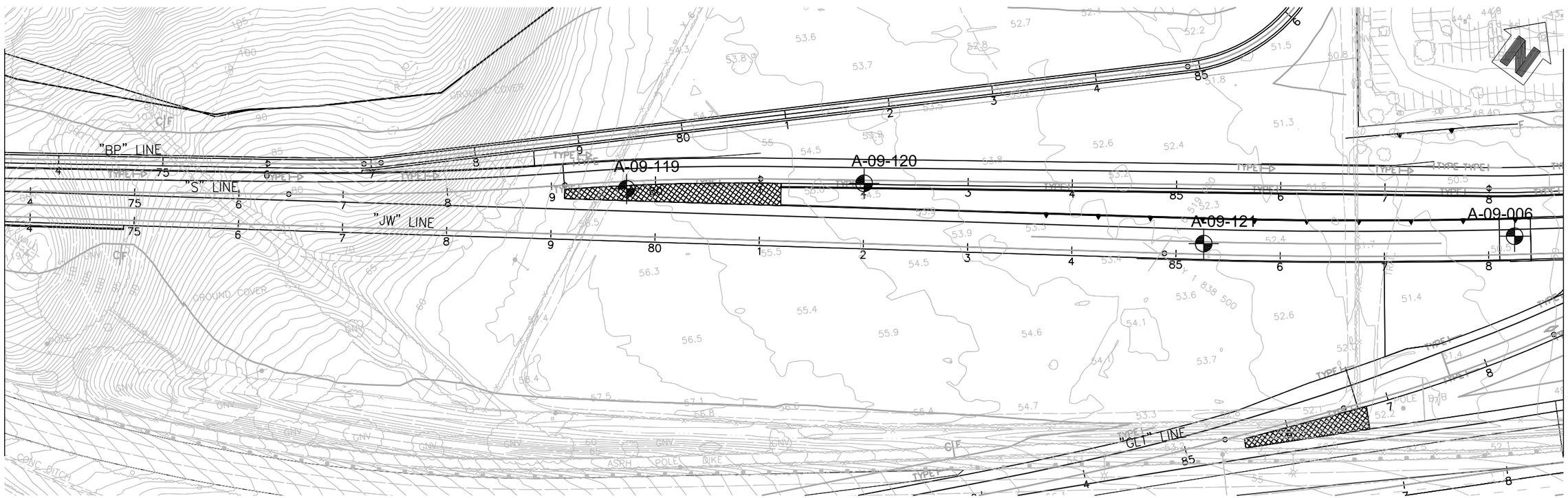
A-09-001 — Approx. Boring Location

CPT-09-007 — Approx. CPT Location

A-09-110 — Approx. Bulk Sample Location

SCALE 1 inch = 50 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by Mark Thomas & Co., Inc.



SEE ABOVE

SEE LOG OF TEST BORINGS NO. 2

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG — PROJECT ENGINEER

BRIDGE NO. —
POST MILES —

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 1

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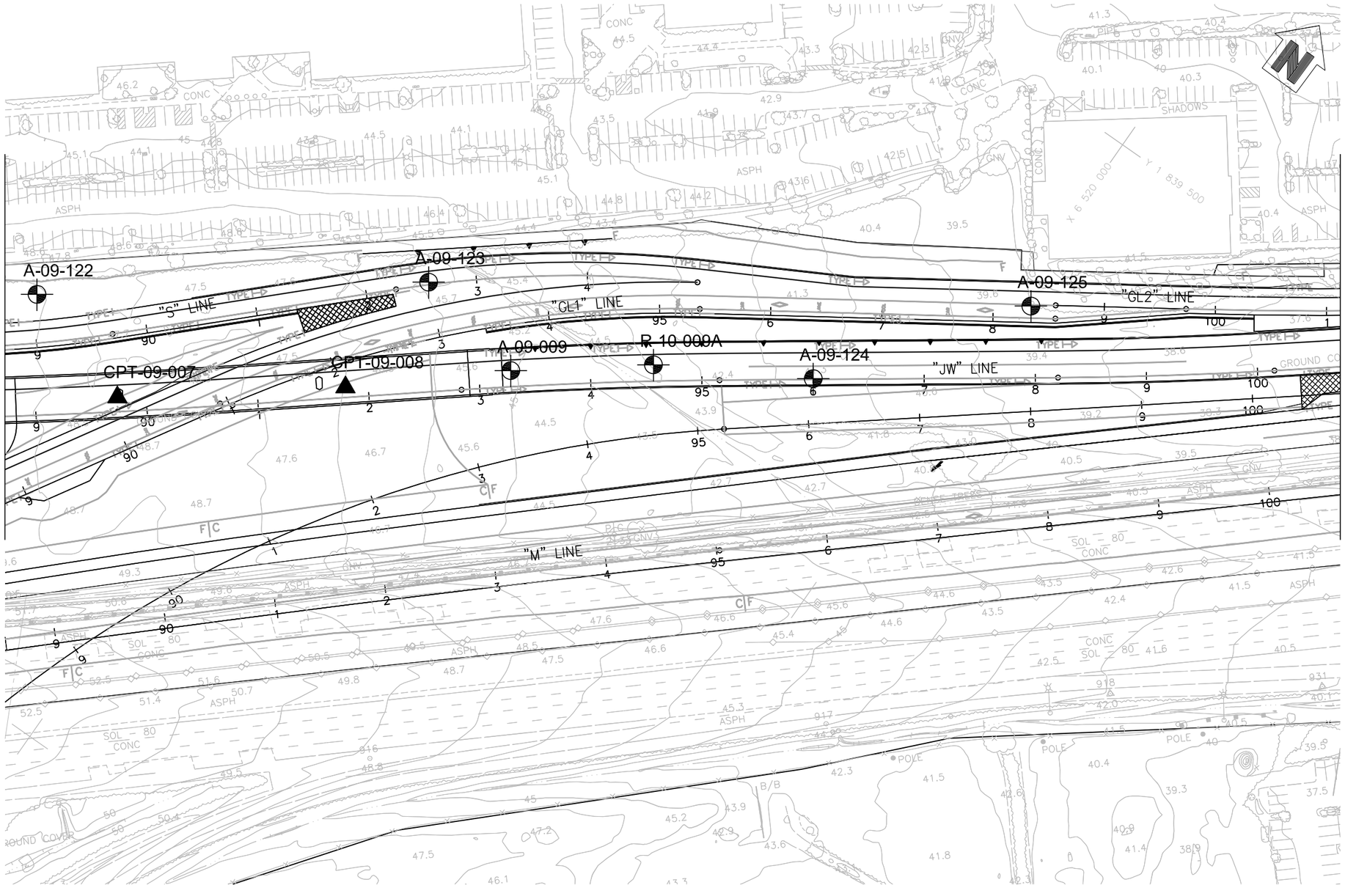

SEE LOG OF TEST BORINGS NO. 3

LEGEND

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CPT-09-007 — Approx. CPT Location

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Brass disc set vertically in the east face at the first concrete pier east at the west abutment at the Union Pacific (formerly Southern Pacific) Railroad overcrossing at Interstate Highway 80, 21.7 feet northwest at the center at the most northwesterly westbound lane of the highway. The disc is stamped "A 1393 1987"
Northing: 1837422 Easting: 6518256
(NAD83, CCSII)
Elevation: 67.07 (NAVD 88) Stability: B

HPGN D CA 10 LC (NGS PID AC9890)
Survey disc set on aluminum alloy rod encased in a PVC pipe with access cover set in concrete flush with the parking lot pavement in the Park and Ride Lot, 92 feet west at the center line at Green Valley Road and 48 feet southeast of the Green Valley Road onramp to westbound Interstate Highway 80. The disc is stamped "CADT 10 LC"
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(HPGN 1991.35, CCSII)
Elevation: 26.35 (NAVD 88) Stability: B

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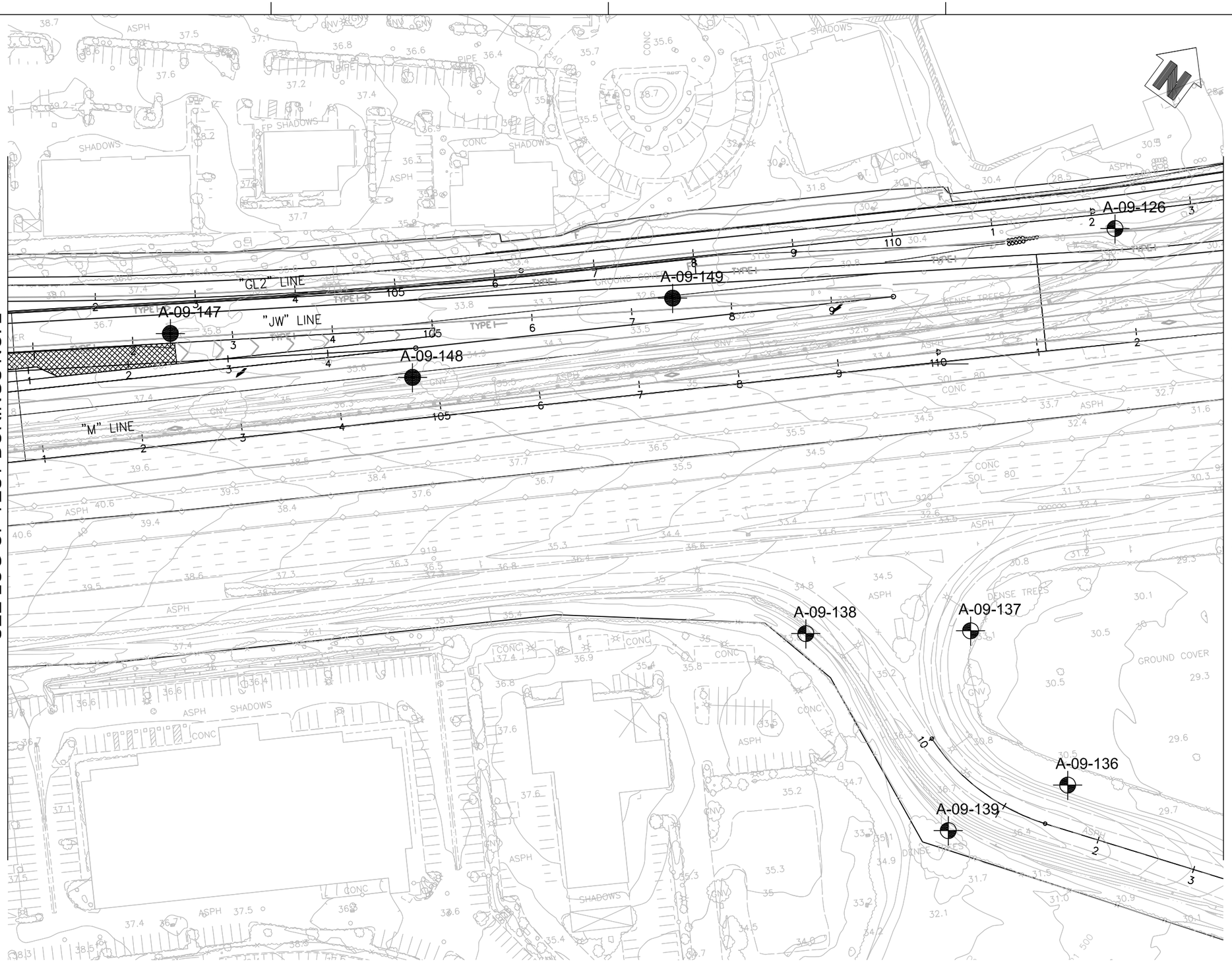

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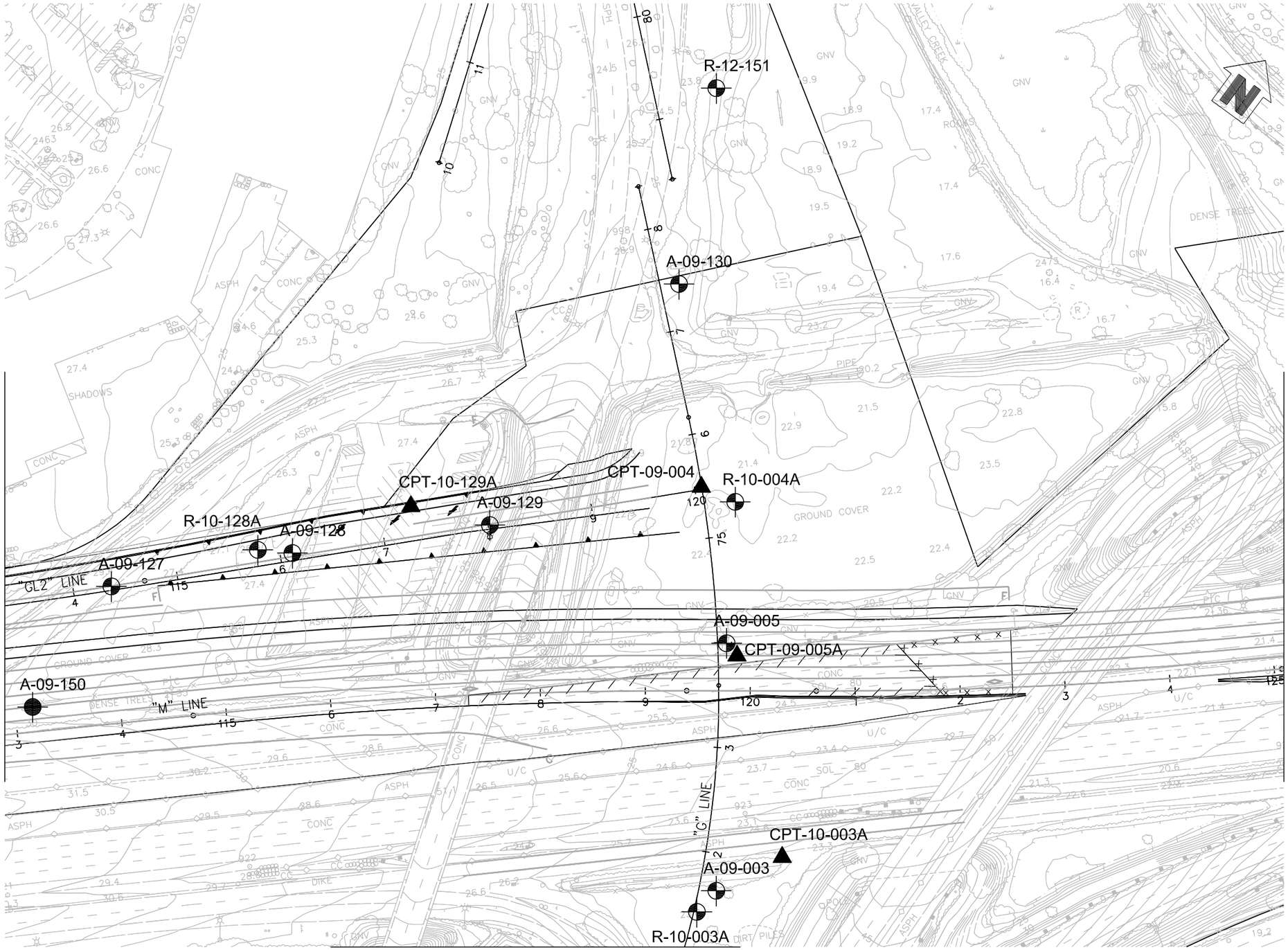

LEGEND

A-09-001 — Approx. Boring Location

CPT-09-007 — Approx. CPT Location

SCALE 1 inch = 50 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by Mark Thomas & Co., Inc.

BENCH MARKS
BENCHMARK NO. A 1393 (NGS PID JT9519)
Brass disc set vertically in the east face at the first concrete pier east at the west abutment at the Union Pacific (formerly Southern Pacific) Railroad overcrossing at Interstate Highway 80, 21.7 feet northwest at the center at the most northwesterly westbound lane of the highway. The disc is stamped "A 1393 1987"
Northing: 1837422 Easting: 6518256
(NAD83, CCSII)
Elevation: 67.07 (NAVD 88) Stability: B

HPGN D CA 10 LC (NGS PID AC9890)
Survey disc set on aluminum alloy rod encased in a PVC pipe with access cover set in concrete flush with the parking lot pavement in the Park and Ride Lot, 92 feet west at the center line at Green Valley Road and 48 feet southeast of the Green Valley Road onramp to westbound Interstate Highway 80. The disc is stamped "CADT 10 LC"
Northing: 1840653.06 Easting: 6521452.79
(HPGN 1991.35, CCSII)
Elevation: 26.35 (NAVD 88) Stability: B

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY L. TRAN

CHECKED BY F. WANG

L.S. BHANGOO / A. BHARADWAJ / V. SANTOS
FIELD INVESTIGATION BY:
DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG
PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 4

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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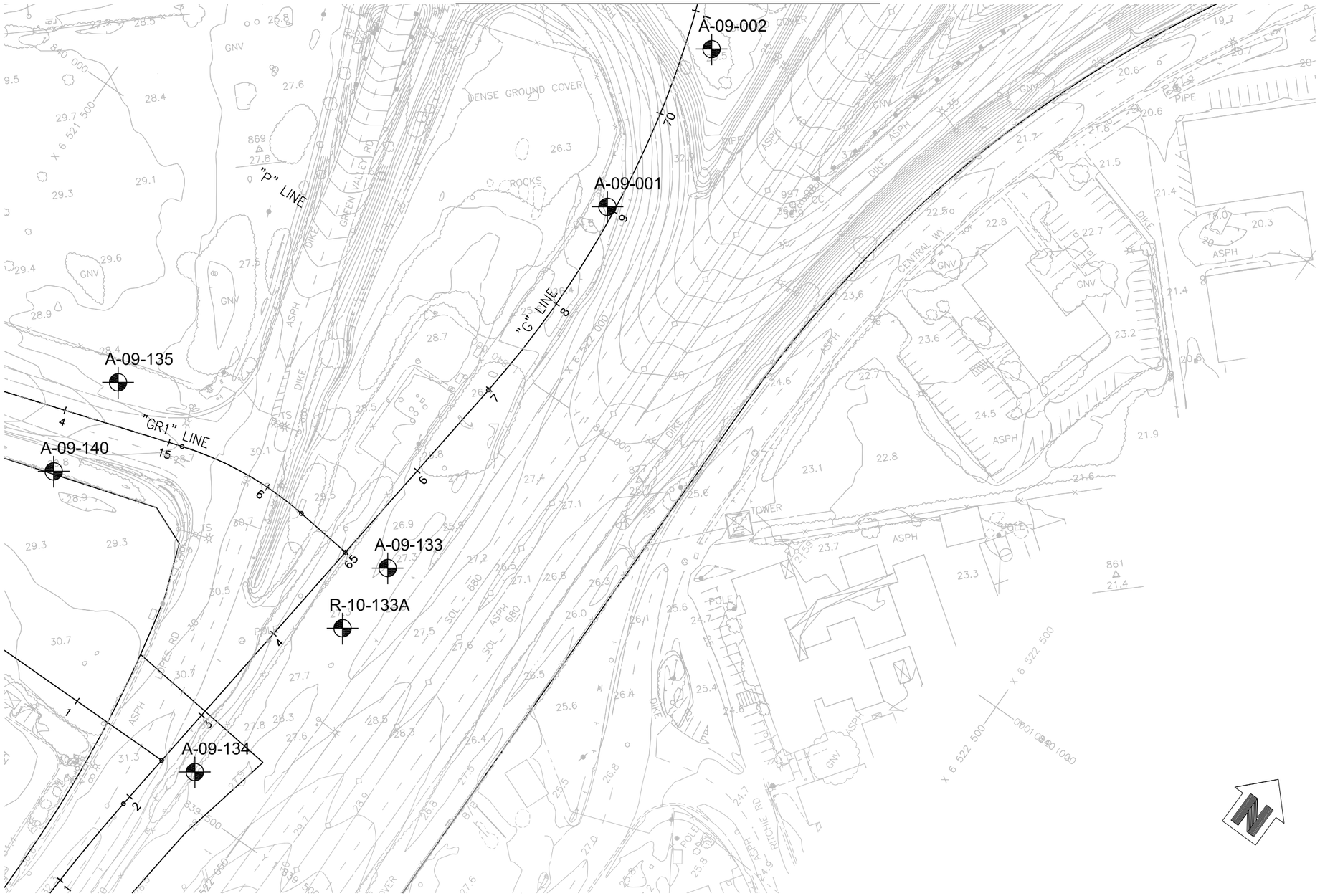
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

SEE LOG OF TEST BORINGS NO. 4



LEGEND

A-09-001 — Approx. Boring Location

CPT-09-007 — Approx. CPT Location

SCALE 1 inch = 50 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by Mark Thomas & Co., Inc.

BENCH MARKS
BENCHMARK NO. A 1393 (NGS PID JT9519)
Brass disc set vertically in the east face at the first concrete pier east at the west abutment at the Union Pacific (formerly Southern Pacific) Railroad overcrossing at Interstate Highway 80, 21.7 feet northwest at the center at the most northwesterly westbound lane of the highway. The disc is stamped "A 1393 1987"
Northing: 1837422 Easting: 6518256
(NAD83, CCSII)
Elevation: 67.07 (NAVD 88) Stability: B

HPGN D CA 10 LC (NGS PID AC9890)
Survey disc set on aluminum alloy rod encased in a PVC pipe with access cover set in concrete flush with the parking lot pavement in the Park and Ride Lot, 92 feet west at the center line at Green Valley Road and 48 feet southeast of the Green Valley Road onramp to westbound Interstate Highway 80. The disc is stamped "CADT 10 LC"
Northing: 1840653.06 Easting: 6521452.79
(HPGN 1991.35, CCSII)
Elevation: 26.35 (NAVD 88) Stability: B

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY: L. TRAN
CHECKED BY: F. WANG

L.S. BHANGOO / A. BHARADWAJ / V. SANTOS
FIELD INVESTIGATION BY:
DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG
PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 5

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

LEGEND

A-09-001 — Approx. Boring Location

CPT-09-007 — Approx. CPT Location

A-09-110 — Approx. Bulk Sample Location

SCALE 1 inch = 50 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by Mark Thomas & Co., Inc.

BENCH MARKS
BENCHMARK NO. A 1393 (NGS PID JT9519)
Brass disc set vertically in the east face at the first concrete pier east at the west abutment at the Union Pacific (formerly Southern Pacific) Railroad overcrossing at Interstate Highway 80, 21.7 feet northwest at the center at the most northwesterly westbound lane of the highway. The disc is stamped "A 1393 1987"
Northing: 1837422 Easting: 6518256
(NAD83, CCSII)
Elevation: 67.07 (NAVD 88) Stability: B

HPGN D CA 10 LC (NGS PID AC9890)
Survey disc set on aluminum alloy rod encased in a PVC pipe with access cover set in concrete flush with the parking lot pavement in the Park and Ride Lot, 92 feet west at the center line at Green Valley Road and 48 feet southeast of the Green Valley Road onramp to westbound Interstate Highway 80. The disc is stamped "CADT 10 LC"
Northing: 1840653.06 Easting: 6521452.79
(HPGN 1991.35, CCSII)
Elevation: 26.35 (NAVD 88) Stability: B

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY L. TRAN

CHECKED BY F. WANG

L.S. BHANGOO / A. BHARADWAJ / V. SANTOS
FIELD INVESTIGATION BY:
DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG
PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 6

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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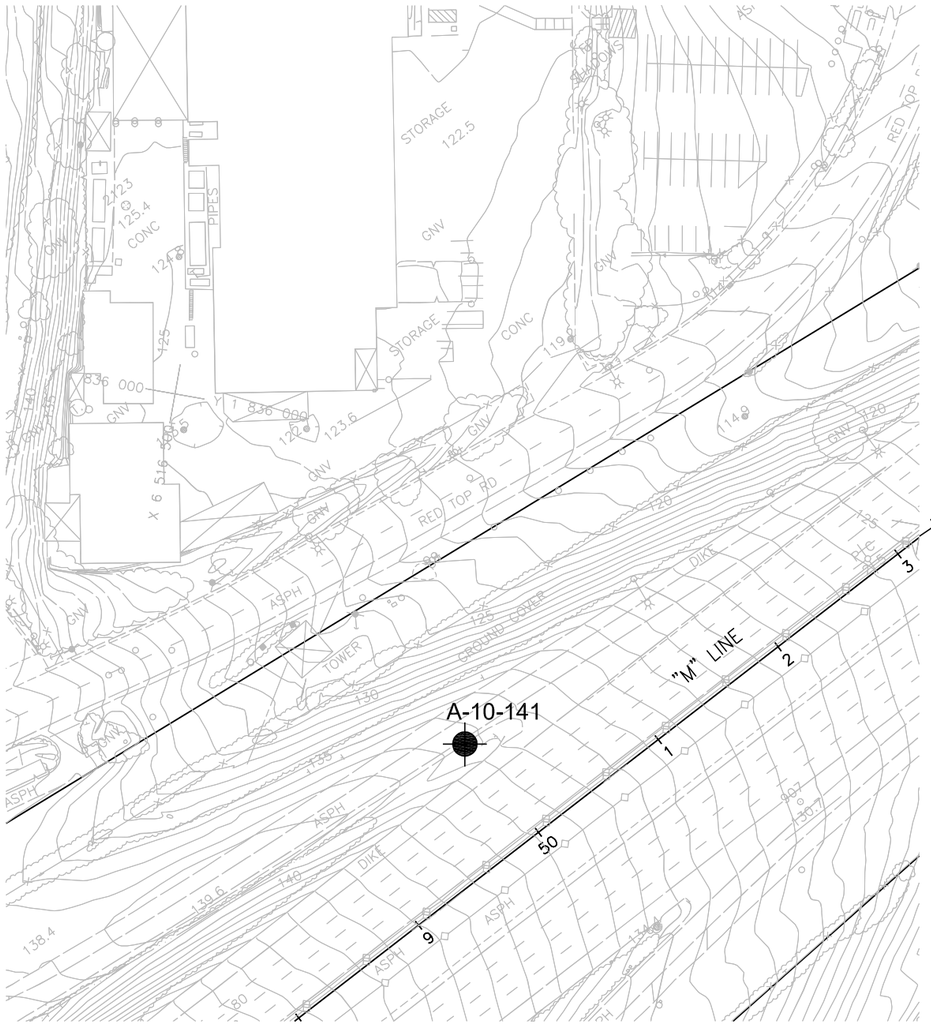
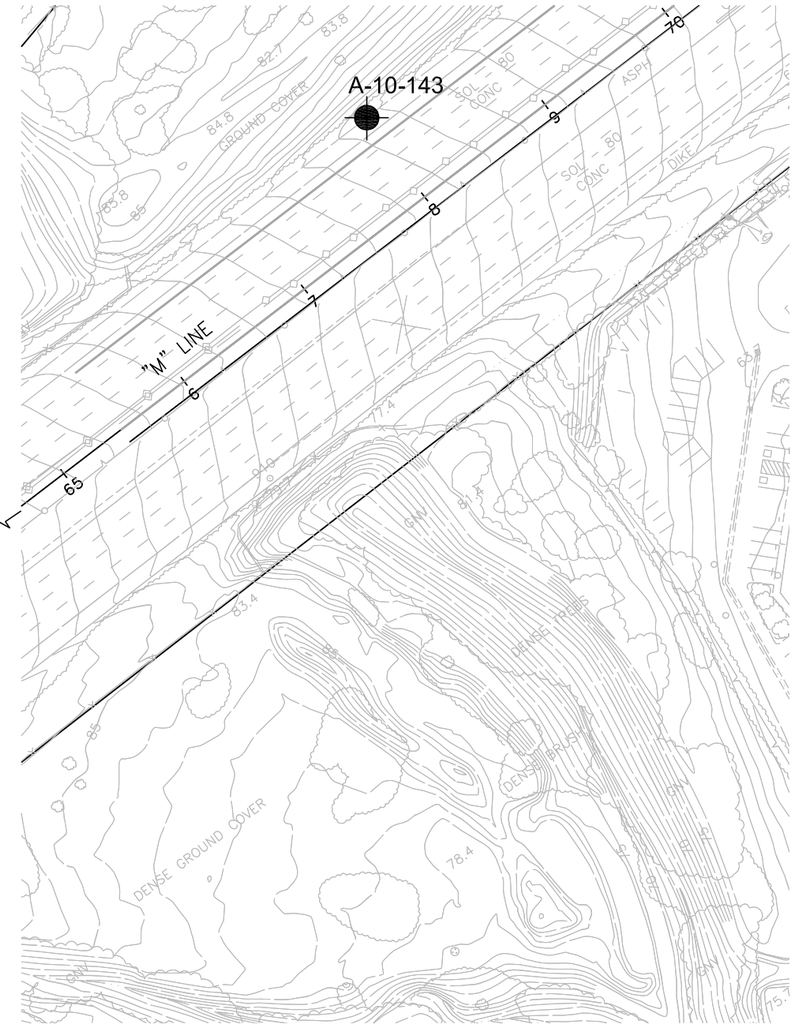
SAN JOSE, CA 95131





LEGEND

A-09-001 — Approx. Boring Location

CPT-09-007 — Approx. CPT Location

A-09-110 — Approx. Bulk Sample Location

SCALE 1 inch = 50 feet

Note: All units are in feet unless otherwise specified
Reference Map was provided by Mark Thomas & Co., Inc.

BENCH MARKS
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Brass disc set vertically in the east face at the first concrete pier east at the west abutment at the Union Pacific (formerly Southern Pacific) Railroad overcrossing at Interstate Highway 80, 21.7 feet northwest at the center at the most northwesterly westbound lane of the highway. The disc is stamped "A 1393 1987"
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(NAD83, CCSII)
Elevation: 67.07 (NAVD 88) Stability: B

HPGN D CA 10 LC (NGS PID AC9890)
Survey disc set on aluminum alloy rod encased in a PVC pipe with access cover set in concrete flush with the parking lot pavement in the Park and Ride Lot, 92 feet west at the center line at Green Valley Road and 48 feet southeast of the Green Valley Road onramp to westbound Interstate Highway 80. The disc is stamped "CADT 10 LC"
Northing: 1840653.06 Easting: 6521452.79
(HPGN 1991.35, CCSII)
Elevation: 26.35 (NAVD 88) Stability: B

DESIGN OVERSIGHT

SIGN OFF DATE

DRAWN BY L. TRAN

CHECKED BY F. WANG

L.S. BHANGOO / A. BHARADWAJ / V. SANTOS
FIELD INVESTIGATION BY:
DATE: OCT–DEC 2009 & MAY 2010 & JAN 2010

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG
PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 7

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

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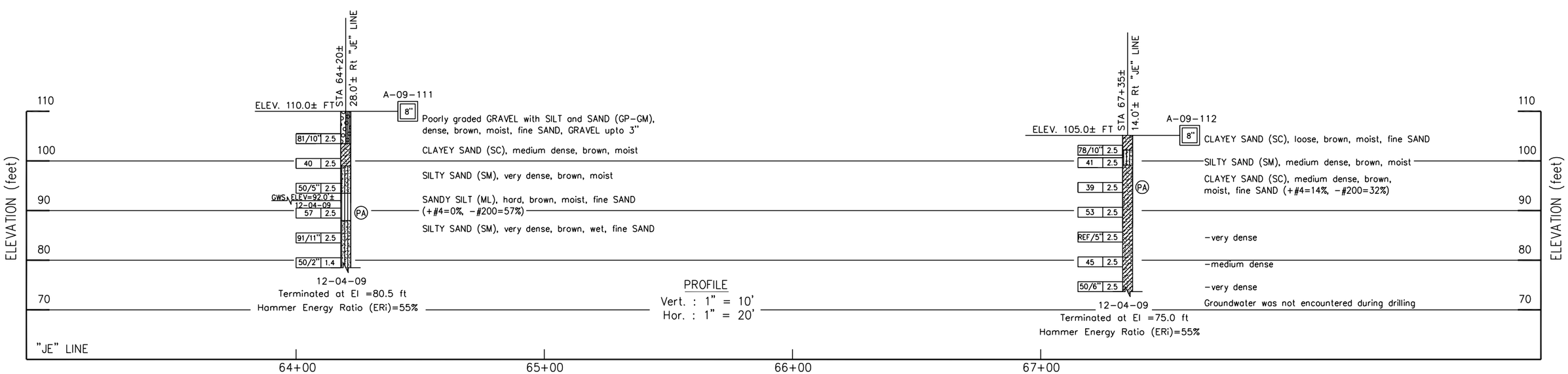
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARK ON LOG OF TEST BORING NO. 1)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 8

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 1)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
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Hammer Assembly: A 140 lb hammer with a 30" drop
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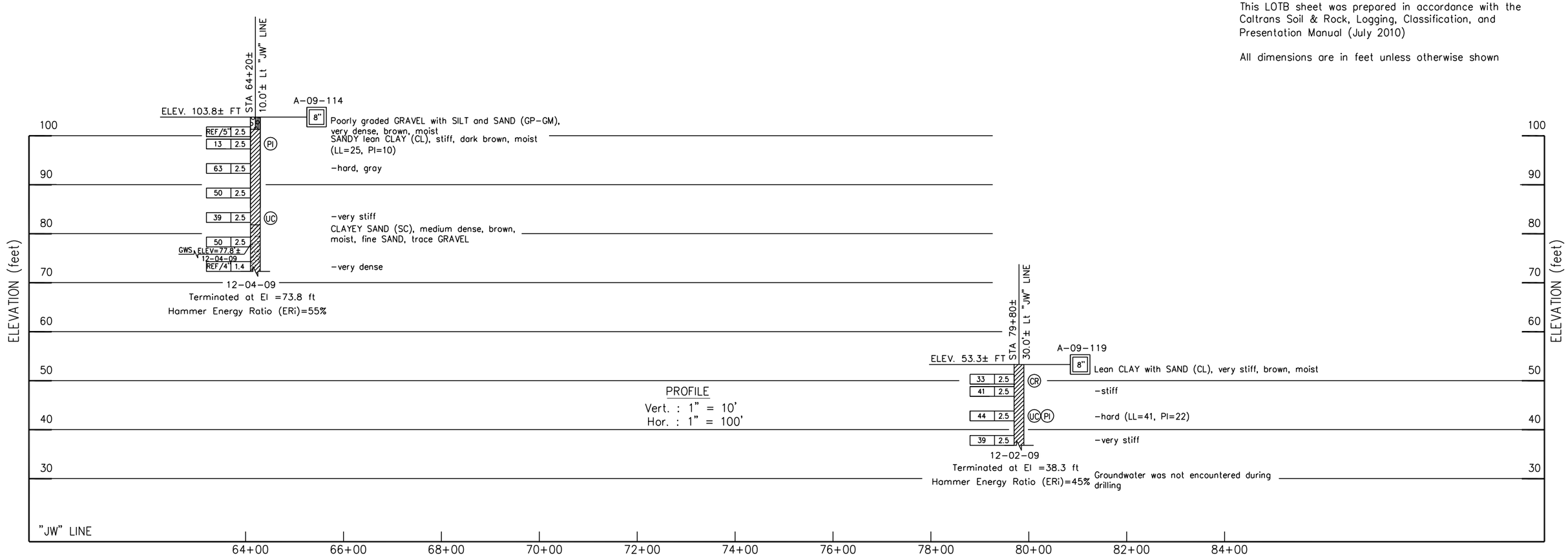

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SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 9

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARK ON LOG OF TEST BORING NO. 1 & 2)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

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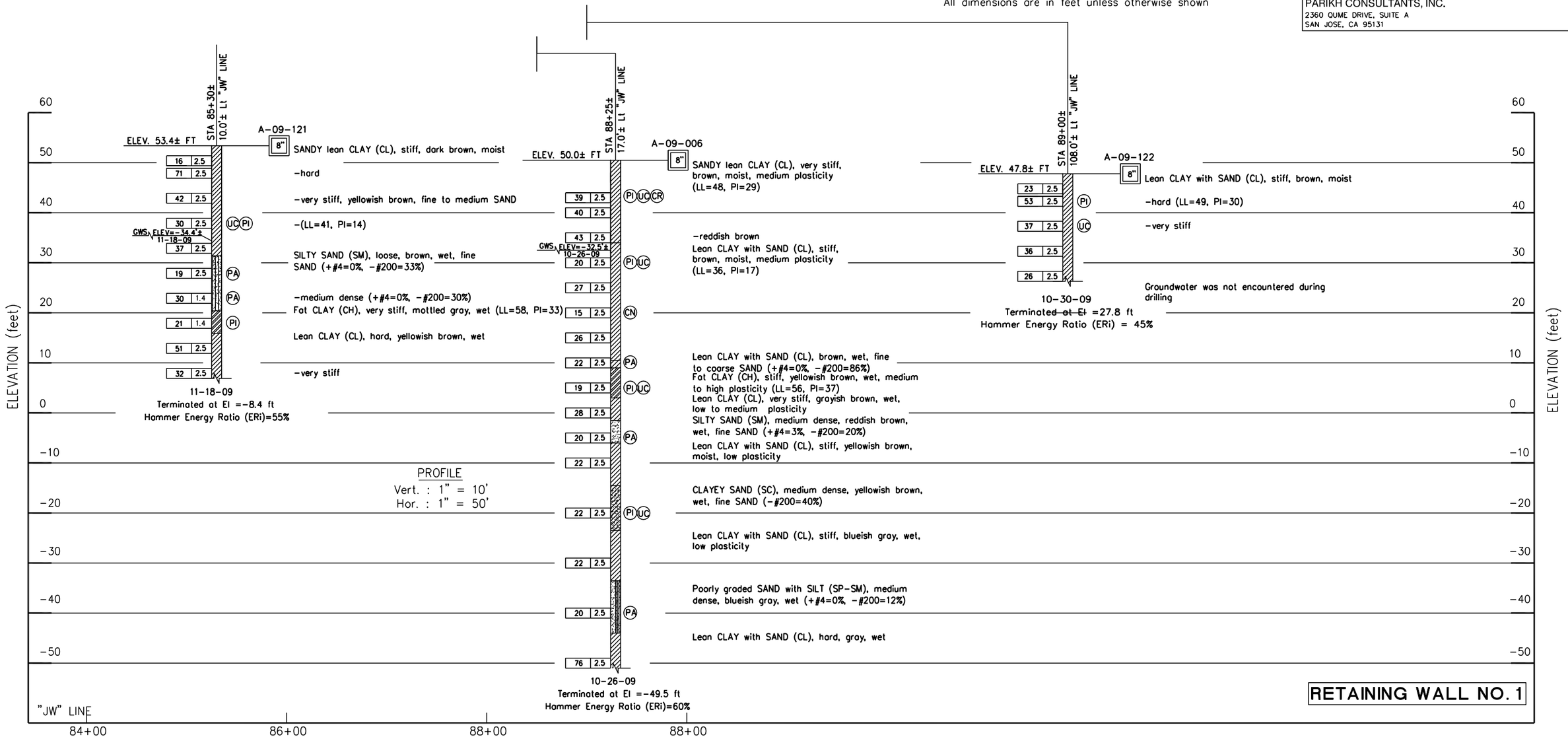

RETAINING WALL NO. 1

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 10

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES 9/10/12

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SUISUN CITY, CA 94585

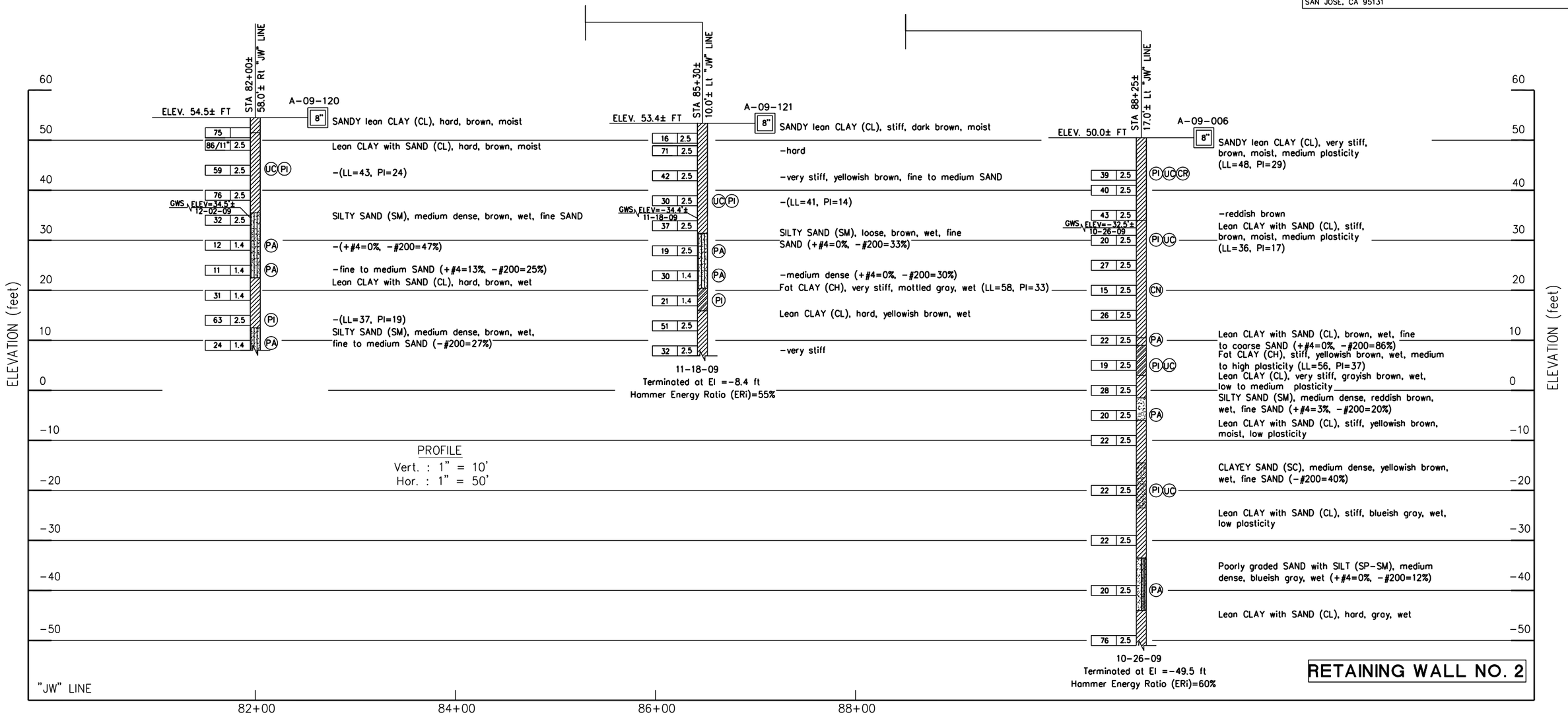
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARK ON LOG OF TEST BORING NO. 1)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



RETAINING WALL NO. 2

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 11

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

REVISION DATES — SHEET — OF

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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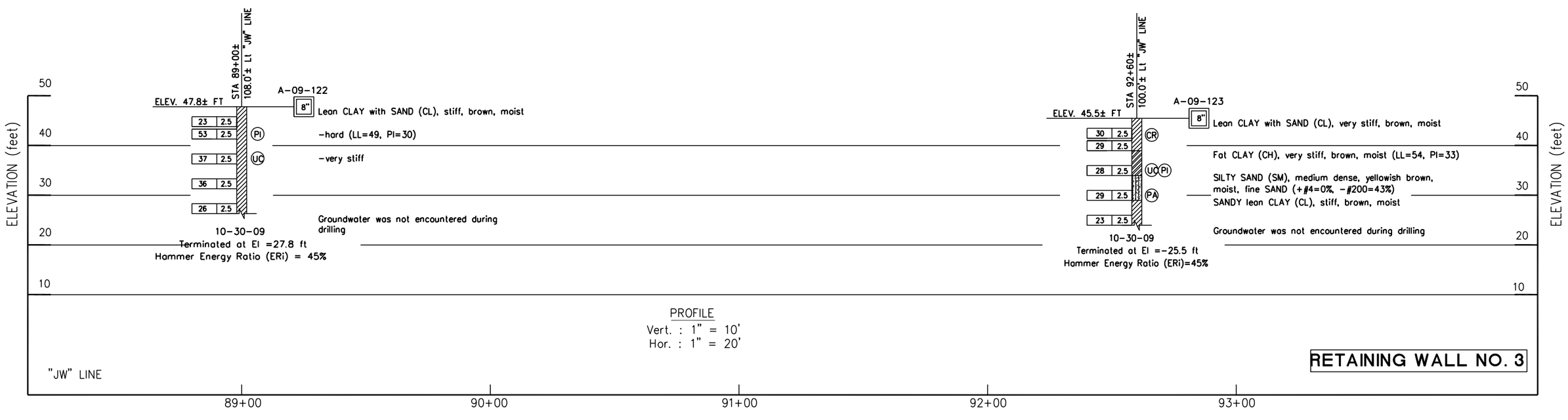
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 2)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



RETAINING WALL NO. 3

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 12

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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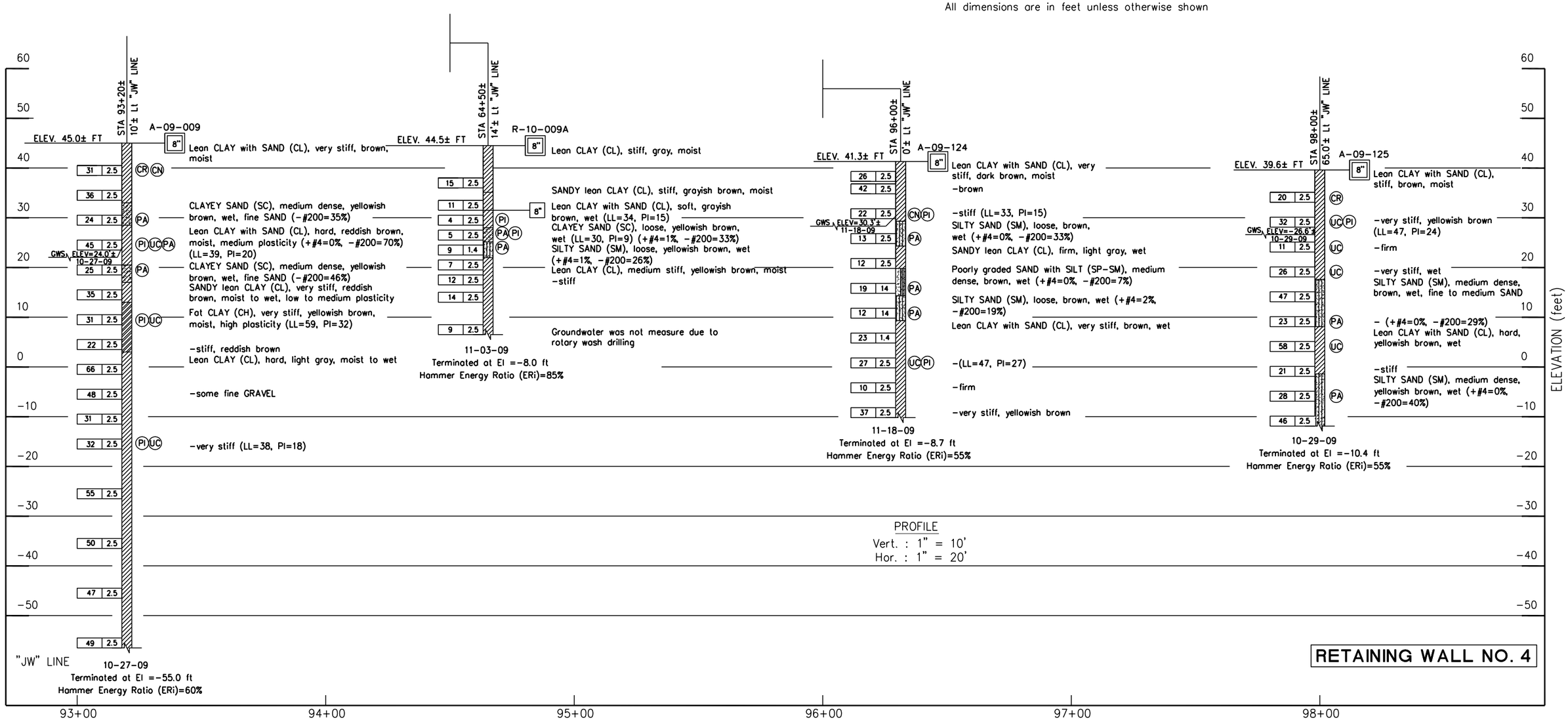
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 2)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer for R-10-009A and Semi-Automatic Hammer (spooling winch system) for A-09-009, A-09-124 & A-09-125)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



RETAINING WALL NO. 4

DESIGN OVERSIGHT	DRAWN BY L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER	BRIDGE NO. –
SIGN OFF DATE	CHECKED BY F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010			POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 13

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

REVISION DATES — SHEET — OF

FILE => $REQUEST

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USERNAME => $USER — DATE PLOTTED => $DATE — TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

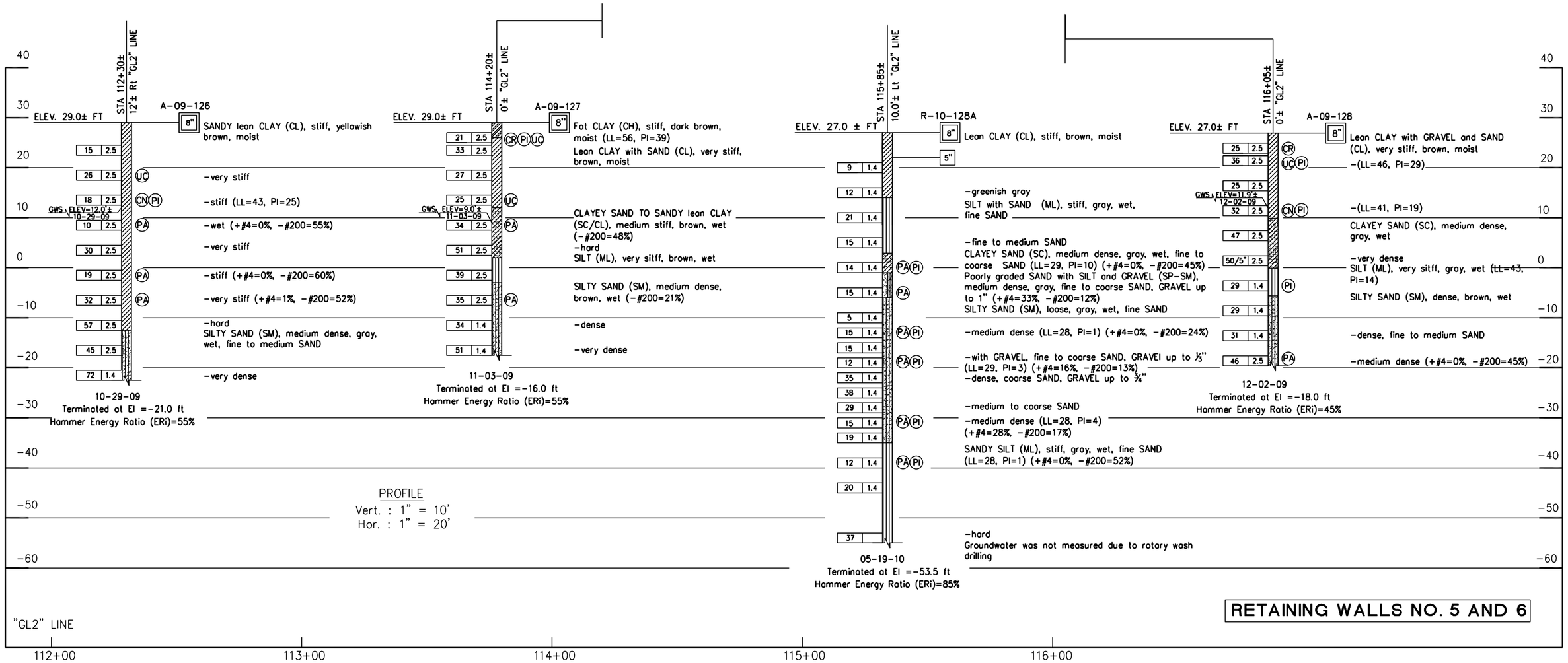
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORINGS NO. 3 & 4)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Automatic Hammer for R-10-128A, Semi-Automatic Hammer for A-09-126, A-09-127 & A-09-128)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



RETAINING WALLS NO. 5 AND 6

DESIGN OVERSIGHT	DRAWN BY L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG	BRIDGE NO. –
SIGN OFF DATE	CHECKED BY F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		PROJECT ENGINEER	POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 14

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SUISUN CITY, CA 94585

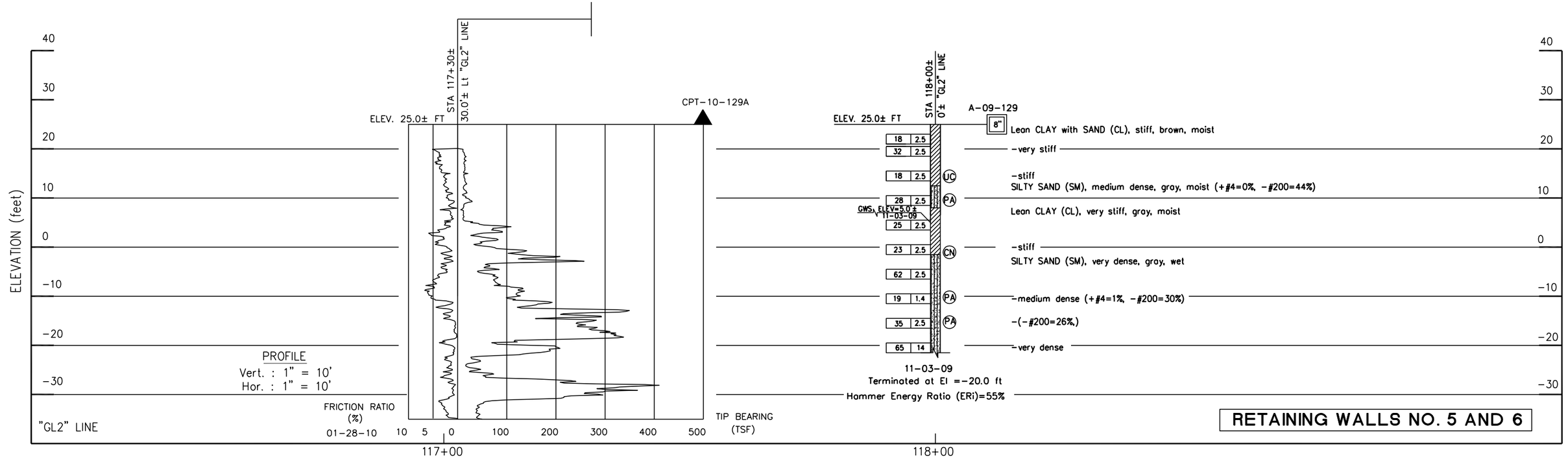
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING/CPT LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 4)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 15

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH No. G.E. 666 Exp. 12/31/13 GEOTECHNICAL — STATE OF CALIFORNIA

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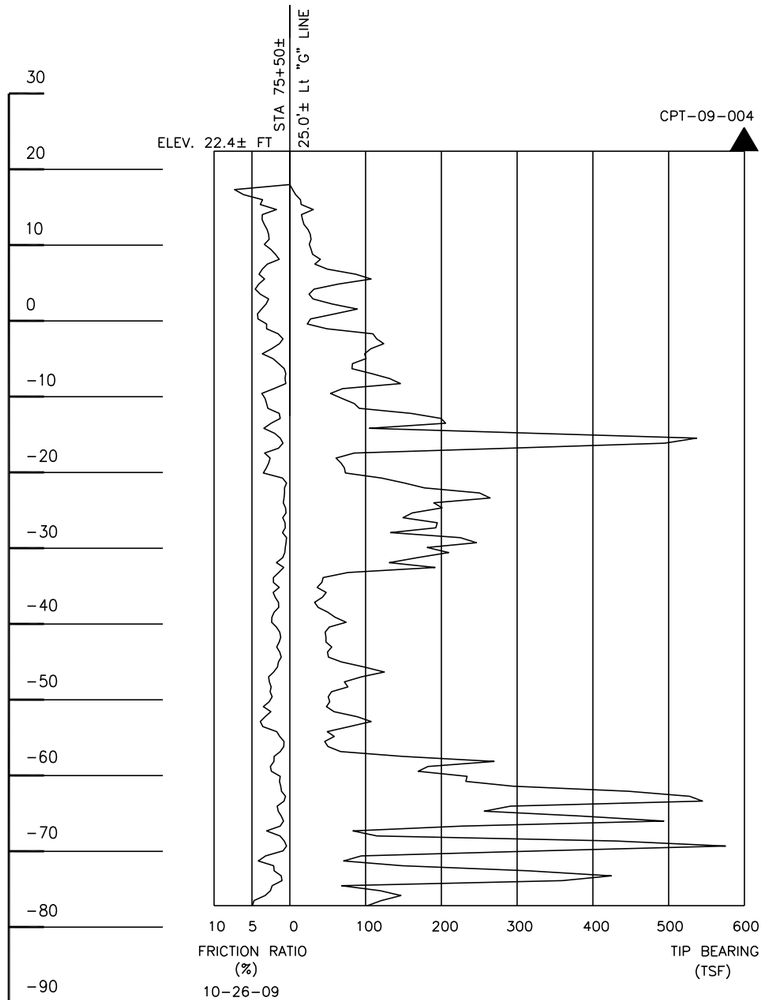
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING/CPT LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 4)



STA 77+60± 20'± Lt "G" LINE

ELEV. 25.0± FT

R-10-004A

Blows	Energy Ratio	Symbol	Description
8"			Lean CLAY (CL), firm, yellowish brown, moist
5"			
7	1.4		Lean CLAY with SAND (CL), stiff, gray, wet (LL=32, PI=12)
1.6	1.4	PI CR	
7	1.4		Lean CLAY with SILT (CL), firm, greenish gray, moist
12	1.4		-stiff
9	1.4	PA PI	SANDY SILT (ML), stiff, greenish gray, wet (LL=46, PI=18) (-#200=66%)
1.7	1.4		Lean CLAY (CL), very stiff, greenish gray, moist
1.0	1.4	PA	SILTY SAND (SM), loose, greenish gray, wet (+#4=6%, -#200=16%)
1.8	1.4		Lean CLAY with SAND (CL), firm, gray, wet
32	1.4		SILTY SAND (SM), dense, greenish gray, wet
22	1.4	PA	-medium dense, moist (-#200=26%)
17	1.4	PA	CLAYEY SAND (SC), medium dense, greenish gray, moist (+#4=3%, -#200=18%)
1.2	1.4	PA	Poorly graded SAND with GRAVEL (SP), medium dense, greenish gray, moist (+#4=33%, -#200=2%)
1.1	1.4		Lean CLAY (CL), stiff, greenish gray, moist
1.5	1.4	PI	SILT (ML), stiff, greenish gray, moist (LL=41, PI=11)
1.7	1.4		SANDY lean CLAY (CL), very stiff, gray, moist
1.8	1.4	PA PI	SILTY SAND (SM), medium dense, greenish gray, wet, fine SAND (LL=29, PI=4) (+#4=0%, -#200=31%)
21	1.4		Lean CLAY (CL), very stiff, greenish gray, moist
10	1.4	PI	SILT (ML), stiff, greenish gray, moist (LL=40, PI=9)
25	1.4	PI	-very stiff (LL=31, PI=8)
			Lean CLAY (CL), hard, greenish gray, moist
66	1.4		
36	1.4		-trace fine SAND
REF/6"	1.4		

05-19-10

Groundwater was not measured due to rotary wash drilling
Terminated at El =-136.0 ft
Hammer Energy Ratio (ERi)=85%

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 20'

RETAINING WALL NO. 6

"G" LINE
75+00 76+00 77+00 78+00 79+00

DESIGN OVERSIGHT	DRAWN BY L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER	BRIDGE NO. –
SIGN OFF DATE	CHECKED BY F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010			POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 16

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SUISUN CITY, CA 94585

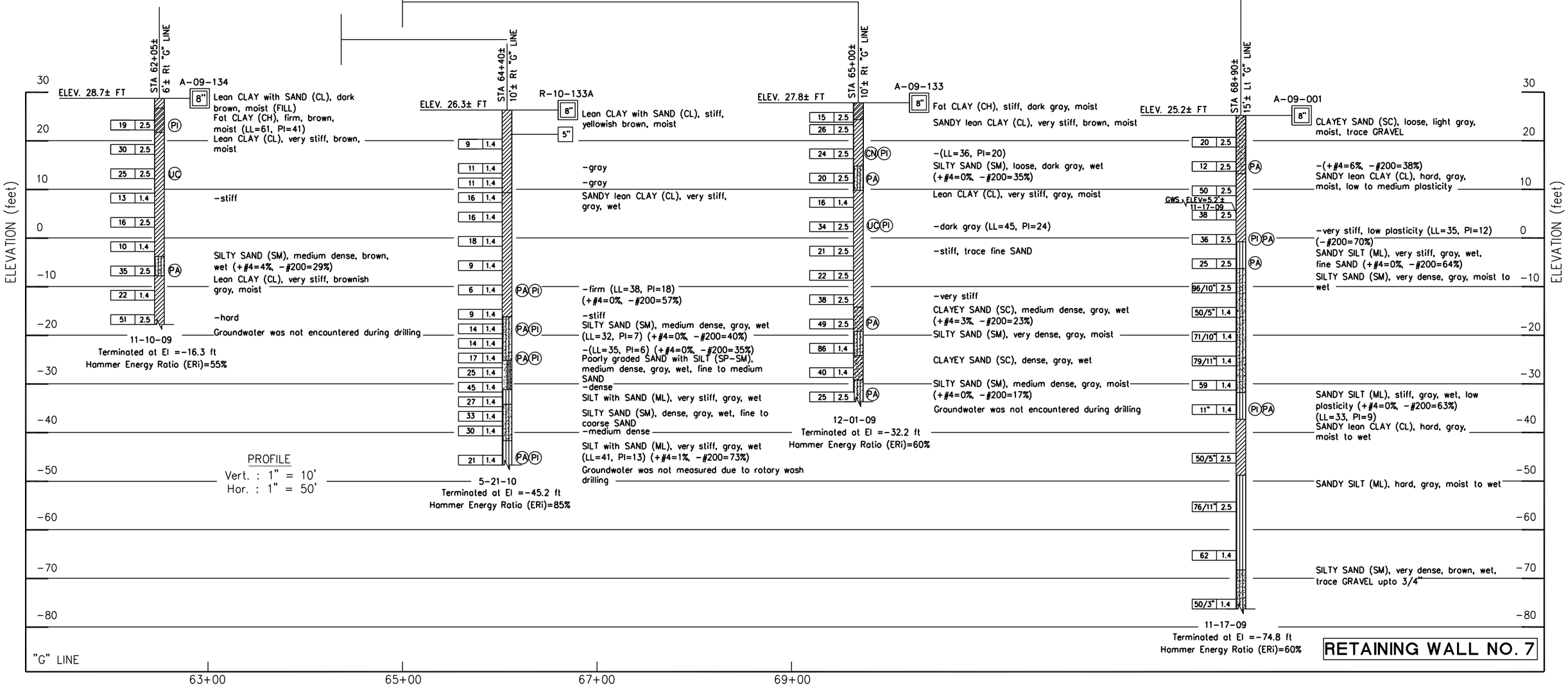
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer for R-10-133A and Semi-Automatic Hammer (spooling winch system) for A-09-134, A-09-133 and A-09-001)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 5)



RETAINING WALL NO. 7

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 17

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES 9/10/12

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SUISUN CITY, CA 94585

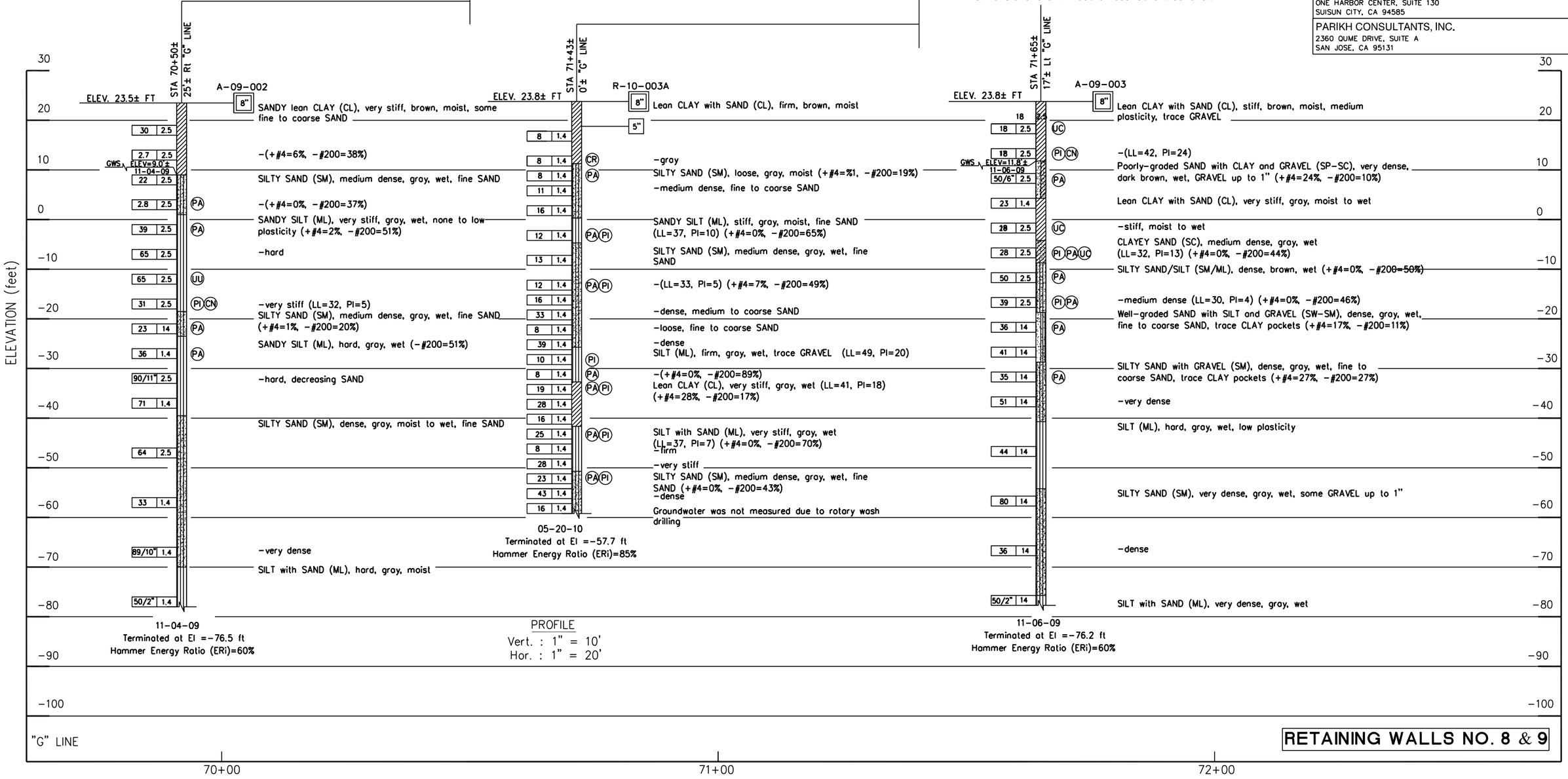
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer for R-10-003A and Semi-Automatic Hammer (spooling winch system) for A-09-002 & A-09-003)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORINGS NO. 4 & 5)



RETAINING WALLS NO. 8 & 9

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 18

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES 9/10/12

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

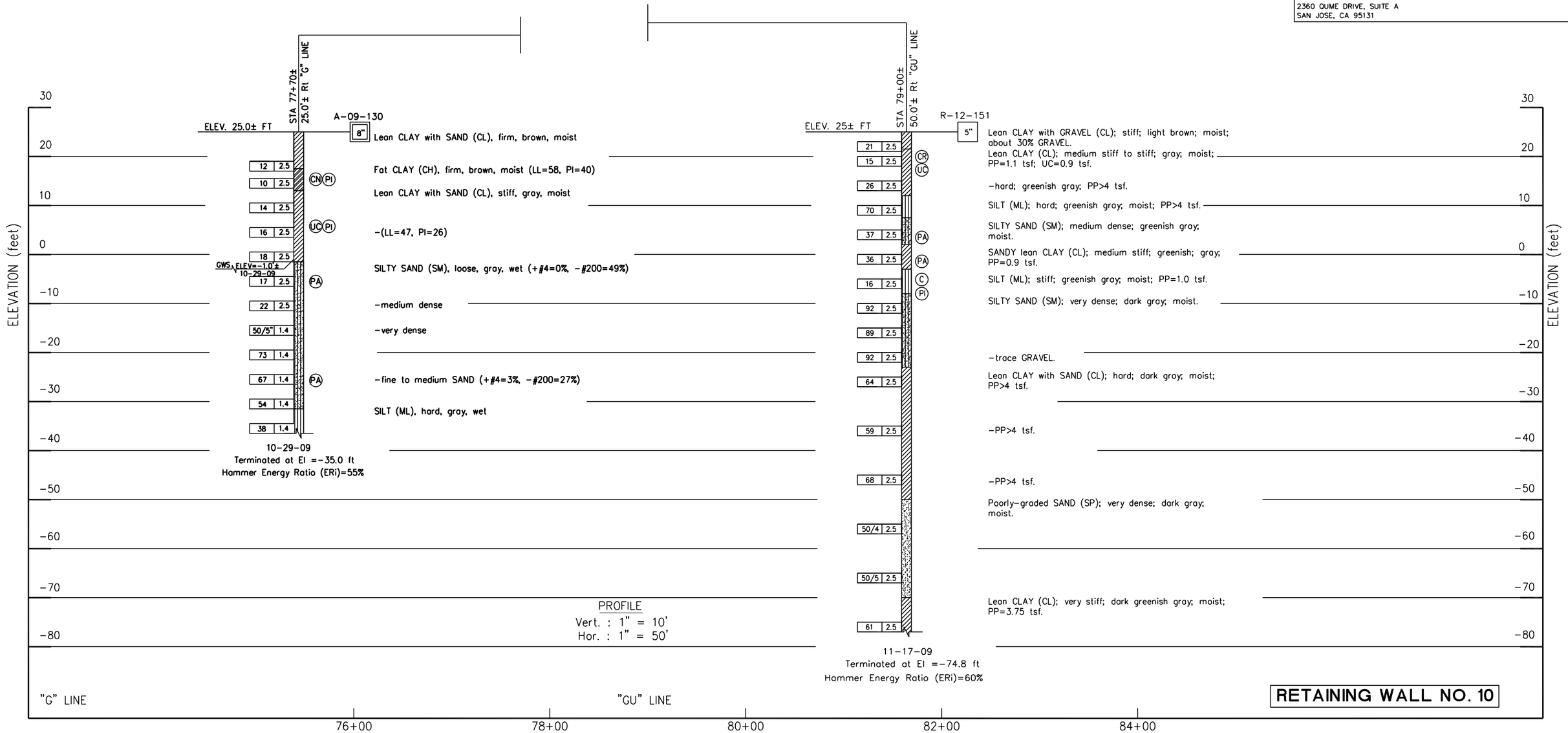
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer for R-12-151 and Semi-Automatic Hammer (spooling winch system) for A-09-130)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORINGS NO. 4)



RETAINING WALL NO. 10

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 19

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
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DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

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SUISUN CITY, CA 94585

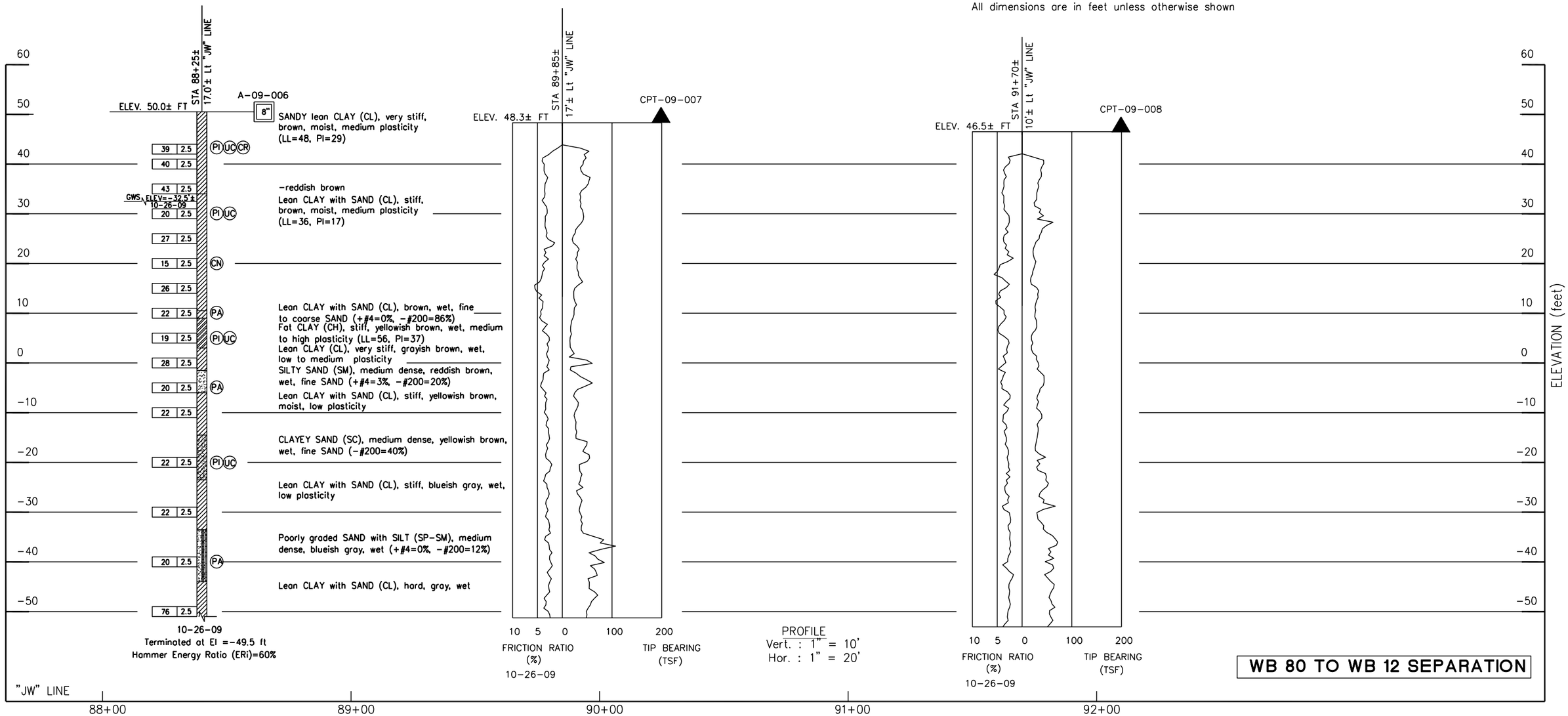
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING/CPT LOCATIONS AND BENCH MARKS ON LOG OF TEST BORINGS NO. 1 & 2)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 20

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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EA

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SUISUN CITY, CA 94585

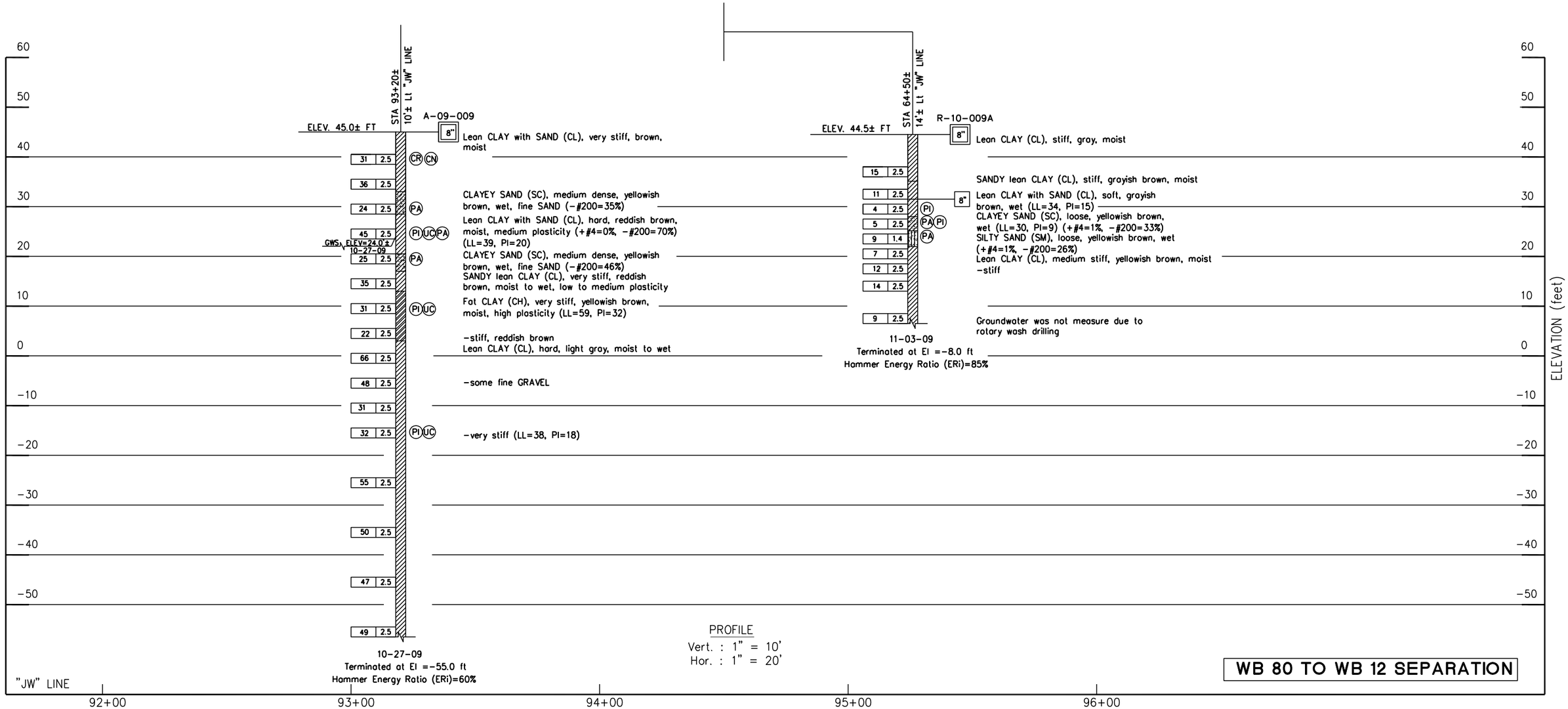
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 2)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer for R-10-009A and Semi-Automatic Hammer (spooling winch system) for A-09-009)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (June 2007)

All dimensions are in feet unless otherwise shown



PROFILE
Vert. : 1" = 10'
Hor. : 1" = 20'

WB 80 TO WB 12 SEPARATION

DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER	BRIDGE NO. – / POST MILES –
	CHECKED BY F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010			I-80/I-680/SR-12 ICP
					LOG OF TEST BORINGS NO. 21

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

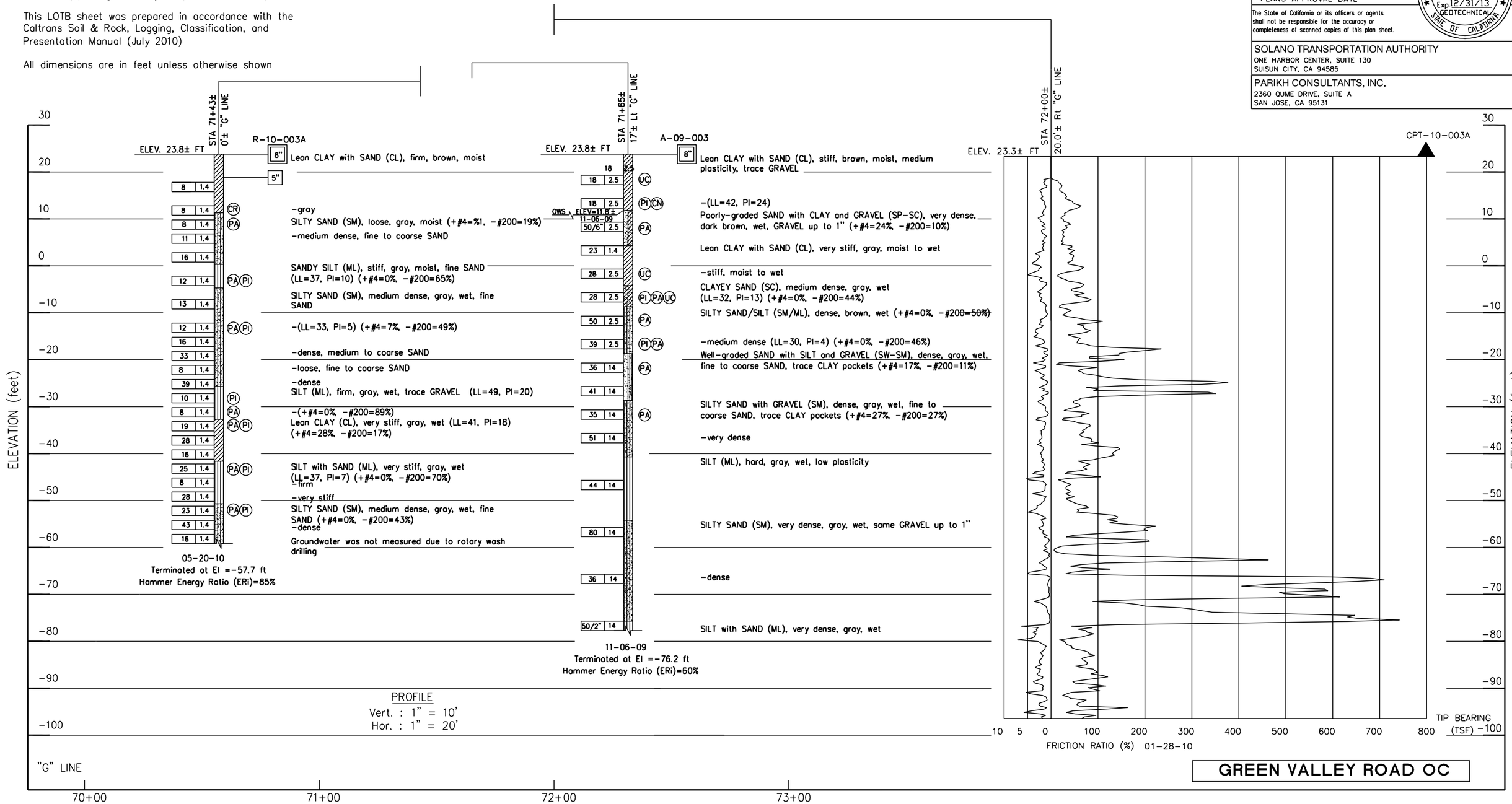
PARIKH CONSULTANTS, INC.
2360 OUME DRIVE, SUITE A
SAN JOSE, CA 95131

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer for R-10-003A and Semi-Automatic Hammer (spooling winch system) for A-09-003)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown

(SEE BORING/CPT LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 4)



GREEN VALLEY ROAD OC

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 22

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES 9/10/12 — SHEET — OF

FILE => $REQUEST

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

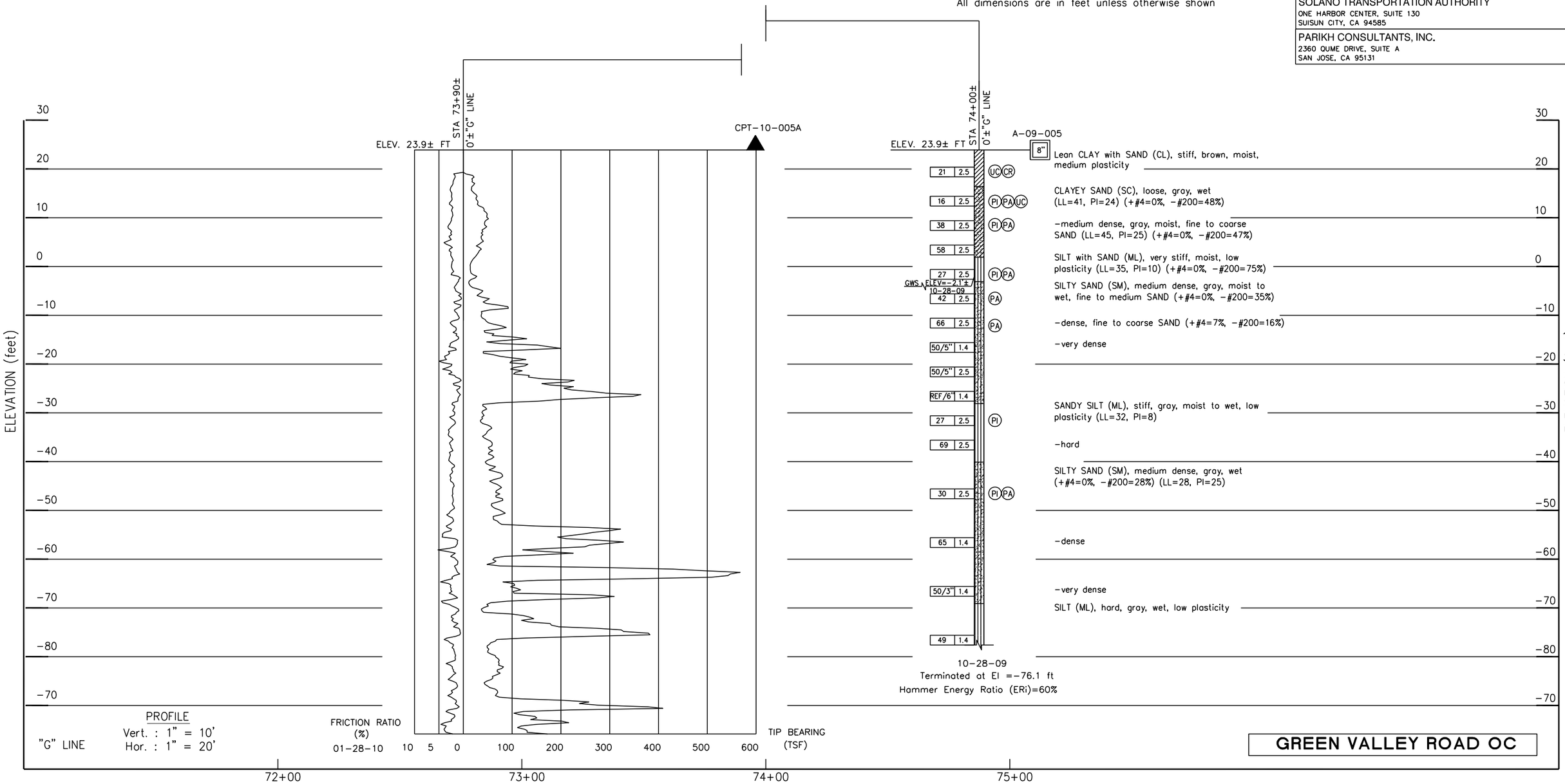
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown

(SEE BORING/CPT LOCATIONS AND BENCH MARKS ON LOG OF TEST BORINGS NO. 4)



GREEN VALLEY ROAD OC

DESIGN OVERSIGHT	DRAWN BY L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG	BRIDGE NO. –
SIGN OFF DATE	CHECKED BY F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		PROJECT ENGINEER	POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 23

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES 9/10/12 — SHEET — OF

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USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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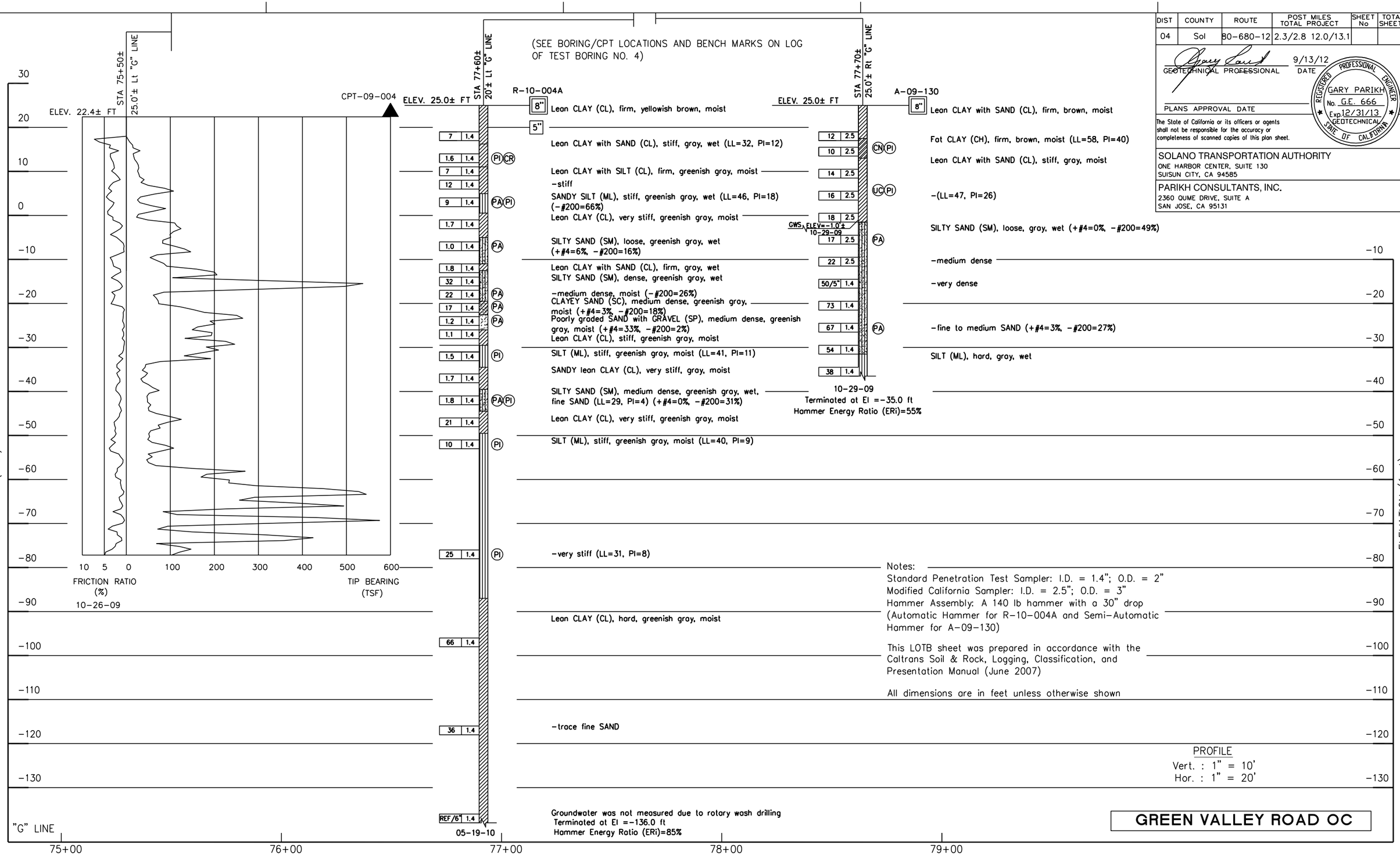
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131



DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS — FIELD INVESTIGATION BY:
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

F. WANG — PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 24

CU
EA

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES 9/10/12 — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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SUISUN CITY, CA 94585

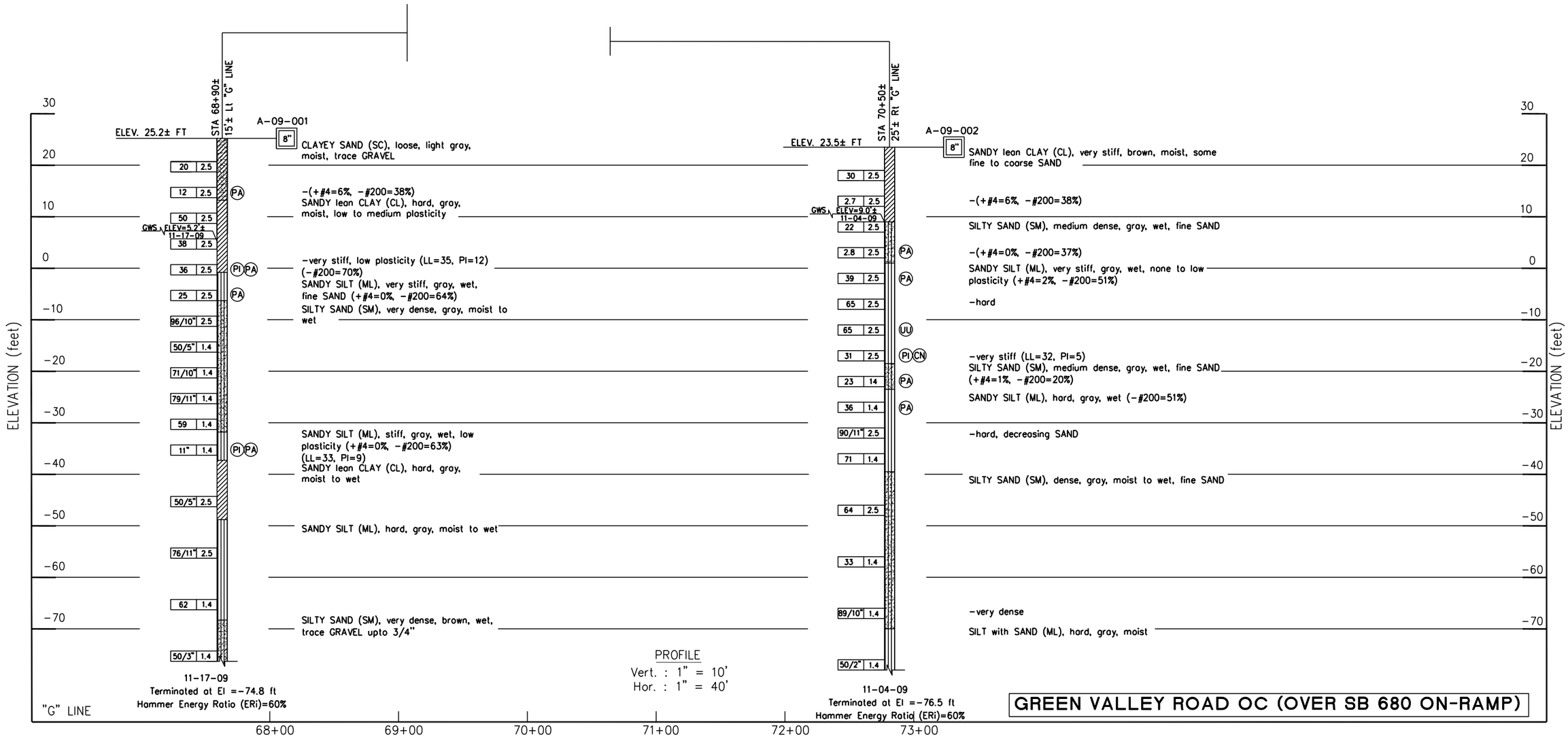
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 5)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)

DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 25

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES 9/10/12

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

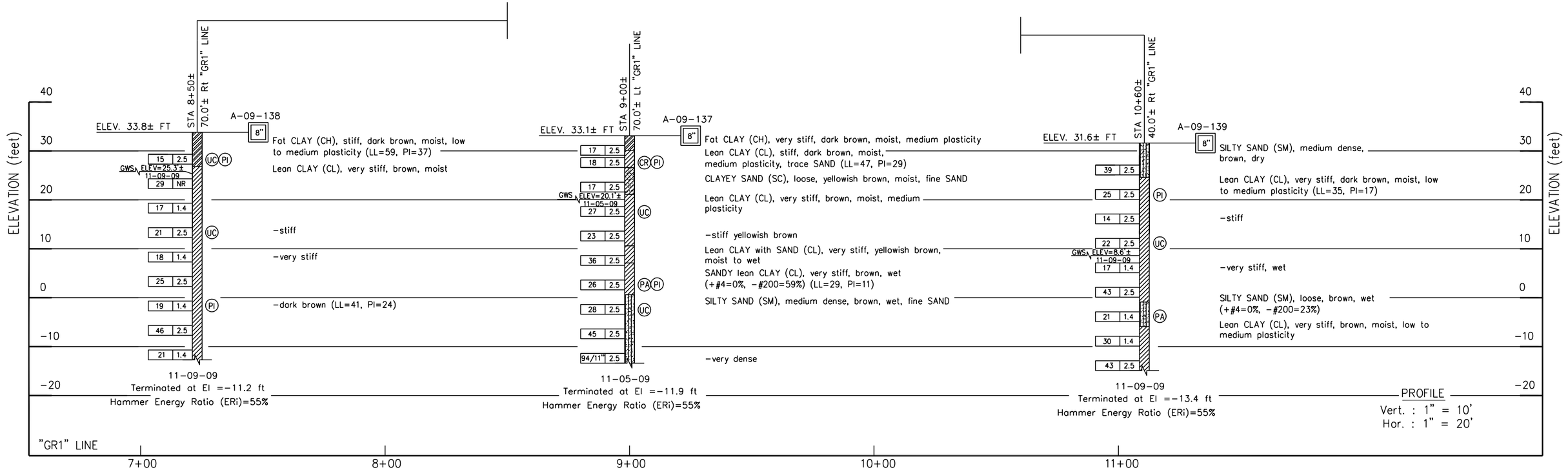
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORING NO. 3)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 26

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES 9/10/12

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

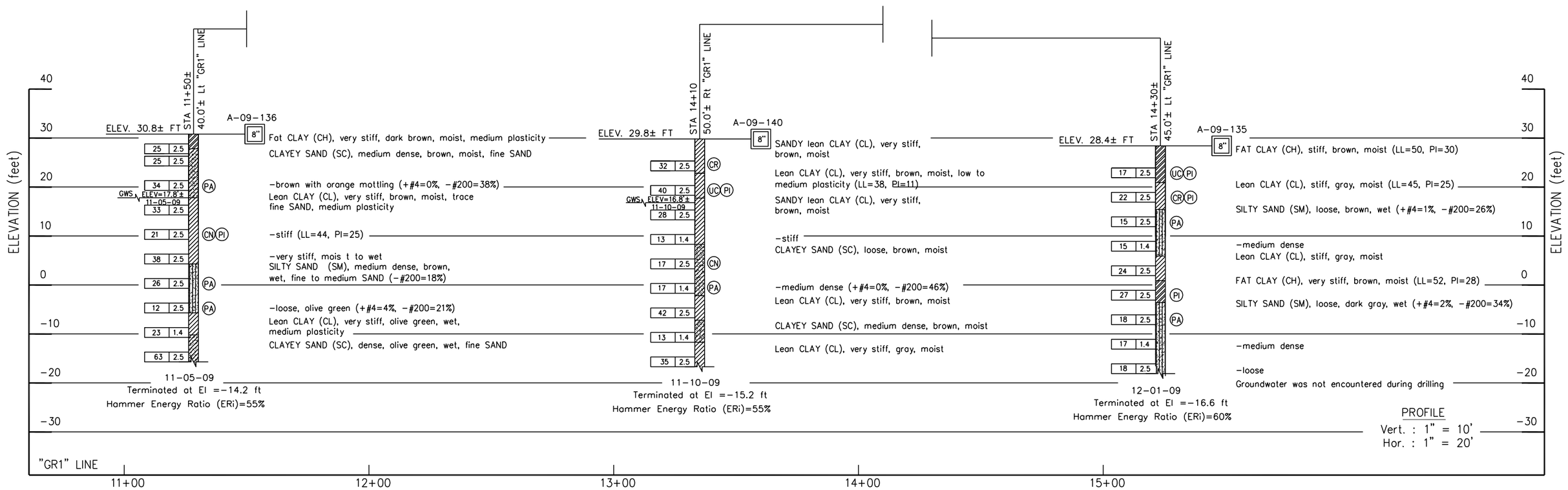
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORINGS NO. 3 & 5)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi-Automatic Hammer (spooling winch system))

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



DESIGN OVERSIGHT	DRAWN BY	L. TRAN	L.S. BHANGOO / A. BHARADWAJ / V. SANTOS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG
SIGN OFF DATE	CHECKED BY	F. WANG	FIELD INVESTIGATION BY: DATE: OCT-DEC 2009 & MAY 2010 & JAN 2010		PROJECT ENGINEER

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP

LOG OF TEST BORINGS NO. 27

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

REVISION DATES — SHEET — OF

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

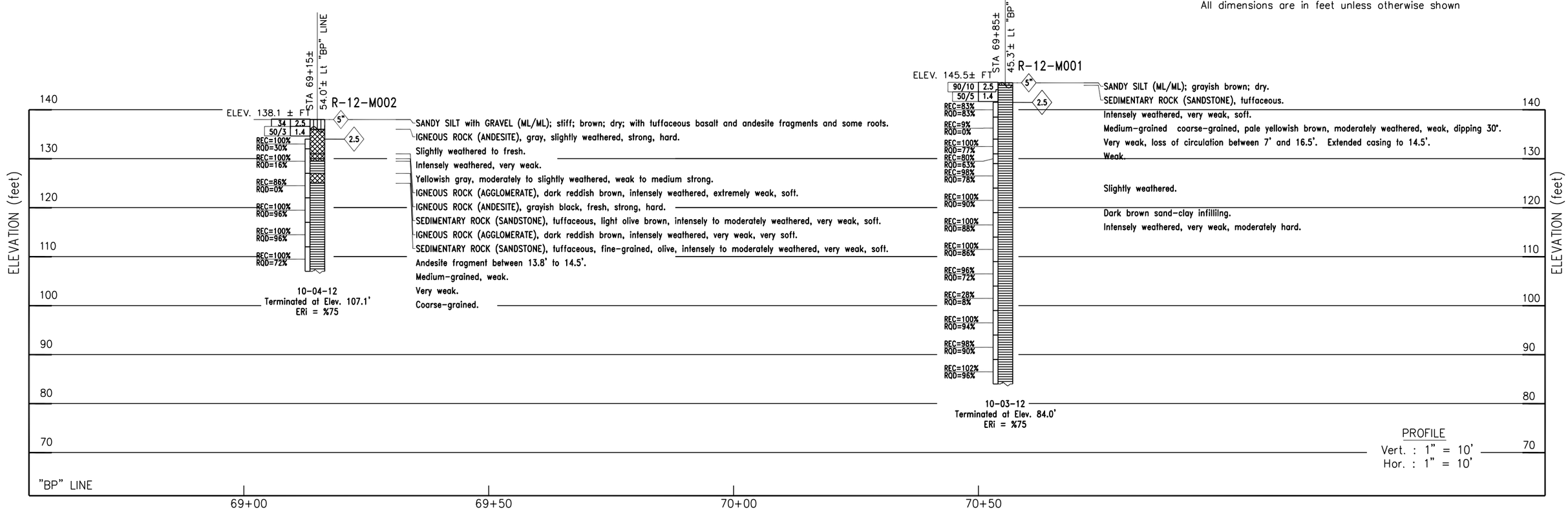
PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

(SEE BORING LOCATIONS AND BENCH MARKS ON LOG OF TEST BORINGS NO. 1)

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
HQ Rock Core Sampler I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop (Automatic Hammer)

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock, Logging, Classification, and Presentation Manual (July 2010)

All dimensions are in feet unless otherwise shown



DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	M. McKEE FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCTOBER 2012		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 28

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Sol	80-680-12	2.3/2.8 12.0/13.1		

GEOTECHNICAL PROFESSIONAL — DATE 9/13/12

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GARY PARIKH — No. G.E. 666 — Exp. 12/31/13 — GEOTECHNICAL — STATE OF CALIFORNIA

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ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

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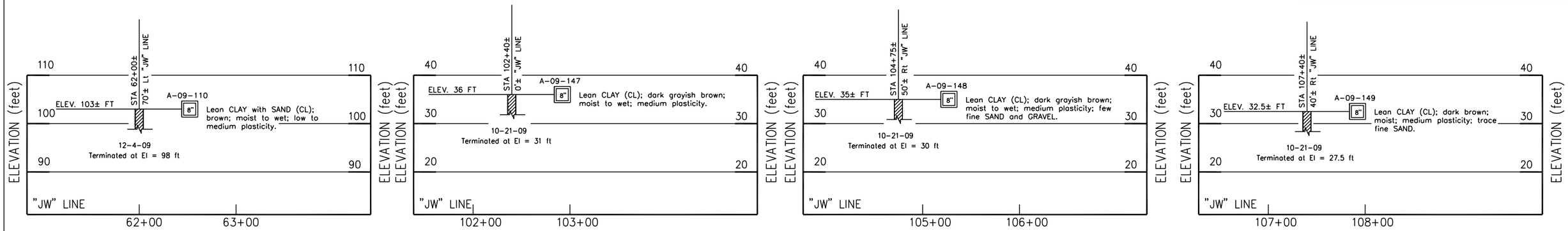
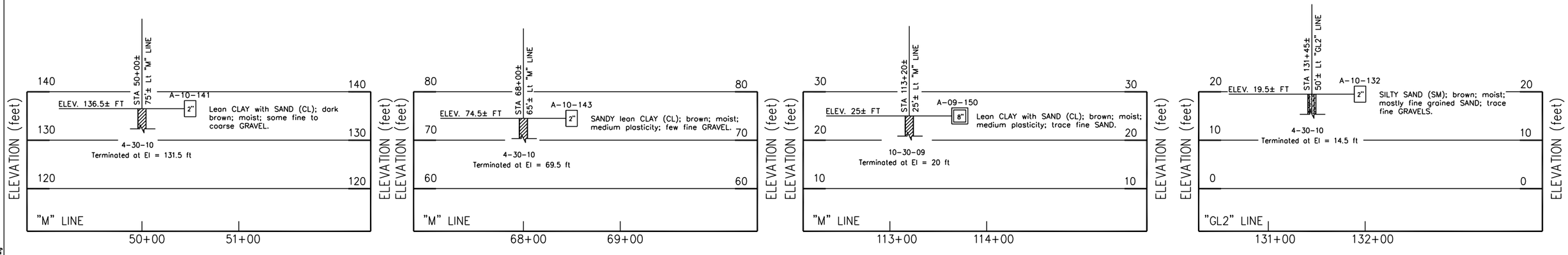
All dimensions are in feet unless otherwise shown





PROFILE
Vert. : 1" = 10'
Hor. : 1" = 50'

DESIGN OVERSIGHT	DRAWN BY	O. GOUTHIER	L.S. Bhangoo FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	F. WANG PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	F. WANG	DATE: OCTOBER & DECEMBER 2009, APRIL 2010		

BRIDGE NO. –
POST MILES –

I-80/I-680/SR-12 ICP
LOG OF TEST BORINGS NO. 29

OGS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 06-01-09)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 9/10/12

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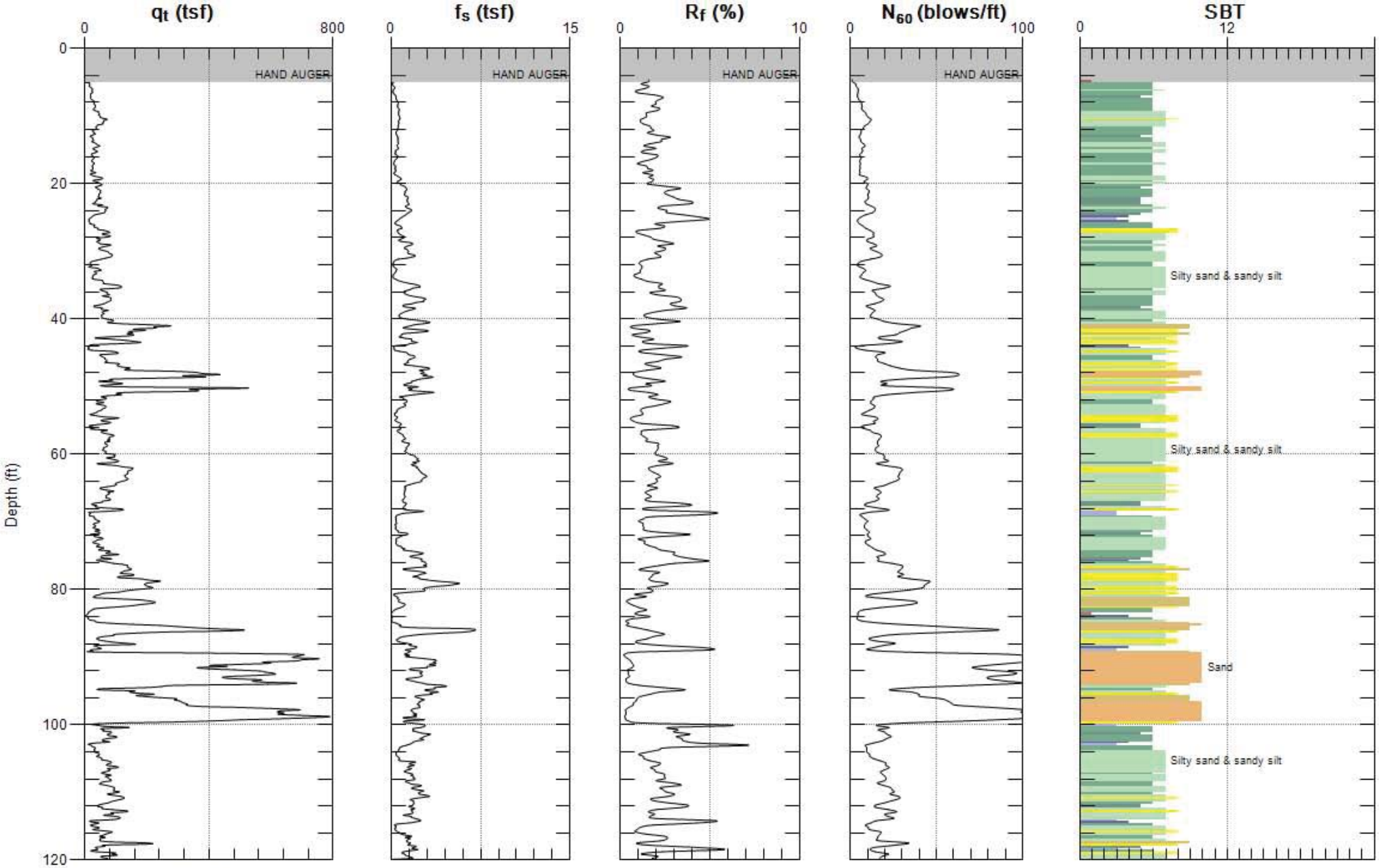
PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-003A

Engineer: E.BHANGOO
Date: 2010-01-28 09:25



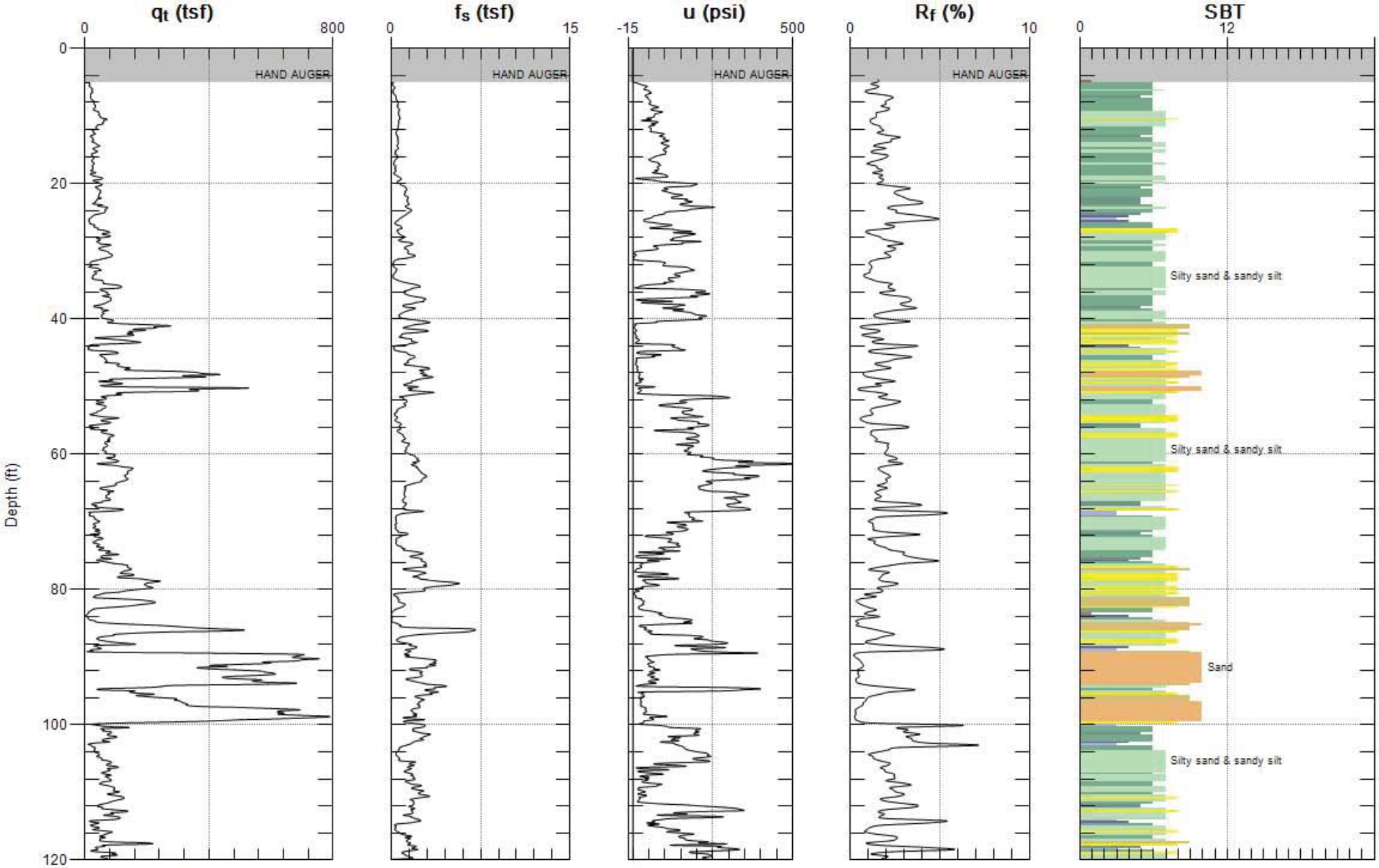
Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-003A

Engineer: E.BHANGOO
Date: 2010-01-28 09:25



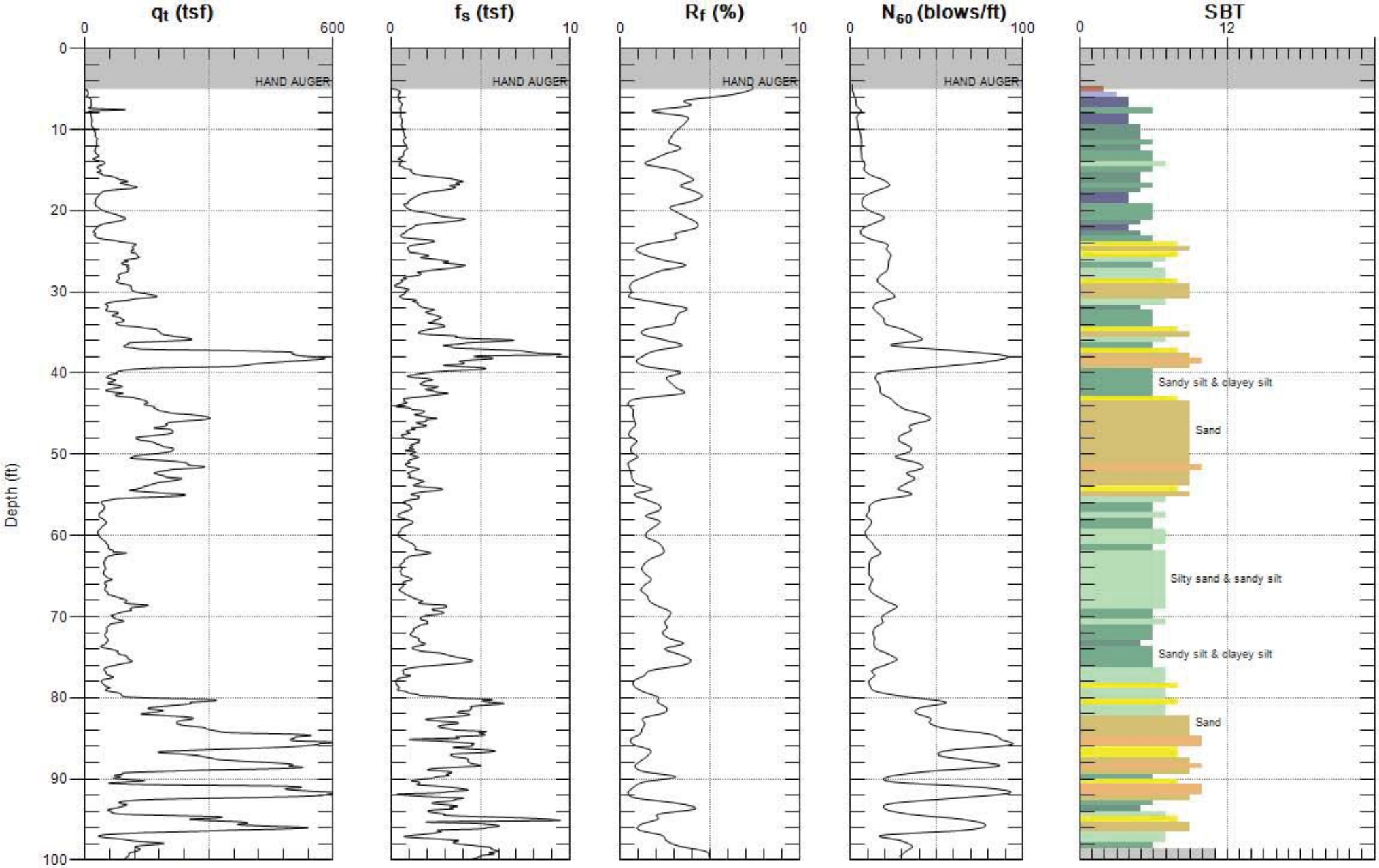
Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-04

Engineer: F.WANG
Date: 10/26/2009 03:46



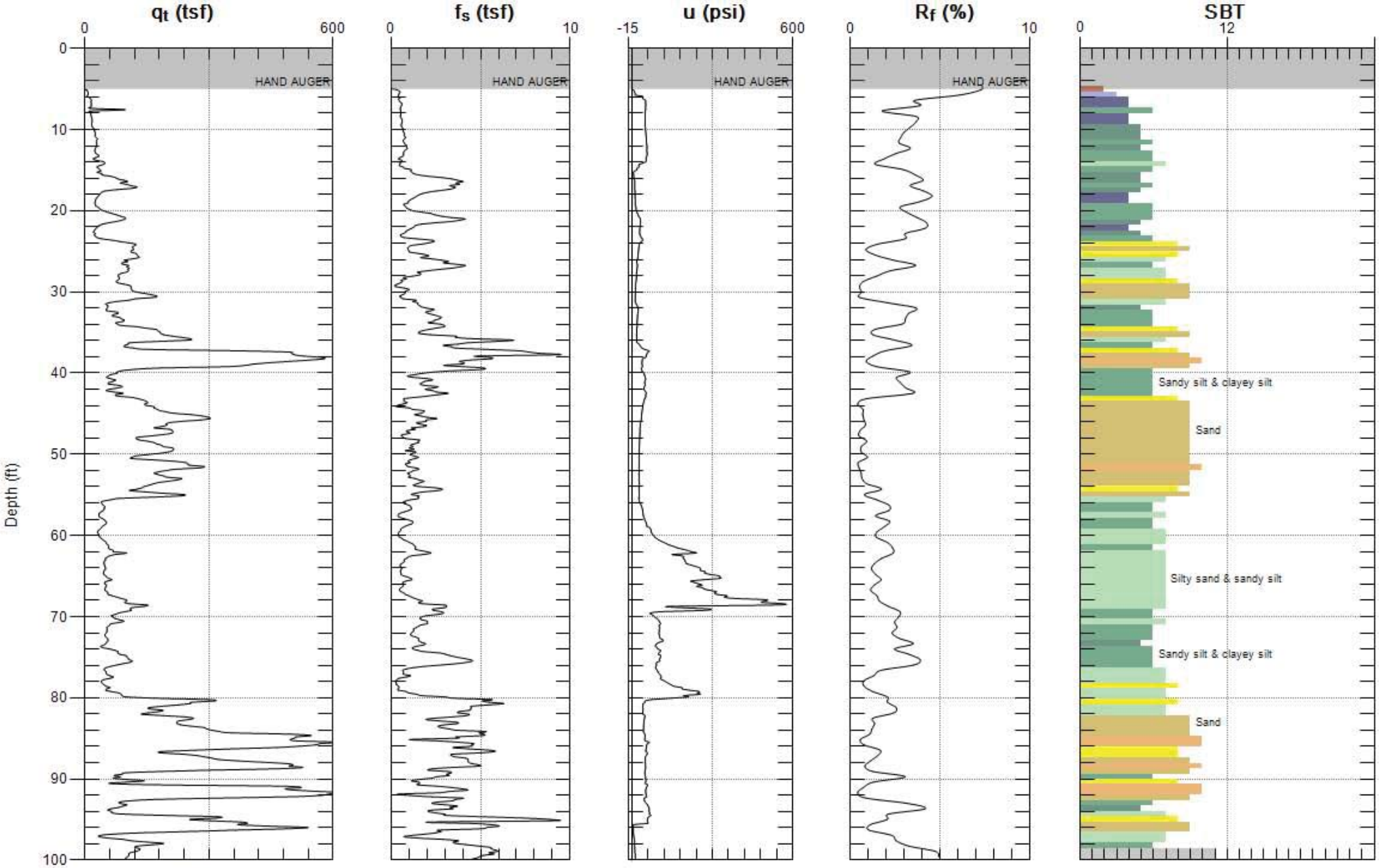
Max. Depth: 100.394 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-04

Engineer: F.WANG
Date: 10/26/2009 03:46



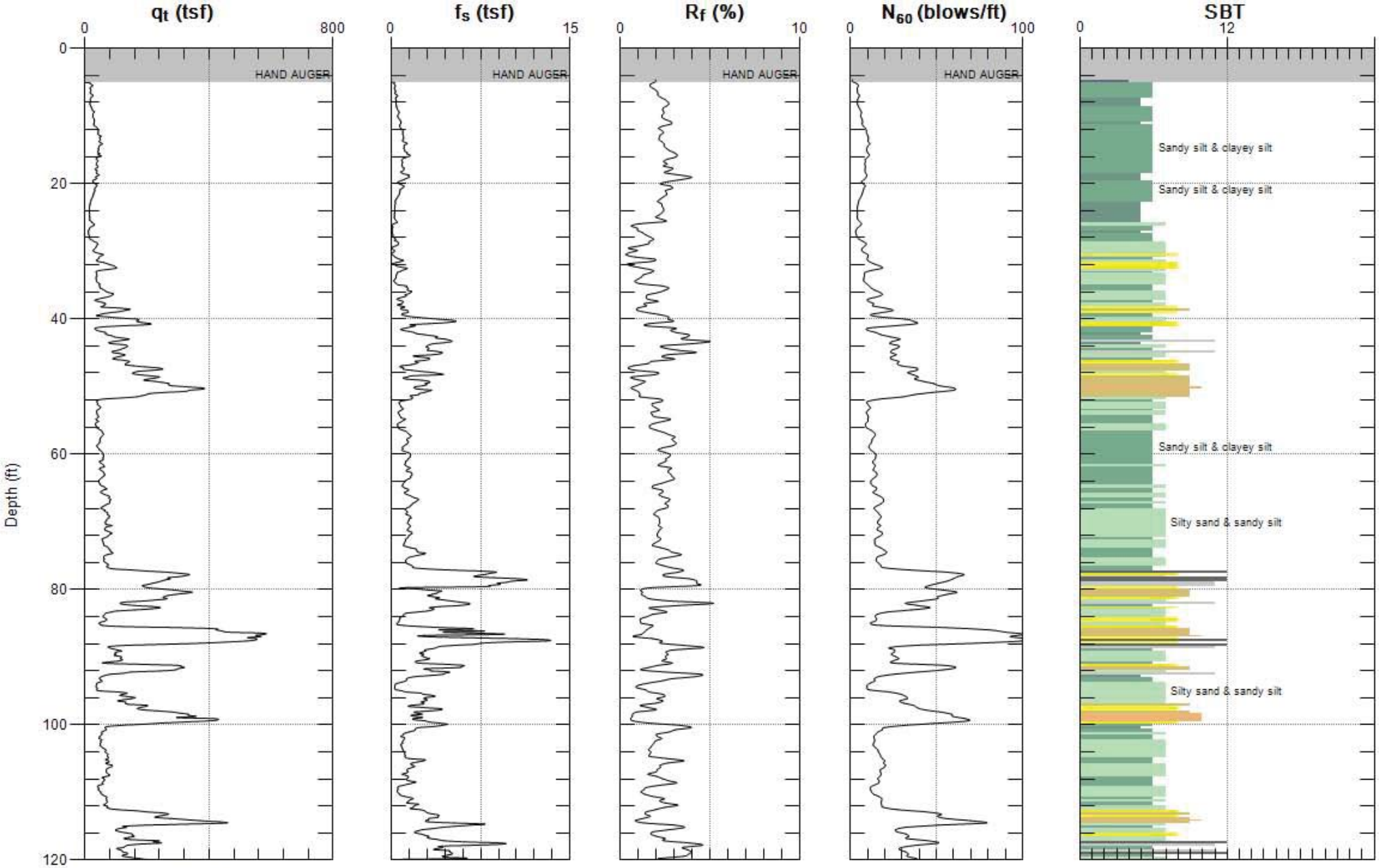
Max. Depth: 100.394 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-005A

Engineer: E.BHANGOO
Date: 2010-01-28 11:39



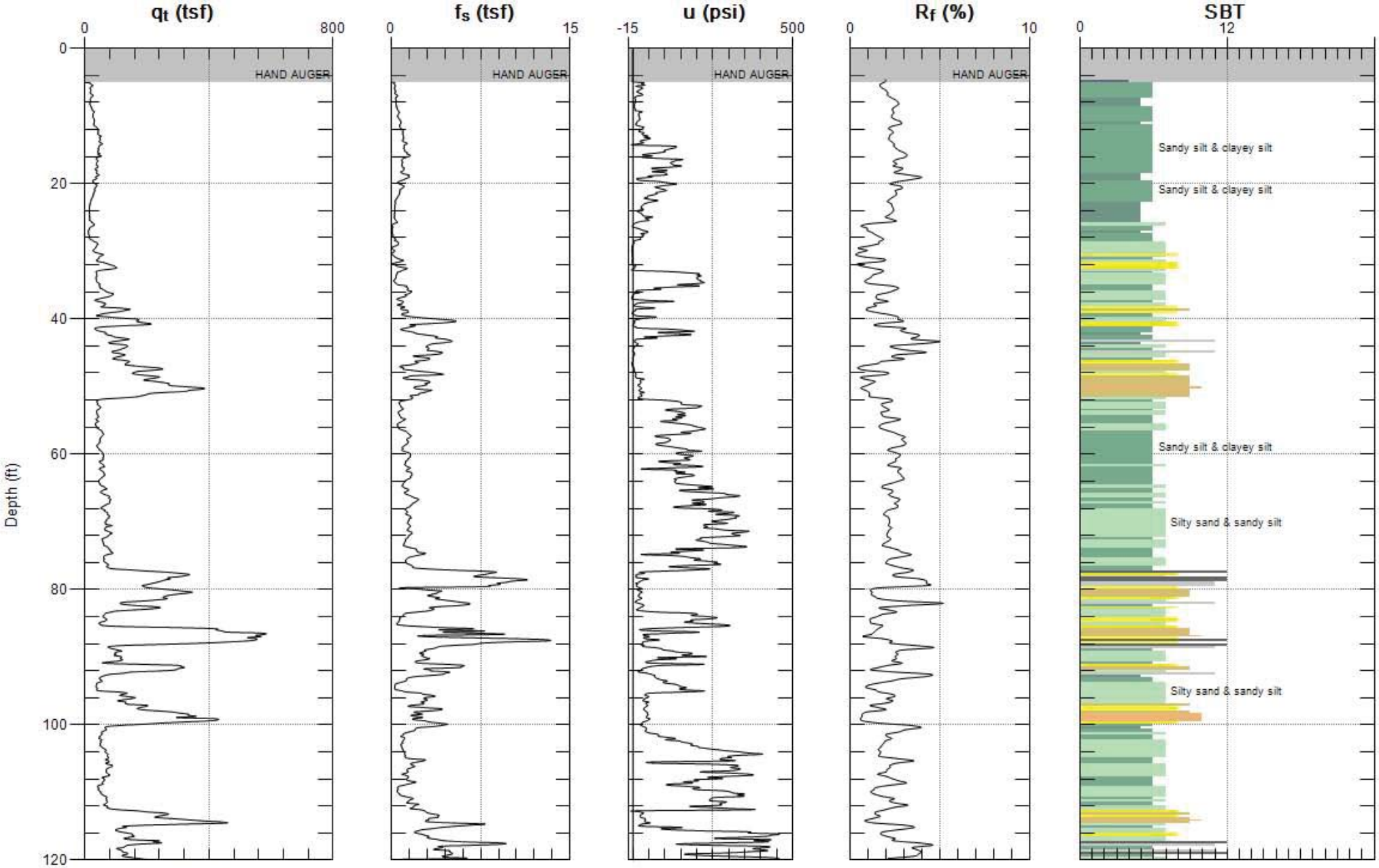
Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-005A

Engineer: E.BHANGOO
Date: 2010-01-28 11:39



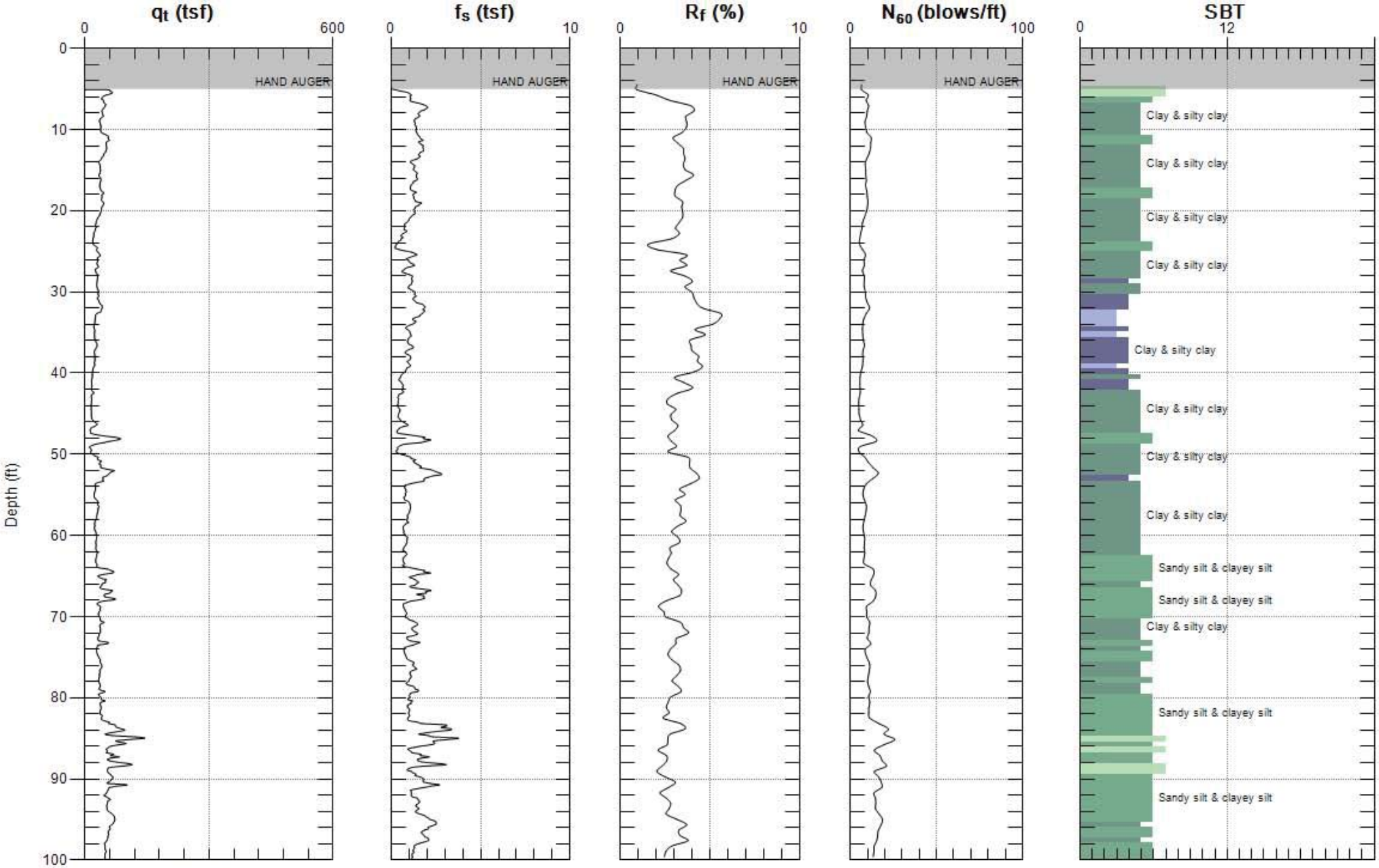
Max. Depth: 120.079 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-07

Engineer: F.WANG
Date: 10/26/2009 12:25



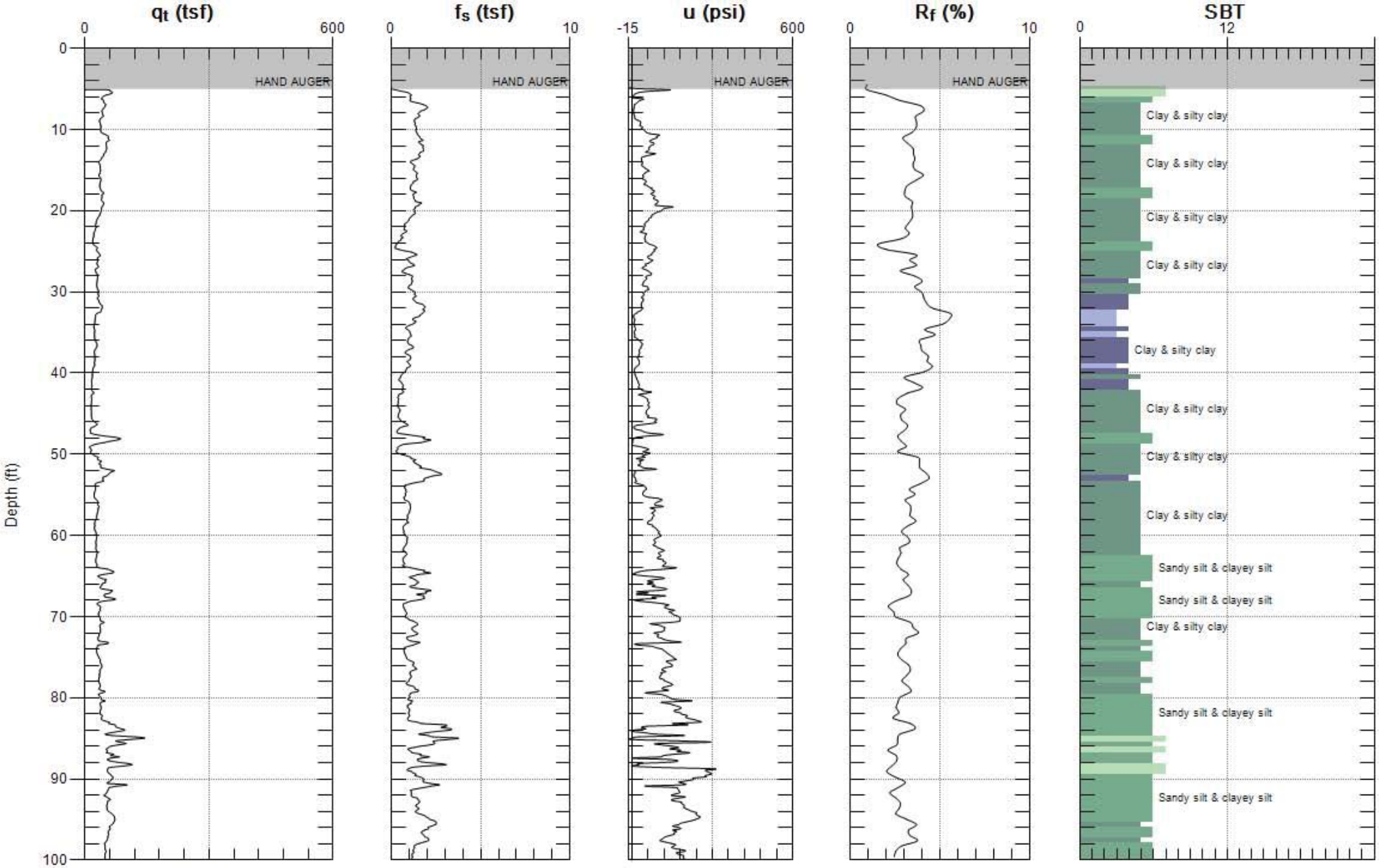
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-07

Engineer: F.WANG
Date: 10/26/2009 12:25



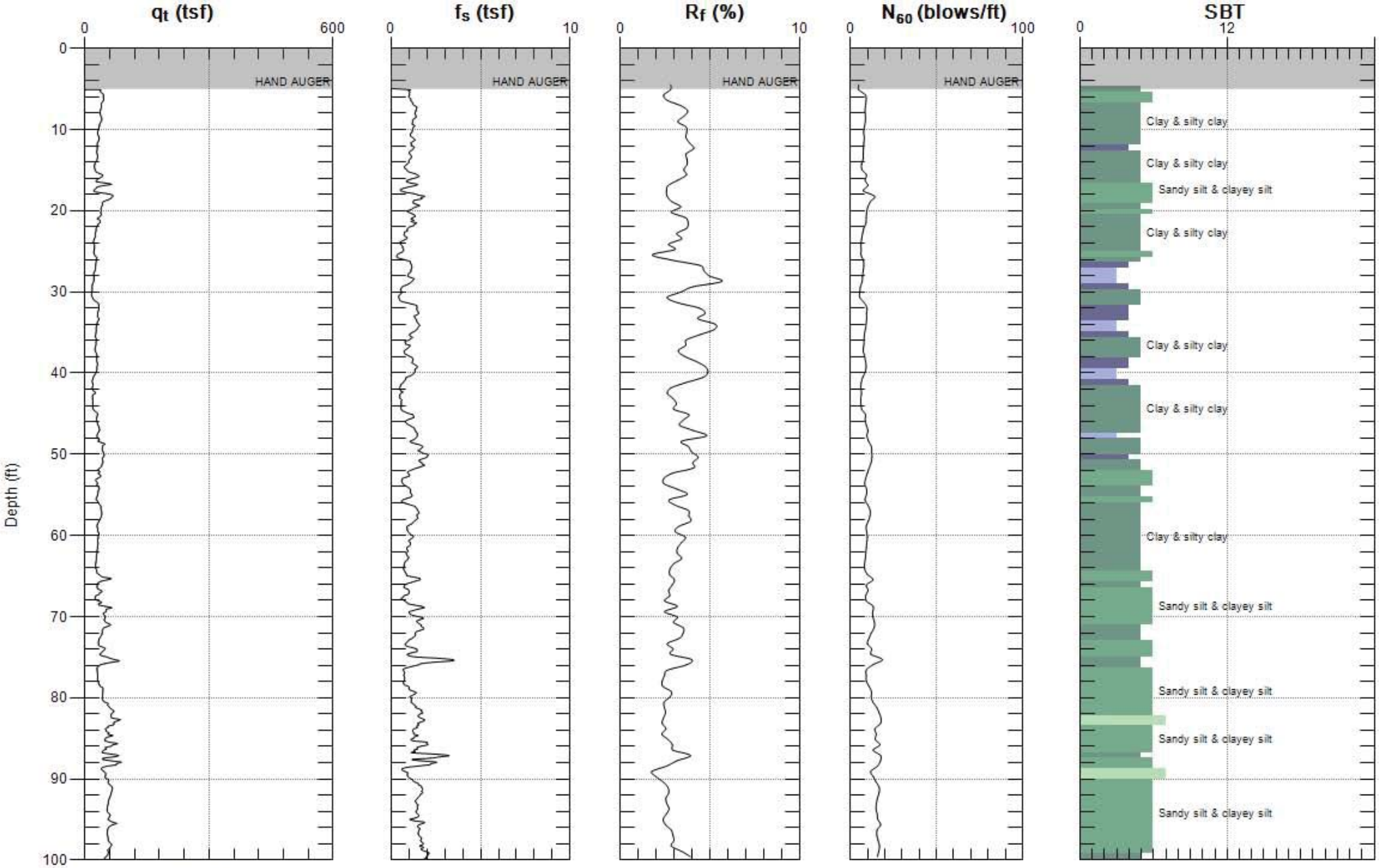
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-08

Engineer: F.WANG
Date: 10/26/2009 09:19



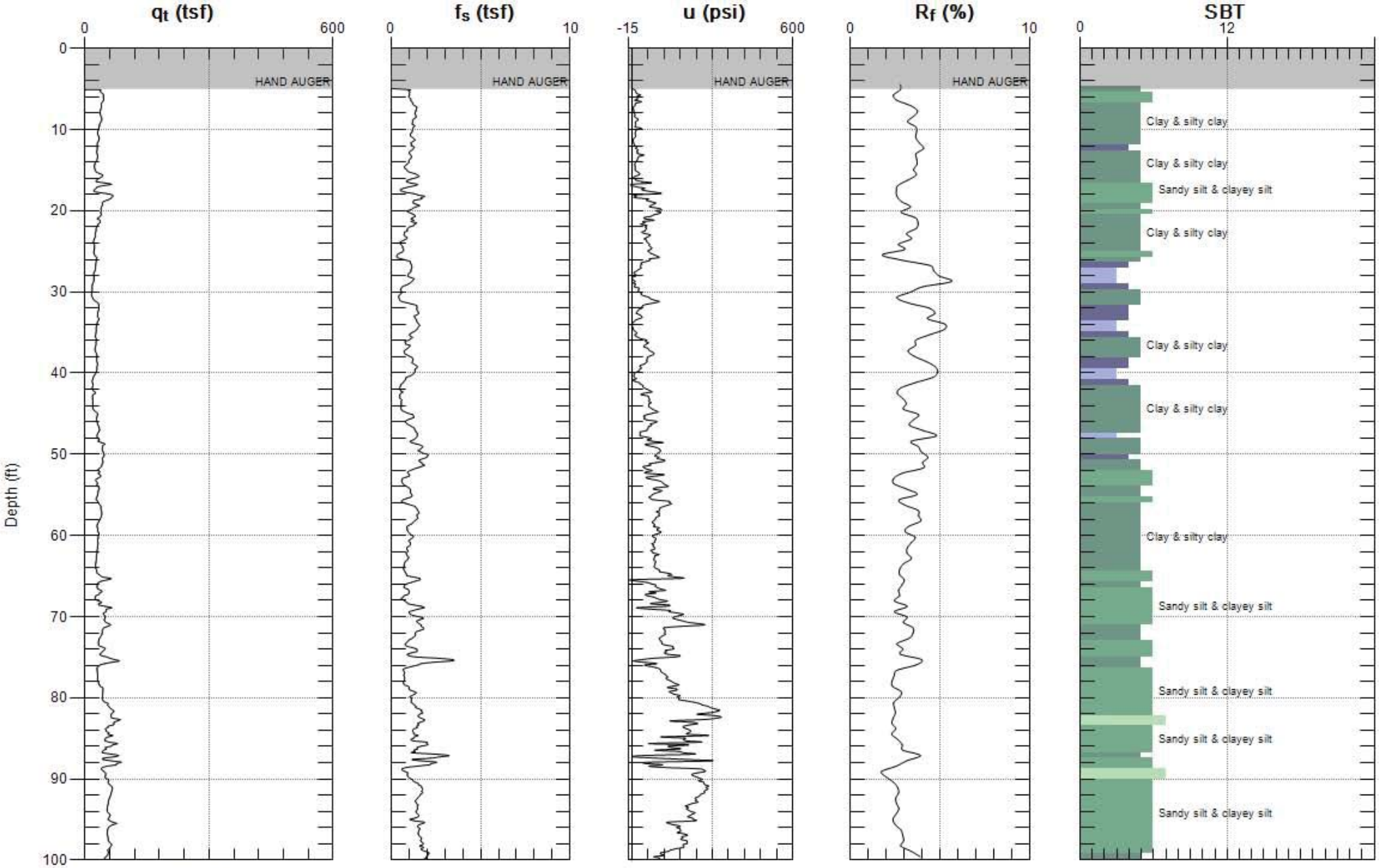
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: GREEN VALLEY RD.
Sounding: CPT-08

Engineer: F.WANG
Date: 10/26/2009 09:19



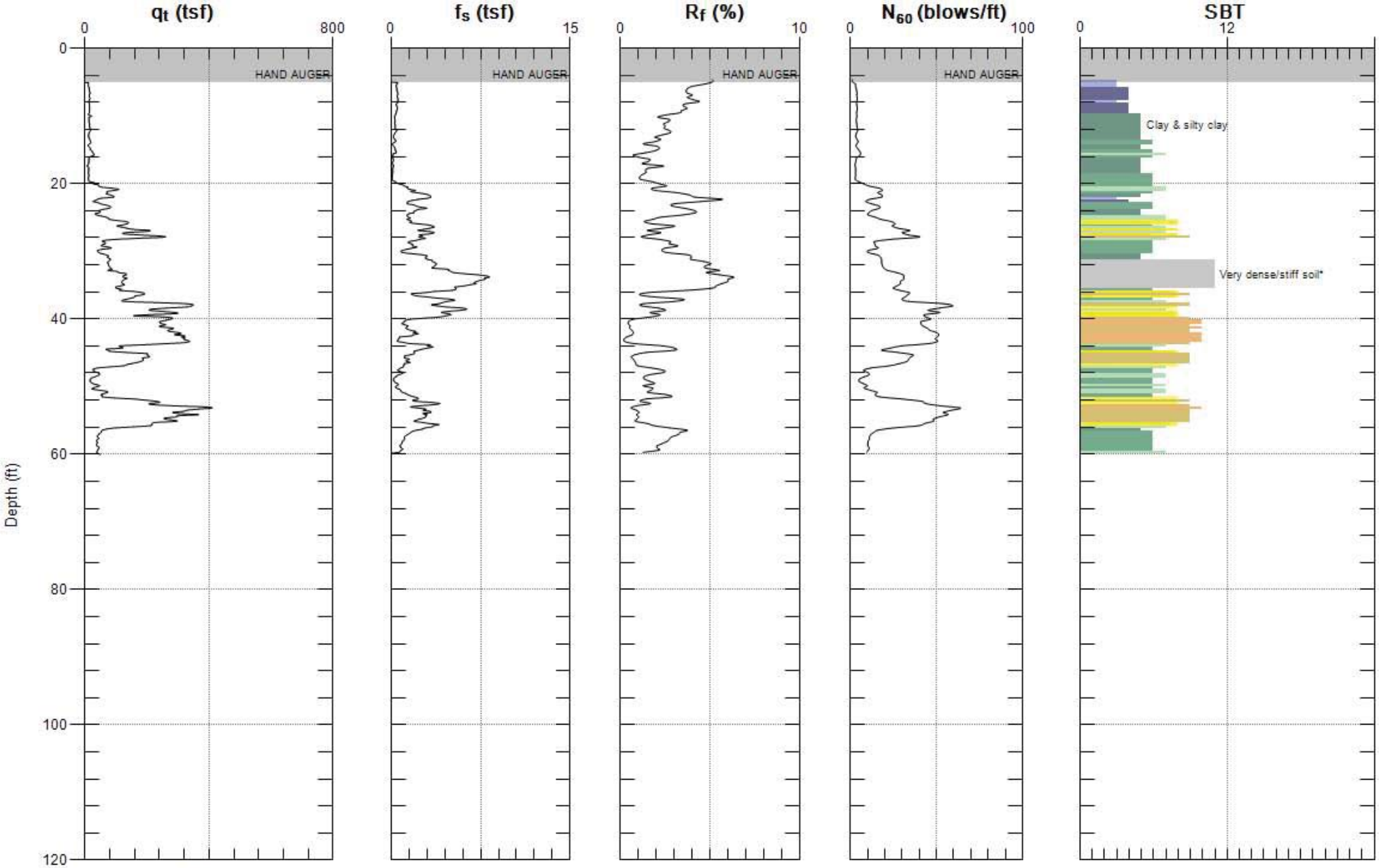
Max. Depth: 100.066 (ft)
Avg. Interval: 0.656 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-129A

Engineer: E.BHANGOO
Date: 2010-01-28 01:47



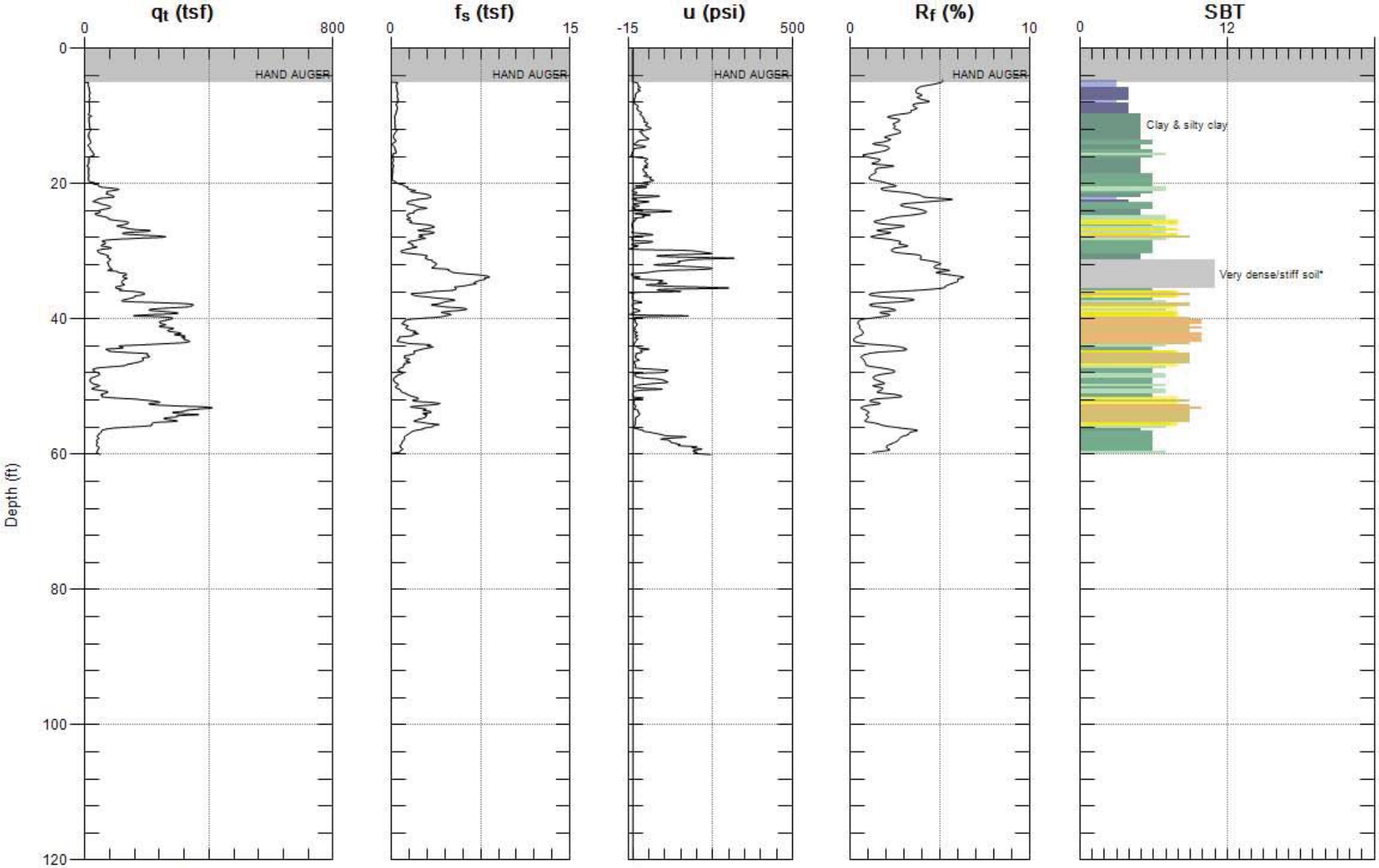
Max. Depth: 60.039 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

PARIKH CONSULTANTS

Site: 680-80-12 IC
Sounding: CPT-10-129A

Engineer: E.BHANGOO
Date: 2010-01-28 01:47



Max. Depth: 60.039 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

APPENDIX B

APPENDIX B
LABORATORY TESTS

Classification Tests
The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented in "Log of Test Borings", Appendix A.

Moisture-Density
The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with California Test Method 226 (Moisture Content) and 212 (Unit Weight). This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Lab Summary", Plates B-2A thru B-2AI.

Unconfined Compression Tests
Strength tests were performed on selected undisturbed samples using unconfined compression machine. Unconfined compression tests were performed in general accordance with California Test Method 221. The results are presented on "Lab Summary", Plates B-2A thru B-2AI.

Atterberg Limits
The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the effective strength characteristics and expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with California Test Method 204. The results of these tests are presented on Plates B-3A thru B-3E, "Plasticity Chart".

Grain Size Classification
Grain size classification tests (California Test Method 202) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates B-4A thru B-4T, "Grain Size Distribution Curves".

Consolidation Tests
Consolidation tests (California Test Method 219) were performed on twelve selected undisturbed samples. The test results are presented on Plates B-5A thru B-5AK.

R-value Tests
R-value tests were performed on representative bulk samples for pavement design. The tests were performed according to California Test Method 301. The test results are presented on Plates B-6A thru B-6I.

Unconfined Compressive Strength Tests
Unconfined Compressive Strength tests were performed on selected samples in accordance with California Test Method 373. The results are presented on Plates B-6J thru B-6L.

Corrosion Tests
Corrosion tests were performed on a selected sample to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The tests were performed by Sunland Analytical. The test results are presented on Plates B-7A and B-7O.

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-001	1	4.5	SM								59.2	45.5	
	2	9.5	SC	5.6	57.0	37.5					107.8	18.1	
	3	14.5	CL								109.2	19.0	
	4	19.5	CL								-	18.9	
	5	24.5	CL			69.5	35	23	12		100.6	25.0	
	6	29.5	ML	0.0	36.3	63.7					100.1	26.1	
	7	34.5	ML								101.1	23.3	
	8	39.5	SM								-	22.3	
	9	44.5	SM								-	19.6	
	10	49.5	SM								-	20.1	
	11	54.5	SM								-	14.2	
	12	59.5	ML	0.0	37.0	63.0	33	24	9		-	35.9	
	13	69.5	ML								-	27.0	
	14	79.5	SM								103.4	22.3	
	15	89.5	SM								-	27.0	
	16	99.5	SM								-	10.7	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

PARIKH

Practicing in the Geosciences

Notes:

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2A

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-002	1	4.5	CL								99.8	24.4	
	2	9.5	CL								108.0	20.4	
	3	14.5	SM								108.0	20.0	
	4	19.5	SM	0.0	63.0	37.0					102.5	25.0	
	5	24.5	ML	1.9	47.7	50.5					107.0	21.7	
	6	29.5	ML								92.1	30.1	
	7	34.5	CL-ML								95.3	26.7	
	8	39.5	ML				32	27	5		94.1	29.7	C. - See Plate No: B-5A thru B-5C
	9	44.5	ML	1.3	79.0	19.6					-	34.8	
	10	49.5	ML			50.6					-	28.8	
	11	54.5	ML								91.3	31.6	
	12	59.5	ML								-	27.2	
	13	69.5	SM								101.0	24.2	
	14	79.5	SM								-	14.7	
	15	89.5	SM								-	14.6	
	16	99.5	SM								-	32.3	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2B

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-003	1	4.5	CL							2.0	98.9	22.9	
	2	9.5	CL				42	18	24		105.4	23.0	C. - See Plate No: B-5D thru B-5F
	3	14.5	SP-SC	23.8	66.4	9.8					-	36.6	
	4	19.5	SM								-	27.7	
	5	24.5	CL							1.0	86.2	35.0	
	6	29.5	SM	0.0	55.8	44.2	32	19	13	1.4	98.5	25.2	
	7	34.5	ML	0.0	49.9	50.1					96.6	27.0	
	8	39.5	SM	0.0	54.0	46.0	30	26	4		90.3	31.3	
	9	44.5	SM								-	15.6	
	10	49.5	SW-SM	16.7	72.4	10.9					-	16.8	
	11	54.5	SM	26.8	45.9	27.3					-	24.2	
	12	59.5	SM								-	18.0	
	13	69.5	ML								-	29.1	
	14	79.5	SM								-	21.0	
	15	89.5	SM								-	29.9	
	16	99.5	SM								-	18.0	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2C

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-137	1	2.0	CH								109.6	17.7	
	2	4.5	CL				47	18	29		103.7	20.7	Corr. - See Plate No.: B-7M
	3	9.5	SM								105.3	22.4	
	4	14.5	CL							6.5	105.4	21.2	
	5	19.5	CL								102.8	23.1	
	6	24.5	CL								110.9	18.4	
	7	29.5	CL	0.0	41.2	58.8	29	18	11		98.3	26.3	
	8	34.5	ML							1.9	105.6	20.6	
	9	39.5	SM								100.6	24.6	
	10	44.5	SM								97.4	25.2	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2D

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-003A	1	5.0	CL								-	-	
	2	10.0	CL								-	-	Corr. - See Plate No: B-7A
	3	13.0	SM	0.9	80.1	19.0					-	27.5	
	4	16.0	SM								-	-	
	5	20.0	SM								-	-	
	6	25.0	ML	0.0	34.7	65.3	37	27	10		-	36.2	
	7	30.0	SM								-	-	
	8	35.0	SM	7.3	43.8	48.9	33	28	5		-	28.8	
	9	38.0	SM								-	-	
	10	41.0	SM								-	-	
	11	44.0	SM								-	-	
	12	47.0	SM								-	-	
	13	50.0	ML				49	29	20		-	42.6	
	14	53.0	ML	0.3	10.8	88.9					-	37.4	
	15	56.0	CL	0.0	13.5	86.5	41	23	18		-	25.8	
	16	59.0	CL								-	-	
	17	62.0	CL								-	-	
	18	65.0	ML	0.0	29.7	70.3	37	30	7		-	33.7	
	19	68.0	ML								-	-	
	20	71.0	ML								-	-	
	21	74.0	SM	0.0	56.8	43.2					-	33.0	
	22	77.0	SM								-	-	
	23	80.0	SM								-	-	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2E

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-004A	1	6.0	CL								-	20.9	
	2	11.0	CL				32	20	12		-	22.5	Corr. - See Plate No: B-7B
	3	14.0	CL								-	32.1	
	4	17.0	CL								-	33.1	
	5	21.0	ML			66.2	46	28	18		-	32.4	
	6	26.0	CL								-	31.0	
	7	31.0	SM	5.9	77.7	16.4					-	29.6	
	8	36.0	CL								-	32.6	
	9	39.0	SM								-	16.9	
	10	42.0	SM			25.6					-	28.9	
	11	45.0	SC	3.4	78.2	18.4					-	31.9	
	12	48.0	SP	33.1	64.7	2.3					-	18.8	
	13	51.0	CL								-	37.8	
	14	56.0	ML				41	30	11		-	37.7	
	15	61.0	CL								-	30.6	
	16	66.0	SM	0.4	68.8	30.8	29	25	4		-	28.8	
	17	71.0	CL								-	34.5	
	18	76.0	ML				40	31	9		-	41.2	
	19	101.0	ML				31	23	8		-	22.2	
	20	121.0	CL								-	36.7	
	21	141.0	CL								-	28.2	
	22	161.0	CL								-	20.8	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2F

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-006	1	6.5	CL				48	19	29		108.7	17.7	Corr. - See Plate No.: B-7D
	2	9.5	CL								111.7	15.8	
	3	14.5	CL								109.5	18.2	
	4	19.5	CL				36	19	17	1.8	94.8	28.7	
	5	24.5	CL								95.1	30.0	
	6	29.5	CL								89.9	32.5	C. - See Plate No.: B-5G thru B-5I
	7	34.5	CL								100.9	25.1	
	8	39.5	CL	0.0	13.9	86.1					94.5	29.3	
	9	44.5	CH				56	19	37	2.3	90.6	32.1	
	10	49.5	CL								100.7	24.5	
	11	54.5	SM	3.0	77.4	19.6					103.7	23.3	
	12	59.5	CL								104.6	24.5	
	13	69.5	SC			40.1				1.6	103.9	22.2	
	14	79.5	CL								101.4	26.0	
	15	89.5	SP-SM	0.0	88.0	12.0					104.3	23.3	
	16	99.5	CL								105.4	21.7	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2G

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-005	1	4.5	CL							3.0	96.8	24.6	Corr. - See Plate No.: B-7C
	2	9.5	SC	0.0	52.2	47.8	41	17	24	3.2	100.4	24.4	
	3	14.5	SM	0.0	72.2	27.8	28	23	5		99.8	22.2	
	4	19.5	SC								95.7	27.6	
	5	24.5	SC	0.0	56.5	43.5	45	20	25		93.2	29.7	
	6	29.5	SM	0.0	65.0	35.0					95.6	27.7	
	7	34.5	ML	0.1	25.1	74.8					-	15.4	
	8	39.5	SM								-	14.5	
	9	44.5	SM								93.1	29.7	
	10	49.5	SM								-	12.6	
	11	54.5	ML				32	24	8		-	31.1	
	12	59.5	ML								92.7	29.7	
	13	69.5	ML	6.8	77.4	15.9					89.3	29.5	
	14	79.5	ML								105.5	19.8	
	15	89.5	SM								-	16.0	
	16	99.5	ML								-	29.7	

SUMMARY OF LABORATORY TEST RESULTS

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Job No.: 209130.GDR Plate No.: B-2H

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-009	1	4.5	CL								105.5	21.8	C. : B-5J thru B-5L, Corr.: B-7E
	2	9.5	CL								101.5	19.4	
	3	14.5	SC			34.9					98.2	26.6	
	4	19.5	CL	0.0	29.7	70.3	39	19	20	7.6	107.7	21.0	
	5	24.5	SC			46.1					110.5	19.1	
	6	29.5	CL								109.4	19.6	
	7	34.5	CH				59	27	32	2.4	90.3	31.4	
	8	39.5	CL								90.4	31.5	
	9	44.5	CL								99.8	23.8	
	10	49.5	CL								110.0	18.1	
	11	54.5	CL								101.1	25.6	
	12	59.5	CL				38	20	18	2.8	93.6	29.4	
	13	69.5	CL								100.5	24.6	
	14	79.5	CL								109.9	21.1	
	15	89.5	CL								107.4	21.1	
	16	99.5	CL								98.6	27.4	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2I

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-009A	1	6.5	CL								-	-	
	2	11.0	CL								-	-	
	3	13.0	CL				34	19	15		-	26.8	
	4	16.0	SC	0.5	67.0	32.6	30	21	9		-	28.4	
	5	19.0	SM	0.6	73.7	25.7					-	28.1	
	6	23.0	CL								-	-	
	7	26.0	CL								-	-	
	8	29.0	CL								-	-	
	9	36.0	CL								-	-	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2J

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-011	1	4.5	GP-GM								-	0.2	
	2	9.5	SC								-	18.4	
	3	14.5	SM								112.3	16.6	
	4	19.5	ML	0.0	42.9	57.1					102.1	24.2	
	5	24.5	SM								98.1	26.0	
	6	29.5	SM								-	35.4	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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R. = R-Value U.C. = Unconf. Compression

Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2K

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-112	1	2.0	SC								-	20.6	
	2	4.5	SM								-	40.3	
	3	9.5	SC	13.5	54.1	32.4					-	38.1	
	4	14.5	SC								-	49.2	
	5	19.5	SC								-	41.4	
	6	24.5	SC								-	36.6	
	7	29.5	SC								-	58.6	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Notes:

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2L

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-114	1	2.0	GP-GM								-	2.6	
	2	4.5	CL				25	15	10		103	21.5	
	3	9.5	CL								100.1	22.9	
	4	14.5	CL								97.9	25	
	5	19.5	CL							1.3	91.4	30.3	
	6	24.5	SC								107.7	20.8	
	7	29.5	CL								-	37.2	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2M

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-120	1	2.0	CL								115.3	14.3	
	2	4.5	CL								104.7	21.2	
	3	9.5	CL				43	19	24	10.0	106.0	19.8	
	4	14.5	CL								107.0	20.6	
	5	19.5	SM								99.1	25.7	
	6	24.5	SM	0.0	53.1	46.9					-	29.8	
	7	29.5	SM	13.0	62.2	24.7					-	33.2	
	8	34.5	CL								-	28.3	
	9	39.5	CL				37	18	19		103.5	23.0	
	10	44.5	SM			26.8					-	26.2	

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SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2N

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-119	1	2.0	CL								106.7	19.2	Corr. - See Plate No.: B-7F
	2	4.5	CL								107.3	19.4	
	3	9.5	CL				41	19	22	22	103.7	20.4	
	4	14.5	CL								109.4	18.4	

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2O

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-121	1	2.0	CL								96.2	11.7	
	2	4.5	CL								114.1	13.5	
	3	9.5	CL								106.2	16.8	
	4	14.5	CL				41	27	14	5.4	108.1	17.2	
	5	19.5	CL								106.5	19.9	
	6	24.5	SM	0.0	67.3	32.7					96.2	27.2	
	7	29.5	SM	0.0	70.2	29.8					-	25.6	
	8	34.5	CH				58	25	33		-	22.2	
	9	39.5	CL								107.8	21.0	
	10	44.5	CL								93.7	27.4	

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SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2P

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-122	1	2.0	CL								119.6	12	
	2	4.5	CL				49	19	30		109.8	16.7	
	3	9.5	CL							4.9	108.9	18.5	
	4	14.5	CL								95.4	17.3	
	5	19.5	SM								84.8	22.9	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2Q

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-123	1	2.0	CH								-	16.2	Corr. - See Plate No.: B-7G
	2	4.5	CL								-	14.1	
	3	9.5	CH				54	21	33	8.0	102.7	22.3	
	4	14.5	SM	0.0	57.0	43.0					108.9	19.0	
	5	19.5	CL								103.0	23.1	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2R

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-124	1	2.0	CL								100.4	20.0	
	2	4.5	CL								104.4	19.5	
	3	9.5	CL				33	18	15		105.2	19.0	C. - See Plate No.: B-5M thru B-5O
	4	14.5	SM	0.0	67.5	32.5					100.1	24.9	
	5	19.5	CL								-	29.9	
	6	24.5	SP-SM	0.2	92.8	7.0					-	27.0	
	7	29.5	SM	2.0	78.9	19.1					-	23.1	
	8	34.5	CL								-	22.8	
	9	39.5	CL				47	20	27	7.1	103.9	21.8	
	10	44.5	CL								96.3	29.0	
	11	49.5	CL								-	20.5	

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ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2S

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-125	1	4.5	CL								101.1	20.5	Corr. - See Plate No: B-7H
	2	9.5	CL				47	23	24	7.2	101.9	22.9	
	3	14.5	CL							2.1	99.8	25.3	
	4	19.5	CL							4.1	104.9	21.6	
	5	24.5	SM								101.1	24.6	
	6	29.5	SM	0.0	71.5	28.5					101.8	24.1	
	7	34.5	CL							6.1	102.3	22.8	
	8	39.5	CL								99.4	24.8	
	9	44.5	SM	0.2	59.6	40.2					102.4	23.4	
	10	49.5	SM								109.3	19.7	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2T

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-126	1	4.5	CL								109.8	18.5	
	2	9.5	CL							5.3	106.8	20.0	
	3	14.5	CL				43	18	25		99.9	25.5	C. - See Plate No: B-5P thru B-5R
	4	19.5	CL	0.0	45.0	55.0					91.2	33.8	
	5	24.5	CL								103.2	24.2	
	6	29.5	CL	0.0	39.7	60.3					110.6	21.9	
	7	34.5	CL	0.6	47.6	51.8					103.4	23.2	
	8	39.5	ML								104.7	22.4	
	9	44.5	SM								102.9	23.3	
	10	49.5	SC								-	22.9	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2U

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-127	1	2.0	CH				56	17	39	2.5	96.3	24.7	Corr. - See Plate No.: B-7I
	2	4.5	CL								102.0	11.2	
	3	9.5	CL								110.6	18.7	
	4	14.5	CL							1.9	96.4	26.8	
	5	19.5	CL			48.4					106.0	21.6	
	6	24.5	CL								106.5	16.9	
	7	29.5	ML								97.2	26.3	
	8	34.5	SM			20.9					106.8	20.1	
	9	39.5	SM								-	14.9	
	10	44.5	SM								-	14.0	

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2V

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-128	1	2.0	CL								-	24.1	Corr. - See Plate No: B-7J
	2	4.5	CL				46	17	29	3.1	105.0	18.8	
	3	9.5	CL							7.8	102.9	23.0	
	4	14.5	CL								97.4	27.6	C. - See Plate No: B-5S thru B-5U
	5	19.5	SM								107.3	20.2	
	6	24.5	SM								105.5	20.9	
	7	29.5	ML				43	29	14		-	40.0	
	8	34.5	SM								-	36.6	
	9	39.5	SM								-	28.4	
	10	44.5	SM	0.0	54.7	45.3					-	31.6	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2W

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-128A	1	6.0	CL								-	-	
	2	11.0	CL								-	-	
	3	16.0	ML								-	-	
	4	21.0	ML								-	-	
	5	26.0	SC	0.3	54.7	45.0	29	19	10		-	28.6	
	6	31.0	SP-SM	33.1	55.0	11.9					-	-	
	7	36.0	SM								-	-	
	8	39.0	SM	0.0	75.8	24.2	28	27	1		-	31.9	
	9	42.0	SM								-	-	
	10	45.0	SM				29	26	3		-	25.5	
	11	48.0	SM	16.4	70.8	12.8					-	-	
	12	51.0	SM								-	-	
	13	54.0	SM								-	-	
	14	57.0	SM	28.4	54.6	17.0	28	24	4		-	22.5	
	15	60.0	SM								-	-	
	16	65.0	ML	0.0	47.6	52.4	28	27	1		-	34.0	
	17	70.0	ML								-	-	
	18	80.0	ML								-	-	

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Job No.: 209130.GDR Plate No.: B-2X

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-129	1	2.0	SC								-	18.2	
	2	4.5	CH								109.5	18.3	
	3	9.5	CL							3.0	102.8	21.7	
	4	14.5	SM	0.0	55.7	44.3	34	19	15		105.5	21.9	
	5	19.5	CL								100.1	25.1	
	6	24.5	CL								82.4	38.5	C. - See Plate No: B-5V thru B-5X
	7	29.5	ML								102.1	23.8	
	8	34.5	SM	0.7	69.2	30.1					-	26.3	
	9	39.5	SM			25.9					97.1	27.5	
	10	44.5	SP-SM								-	19.5	

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Job No.: 209130.GDR Plate No.: B-2Y

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-130	1	6.0	CL								104.1	22.5	
	2	9.5	CH				58	18	40		97.0	26.7	C. - See Plate No.: B-5Y thru B-5AA
	3	14.5	CL								105.0	21.6	
	4	19.5	CL				47	21	26	2.6	91.9	28.8	
	5	24.5	CL								91.2	31.1	
	6	29.5	SM	0.3	50.9	48.8					86.2	34.6	
	7	34.5	SM								90.7	29.2	
	8	39.5	SM								-	15.8	
	9	44.5	SM								-	10.9	
	10	49.5	SM	2.6	70.1	27.3					-	14.7	
	11	54.5	SM								-	17.1	
	12	59.5	ML								-	31.5	

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2Z

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-133	1	2.0	CH								97.5	26.3	
	2	5.0	CL								104.5	20.6	
	3	10.0	CL				36	16	20		110.0	19.4	C. - See Plate No:B-5AB thru B-5AD
	4	15.0	SM	0.3	64.6	35.1					98.8	23.3	
	5	20.0	CL								-	26.4	
	6	25.0	CL				45	21	24	5.5	103.4	22.6	
	7	30.0	CL								101.8	25.7	
	8	35.0	CL								100.3	23.4	
	9	40.0	CL								99.5	25.7	
	10	45.0	SC	3.4	73.8	22.8					101.5	25.8	
	11	50.0	SM								-	27.1	
	12	55.0	SC								-	17.7	
	13	60.0	SM	0.0	82.7	17.3					87.3	30.6	

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Job No.: 209130.GDR Plate No.: B-2AA

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-10-133A	1	5.0	CL								-	-	Corr. - See Plate No: B-7K
	2	10.0	CL								-	-	
	3	13.0	CL								-	-	
	4	16.0	CL								-	-	
	5	20.0	CL								-	-	
	6	25.0	CL								-	-	
	7	30.0	CL								-	-	
	8	35.0	CL	0.3	42.9	56.8	38	20	18		-	25.2	
	9	40.0	CL								-	-	
	10	43.0	SM	0.3	59.8	39.8	32	25	7		-	35.1	
	11	46.0	SM								-	-	
	12	49.0	SM	0.0	65.0	35.0	35	29	6		-	36.3	
	13	52.0	SP-SM								-	-	
	14	55.0	SP-SM								-	-	
	15	58.0	ML								-	-	
	16	61.0	SM								-	-	
	17	64.0	SM								-	-	
	18	70.0	ML	1.1	25.8	73.2	41	28	13		-	26.5	

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Job No.: 209130.GDR Plate No.: B-2AB

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-134	1	4.5	CH				61	20	41		99.1	22.0	
	2	9.5	CL								109.8	19.1	
	3	14.5	CL							6.4	107.3	20.2	
	4	19.5	CL								-	23.3	
	5	24.5	CL								-	27.8	
	6	29.5	CL								-	28.7	
	7	34.5	SC	3.7	67.6	28.7					100.8	24.2	
	8	39.5	CL								-	21.6	
	9	44.5	CL								105.7	21.2	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Notes:

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2AC

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-135	1	5.0	CH				50	20	30	3.6	99.7	21.8	
	2	10.0	CL				45	20	25		103.6	21.3	Corr. - See Plate No: B-7L
	3	15.0	SM	0.5	73.4	26.1					123.1	25.7	
	4	20.0	SM								-	24.2	
	5	25.0	CL								103.0	19.3	
	6	30.0	CH				52	24	28		97.1	26.9	
	7	35.0	SM	2.1	64.3	33.7					86.3	29.4	
	8	40.0	SM								-	24.1	
	9	45.0	CL								102.4	23.5	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2AD

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-136	1	2.0	CH								92.4	25.2	
	2	4.5	CL								100.4	16.6	
	3	9.5	SC	0.0	61.9	38.1					108.3	18.7	
	4	14.5	CL								108.7	20.2	
	5	19.5	CL				44	19	25		99.5	23.9	C. - See Plate No: B-5AE thru B-5AG
	6	24.5	CL								108.2	19.5	
	7	29.5	SM			18.0					100.6	24.2	
	8	34.5	SM	3.9	75.0	21.1					93.2	28.6	
	9	39.5	CL								-	26.3	
	10	44.5	SC								105.3	22.1	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2AE

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-138	1	4.5	CH				59	22	37	4.3	65.0	8.2	
	2	14.5	CL								-	20.4	
	3	19.5	CL							4.7	103.0	22.6	
	4	24.5	CL								-	20.0	
	5	29.5	CL								102.4	23.5	
	6	34.5	CL				41	17	24		-	21.7	
	7	39.5	CL								100.4	25.4	
	8	44.5	CL								-	22.5	

SUMMARY OF LABORATORY TEST RESULTS

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SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2AF

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-139	1	4.5	ML								-	14.5	
	2	9.5	CL				35	18	17		110.9	18.0	
	3	14.5	CL								97.6	26.5	
	4	19.5	CL							2.4	114.0	25.0	
	5	24.5	CL								-	21.4	
	6	29.5	CL								133.7	19.0	
	7	34.5	SM	0.0	76.6	23.4					-	20.9	
	8	39.5	CL								-	21.2	
	9	44.5	CL								96.0	28.1	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Corr. = Corrosion

Job No.: 209130.GDR Plate No.: B-2AG

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
A-09-140	1	4.5	CL								112.4	17.9	Corr. - See Plate No.: B-7N
	2	9.5	ML				38	17	21	8.1	110.2	18.4	
	3	14.5	CL								108.9	19.2	
	4	19.5	CL								-	22.8	
	5	24.5	SC								100.6	25.1	C. - See Plate No.: B-5AH thru B-5AJ
	6	29.5	SC	0.1	53.7	46.2					-	22.0	
	7	34.5	CL-ML								-	32.4	
	8A	39.0	CL								-	24.4	
	8B	39.5	SC								-	26.8	
	9	44.5	CL								104.0	25.2	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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Job No.: 209130.GDR Plate No.: B-2AH

Boring No.	Sample No.	Depth (ft)	Soil Type (USCS*)	Grain Size Analysis			Atterberg Limits			Unconfined Compression (ksf)	Dry Density (pcf)	Moisture Content (%)	Remarks
				gravel (%)	sand (%)	fines (%)	LL	PL	PI				
R-12-151	1	2.0	CL								-	16.5	
	2	5.0	CL							1.8	91.0	30.1	
	3	10.0	CL								106.7	20.7	
	4	15.0	ML								106.6	20.0	
	5	20.0	SM	0.0	72.7	27.3					100.2	25.2	
	6	25.0	CL	4.4	36.3	59.3					89.5	31.8	
	7	30.0	ML				41	26	15		86.1	37.6	
	8	35.0	SM								97.0	24.3	
	9	40.0	SM								102.5	18.9	
	10	45.0	SM								96.2	17.3	
	11	50.0	CL								-	26.6	
	12	60.0	CL								94.0	28.9	
	13	70.0	CL								102.4	23.2	
	14	80.0	SP								99.3	16.3	
	15	90.0	SP								87.1	31.5	
	16	100.0	CL								91.6	29.8	

SUMMARY OF LABORATORY TEST RESULTS

ROUTE 80-680-12 INTERCHANGE PROJECT

SOLANO COUNTY, CALIFORNIA

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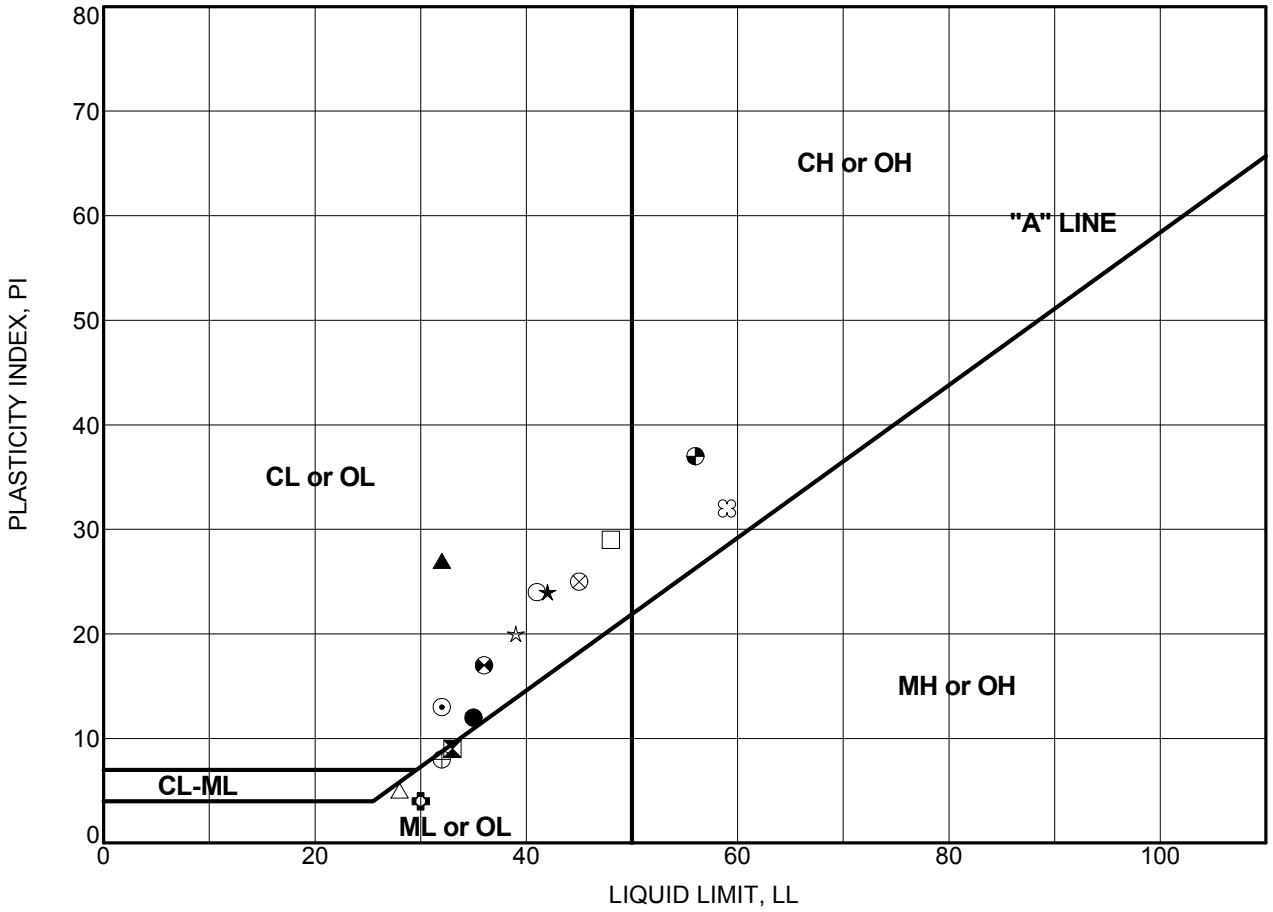
Job No.: 209130.GDR | Plate No.: B-AI



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-001	MC-5	24.5	●	25	35	23	12	SANDY LEAN CLAY (CL)
A-09-001	SPT-12	59.5	⧗	36	33	24	9	SANDY SILT (ML)
A-09-002	MC-8	39.5	▲	30	32	5	27	SANDY SILT (ML)
A-09-003	MC-2	9.5	★	23	42	18	24	LEAN CLAY WITH SAND (CL)
A-09-003	MC-6	29.5	⊙	25	32	19	13	SILTY SAND (SM)
A-09-003	MC-8	39.5	✿	31	30	26	4	SILTY SAND (SM)
A-09-005	MC-2	9.5	○	24	41	17	24	CLAYEY SAND (SC)
A-09-005	MC-3	14.5	△	22	28	23	5	SILTY SAND (SM)
A-09-005	MC-5	24.5	⊗	30	45	20	25	CLAYEY SAND (SC)
A-09-005	MC-11	54.5	⊕	31	32	24	8	SANDY SILT (ML)
A-09-006	MC-1	6.5	□	18	48	19	29	SANDY LEAN CLAY (CL)
A-09-006	MC-4	19.5	⊠	29	36	19	17	LEAN CLAY WITH SAND (CL)
A-09-006	MC-9	44.5	◕	32	56	19	37	FAT CLAY (CH)
A-09-009	MC-4	19.5	☆	21	39	19	20	LEAN CLAY WITH SAND (CL)
A-09-009	MC-7	34.5	⌘	31	59	27	32	FAT CLAY (CH)

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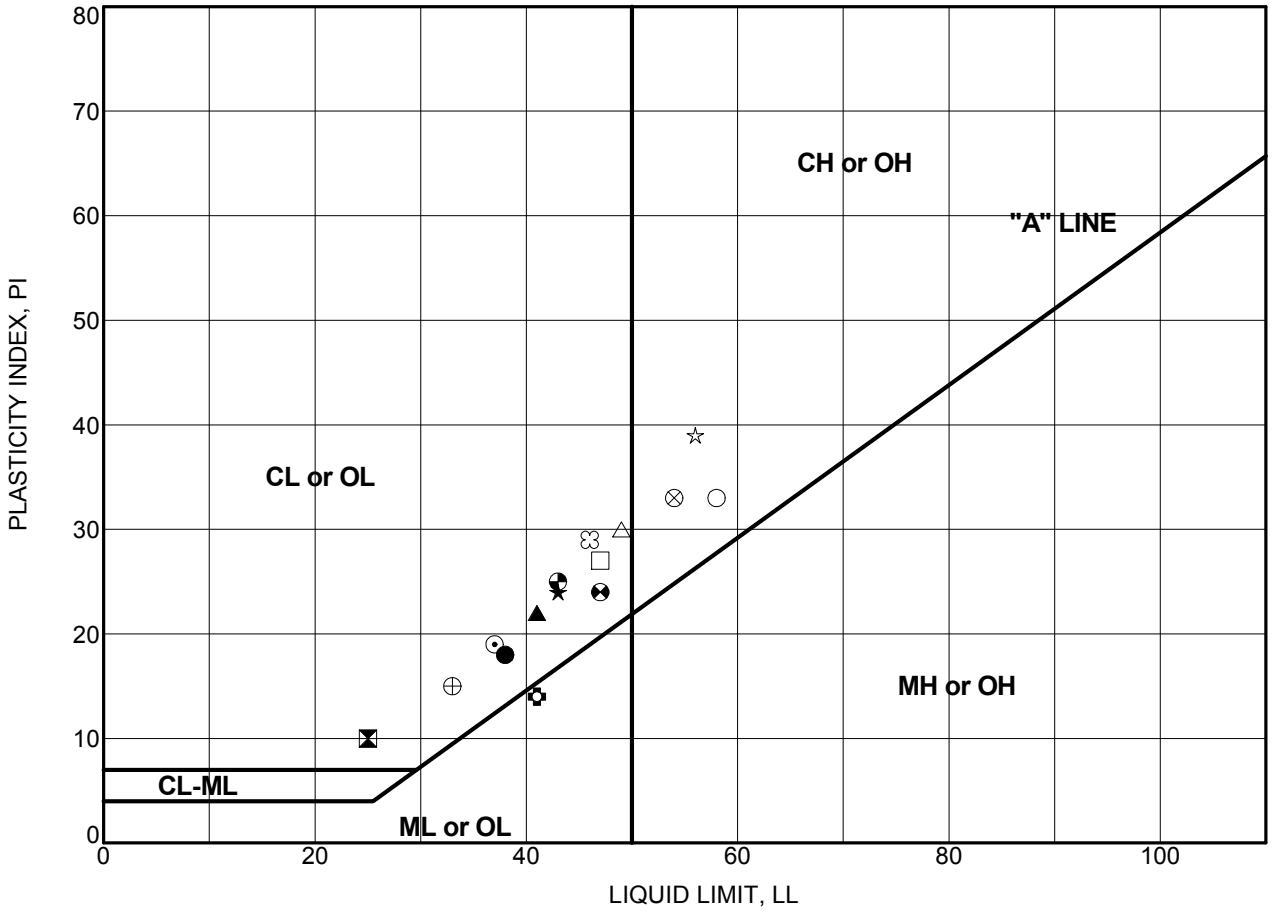
SOLANO COUNTY, CALIFORNIA

JOB NO: 2009-130-GDR | **PLATE NO:** B-3A



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-009	MC-12	59.5	●	29	38	20	18	LEAN CLAY (CL)
A-09-114	MC-2	4.5	⧗	18	25	15	10	SANDY LEAN CLAY (CL)
A-09-119	MC-3	9.5	▲	20	41	19	22	LEAN CLAY (CL)
A-09-120	MC-3	9.5	★	20	43	19	24	LEAN CLAY (CL)
A-09-120	MC-9	39.5	⊙	23	37	18	19	LEAN CLAY (CL)
A-09-121	MC-4	14.5	✿	17	41	27	14	SANDY LEAN CLAY (CL)
A-09-121	SPT-8	34.5	○	22	58	25	33	FAT CLAY (CH)
A-09-122	MC-2	4.5	△	17	49	19	30	LEAN CLAY (CL)
A-09-123	MC-3	9.5	⊗	22	54	21	33	FAT CLAY (CH)
A-09-124	MC-3	9.5	⊕	19	33	18	15	LEAN CLAY WITH SAND (CL)
A-09-124	MC-9	39.5	□	22	47	20	27	LEAN CLAY (CL)
A-09-125	MC-2	9.5	⊠	23	47	23	24	LEAN CLAY (CL)
A-09-126	MC-3	14.5	◕	26	43	18	25	SANDY LEAN CLAY (CL)
A-09-127	MC-1	2.0	☆	25	56	17	39	FAT CLAY (CH)
A-09-128	MC-2	4.5	⁂	19	46	17	29	LEAN CLAY WITH SAND & GRAVEL (CL)

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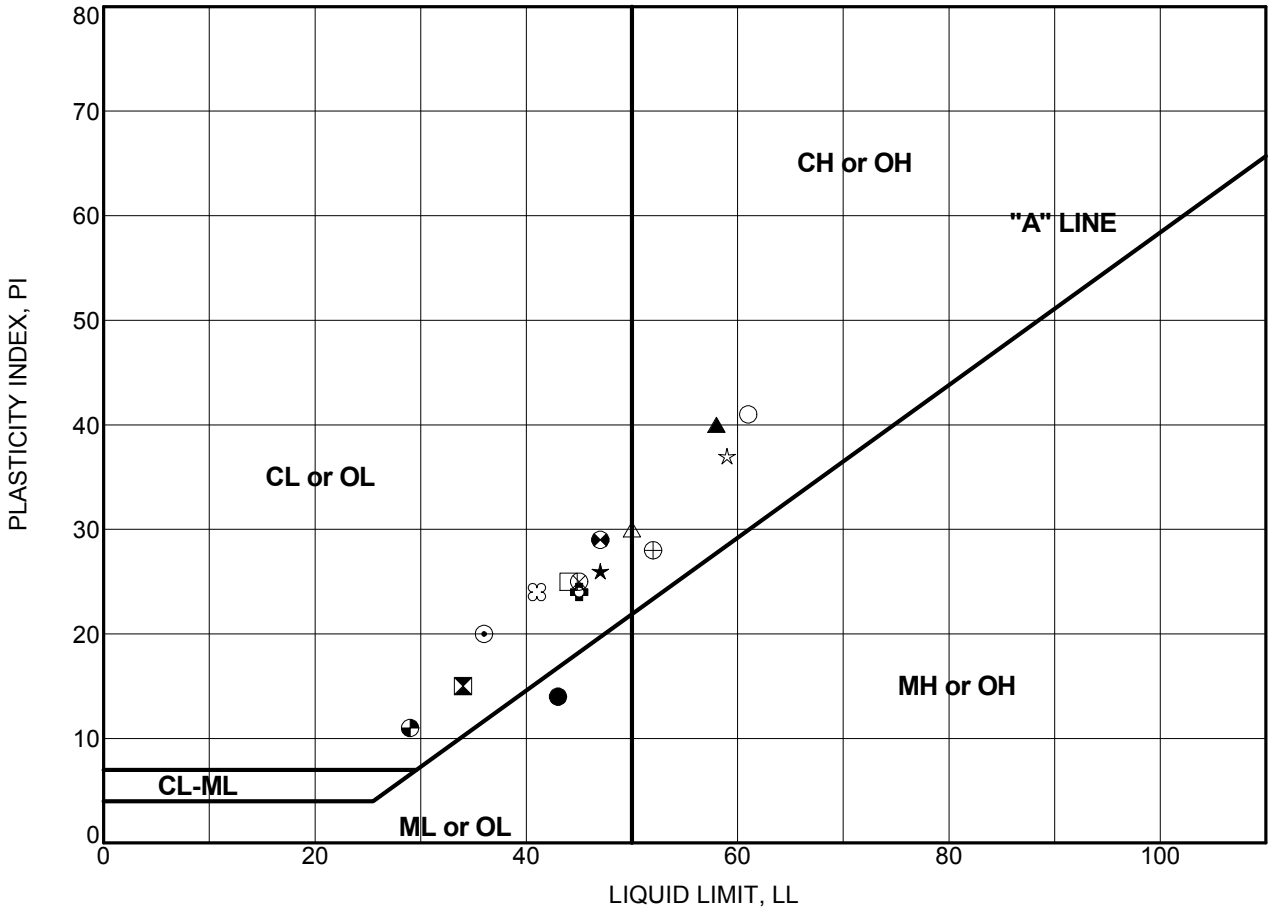
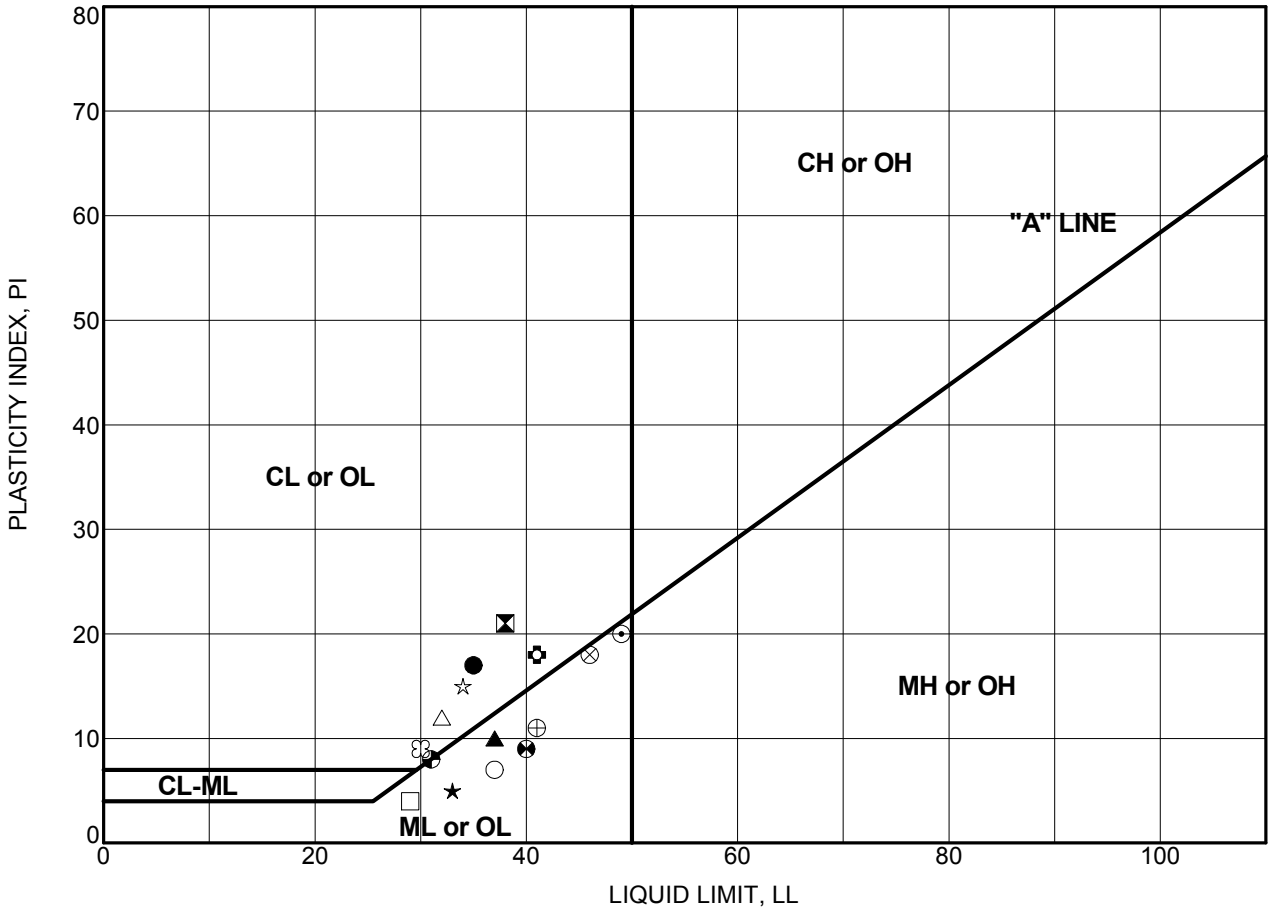
JOB NO: 2009-130-GDR | **PLATE NO:** B-3B



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-128	SPT-7	29.5	●	40	43	29	14	SILT (ML)
A-09-129	MC-4	14.5	⧗	22	34	19	15	SILTY SAND (SM)
A-09-130	MC-2	9.5	▲	27	58	18	40	FAT CLAY (CH)
A-09-130	MC-4	19.5	★	29	47	21	26	LEAN CLAY (CL)
A-09-133	MC-3	10.0	⊙	19	36	16	20	SANDY LEAN CLAY (CL)
A-09-133	MC-6	25.0	✿	23	45	21	24	LEAN CLAY (CL)
A-09-134	MC-1	4.5	○	22	61	20	41	FAT CLAY (CH)
A-09-135	MC-1	5.0	△	22	50	20	30	FAT CLAY (CH)
A-09-135	MC-2	10.0	⊗	21	45	20	25	LEAN CLAY (CL)
A-09-135	MC-6	30.0	⊕	27	52	24	28	FAT CLAY (CH)
A-09-136	MC-5	19.5	□	24	44	19	25	LEAN CLAY (CL)
A-09-137	MC-2	4.5	⊗	21	47	18	29	LEAN CLAY (CL)
A-09-137	MC-7	29.5	◕	26	29	18	11	SANDY LEAN CLAY (CL)
A-09-138	MC-1	4.5	☆	8	59	22	37	FAT CLAY (CH)
A-09-138	SPT-6	34.5	⌘	22	41	17	24	LEAN CLAY (CL)



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
A-09-139	MC-2	9.5	●	18	35	18	17	LEAN CLAY (CL)
A-09-140	MC-2	9.5	⧗	18	38	17	21	LEAN CLAY (CL)
R-10-003A	SPT-6	25.0	▲	36	37	27	10	SANDY SILT (ML)
R-10-003A	SPT-8	35.0	★	29	33	28	5	SILTY SAND (SM)
R-10-003A	SPT-13	50.0	⊙	43	49	29	20	SILT (ML)
R-10-003A	SPT-15	56.0	✿	26	41	23	18	LEAN CLAY (CL)
R-10-003A	SPT-18	65.0	○	34	37	30	7	SILT WITH SAND (ML)
R-10-004A	SPT-2	11.0	△	23	32	20	12	LEAN CLAY WITH SAND (CL)
R-10-004A	SPT-5	21.0	⊗	32	46	28	18	SANDY SILT (ML)
R-10-004A	SPT-14	56.0	⊕	38	41	30	11	SILT (ML)
R-10-004A	SPT-16	66.0	□	29	29	25	4	SILTY SAND (SM)
R-10-004A	SPT-18	76.0	⊠	41	40	31	9	SILT (ML)
R-10-004A	SPT-19	101.0	◕	22	31	23	8	SILT (ML)
R-10-009A	MC-3	14.0	☆	27	34	19	15	LEAN CLAY (CL)
R-10-009A	MC-4	17.0	⌘	28	30	21	9	CLAYEY SAND (SC)

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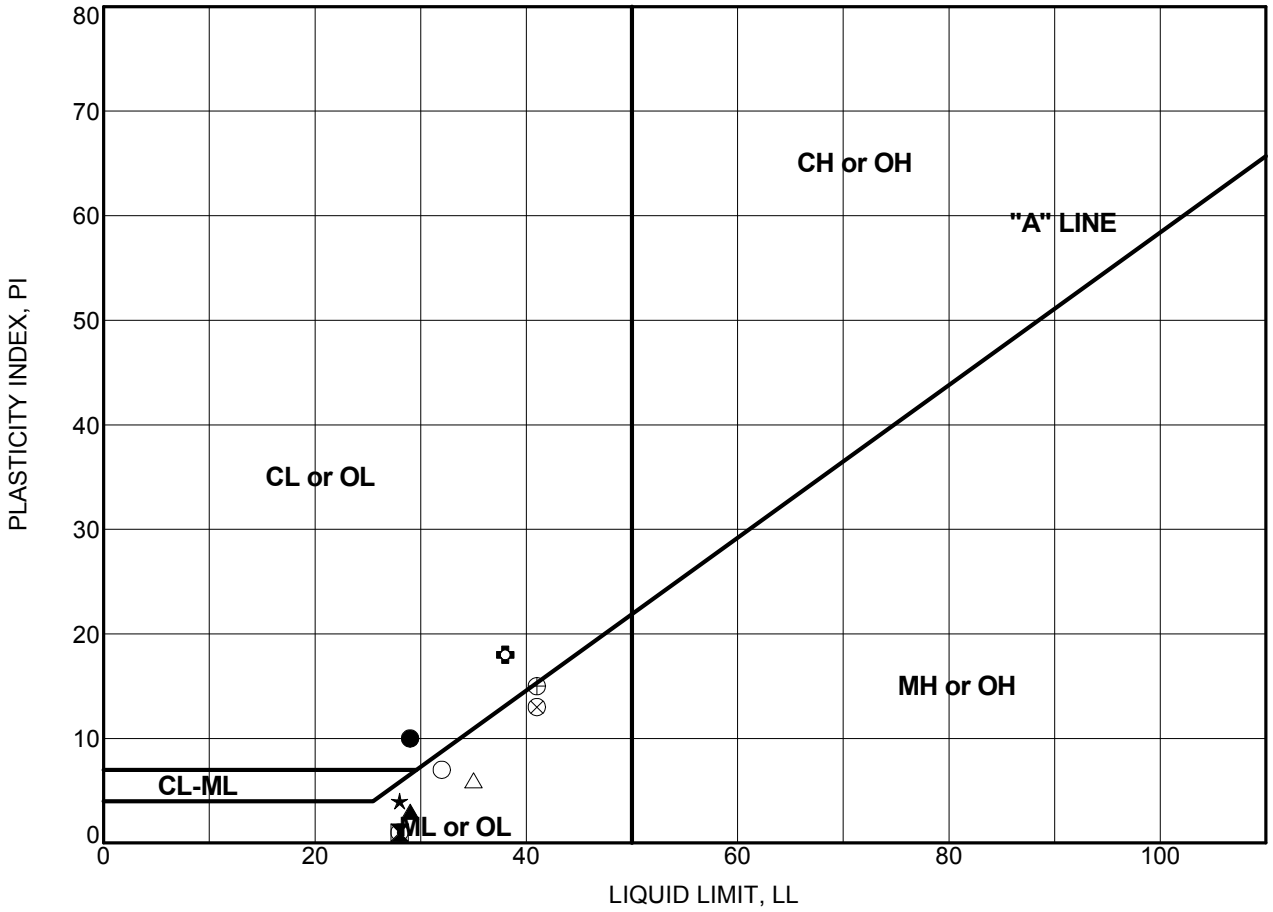
JOB NO: 2009-130-GDR | **PLATE NO:** B-3D



PLASTICITY CHART

Boring Number	Sample Number	Depth (feet)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
R-10-128A	SPT-5	26.0	●	29	29	19	10	CLAYEY SAND (SC)
R-10-128A	SPT-8	39.0	⧗	32	28	27	1	SILTY SAND (SM)
R-10-128A	SPT-10	45.0	▲	26	29	26	3	SILTY SAND (SM)
R-10-128A	SPT-14	57.0	★	23	28	24	4	SILTY SAND (SM)
R-10-128A	SPT-16	65.0	⊙	34	28	27	1	SANDY SILT (ML)
R-10-133A	SPT-8	35.0	✿	25	38	20	18	SANDY LEAN CLAY (CL)
R-10-133A	SPT-10	43.0	○	35	32	25	7	SILTY SAND (SM)
R-10-133A	SPT-12	49.0	△	36	35	29	6	SILTY SAND (SM)
R-10-133A	SPT-18	70.0	⊗	27	41	28	13	SILT WITH SAND (ML)
R-12-151	MC-7	30.0	⊕	38	41	26	15	SILT (ML)

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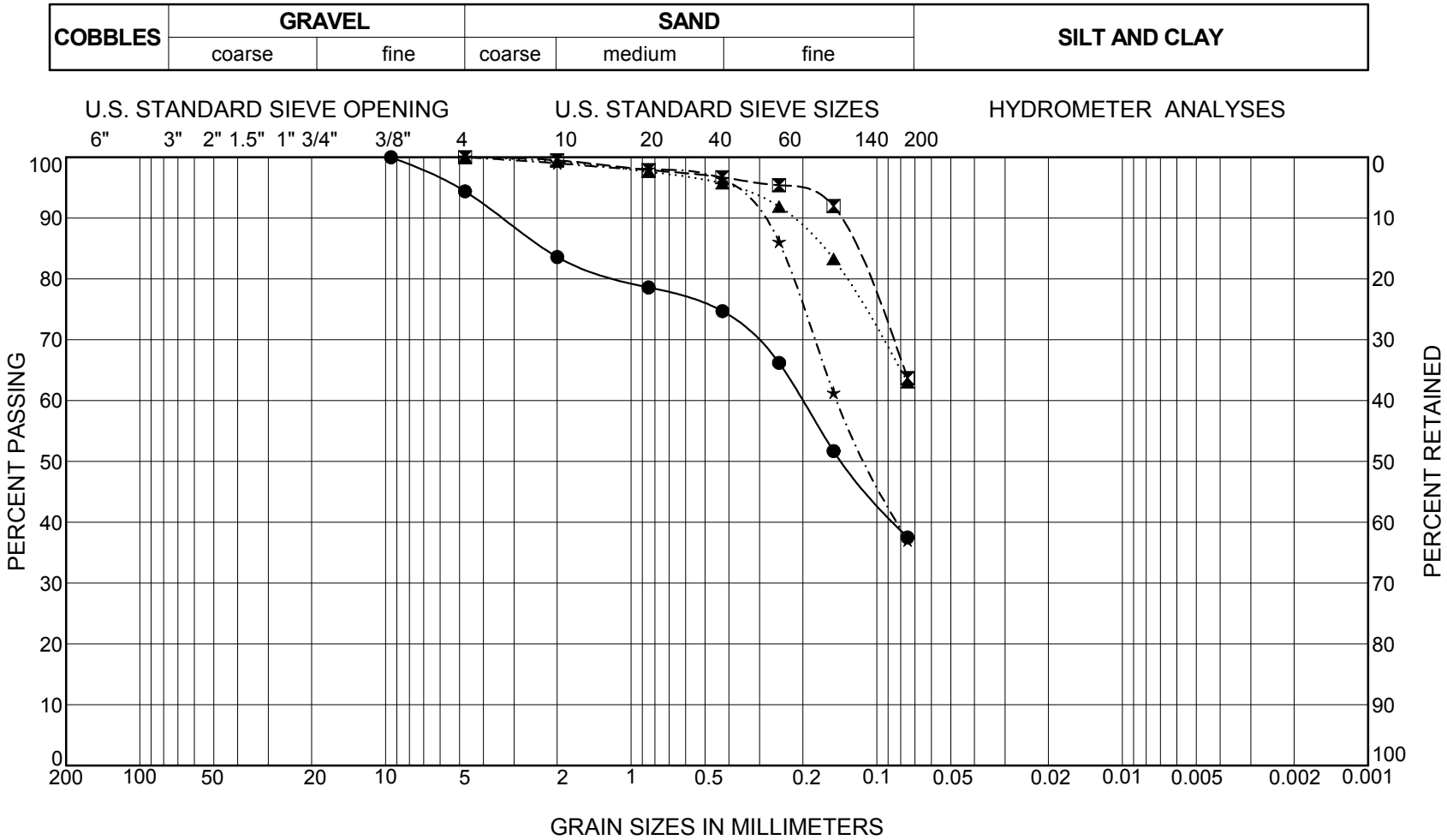
JOB NO: 2009-130-GDR | **PLATE NO:** B-3E

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-001	MC-2	9.5	●			CLAYEY SAND (SC)
A-09-001	MC-6	29.5	⧓			SANDY SILT (ML)
A-09-001	SPT-12	59.5	▲	33	9	SANDY SILT (ML)
A-09-002	MC-4	19.5	★			SILTY SAND (SM)

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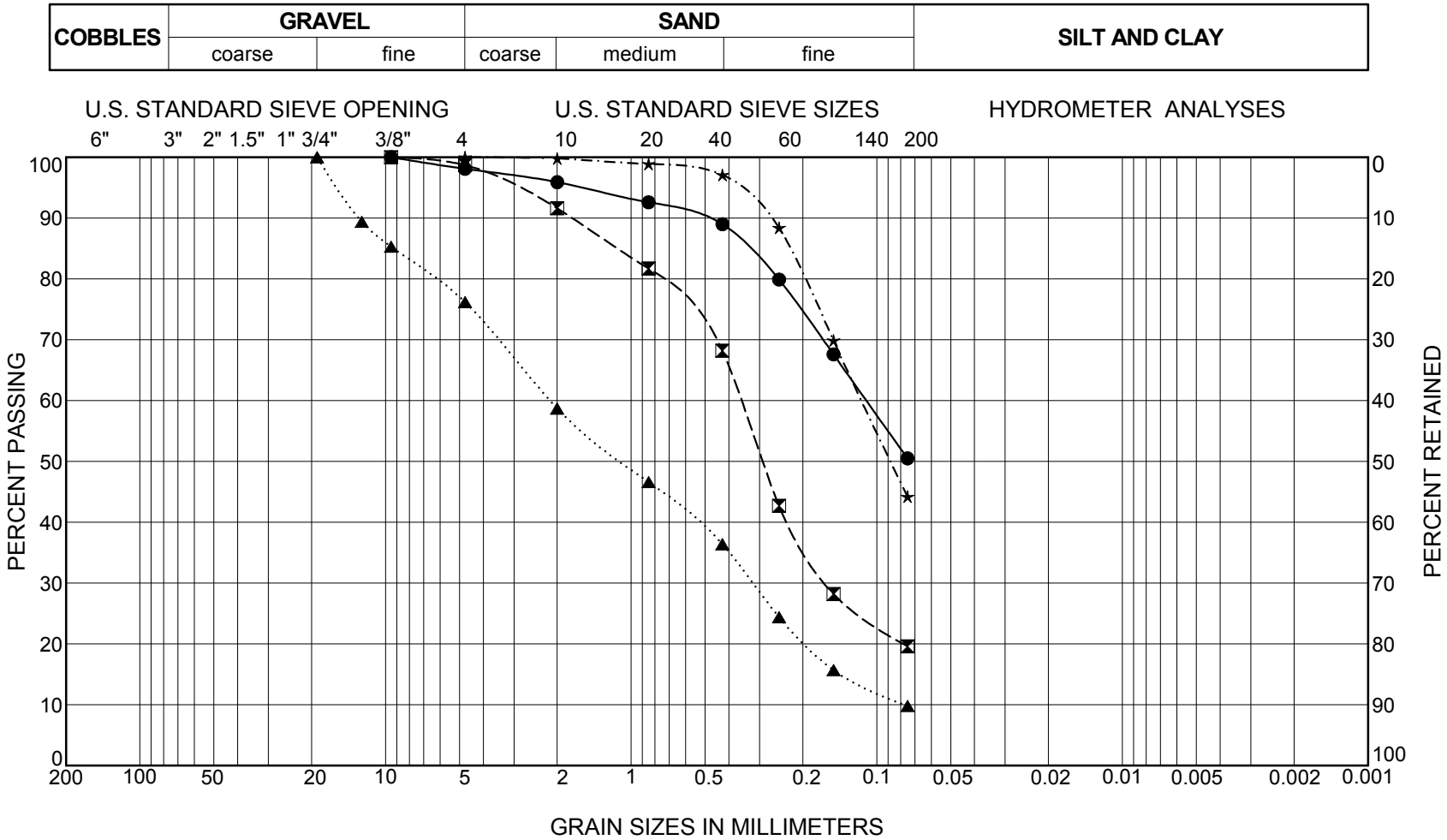
PLATE NO: B-4A

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-002	MC-5	24.5	●			SANDY SILT (ML)
A-09-002	SPT-9	44.5	⧗			SILTY SAND (SM)
A-09-003	MC-3	14.5	▲			POORLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC)
A-09-003	MC-6	29.5	★	32	13	SILTY SAND (SM)

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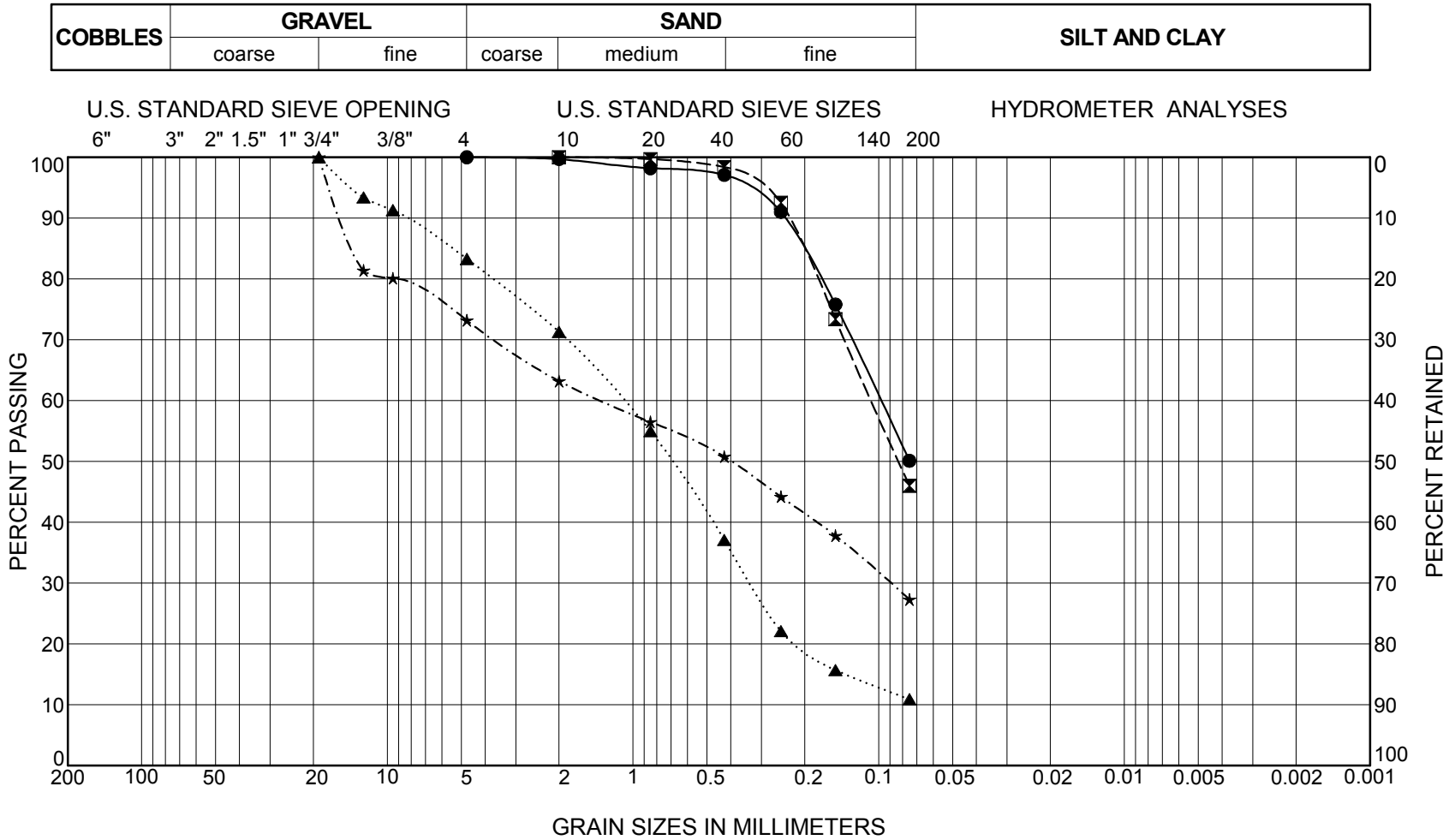
PLATE NO: B-4B

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-003	MC-7	34.5	●			SANDY SILT (ML)
A-09-003	MC-8	39.5	⧓	30	4	SILTY SAND (SM)
A-09-003	MC-10	49.5	▲			WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)
A-09-003	MC-11	54.5	★			SILTY SAND WITH GRAVEL (SM)

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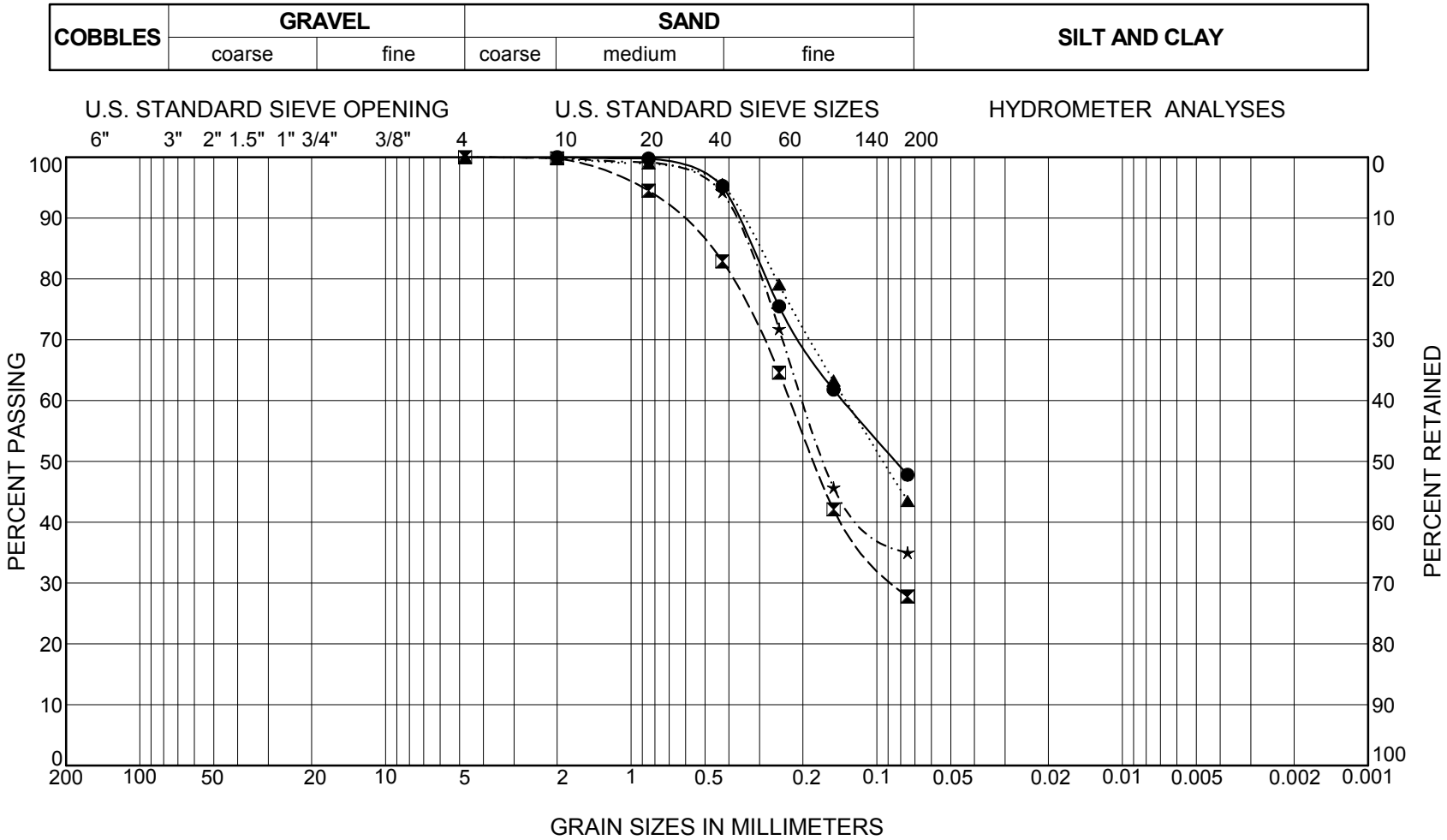
PLATE NO: B-4C

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-005	MC-2	9.5	●	41	24	CLAYEY SAND (SC)
A-09-005	MC-3	14.5	⧓	28	5	SILTY SAND (SM)
A-09-005	MC-5	24.5	▲	45	25	CLAYEY SAND (SC)
A-09-005	MC-6	29.5	★			SILTY SAND (SM)

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MATERIALS ENGINEERING

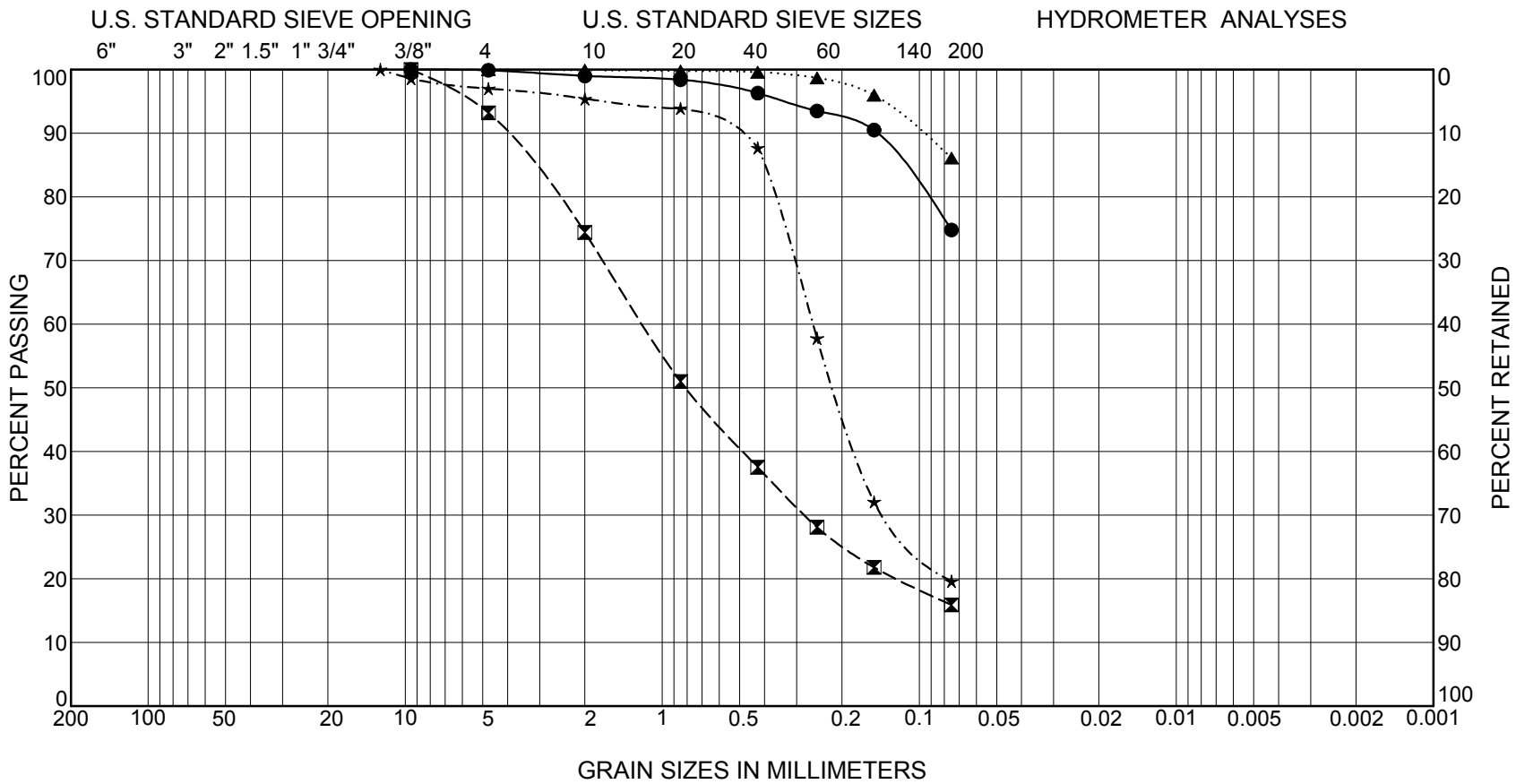
JOB NO: 2009-130-GDR

80/680/12 ICP PROJECT
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4D

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-005	MC-7	34.5	●			SILT WITH SAND (ML)
A-09-005	MC-13	69.5	⊠			SILTY SAND (SM)
A-09-006	MC-8	39.5	▲			LEAN CLAY WITH SAND (CL)
A-09-006	MC-11	54.5	★			SILTY SAND (SM)

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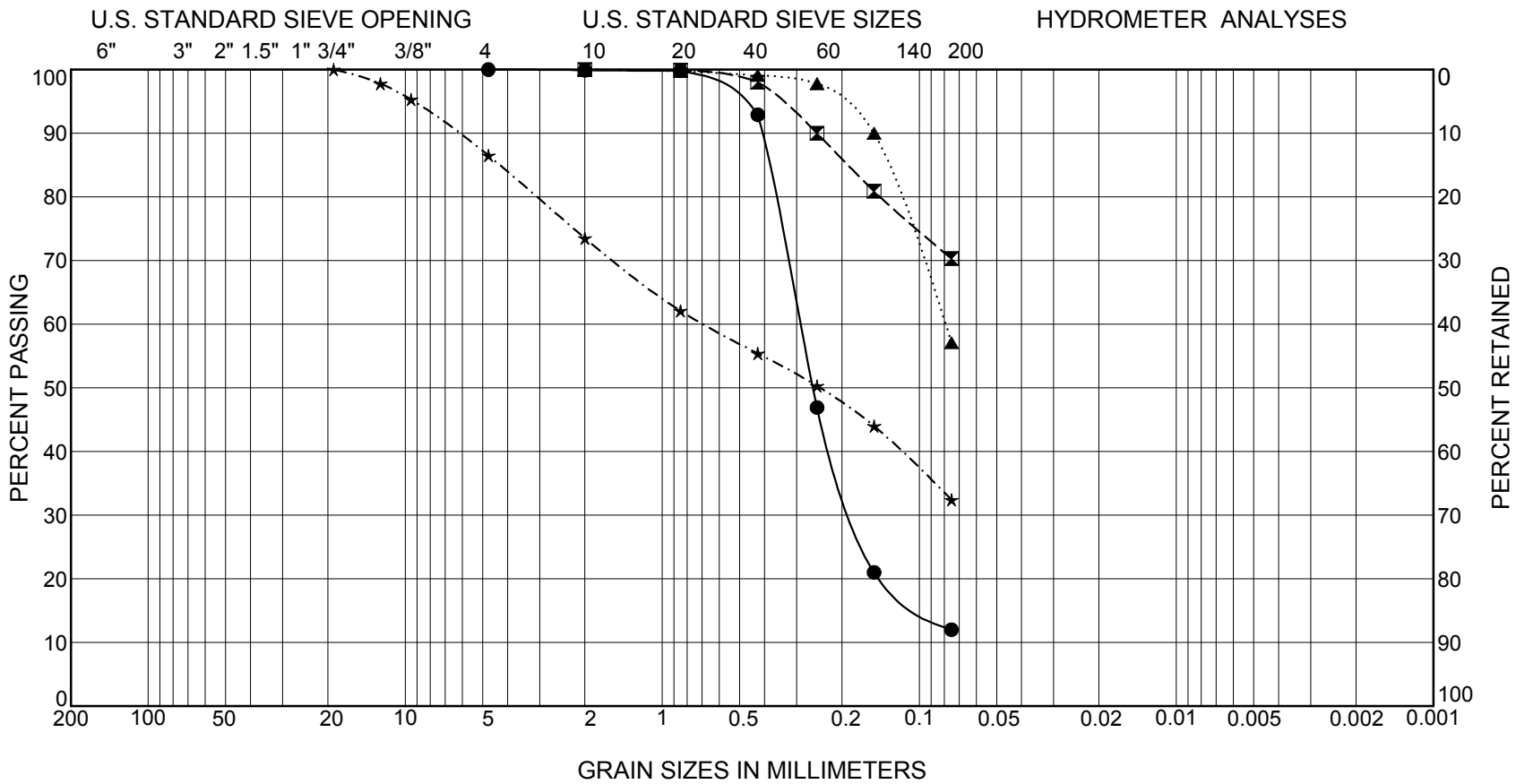
JOB NO: 2009-130-GDR

80/680/12 ICP PROJECT
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4E

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-006	MC-15	89.5	●			POORLY GRADED SAND WITH SILT (SP-SM)
A-09-009	MC-4	19.5	⧓	39	20	LEAN CLAY WITH SAND (CL)
A-09-111	MC-4	19.5	▲			SANDY SILT (ML)
A-09-112	MC-3	9.5	★			CLAYEY SAND (SC)

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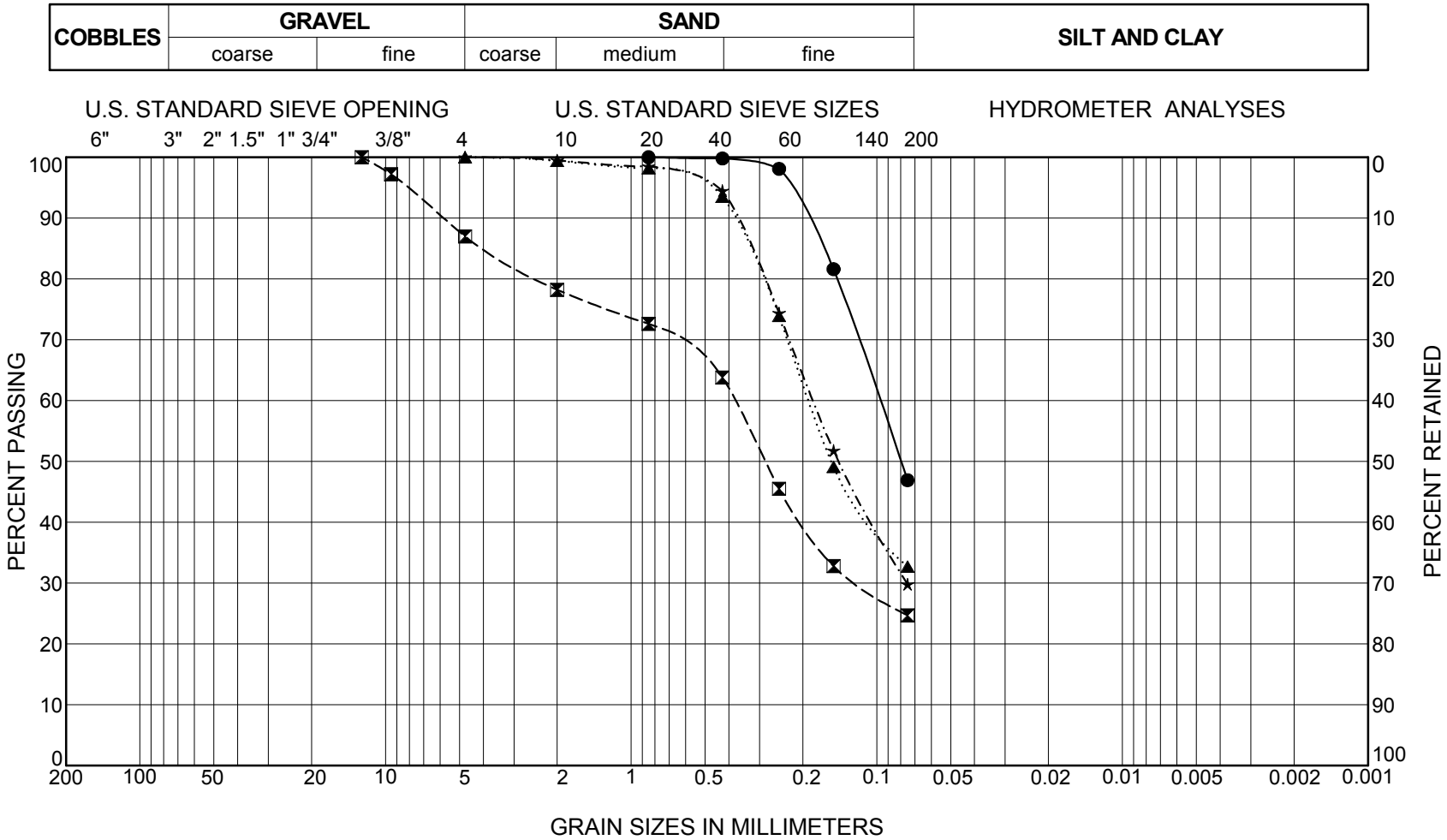
JOB NO: 2009-130-GDR

80/680/12 ICP PROJECT
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4F

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-120	MC-6	24.5	●			SILTY SAND (SM)
A-09-120	MC-7	29.5	⊠			SILTY SAND (SM)
A-09-121	MC-6	24.5	▲			SILTY SAND (SM)
A-09-121	SPT-7	29.5	★			SILTY SAND (SM)

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JOB NO: 2009-130-GDR

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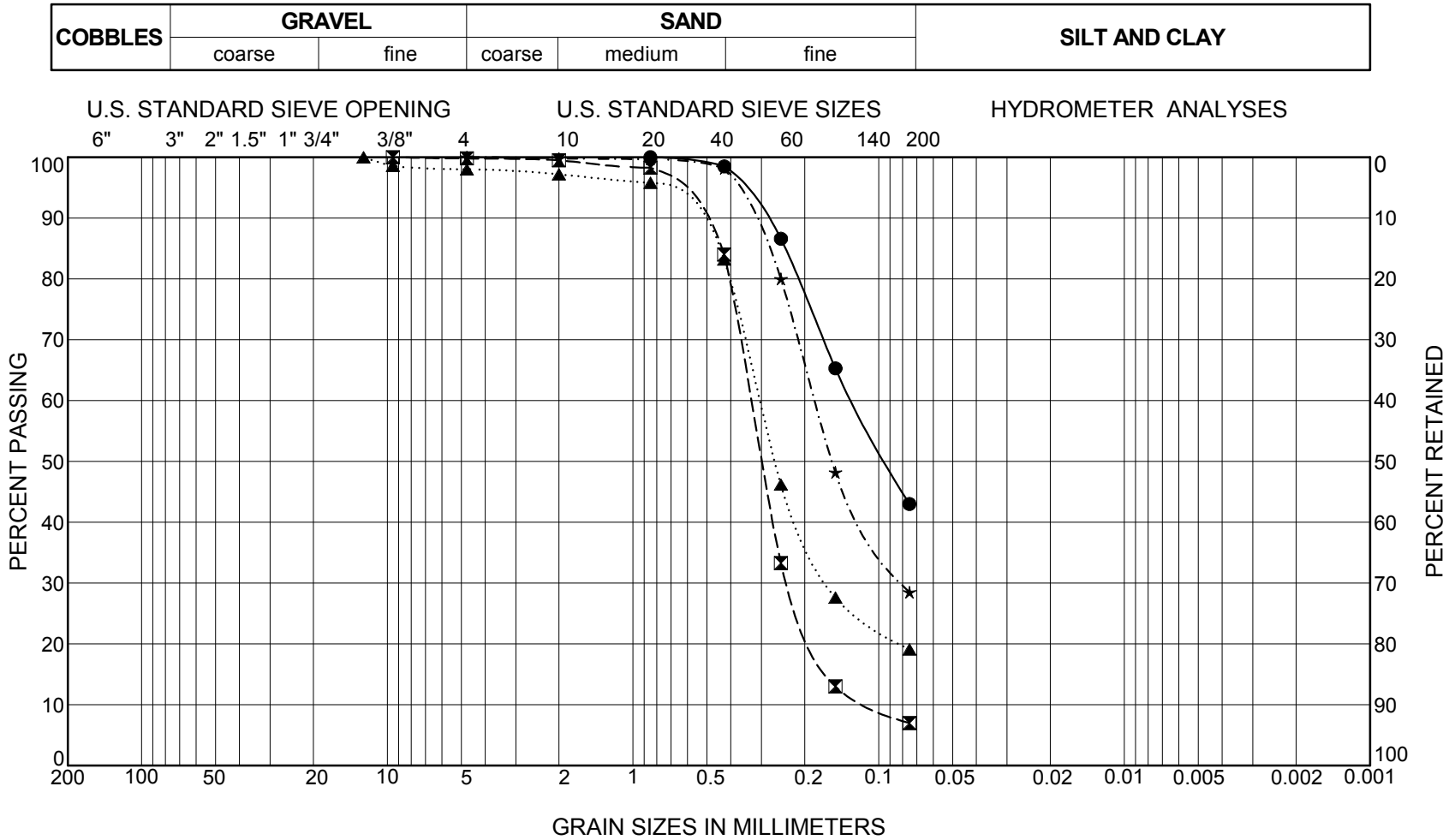
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4G

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-123	MC-4	14.5	●			SILTY SAND (SM)
A-09-124	SPT-6	24.5	⊠			POORLY GRADED SAND WITH SILT
A-09-124	SPT-7	29.5	▲			SILTY SAND (SM)
A-09-125	MC-6	29.5	★			SILTY SAND (SM)

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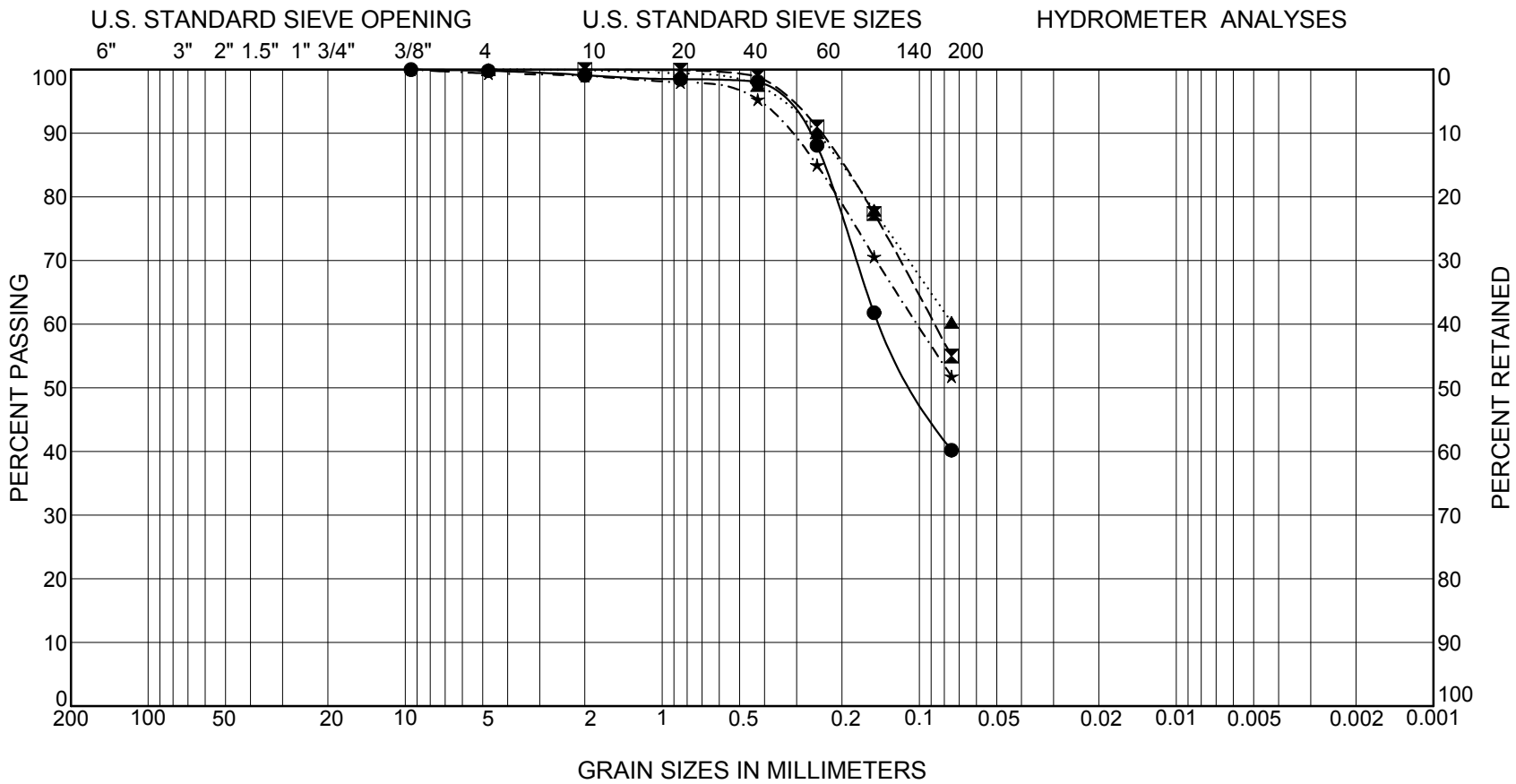
JOB NO: 2009-130-GDR

80/680/12 ICP PROJECT
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4H

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-125	MC-9	44.5	●			SILTY SAND (SM)
A-09-126	MC-4	19.5	⊠			SANDY LEAN CLAY (CL)
A-09-126	MC-6	29.5	▲			SANDY LEAN CLAY (CL)
A-09-126	MC-7	34.5	★			SANDY LEAN CLAY (CL)

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MATERIALS ENGINEERING

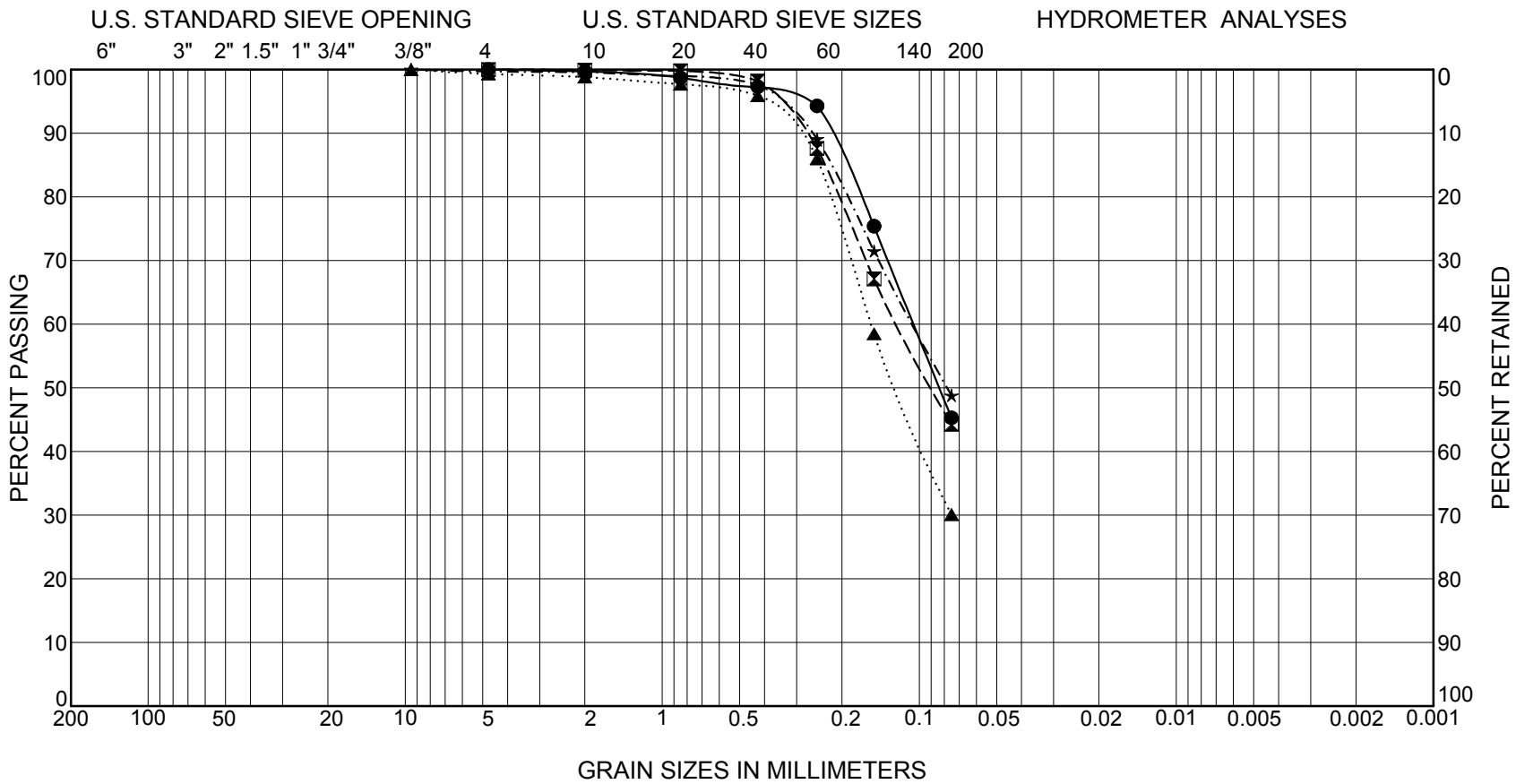
JOB NO: 2009-130-GDR

80/680/12 ICP PROJECT
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4I

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-128	MC-10	44.5	●			SILTY SAND (SM)
A-09-129	MC-4	14.5	⧓	34	15	SILTY SAND (SM)
A-09-129	SPT-8	34.5	▲			SILTY SAND (SM)
A-09-130	MC-6	29.5	★			SILTY SAND (SM)

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JOB NO: 2009-130-GDR

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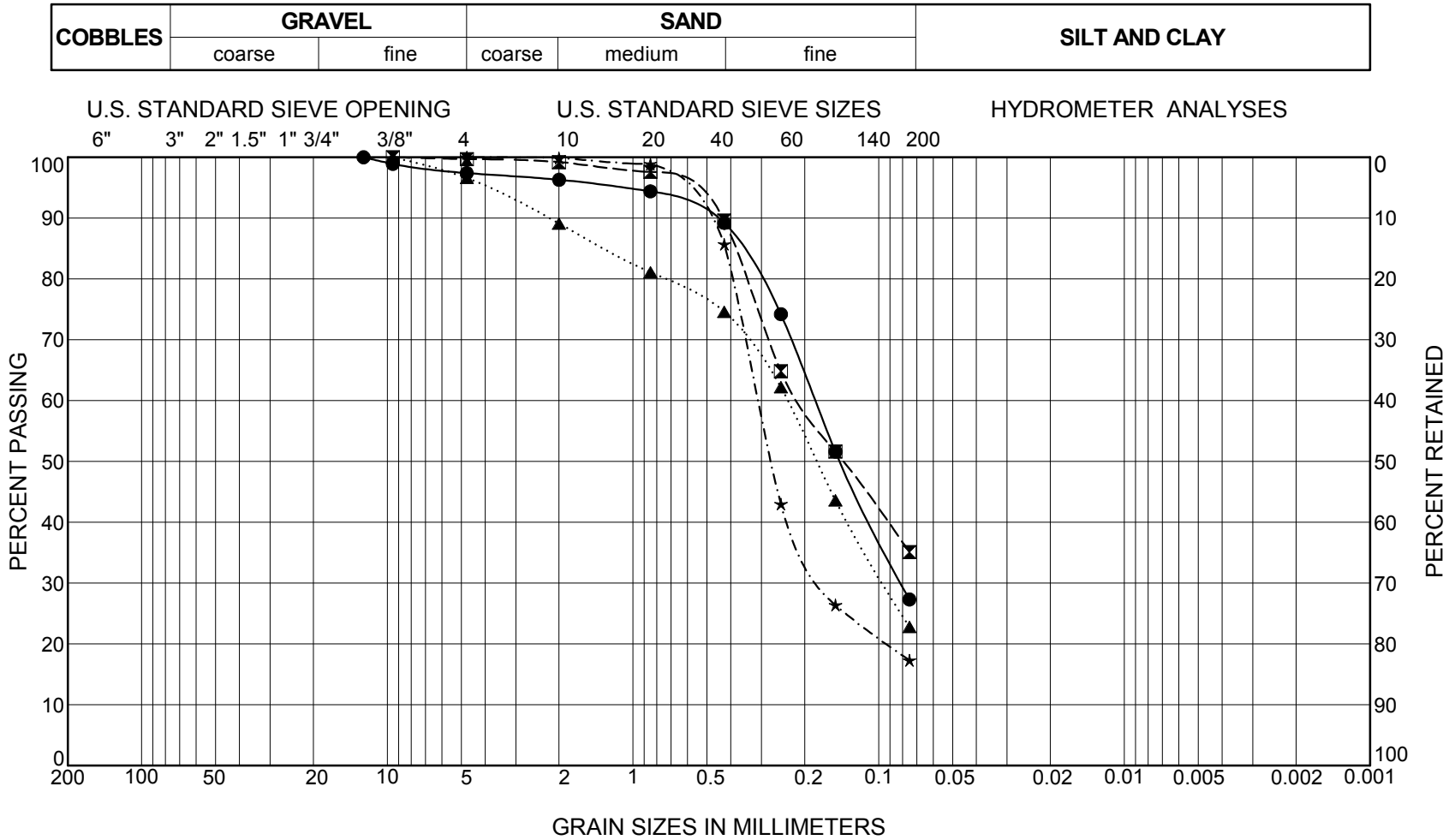
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4J

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-130	SPT-10	49.5	●			SILTY SAND (SM)
A-09-133	MC-4	15.0	⊠			SILTY SAND (SM)
A-09-133	MC-10	45.0	▲			CLAYEY SAND (SC)
A-09-133	MC-13	60.0	★			SILTY SAND (SM)

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JOB NO: 2009-130-GDR

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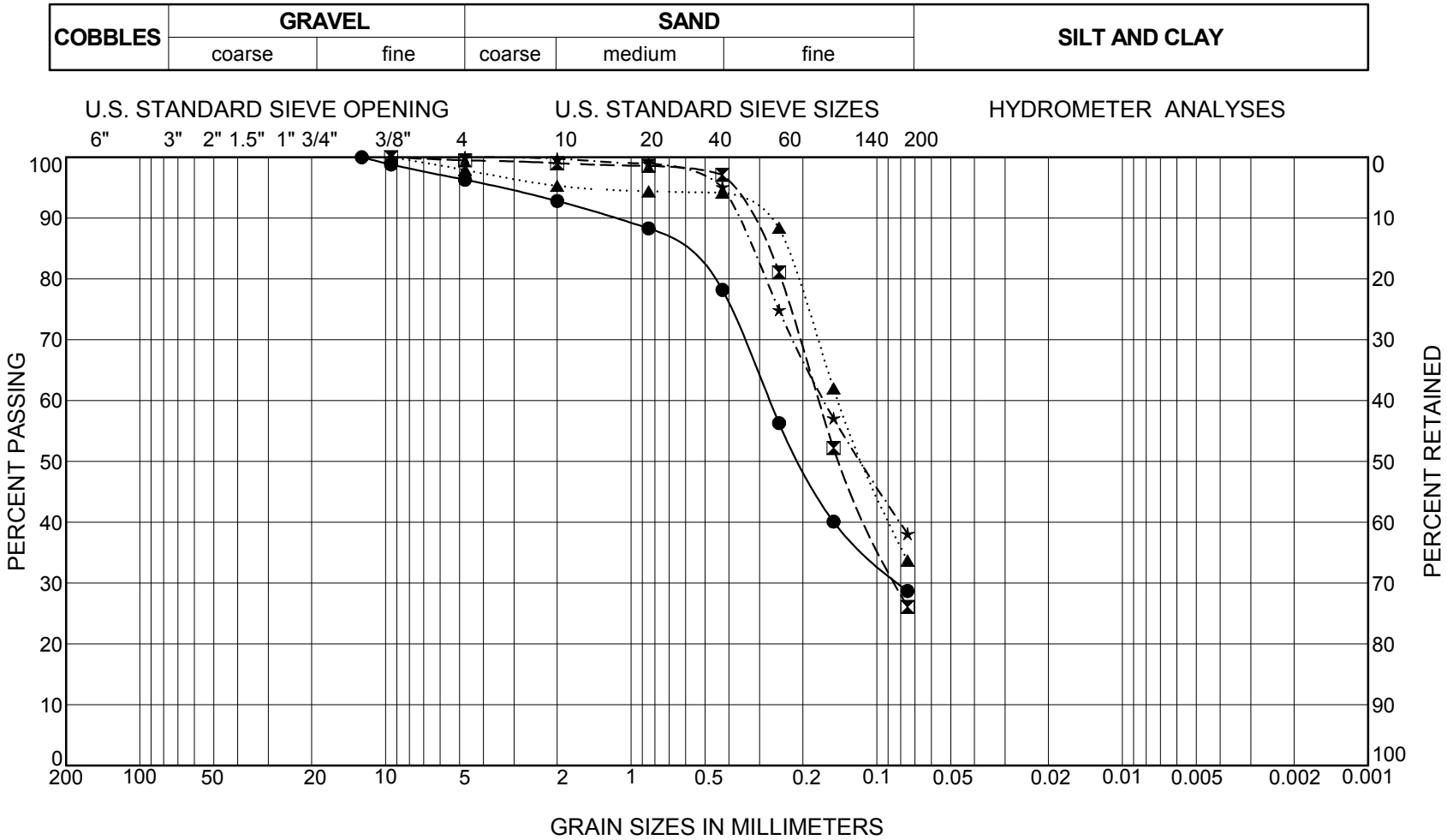
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4K

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-134	MC-7	34.5	●			SILTY SAND (SM)
A-09-135	MC-3	15.0	⊠			FAT CLAY (CH)
A-09-135	MC-7	35.0	▲			SILTY SAND (SM)
A-09-136	MC-3	9.5	★			CLAYEY SAND (SC)

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JOB NO: 2009-130-GDR

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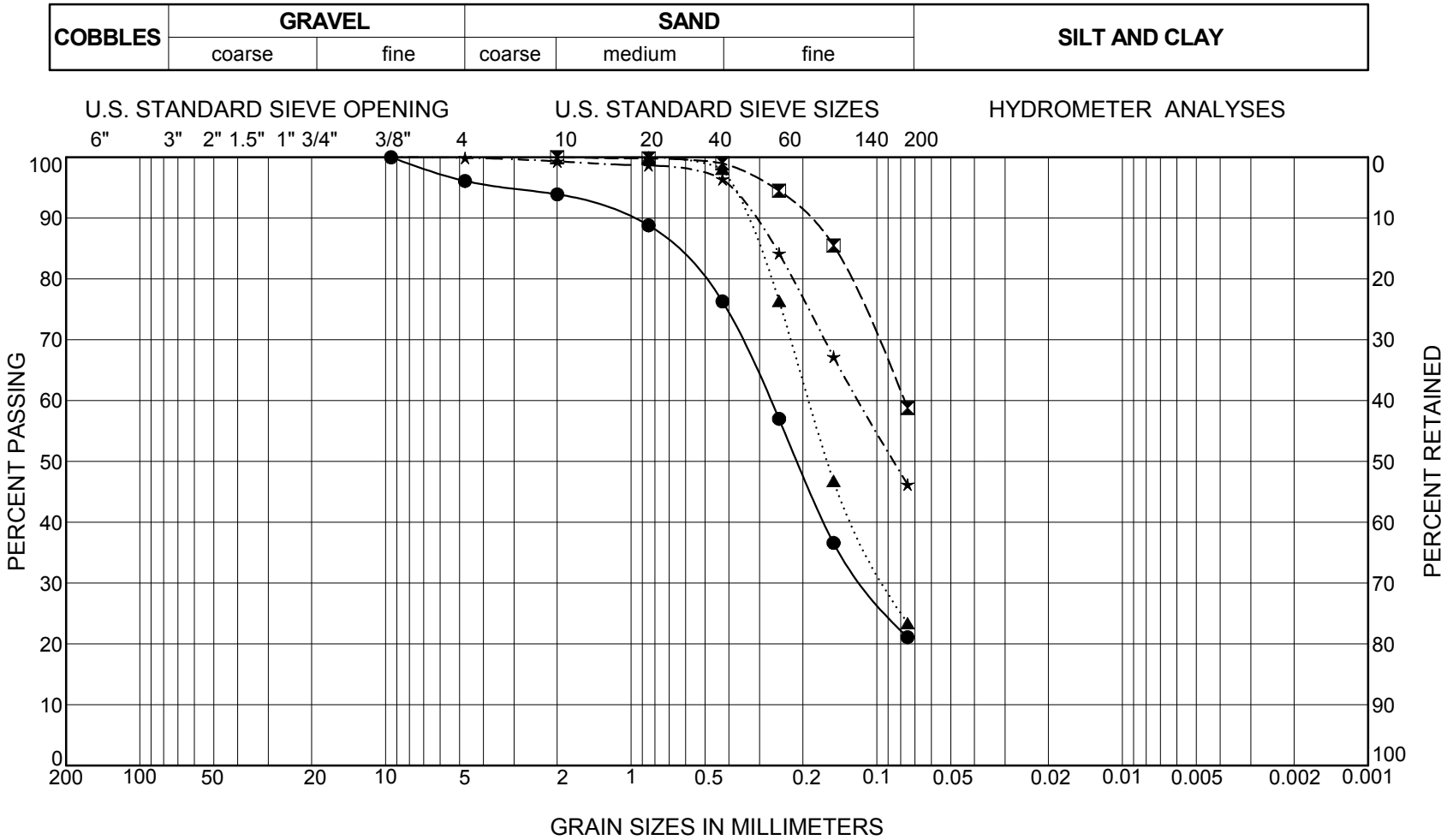
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4L

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
A-09-136	MC-8	34.5	●			SILTY SAND (SM)
A-09-137	MC-7	29.5	⧓	29	11	SANDY LEAN CLAY (CL)
A-09-139	SPT-7	34.5	▲			SILTY SAND (SM)
A-09-140	SPT-6	29.5	★			CLAYEY SAND (SC)

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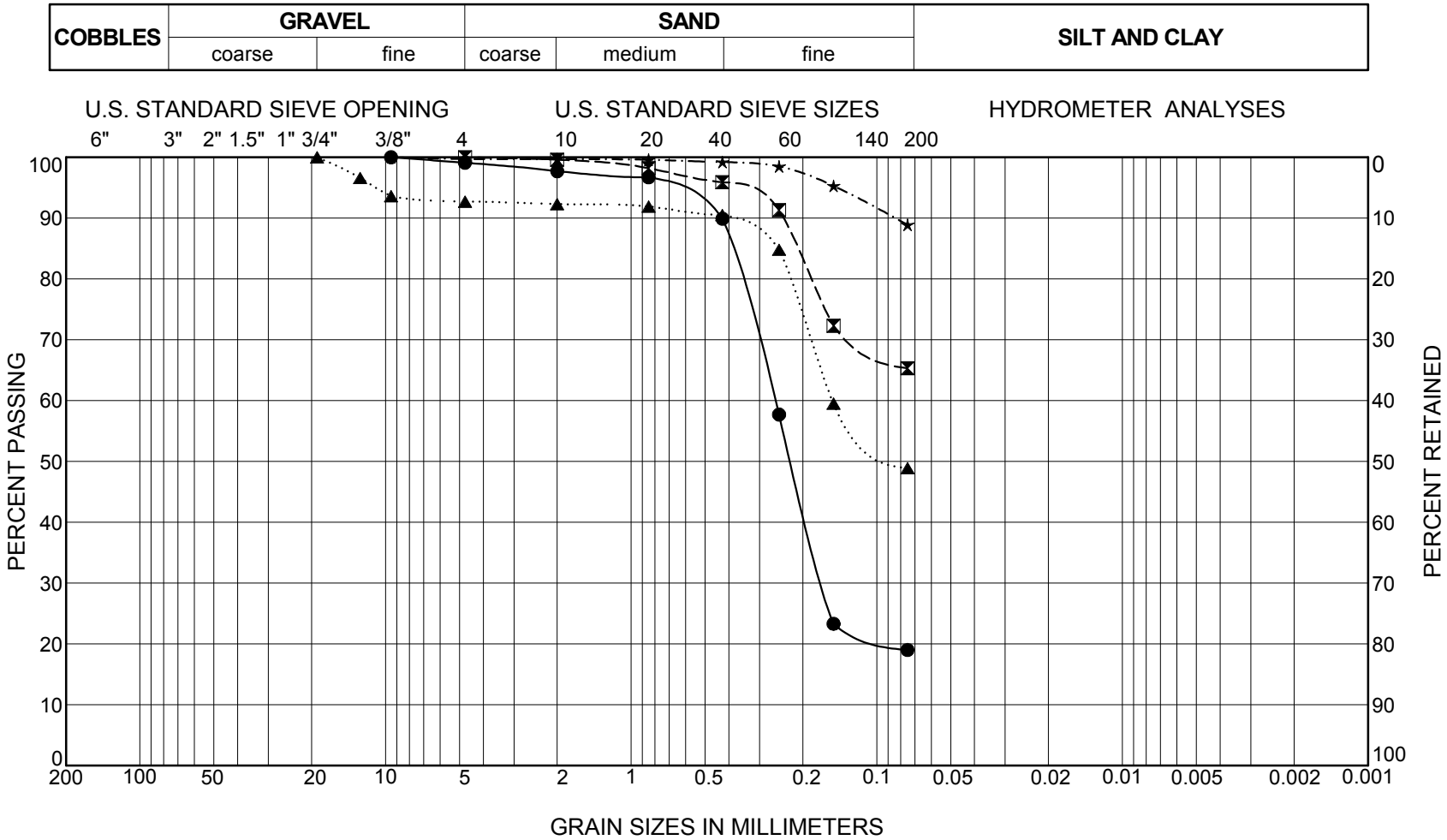
JOB NO: 2009-130-GDR

80/680/12 ICP PROJECT
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4M

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-003A	SPT-3	13.0	●			SILTY SAND (SM)
R-10-003A	SPT-6	25.0	⊠	37	10	SANDY SILT (ML)
R-10-003A	SPT-8	35.0	▲	33	5	SILTY SAND (SM)
R-10-003A	SPT-14	53.0	★			SILT (ML)

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JOB NO: 2009-130-GDR

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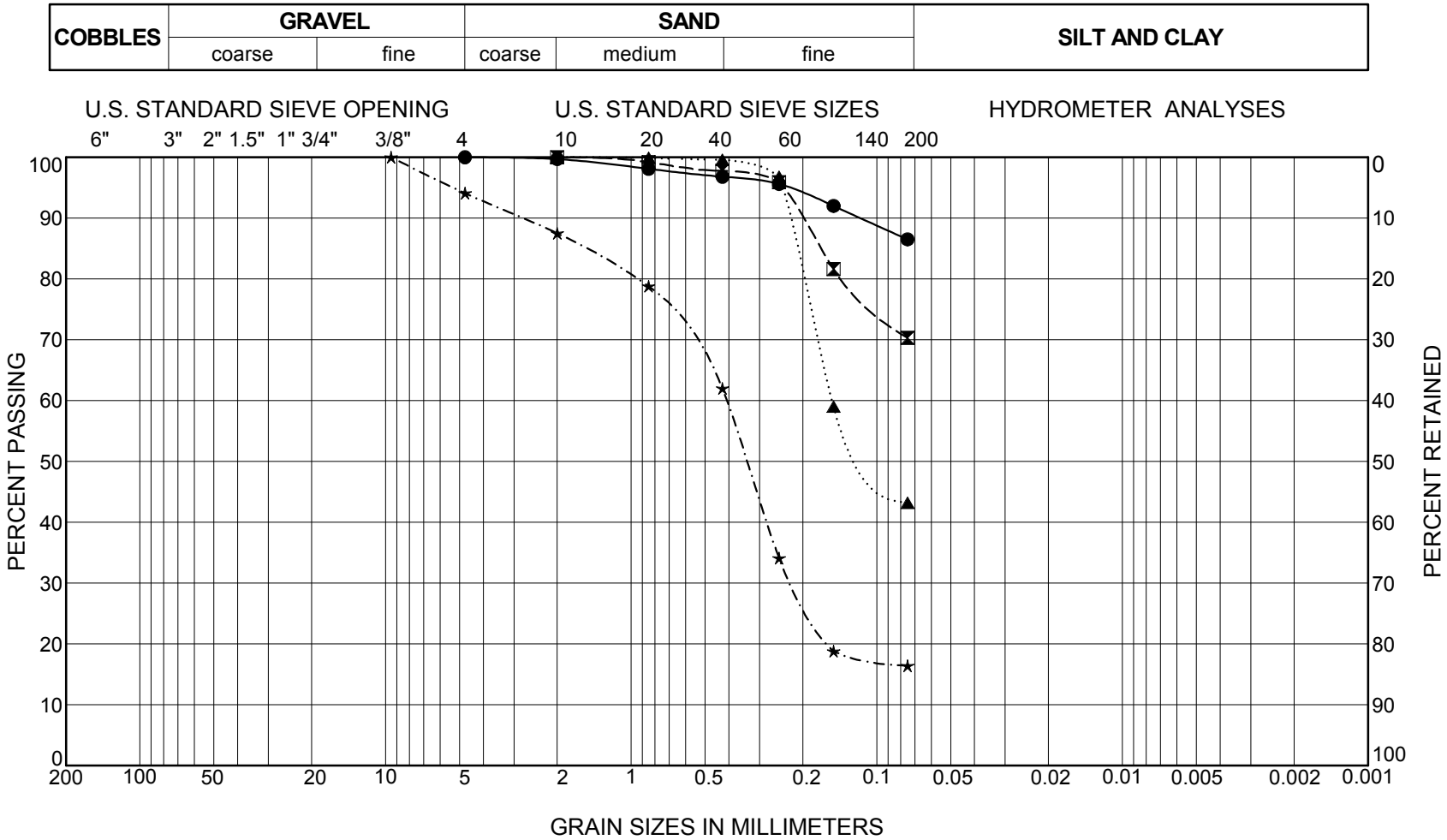
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4N

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-003A	SPT-15	56.0	●	41	18	LEAN CLAY (CL)
R-10-003A	SPT-18	65.0	⧗	37	7	SILT WITH SAND (ML)
R-10-003A	SPT-21	74.0	▲			SILTY SAND (SM)
R-10-004A	SPT-7	31.0	★			SILTY SAND (SM)

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JOB NO: 2009-130-GDR

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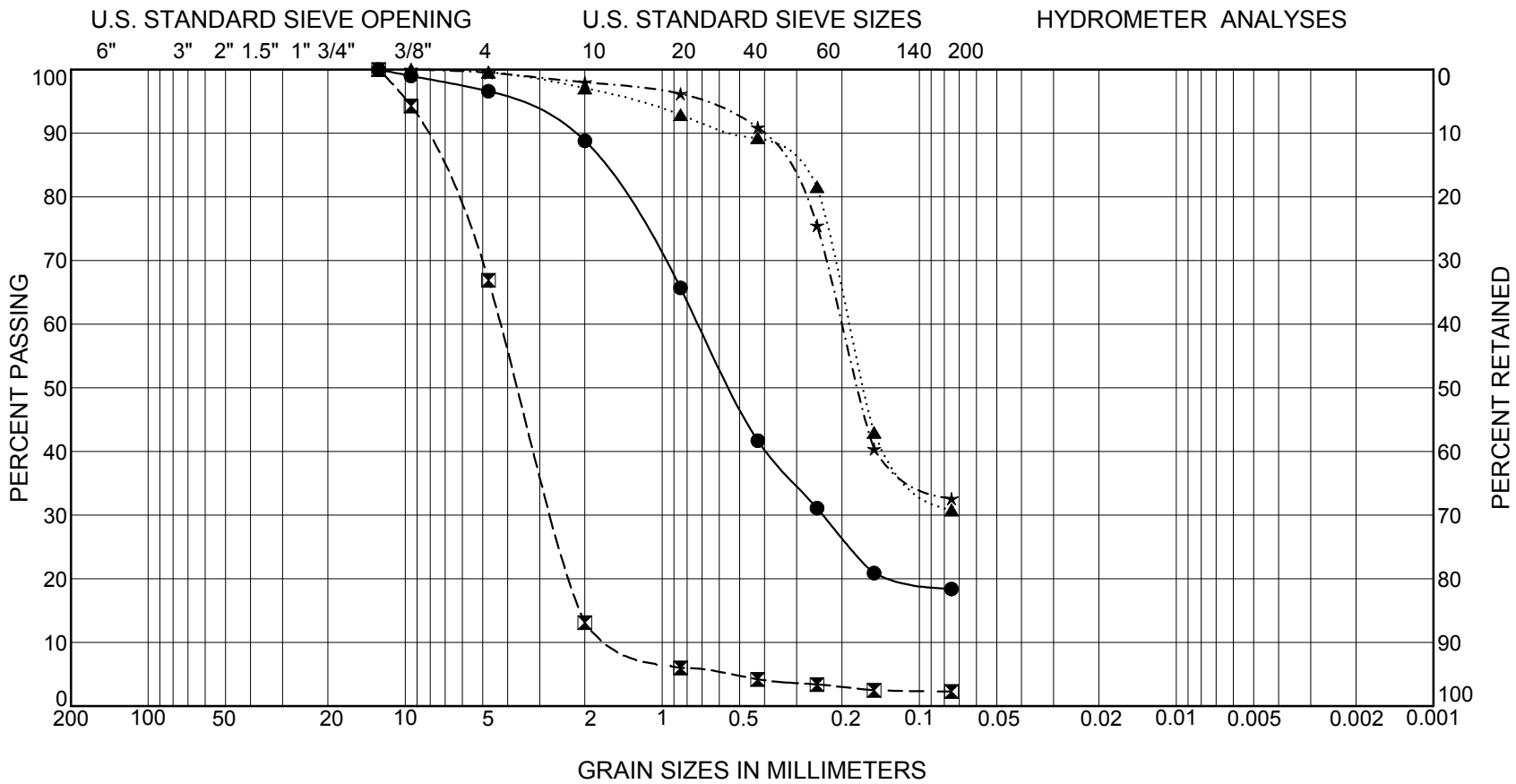
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4O

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-004A	SPT-11	45.0	●			CLAYEY SAND (SC)
R-10-004A	SPT-12	48.0	⊠			POORLY-GRADED SAND WITH GRAVEL (SP)
R-10-004A	SPT-16	66.0	▲	29	4	SILTY SAND (SM)
R-10-009A	MC-4	17.0	★	30	9	CLAYEY SAND (SC)

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JOB NO: 2009-130-GDR

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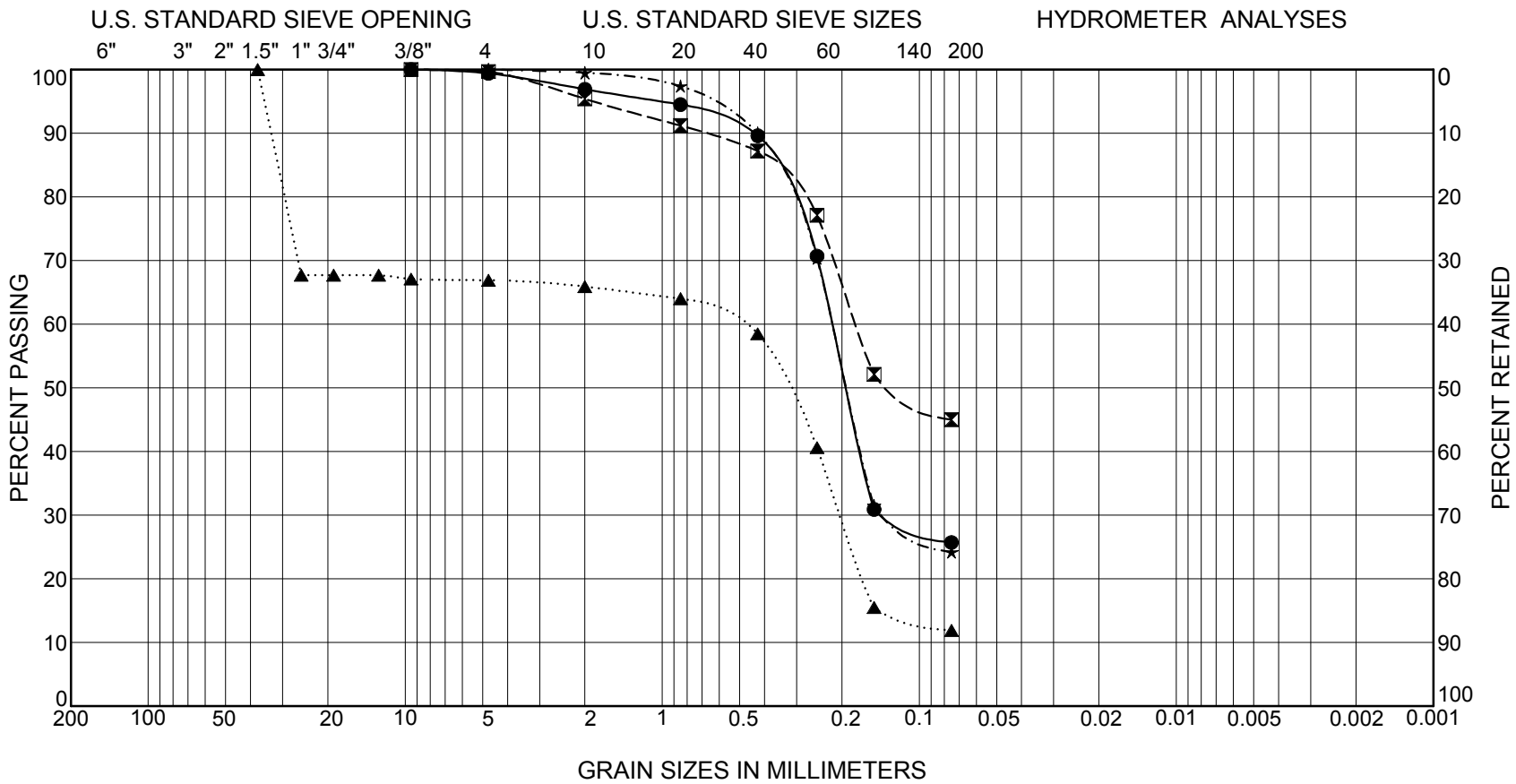
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4P

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-009A	SPT-5	19.0	●			SILTY SAND (SM)
R-10-128A	SPT-5	26.0	⧓	29	10	CLAYEY SAND (SC)
R-10-128A	SPT-6	31.0	▲			POORLY-GRADED SAND WITH SILT AND GRAVEL (SP-SM)
R-10-128A	SPT-8	39.0	★	28	1	SILTY SAND (SM)

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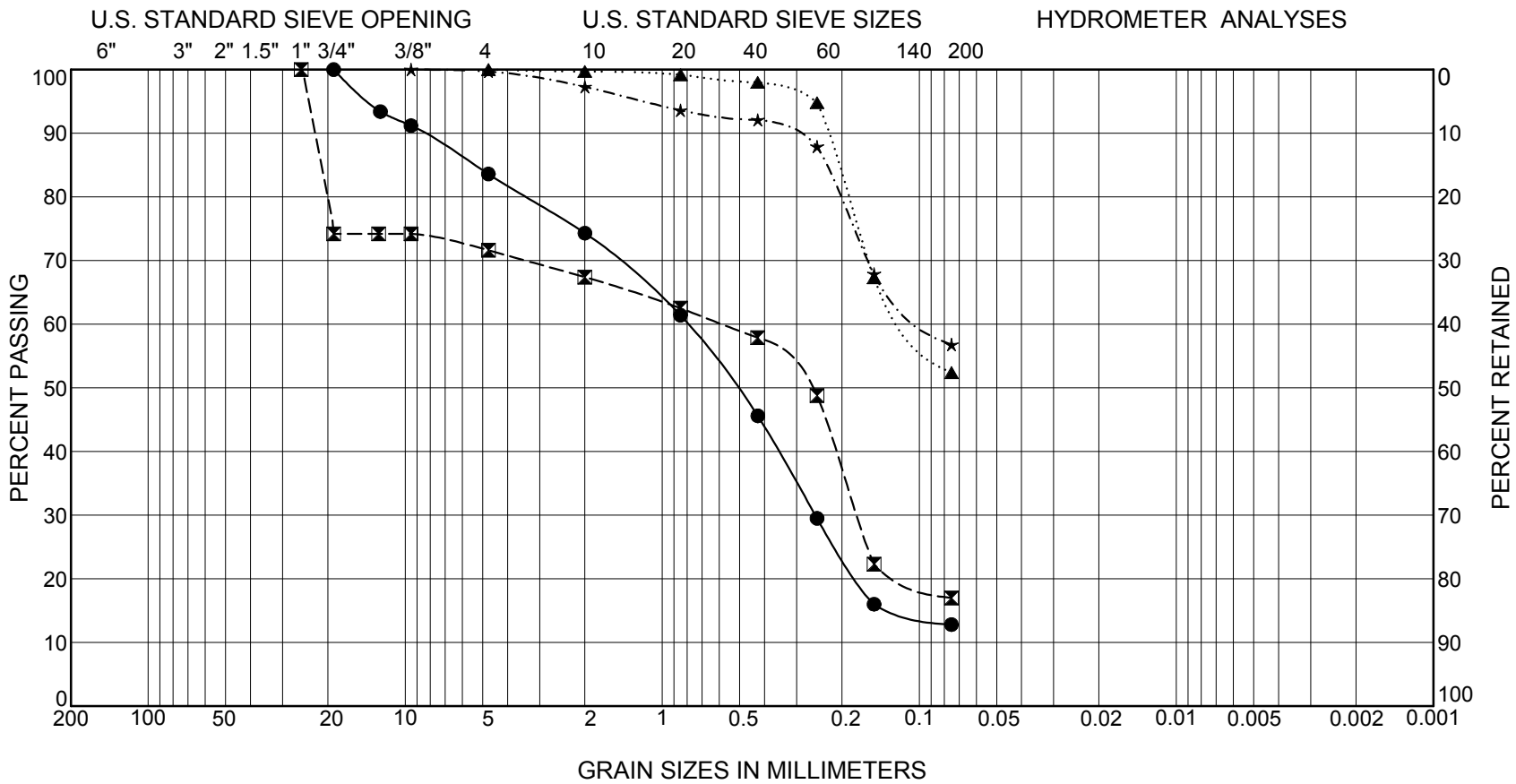
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4Q

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-128A	SPT-11	48.0	●			SILTY SAND WITH GRAVEL (SM)
R-10-128A	SPT-14	57.0	⧓	28	4	SILTY SAND (SM)
R-10-128A	SPT-16	65.0	▲	28	1	SANDY SILT (ML)
R-10-133A	SPT-8	35.0	★	38	18	SANDY LEAN CLAY (CL)

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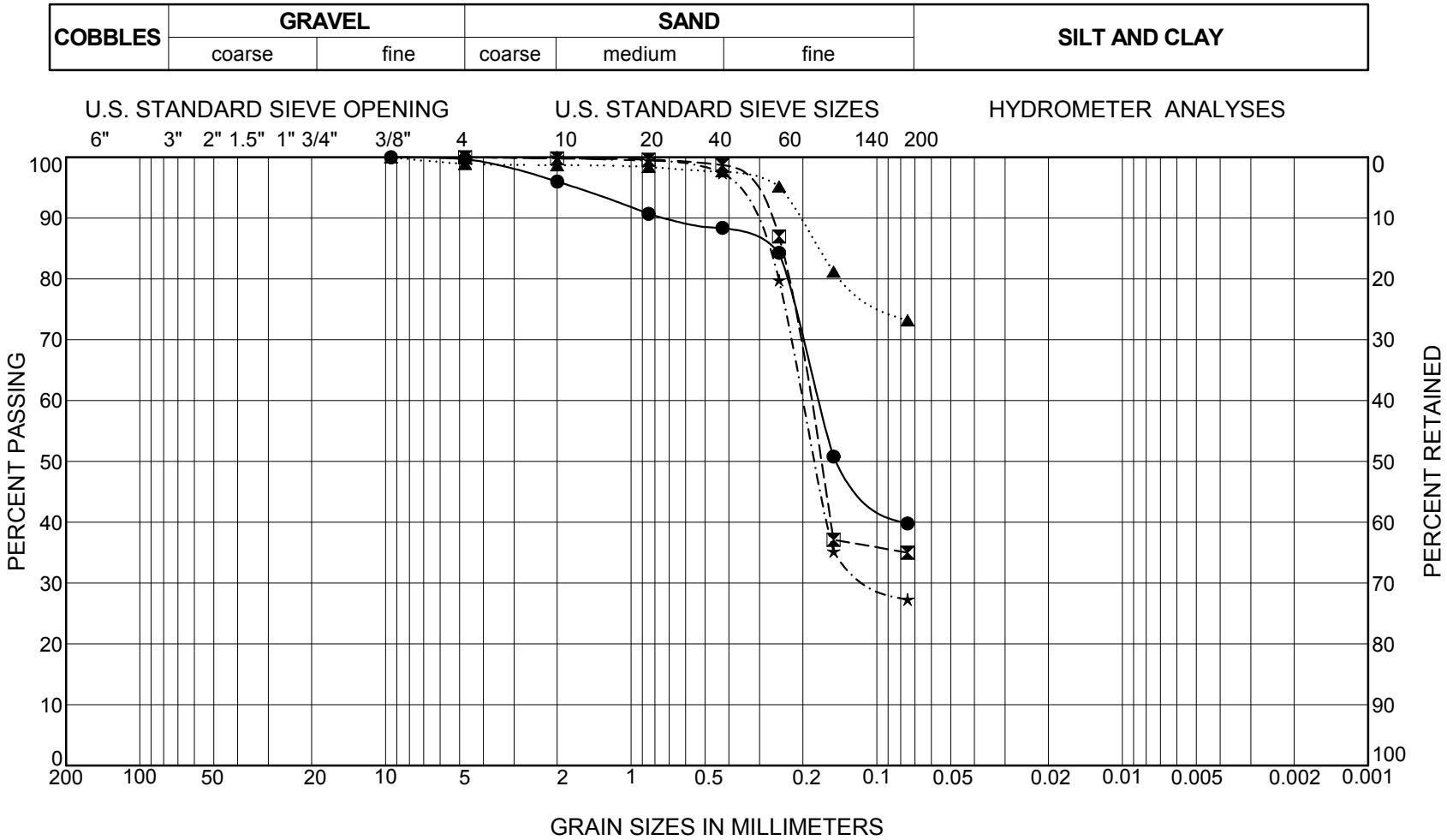
PLATE NO: B-4R

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-10-133A	SPT-10	43.0	●	32	7	SILTY SAND (SM)
R-10-133A	SPT-12	49.0	⊠	35	6	SILTY SAND (SM)
R-10-133A	SPT-18	70.0	▲	41	13	SILT WITH SAND (ML)
R-12-151	MC-5	20.0	★			SILTY SAND (SM)

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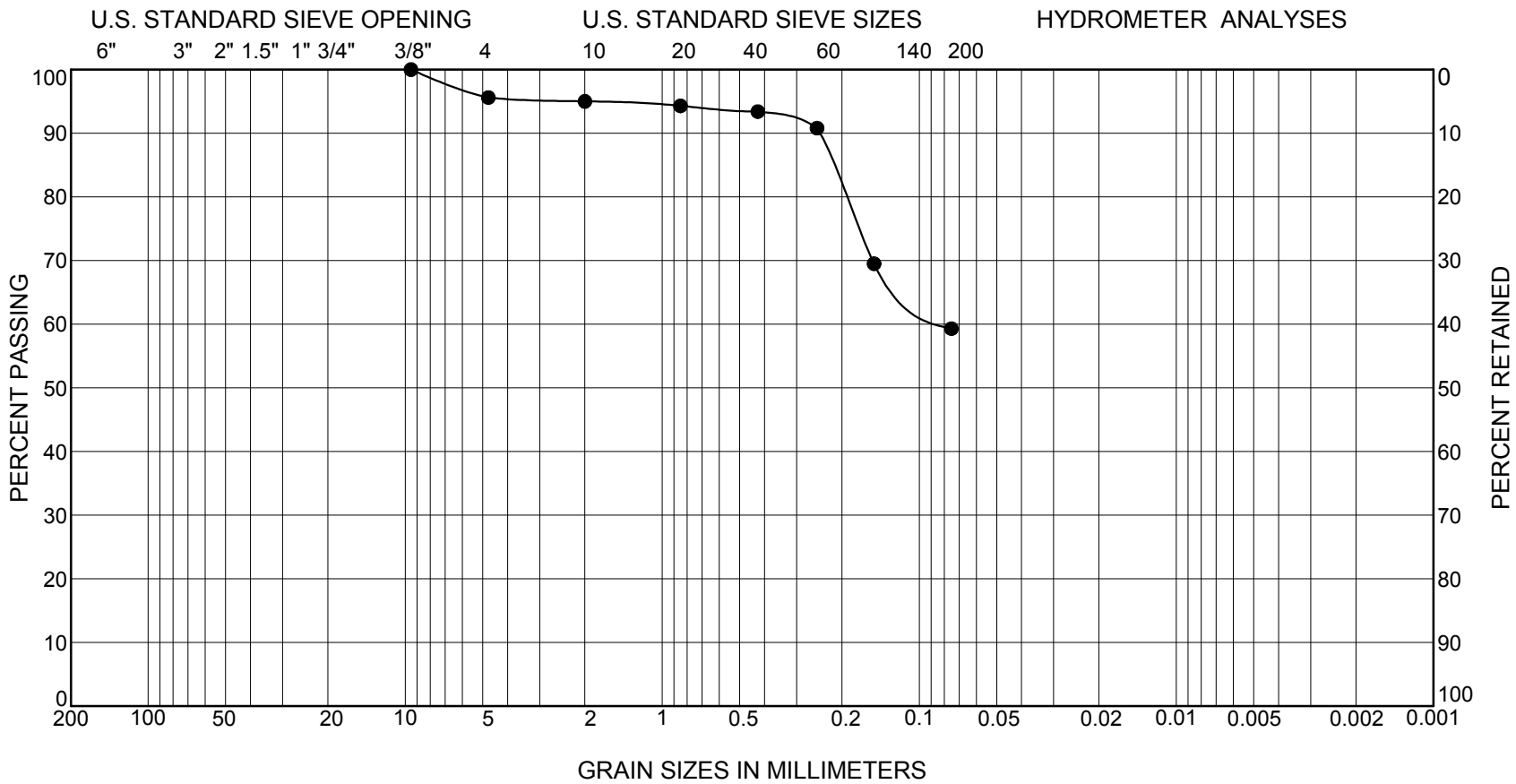
JOB NO: 2009-130-GDR

80/680/12 ICP PROJECT
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4S

GRAIN SIZE DISTRIBUTION CURVES

COBBLES	GRAVEL		SAND			SILT AND CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (feet)	Symbol	LL	PI	Description
R-12-151	MC-6	25.0	●			SANDY lean CLAY (CL)

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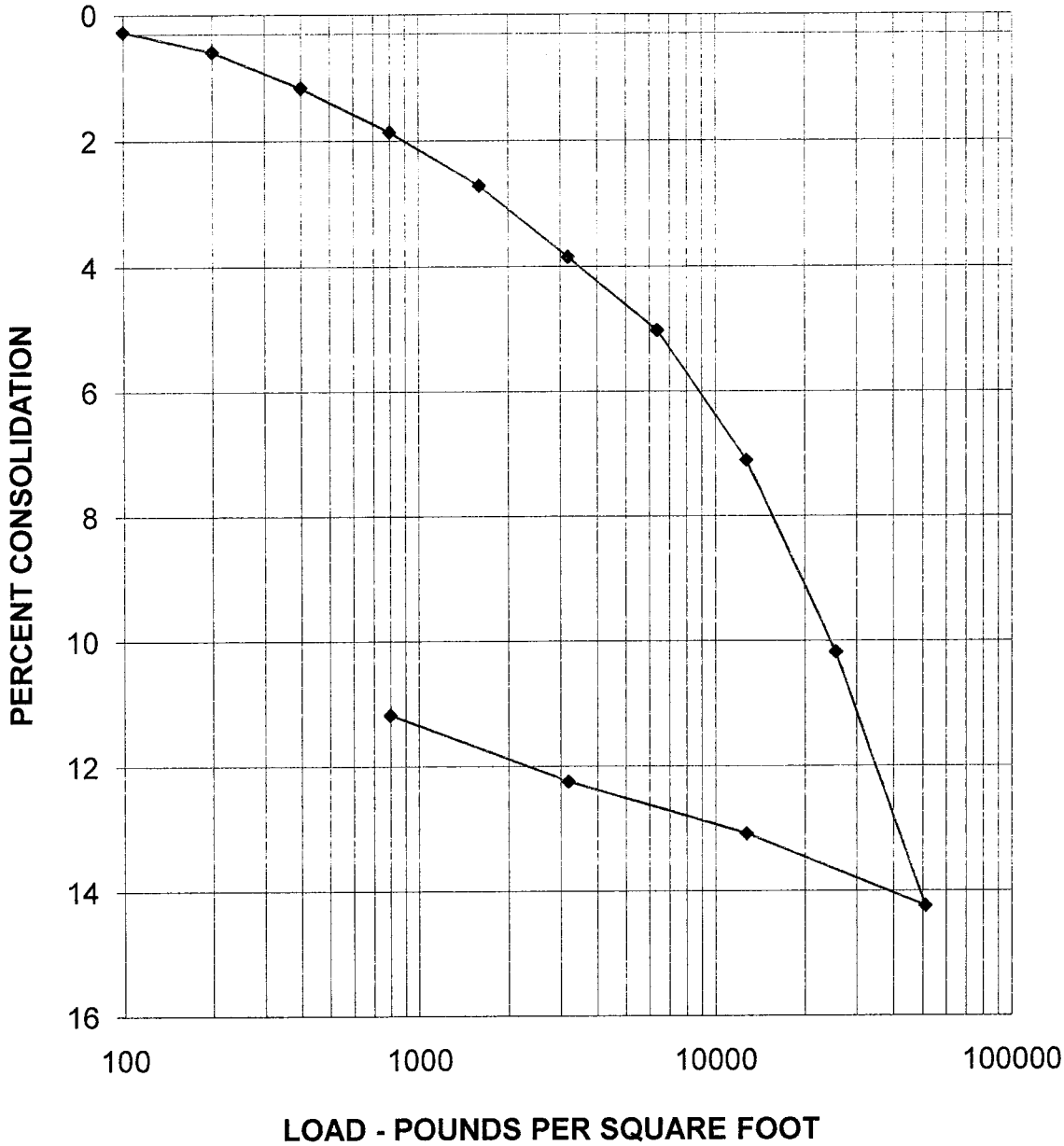
JOB NO: 2009-130-GDR

80/680/12 ICP PROJECT
SOLANO COUNTY, CALIFORNIA

PLATE NO: B-4T

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	29.7	94.1	1.0000	2.416
FINAL	24.1	106.0	0.8883	2.416

BORING NO.	B002	SAMPLE NO.	8	ELEV. OR DEPTH	39.5'
DESCRIPTION	Silt, Gray				

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MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/20/2009	209130.GDR

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

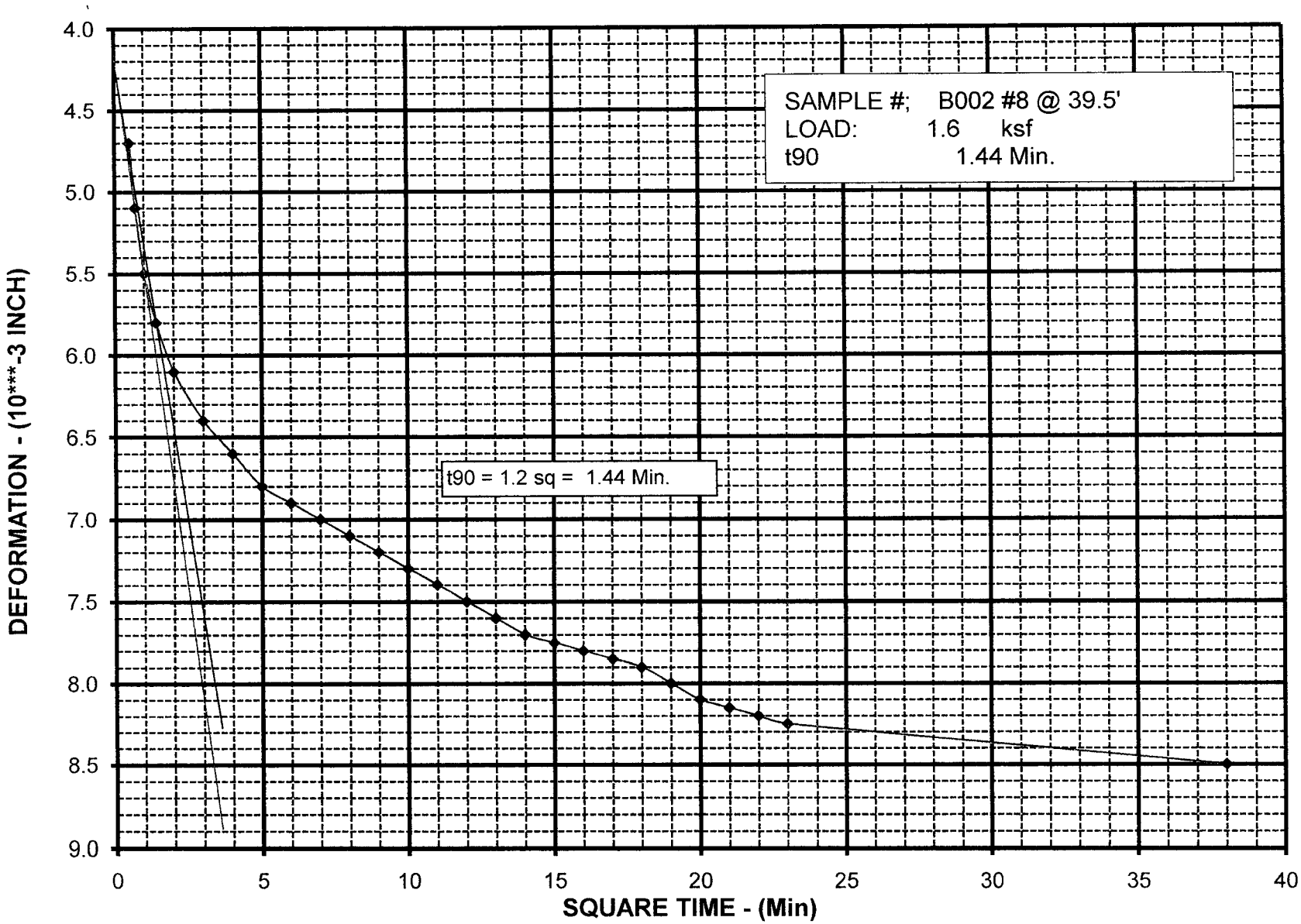


PLATE NO.: B-5B

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

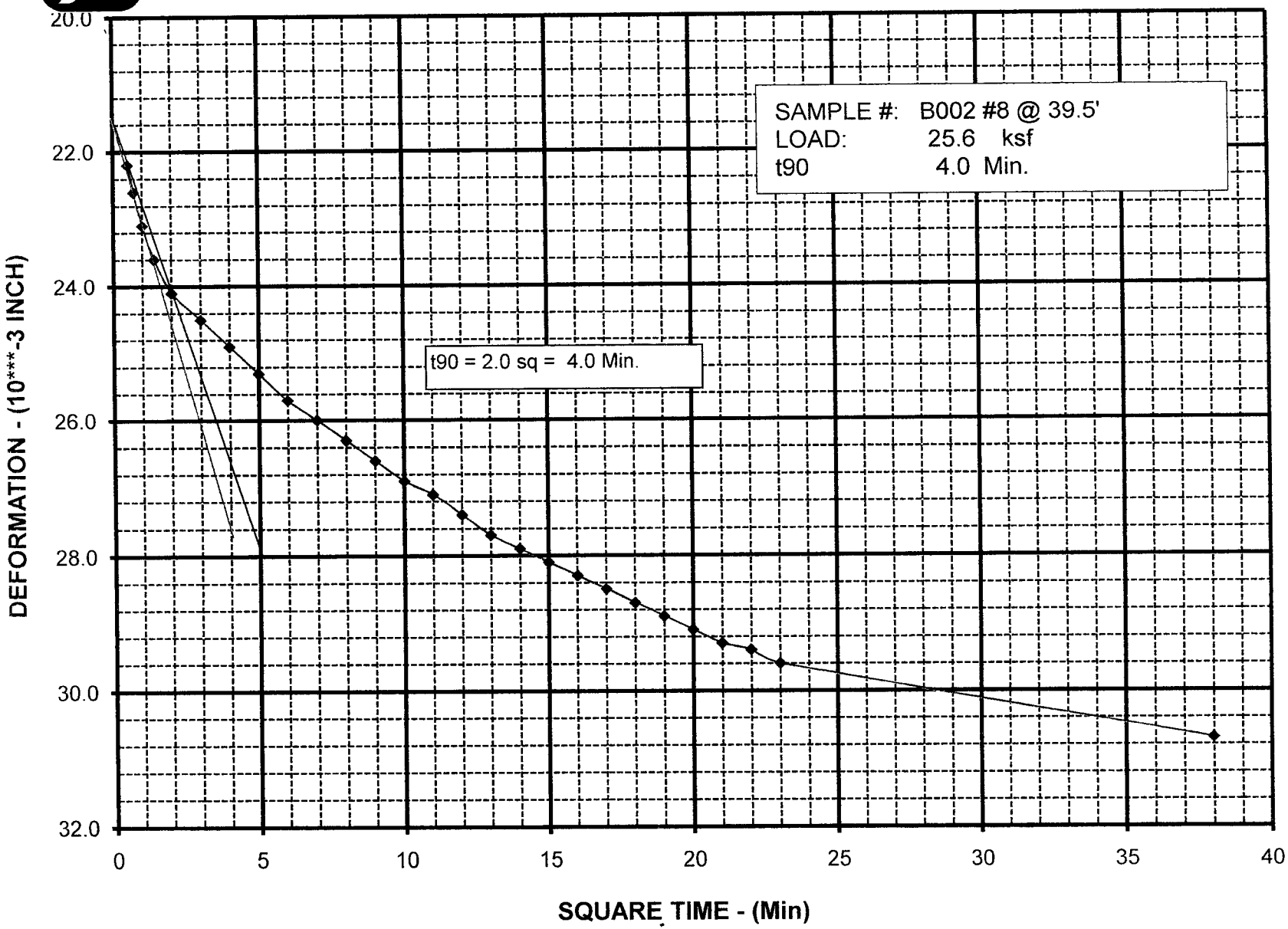
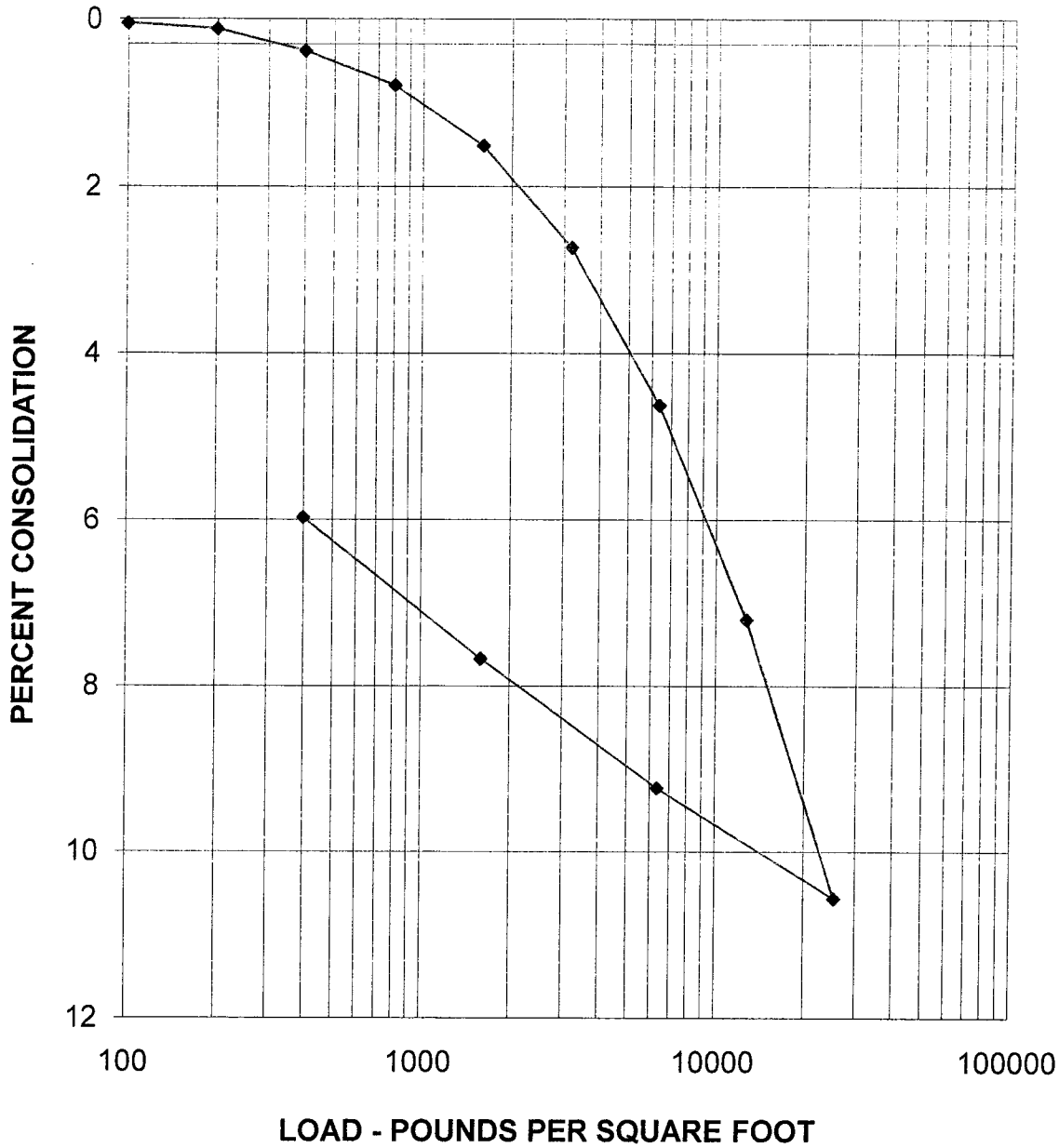


PLATE NO.: B-5C

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	23.0	105.4	1.0000	2.416
FINAL	20.6	112.1	0.9403	2.416

BORING NO.	B003	SAMPLE NO.	2	ELEV. OR DEPTH	9.5'
DESCRIPTION	Lean clay, Reddish/grayish brown				

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GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/18/2009	209130.GDR

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

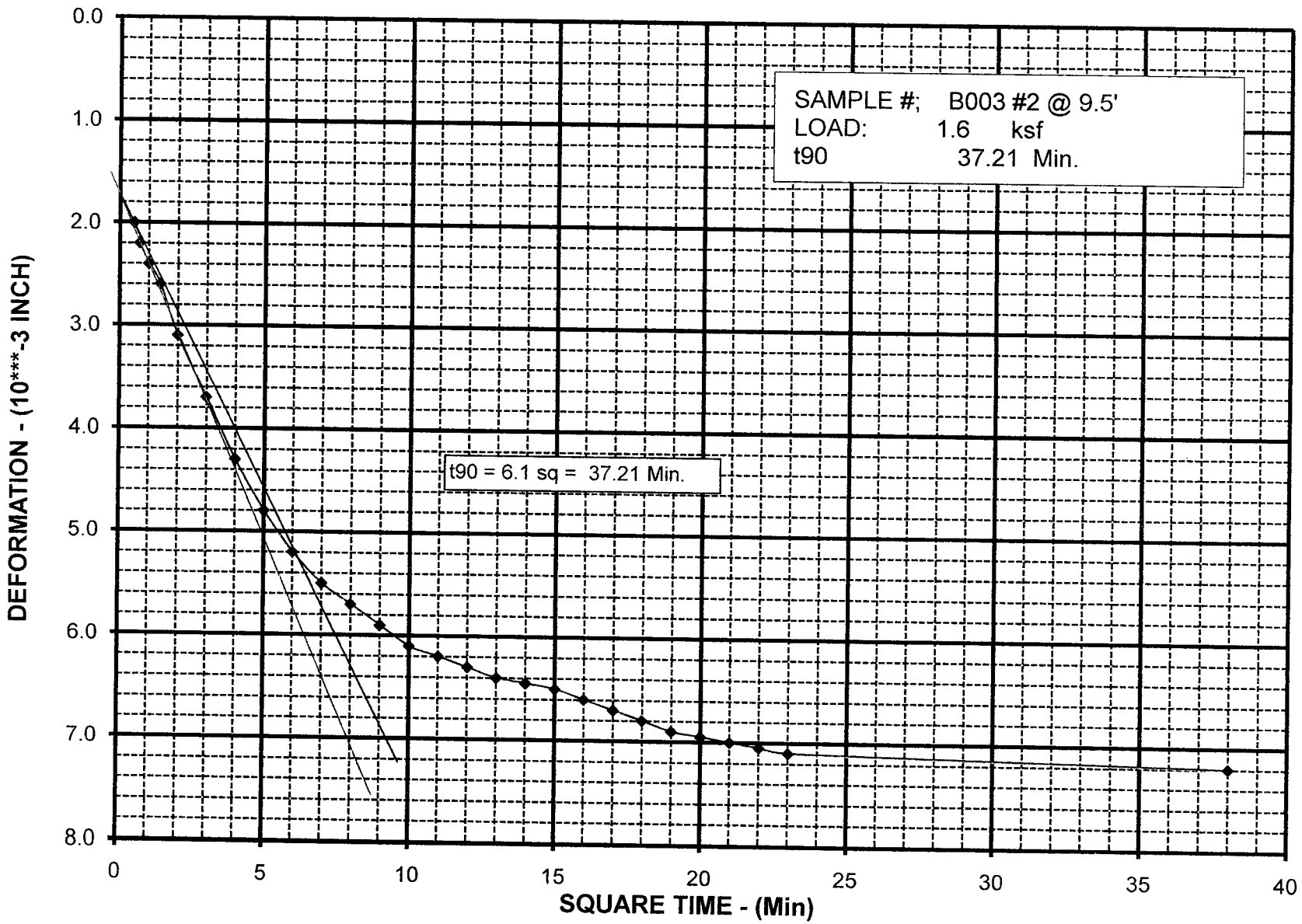


PLATE NO.: B-5E

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

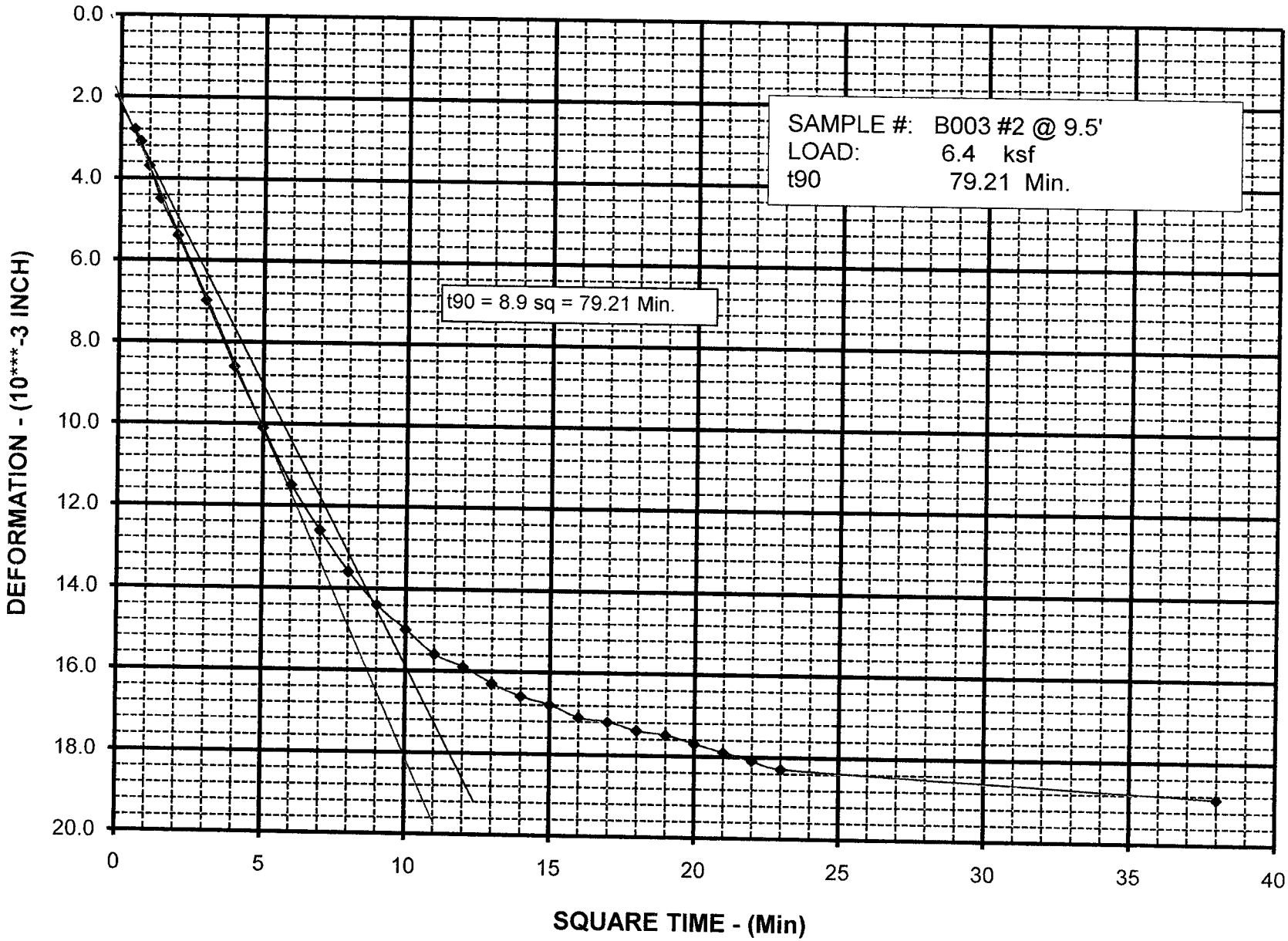
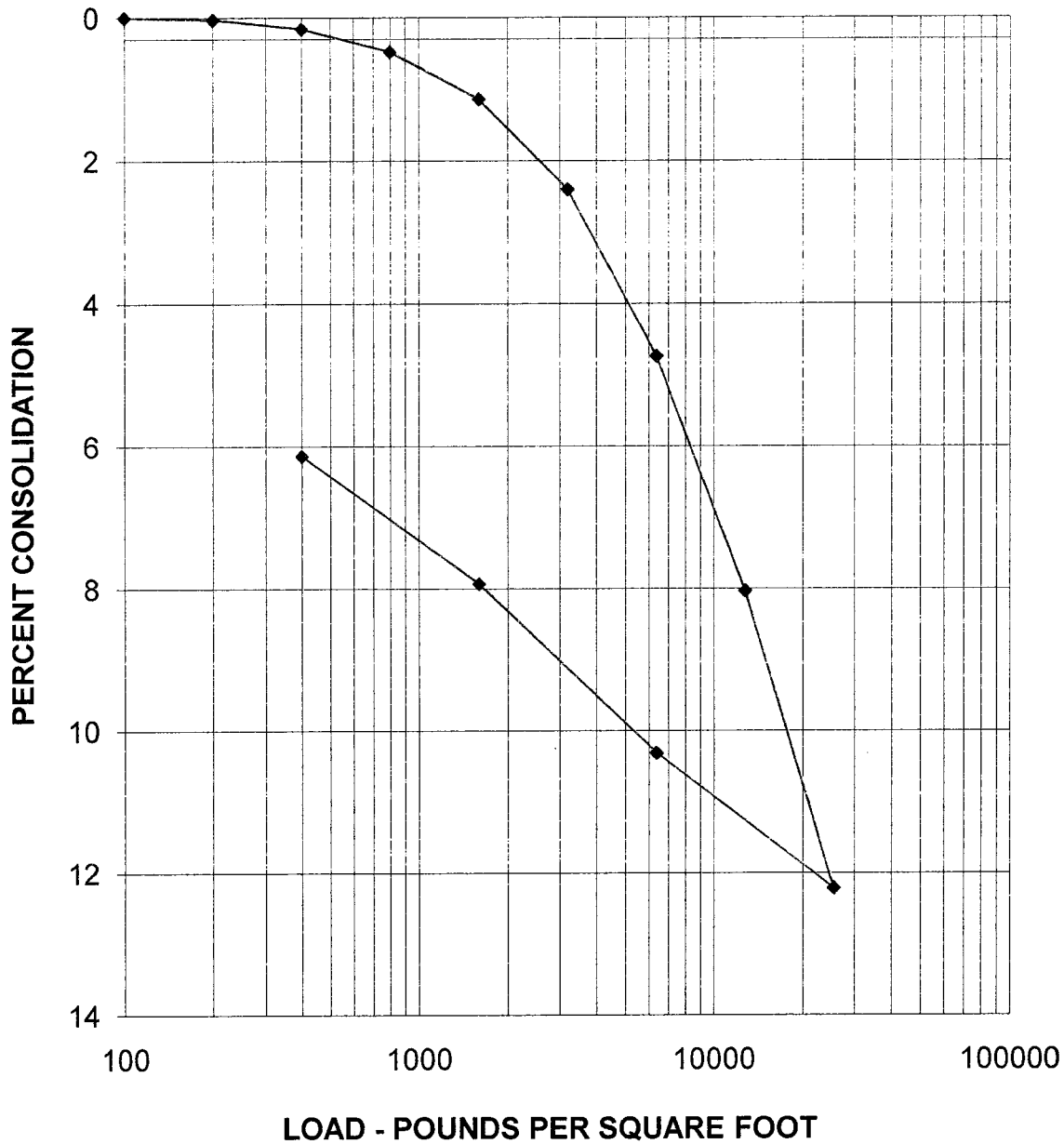


PLATE NO.: B-5F

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	32.5	89.9	1.0000	2.416
FINAL	29.4	95.7	0.9387	2.416

BORING NO.	B006	SAMPLE NO.	6	ELEV. OR DEPTH	29.5'
DESCRIPTION	Lean clay, yellowish brown				

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MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/10/2009	209130.GDR

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

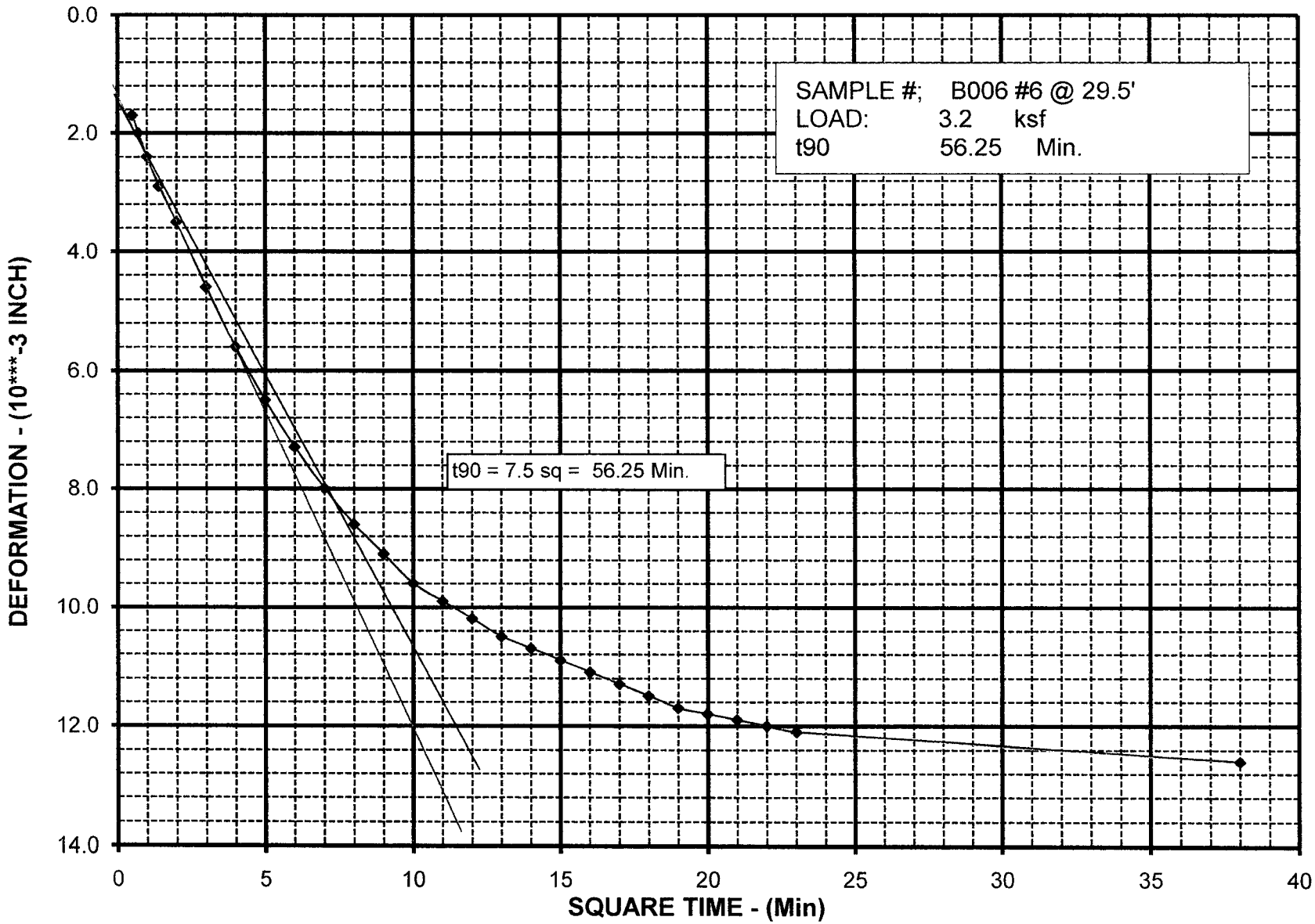


PLATE NO.: B-5H

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

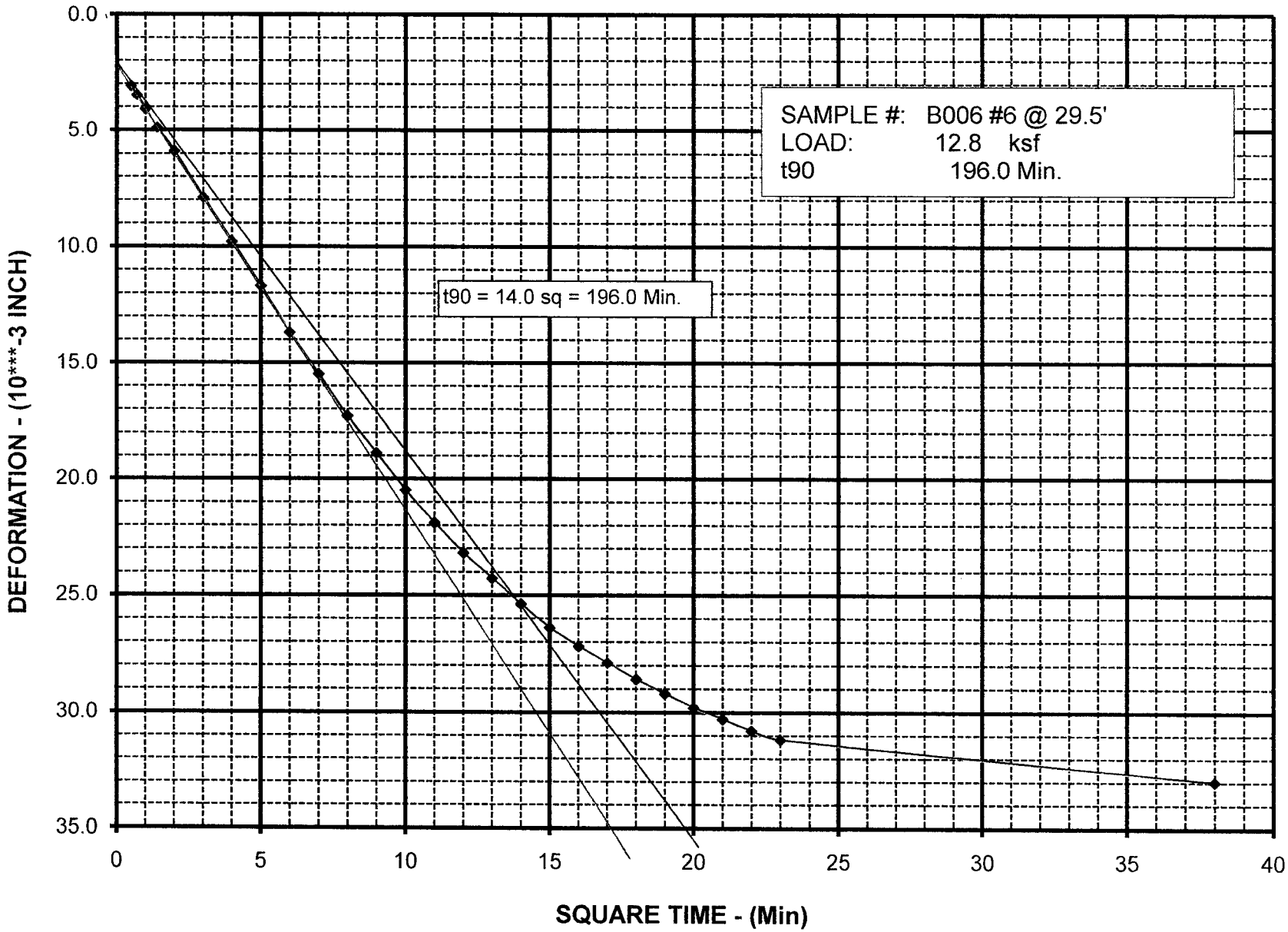
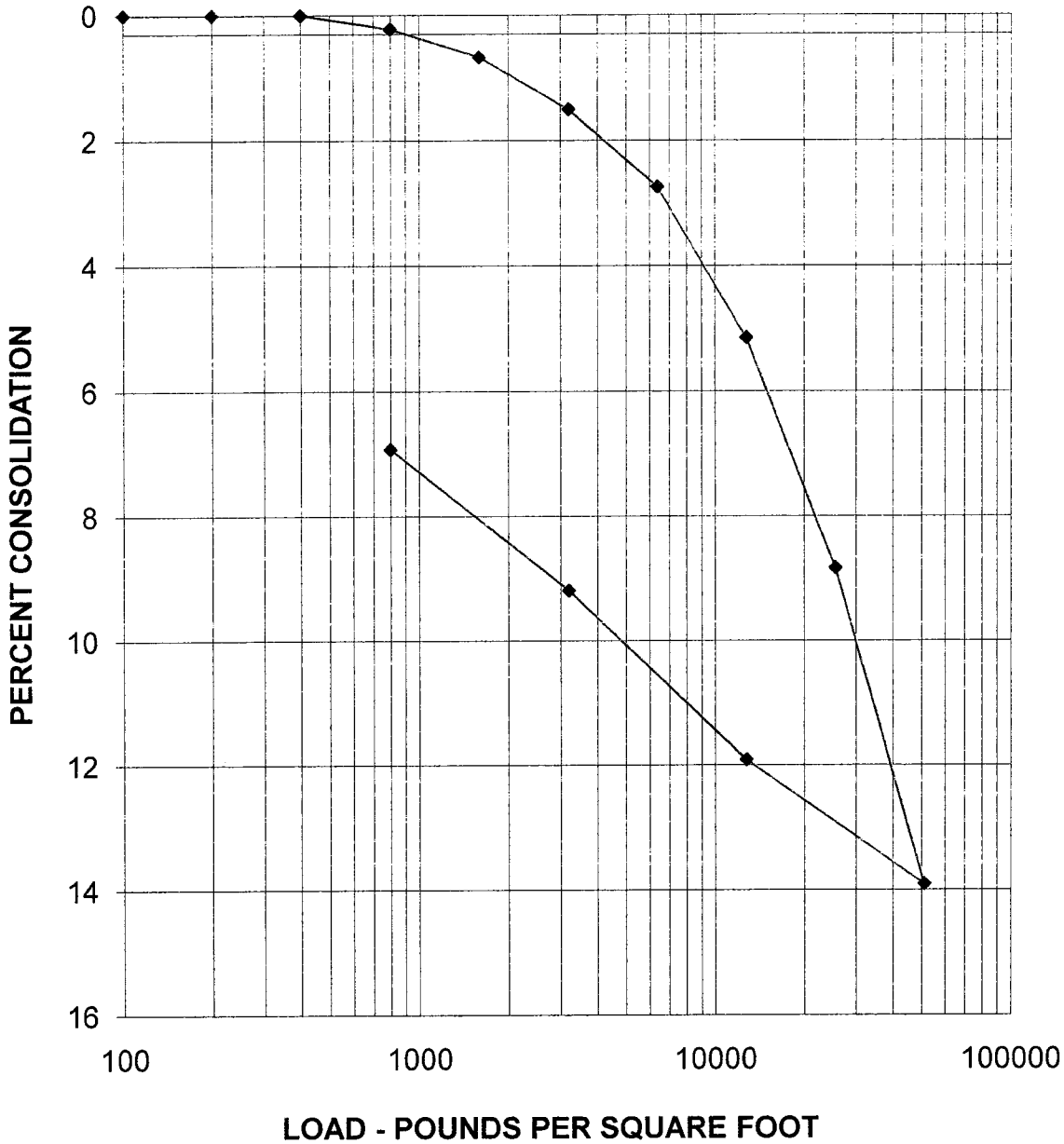


PLATE NO.: B-5I

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	21.8	105.5	1.0000	2.416
FINAL	19.3	113.4	0.9308	2.416

BORING NO.	B009	SAMPLE NO.	1	ELEV. OR DEPTH	4.5'
DESCRIPTION	Sandy lean clay, reddish brown				

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Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
11/10/2009	209130.GDR

Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

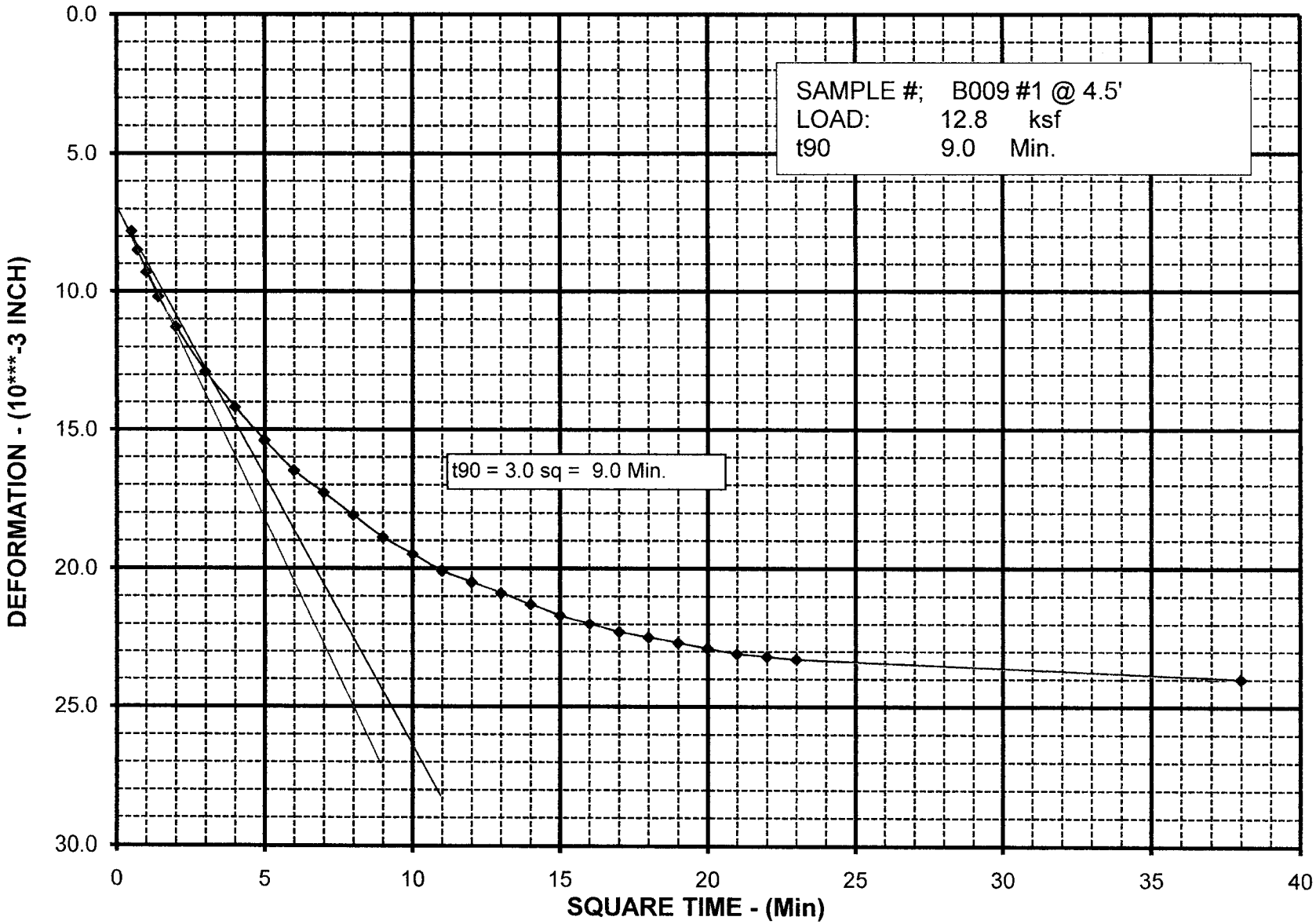


PLATE NO.: B-5K

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

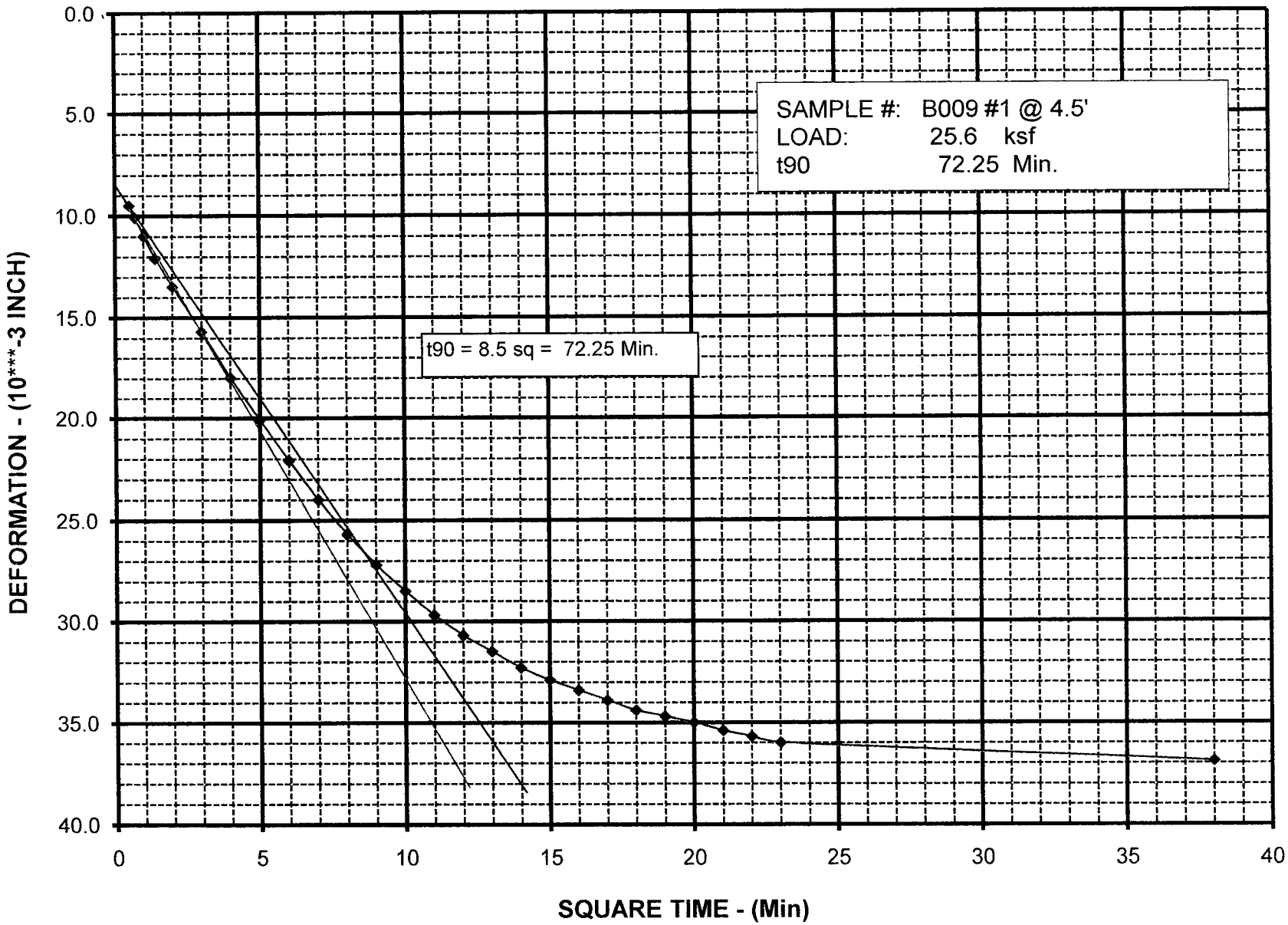
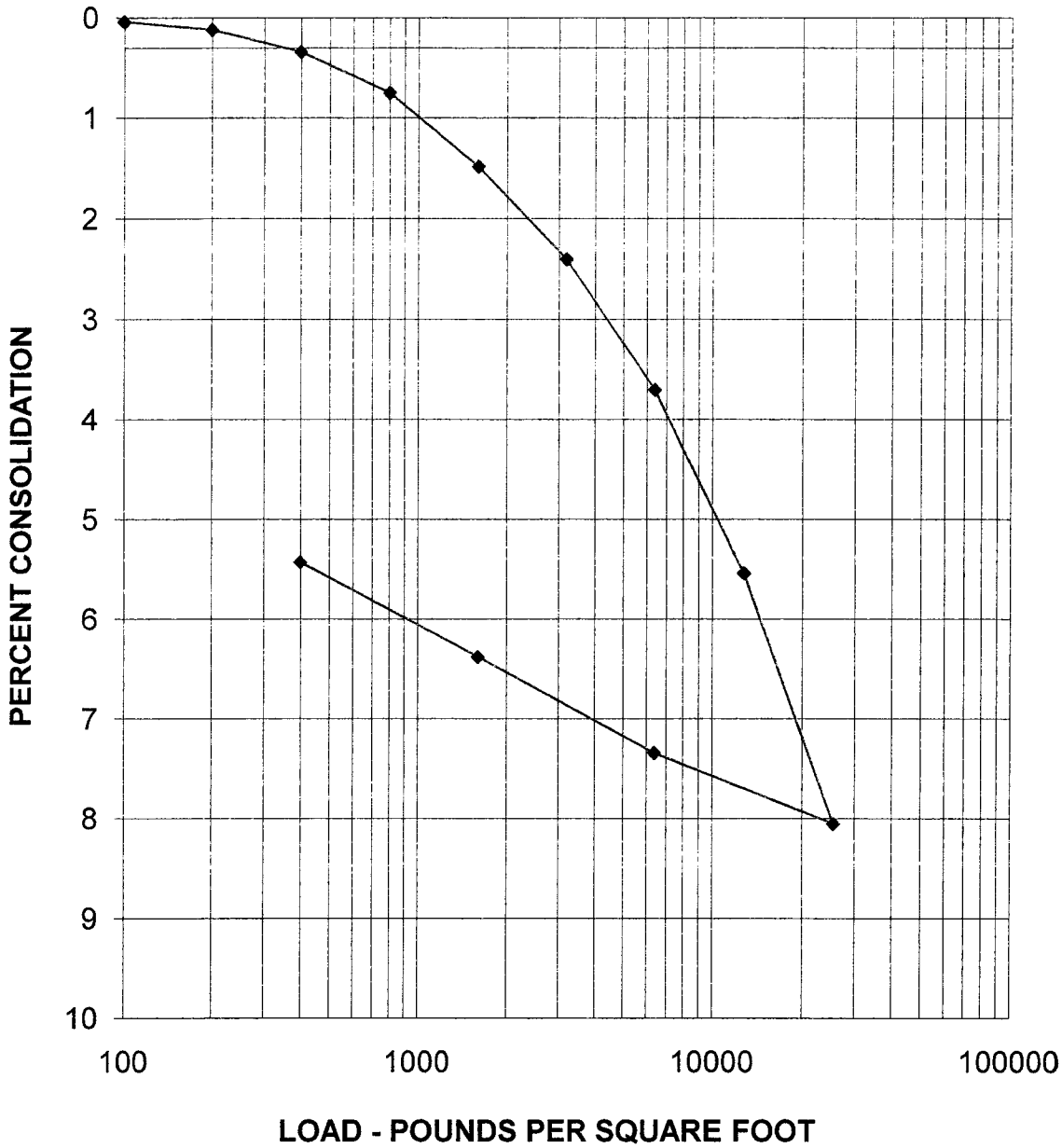


PLATE NO.: B-5L

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	19.0	105.2	1.0000	2.416
FINAL	17.9	111.2	0.9457	2.416

BORING NO.	B124	SAMPLE NO.	3	ELEV. OR DEPTH	9.5'
DESCRIPTION	Sandy Lean Clay, yellowish brown				

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Rte 80 - 680 - 12 Interchange Project
MARK THOMAS

DATE	JOB NO:
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Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

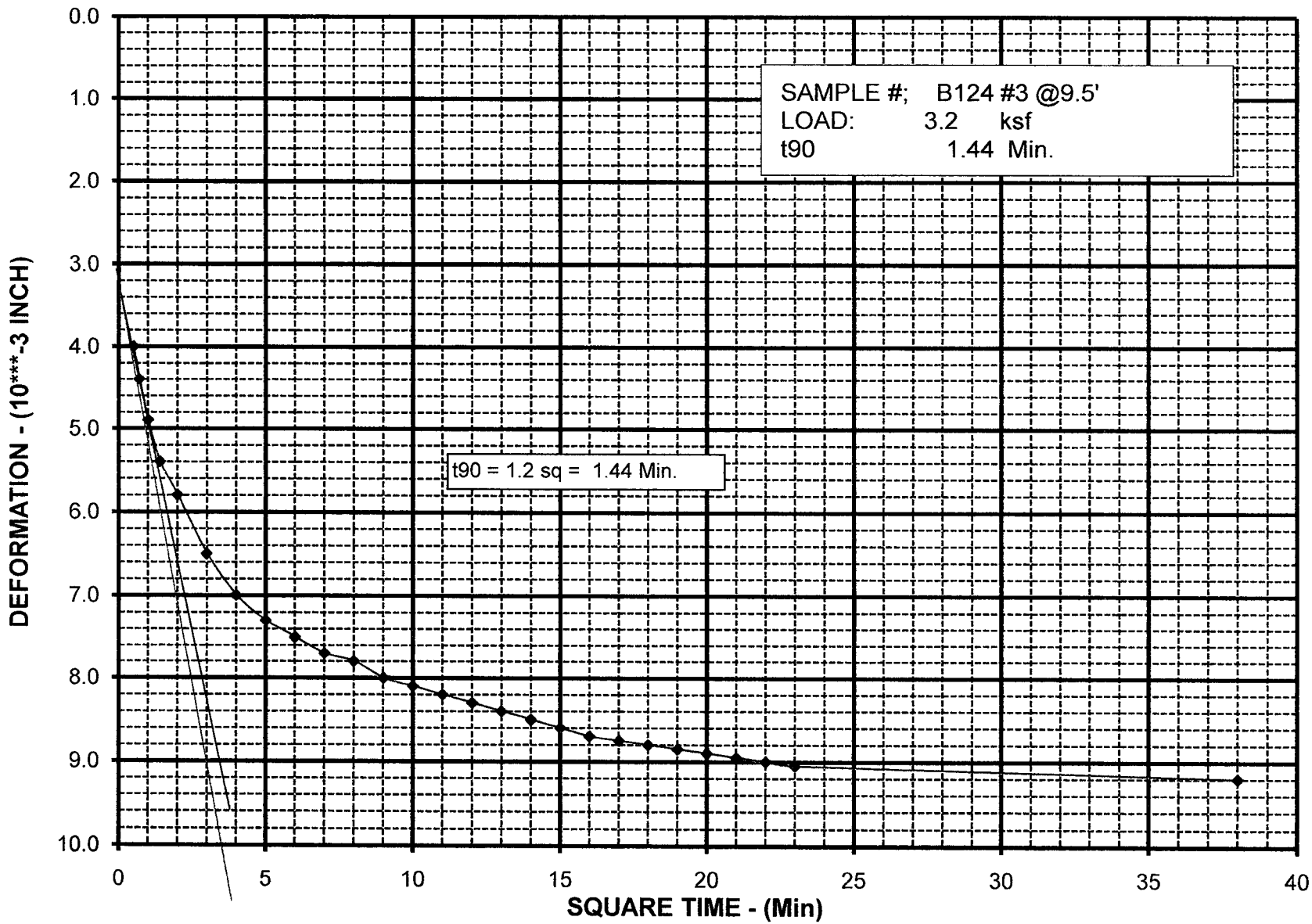


PLATE NO.: B-5N

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

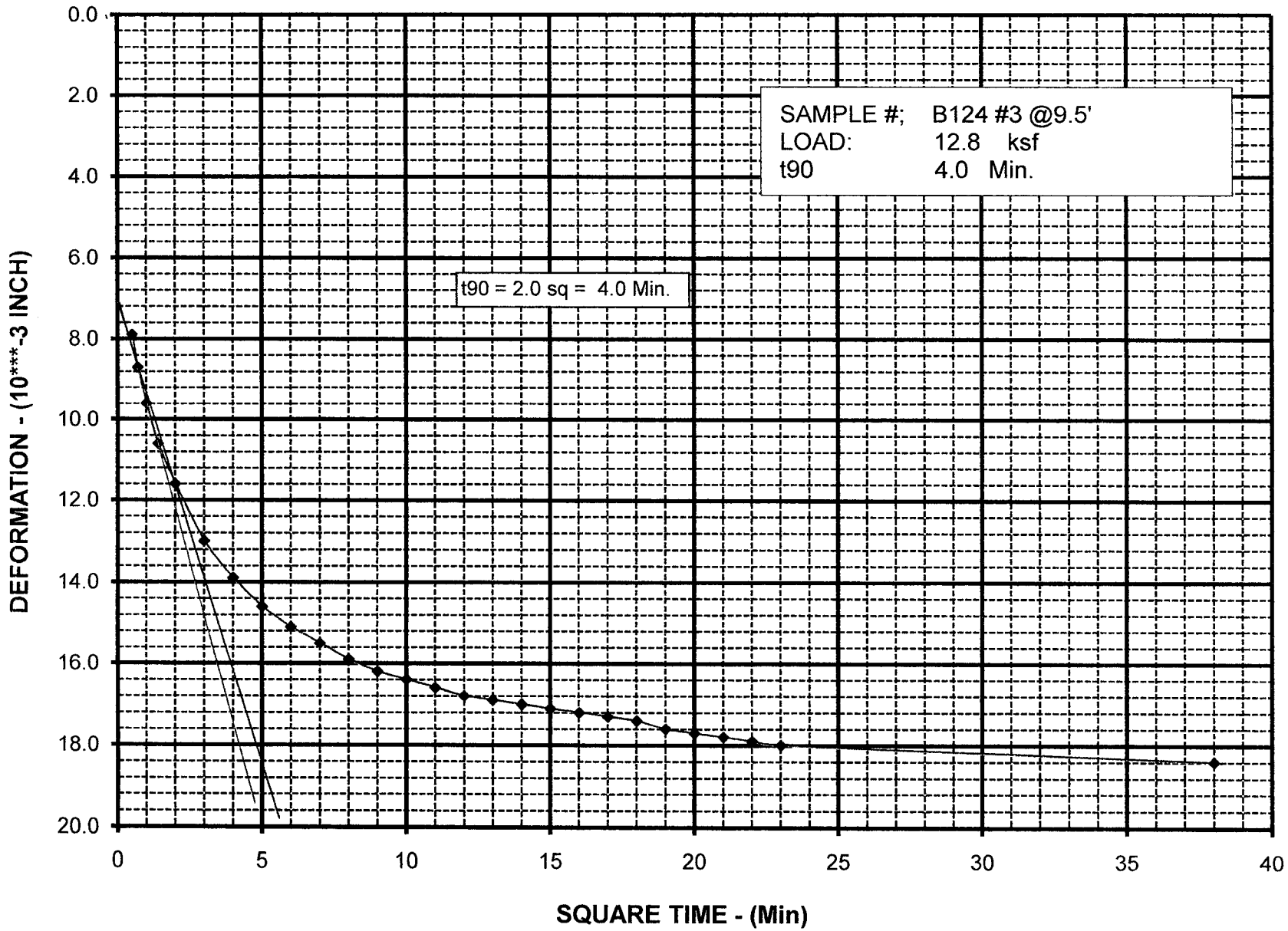
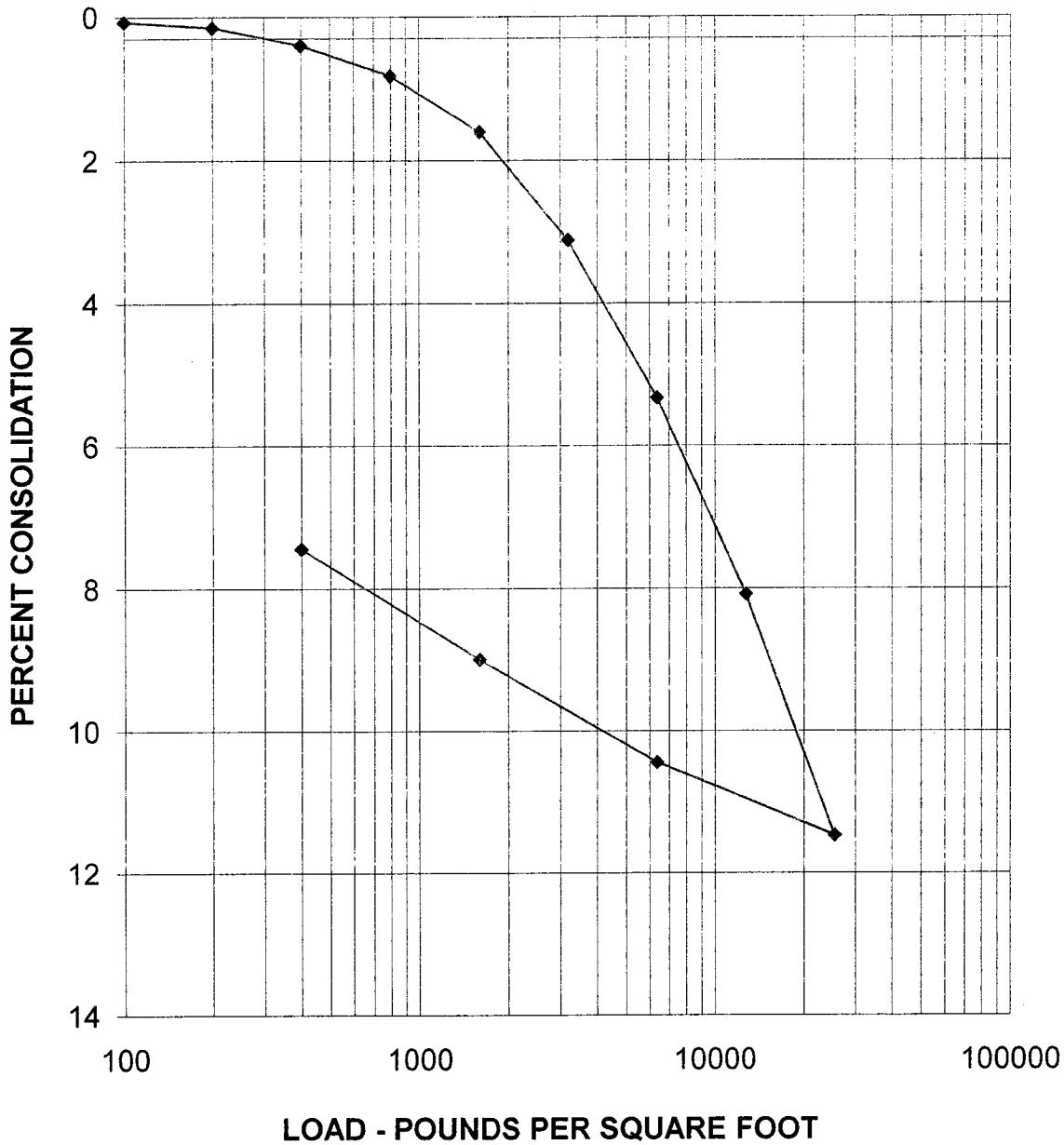


PLATE NO.: B-5O

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	25.5	99.9	1.0000	2.416
FINAL	22.0	107.9	0.9256	2.416

BORING NO.	B126	SAMPLE NO.	3	ELEV. OR DEPTH	14.5'
DESCRIPTION	Sandy lean clay, yellowish brown				

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MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
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Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

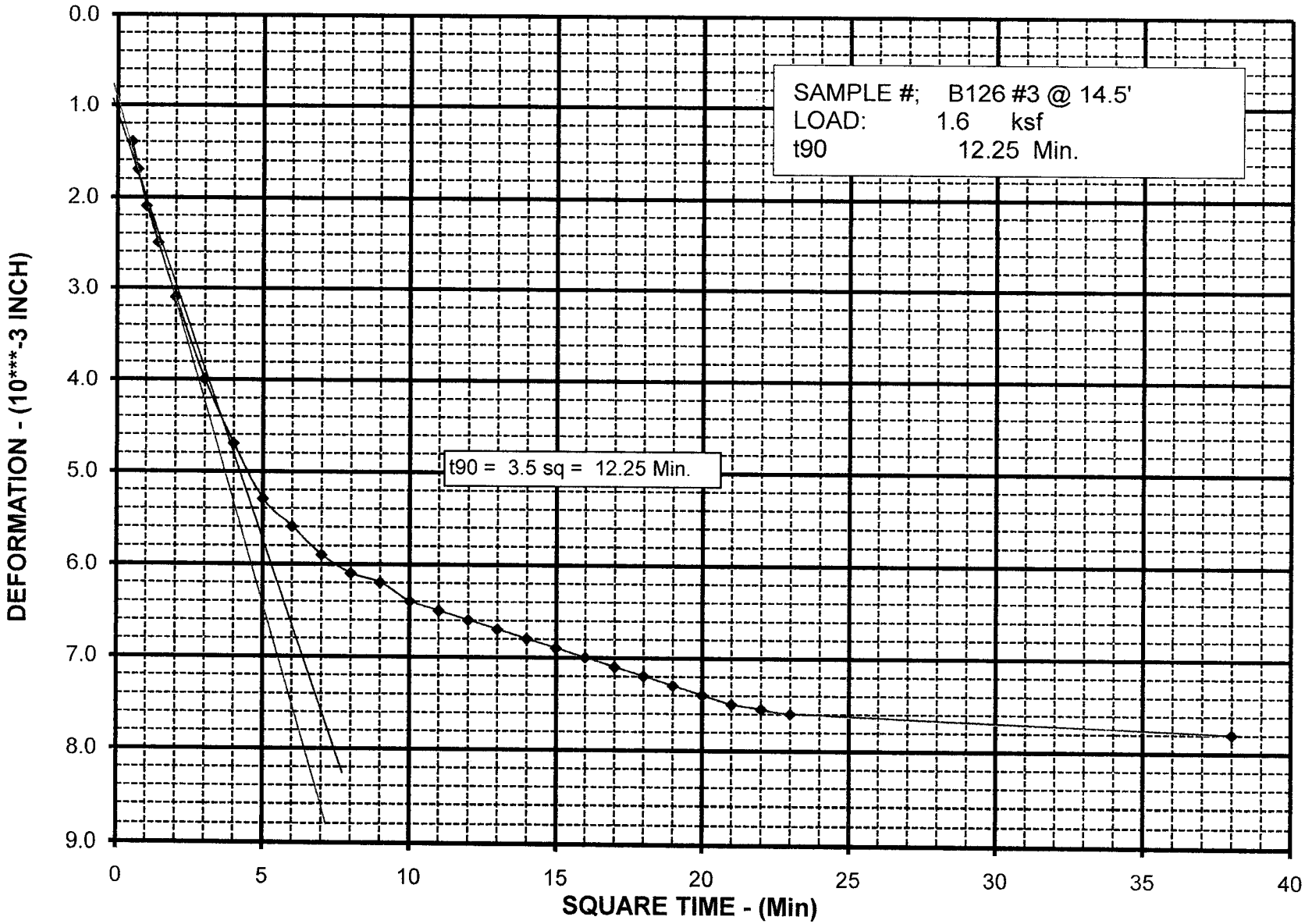


PLATE NO.: B-5Q

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

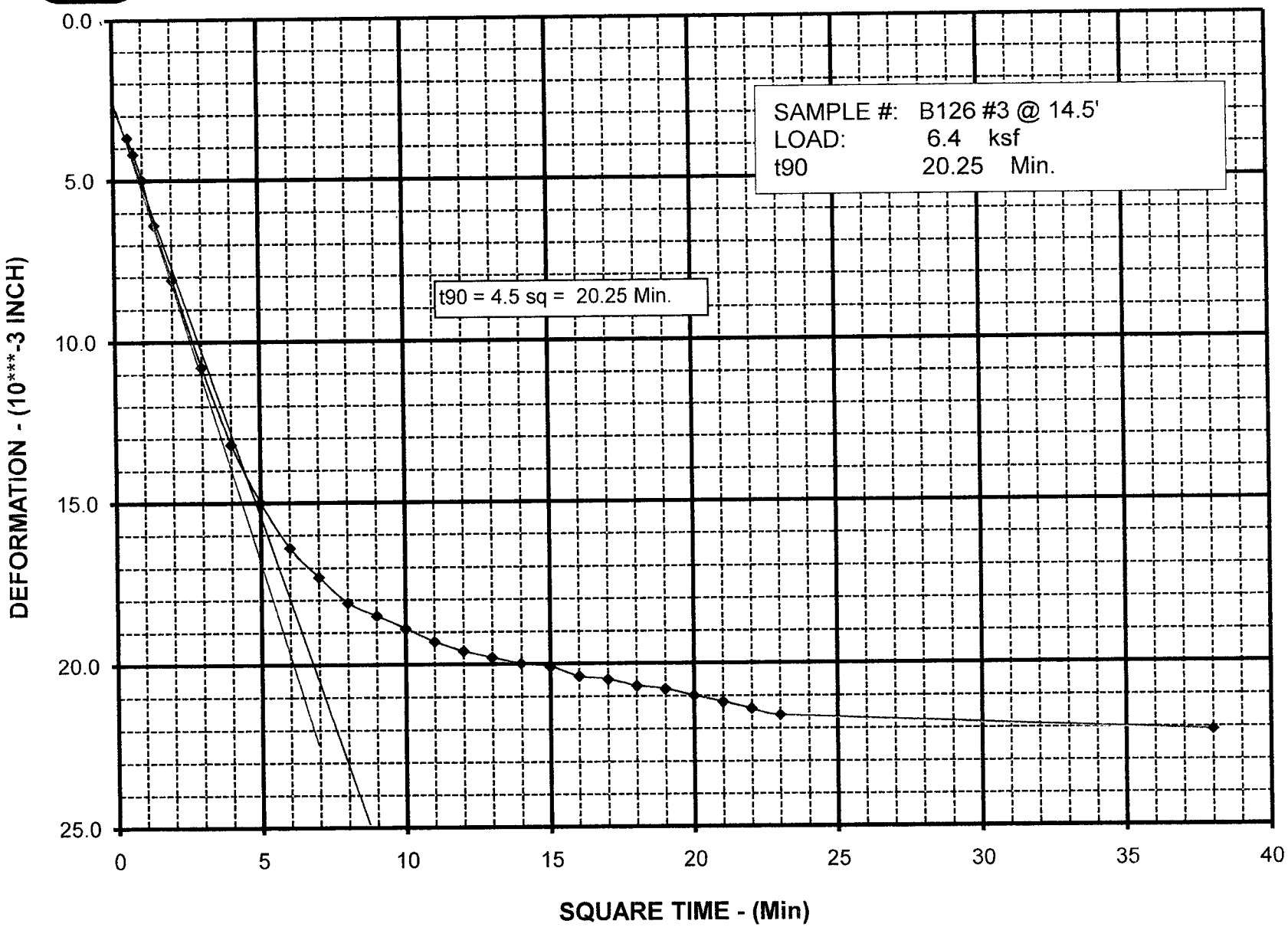
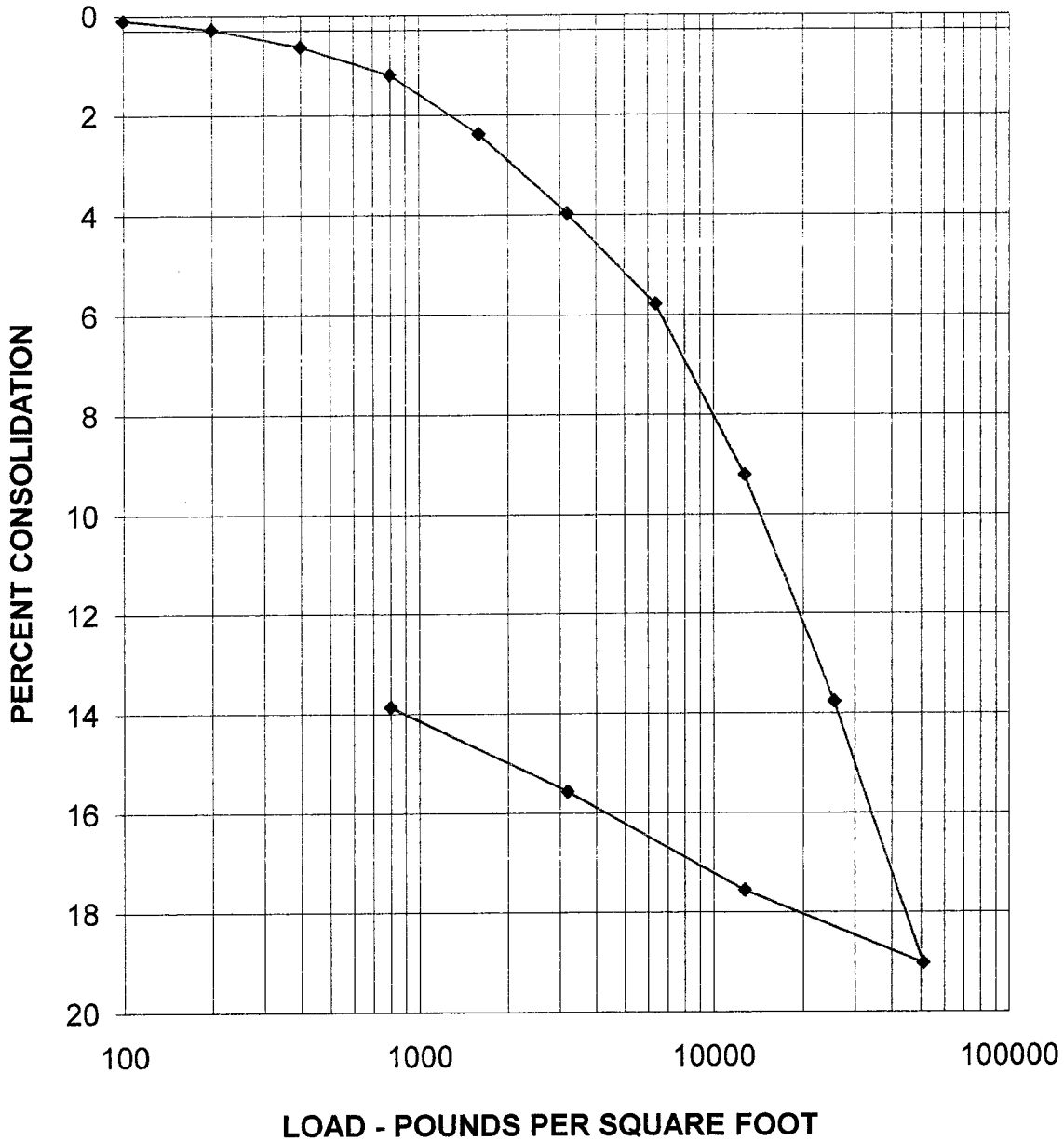


PLATE NO.: B-5R

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	27.6	97.4	1.0000	2.416
FINAL	19.4	113.1	0.8614	2.416

BORING NO.	B128	SAMPLE NO.	4	ELEV. OR DEPTH	14.5'
DESCRIPTION	Lean Clay, gray				

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Rte 80 - 680 - 12 Interchange Project
MARK THOMAS

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Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

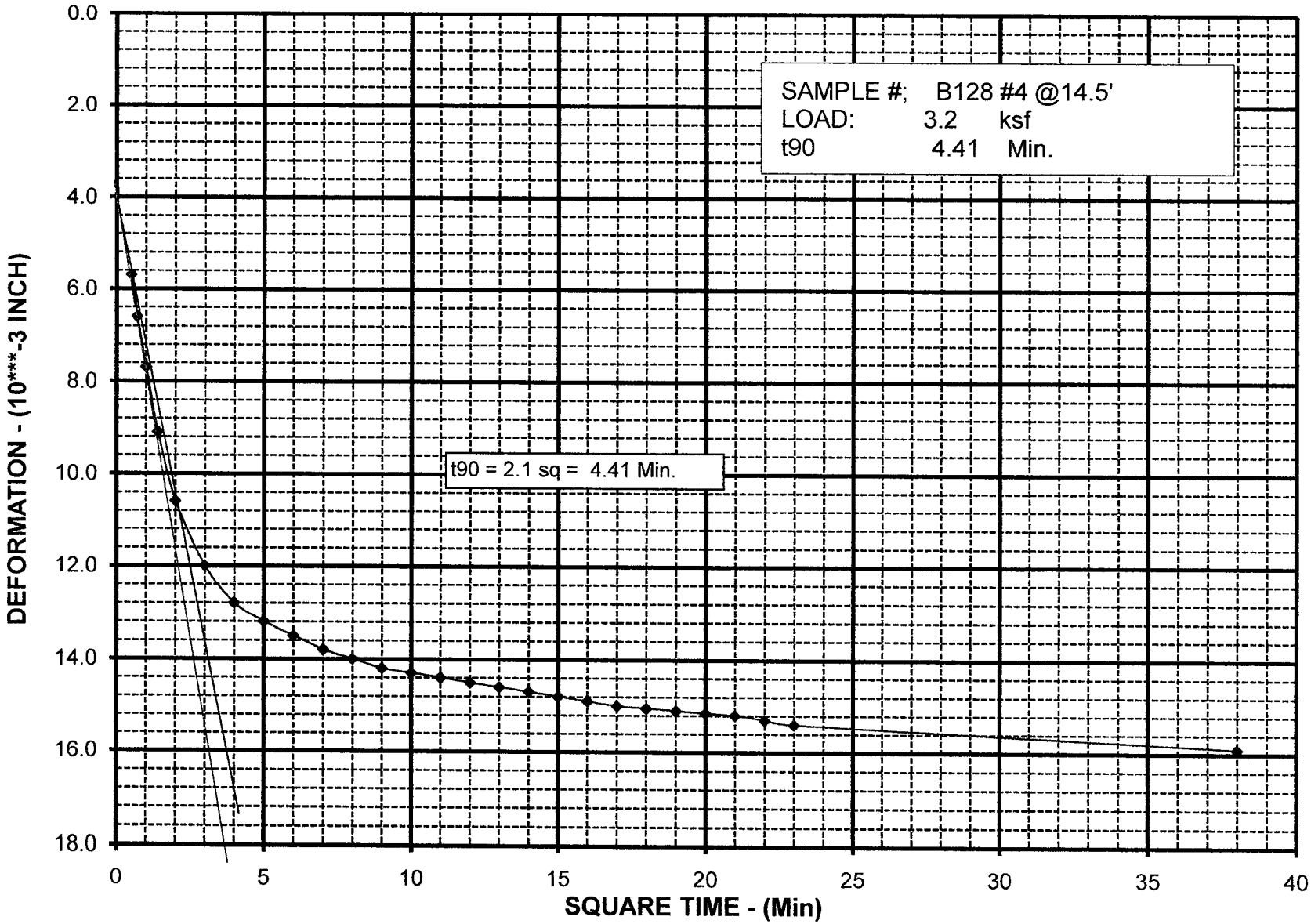


PLATE NO.: B-5T

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

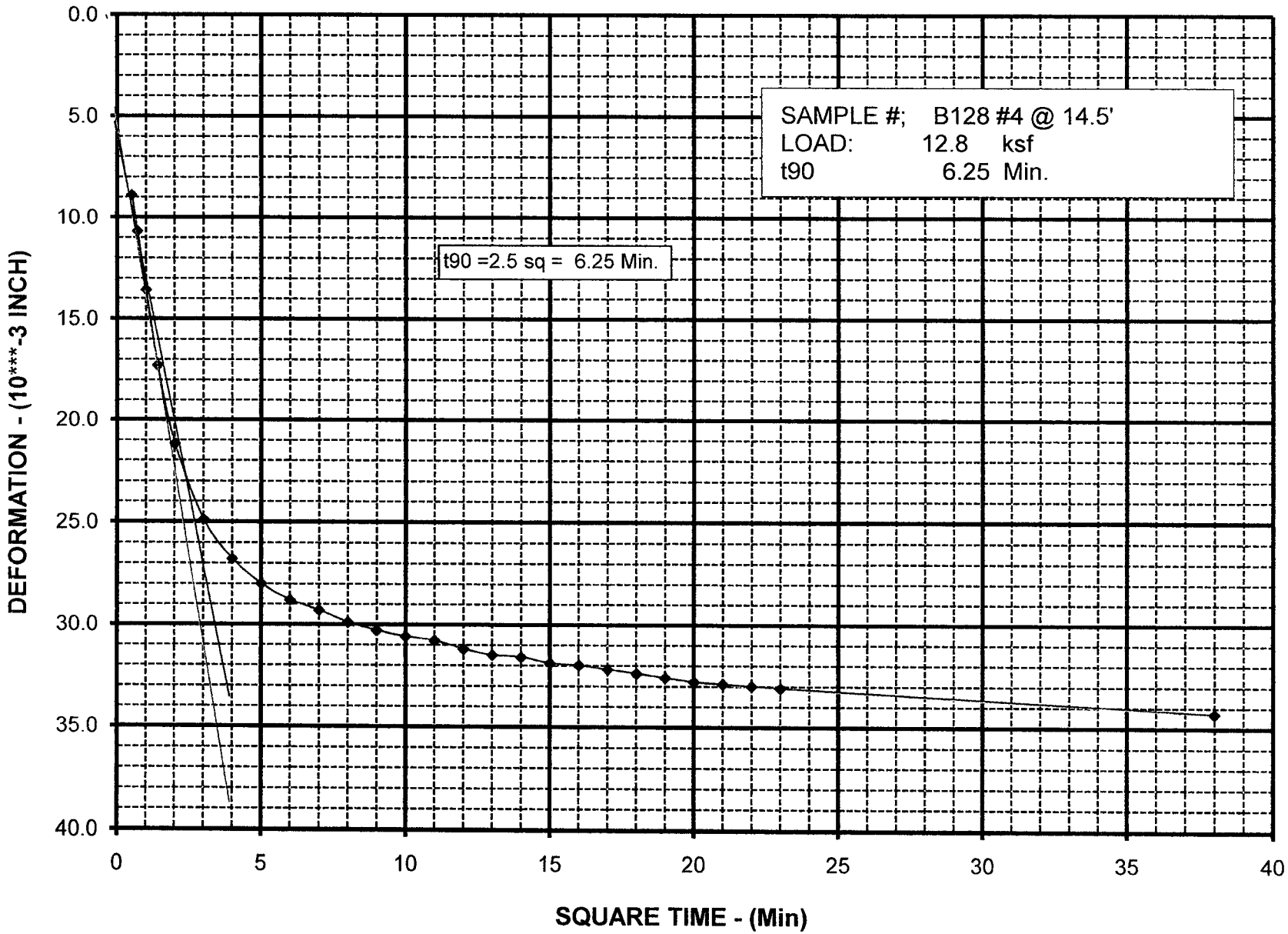
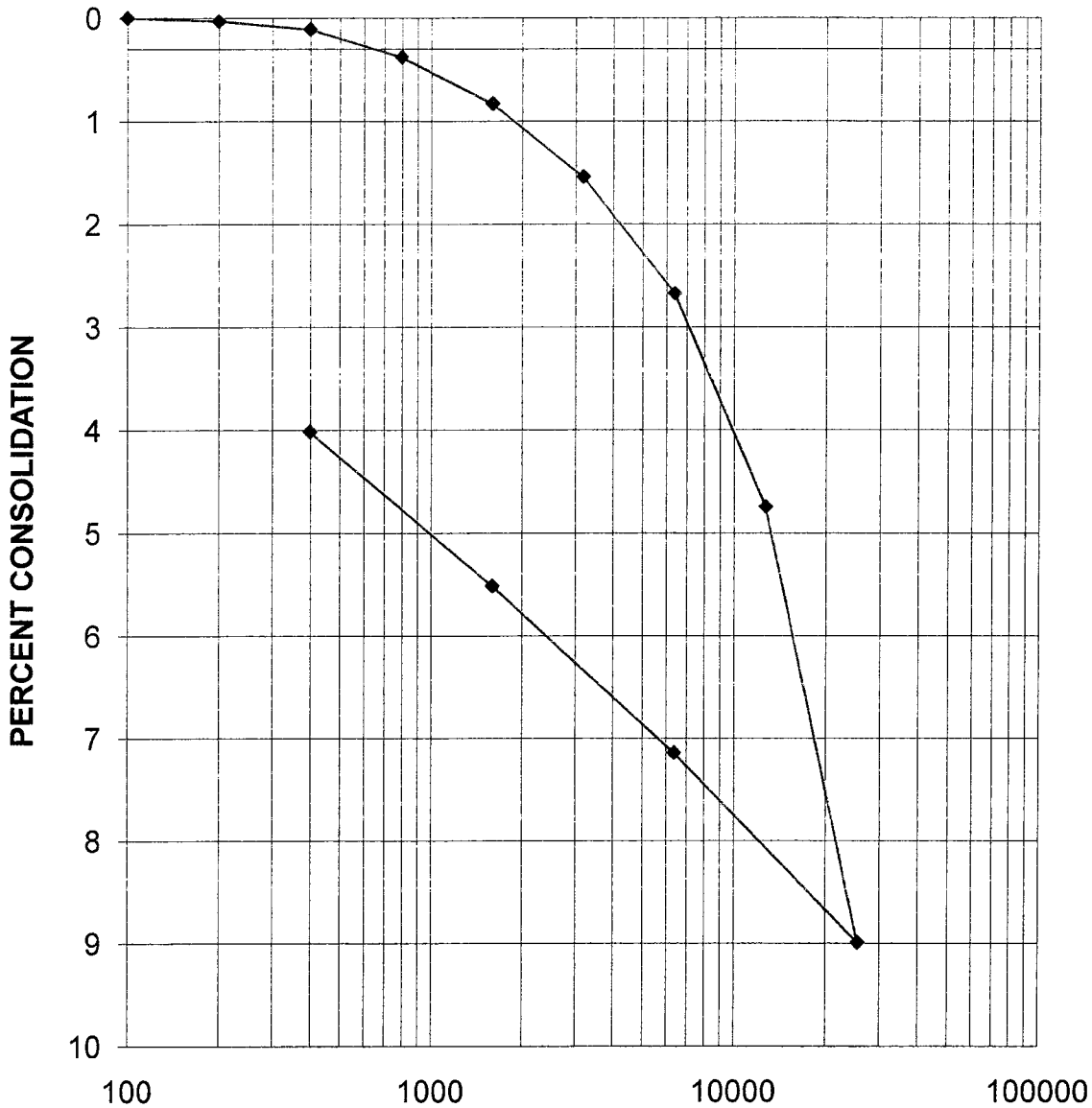


PLATE NO.: B-5U

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	38.5	82.4	1.0000	2.416
FINAL	37.4	85.8	0.9599	2.416

BORING NO.	B129	SAMPLE NO.	6	ELEV. OR DEPTH	24.5'
DESCRIPTION	Lean clay, gray				

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MATERIALS ENGINEERING

Rte 80 - 680 - 12 Interchange Project
M T Co / Nolte

DATE	JOB NO:
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Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

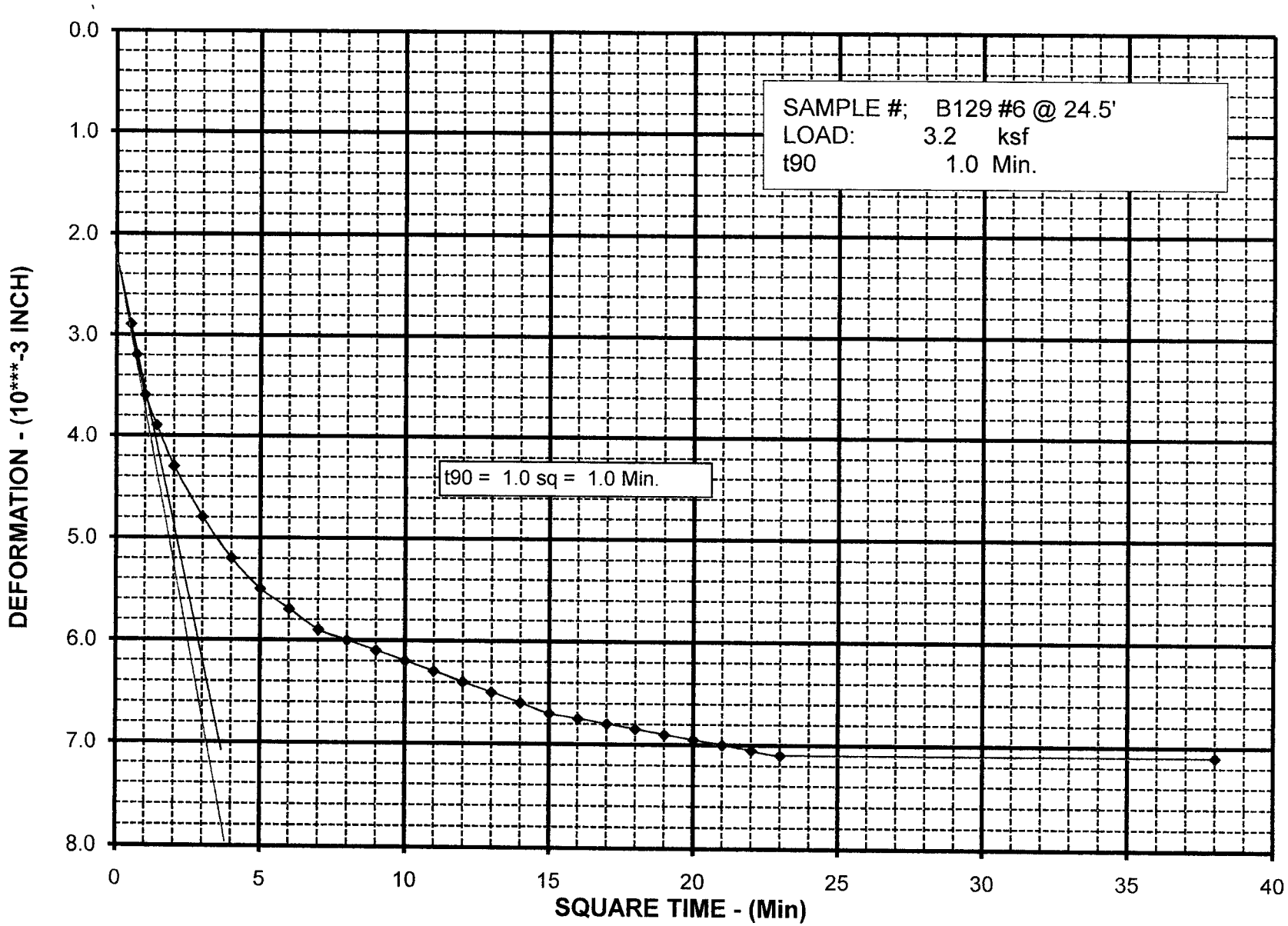


PLATE NO.: B-5W

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

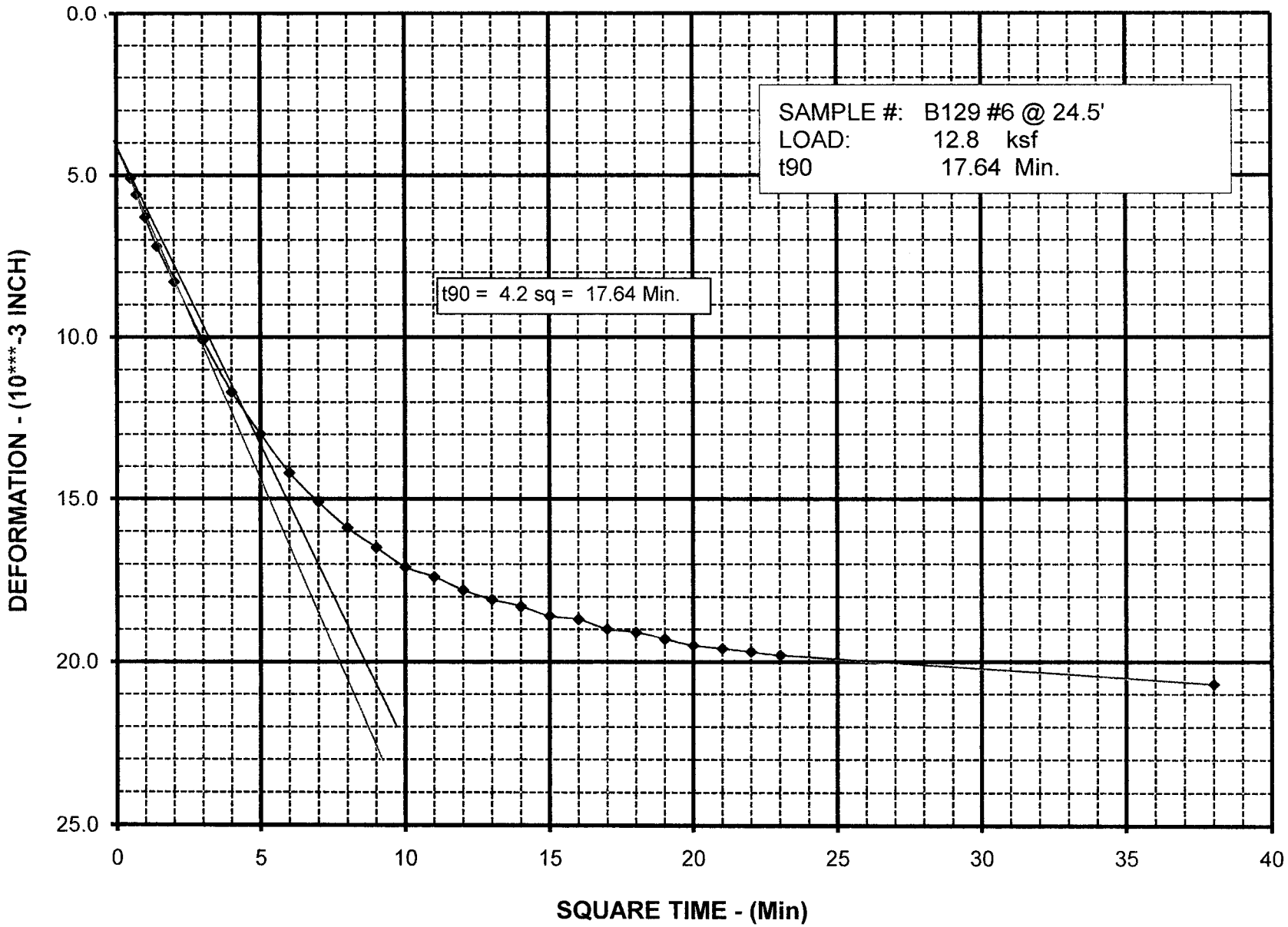
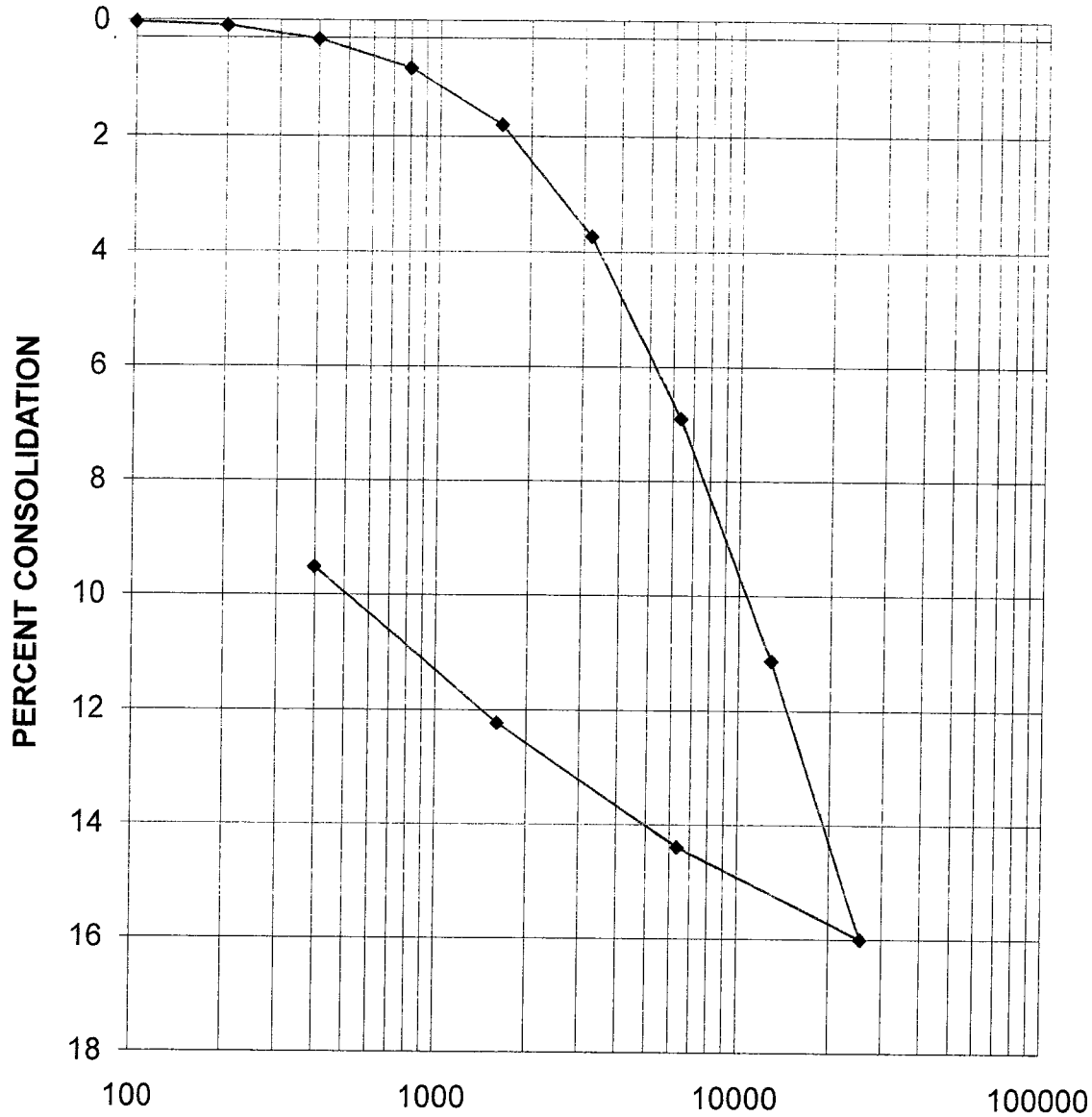


PLATE NO.: B-5X

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	26.7	97.0	1.0000	2.416
FINAL	23.2	107.1	0.9049	2.416

BORING NO.	B130	SAMPLE NO.	2	ELEV. OR DEPTH	9.5'
DESCRIPTION	Fat clay, dark gray				

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Rte 80 - 680 - 12 Interchange Project
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Reported by: Prav Dayah

PLATE NO.: B-5Y

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

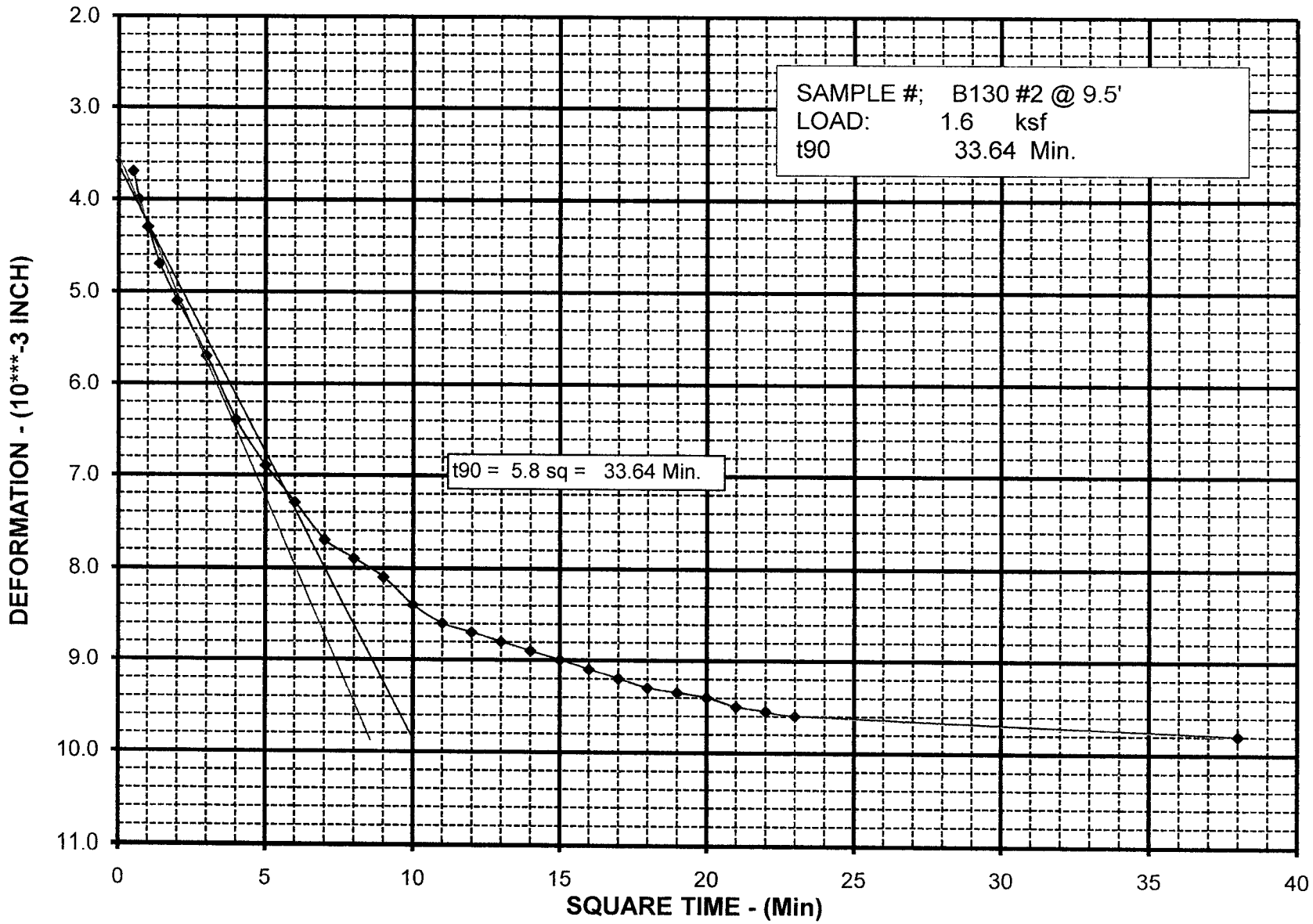


PLATE NO.: B-5Z

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

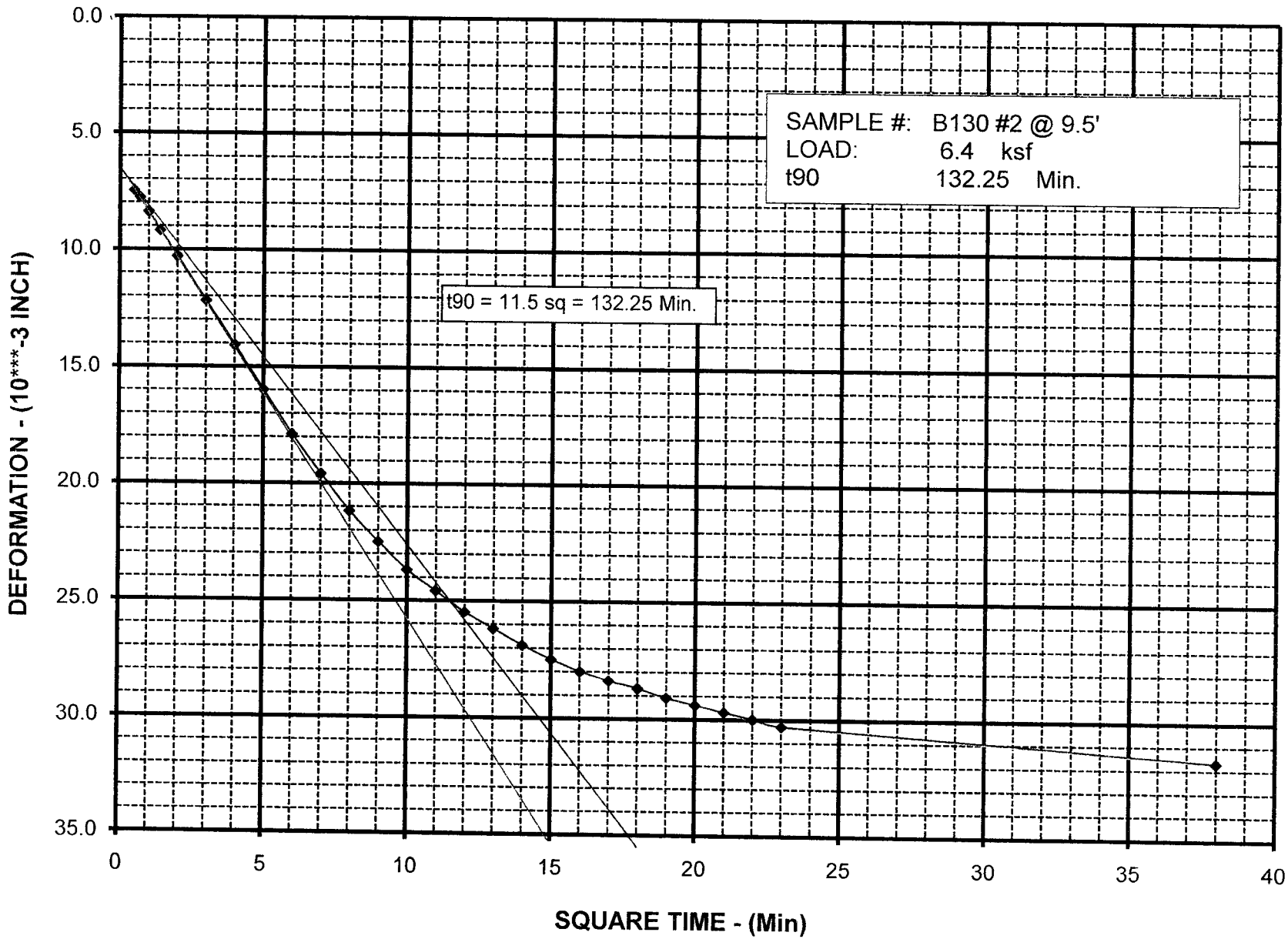
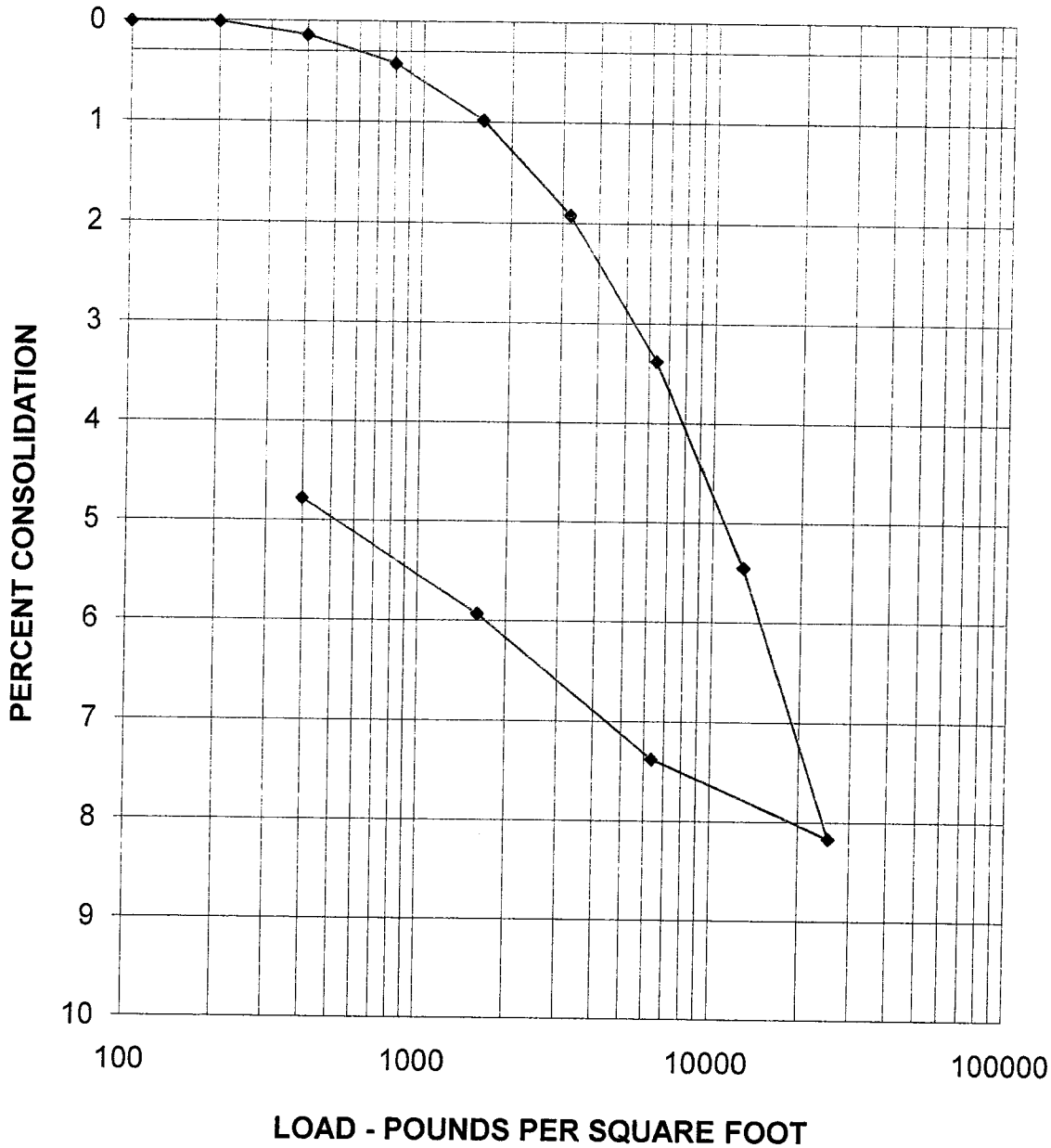


PLATE NO.: B-5AA

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	19.4	110.0	1.0000	2.416
FINAL	18.0	115.5	0.9522	2.416

BORING NO.	B133	SAMPLE NO.	3	ELEV. OR DEPTH	10'
DESCRIPTION	Sandy Lean Clay, yellowish brown				

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Rte 80 - 680 - 12 Interchange Project
MARK THOMAS

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PLATE NO.: B-5AB

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

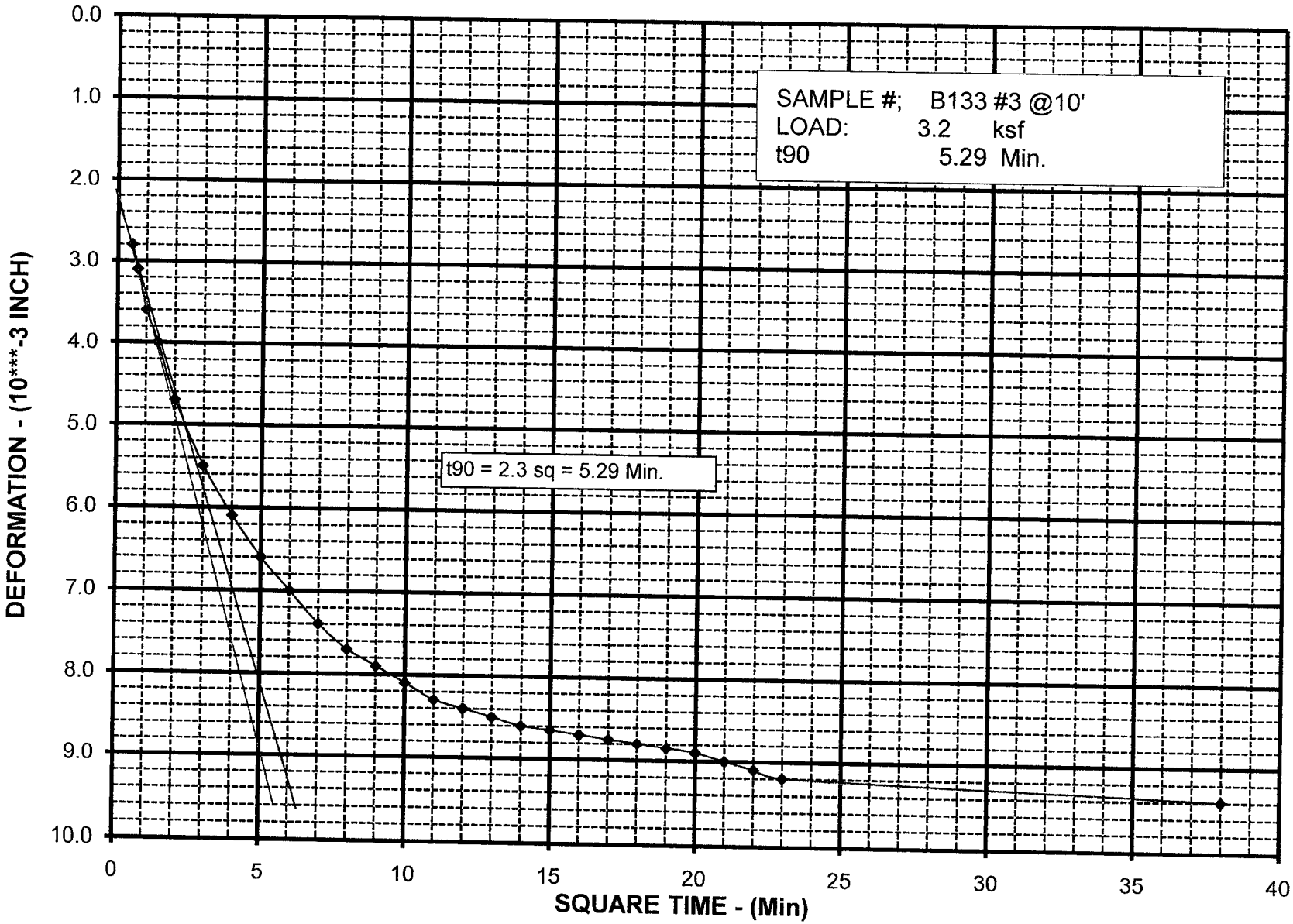


PLATE NO.: B-5AC

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

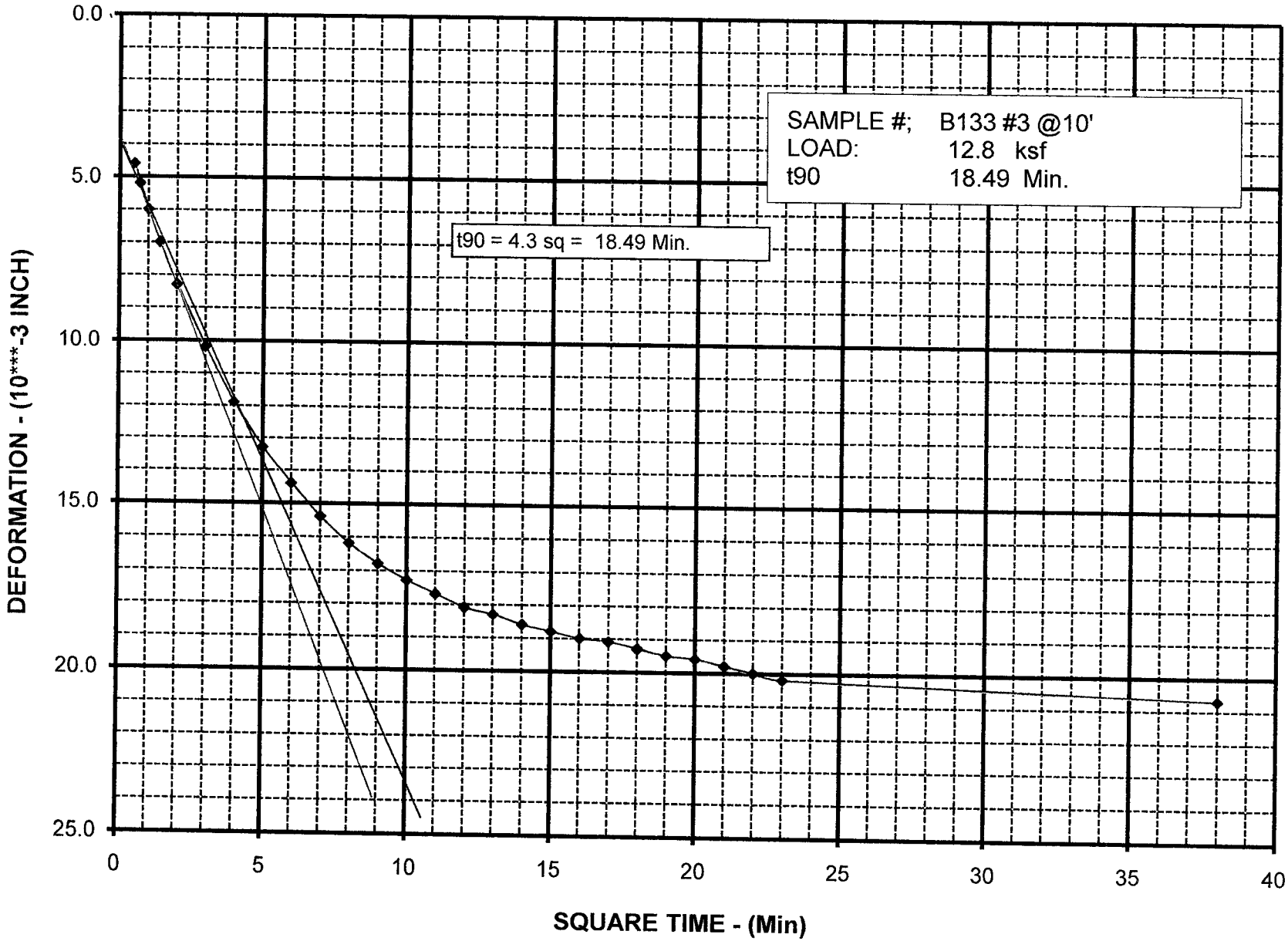
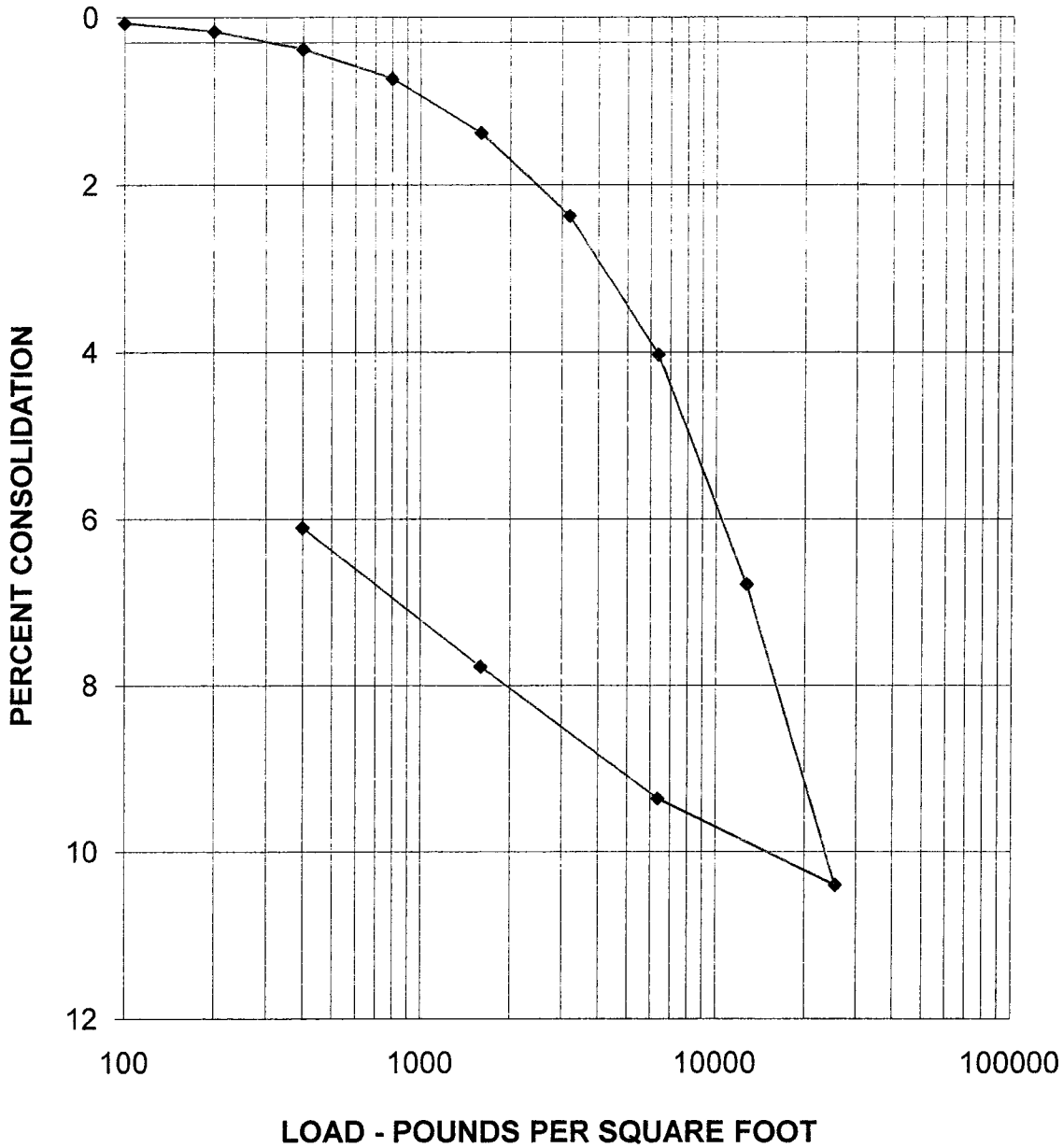


PLATE NO.: B-5AD

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	23.9	99.5	1.0000	2.416
FINAL	21.5	106.0	0.939	2.416

BORING NO.	A-09-136	SAMPLE NO.	5	ELEV. OR DEPTH	19.5'
DESCRIPTION	Lean Clay with some Sand, yellowish brown				

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Rte 80 - 680 - 12 Interchange Project
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Reported by: Prav Dayah

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

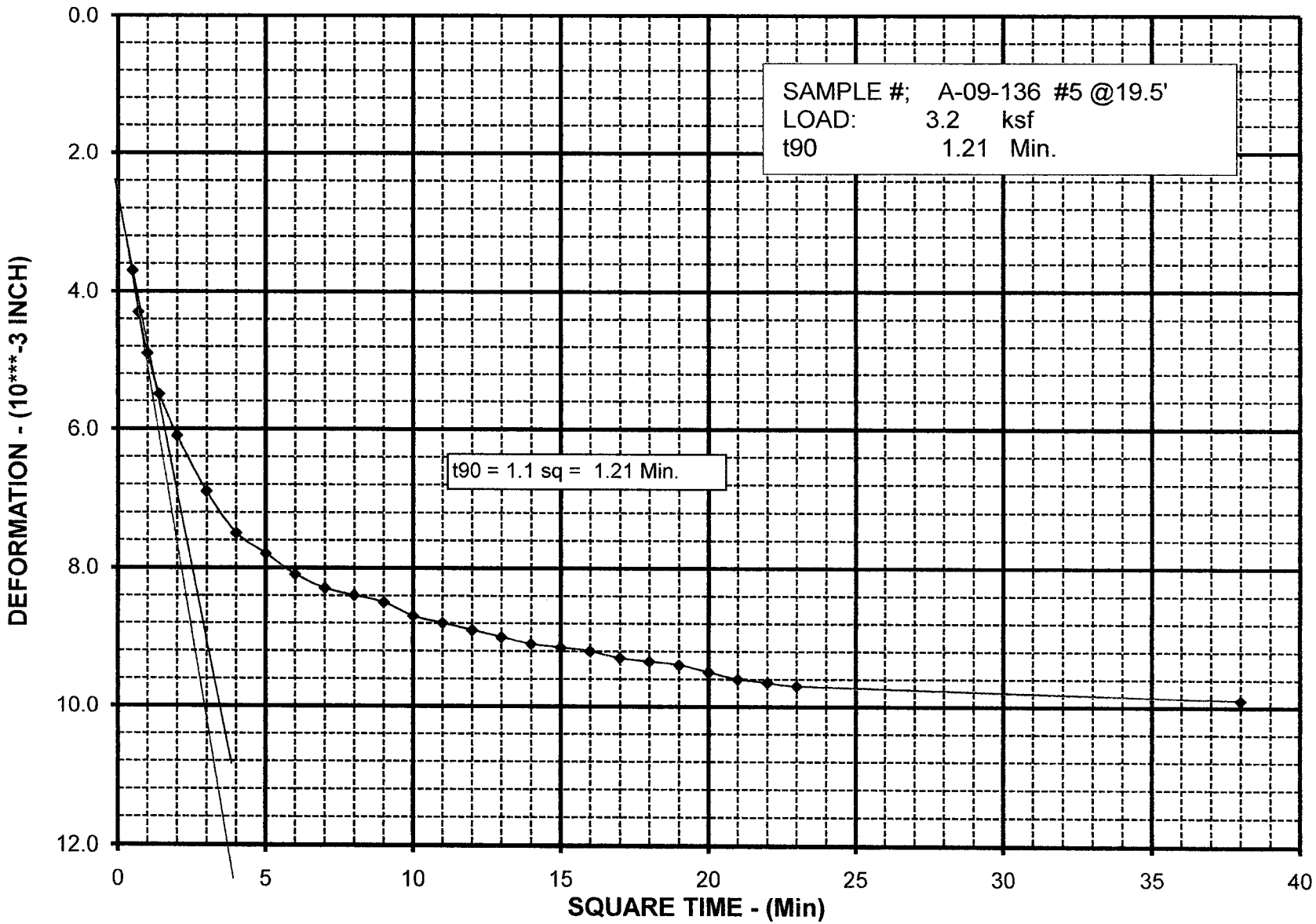


PLATE NO.: B-5AF

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

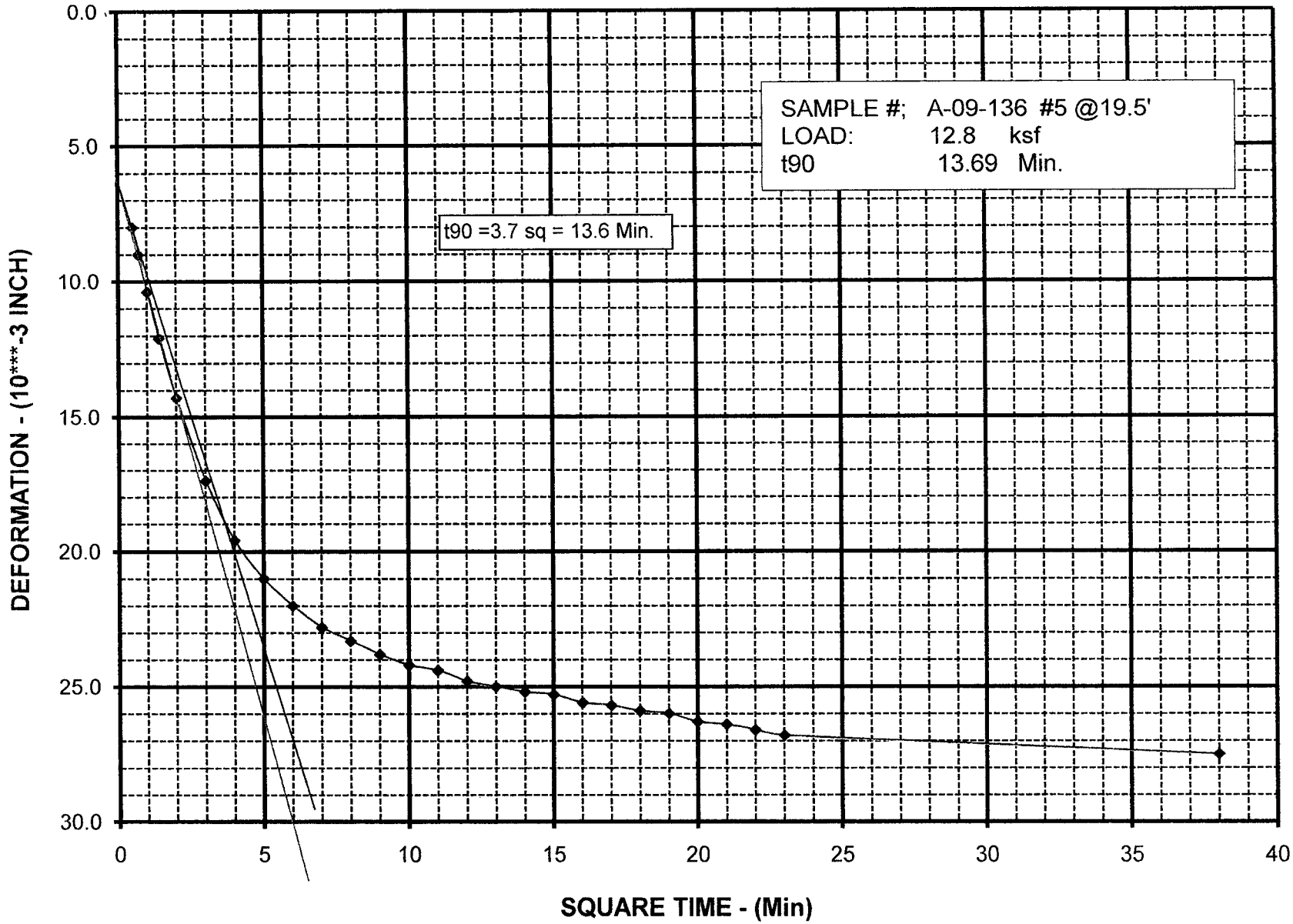
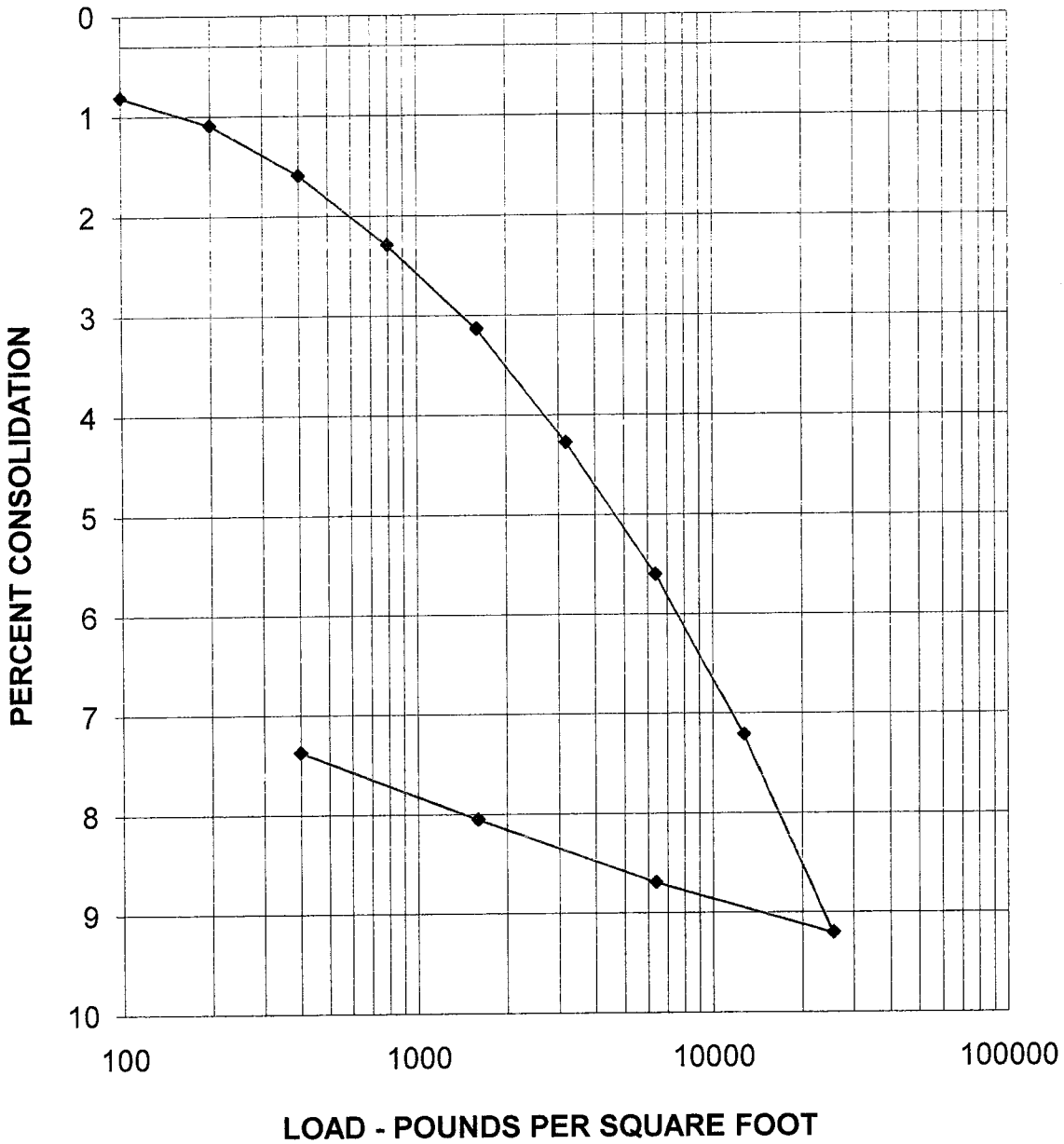


PLATE NO.: B-5AG

CONSOLIDATION TEST RESULTS



	MOISTURE CONTENT %	DRY DENSITY PCF	HEIGHT (INCHES)	DIAMETER (INCHES)
INITIAL	25.1	100.6	1.0000	2.416
FINAL	21.1	108.6	0.9263	2.416

BORING NO.	140	SAMPLE NO.	5	ELEV. OR DEPTH	24.5'
DESCRIPTION	Clayey sand, yellowish brown				

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Rte 80 - 680 - 12 Interchange Project
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Reported by: Prav Dayah

PLATE NO.: B-5AH

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

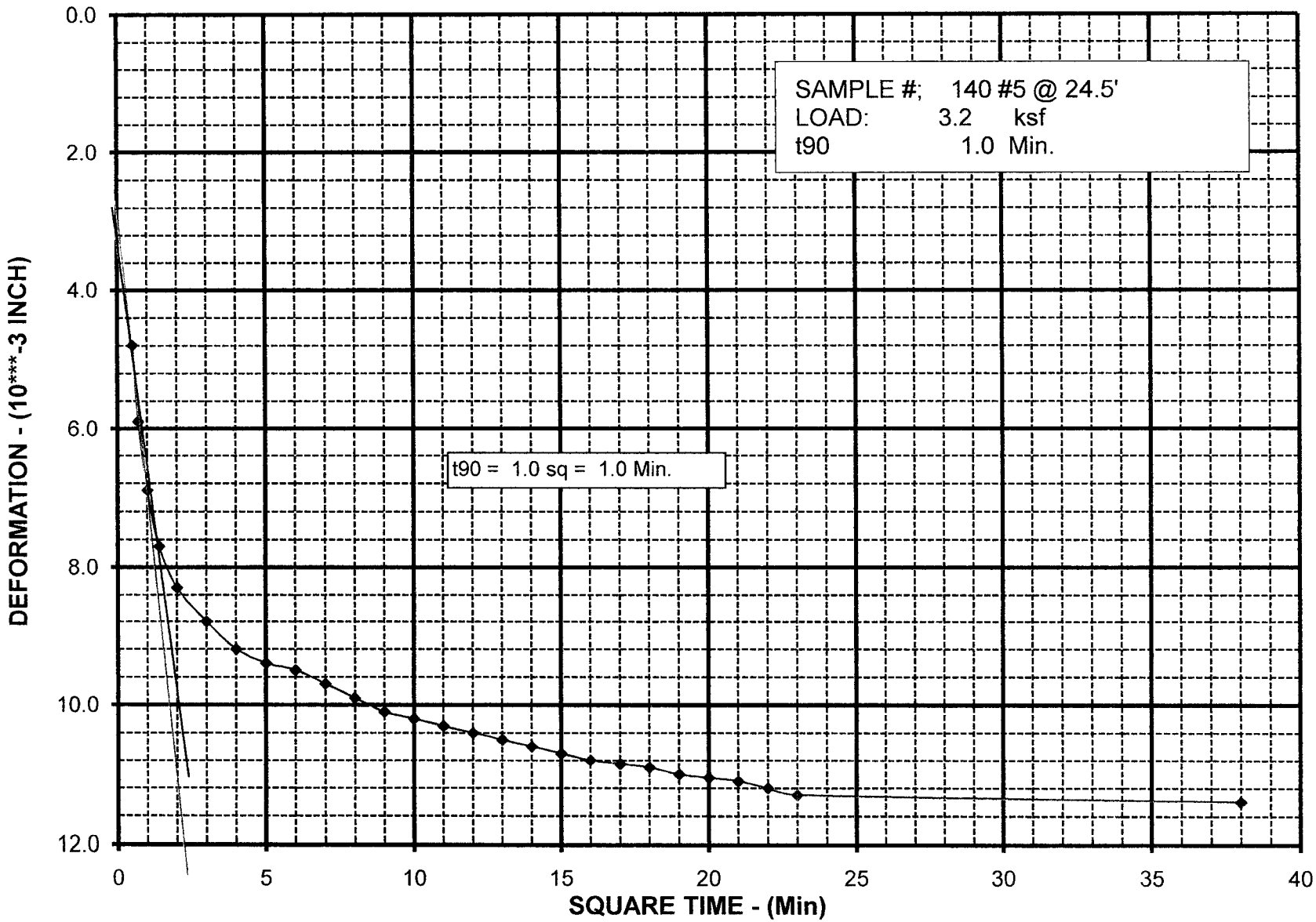


PLATE NO.: B-5AI

CONSOLIDATION TEST - TIME CURVE

JOB #: 209130.GDR

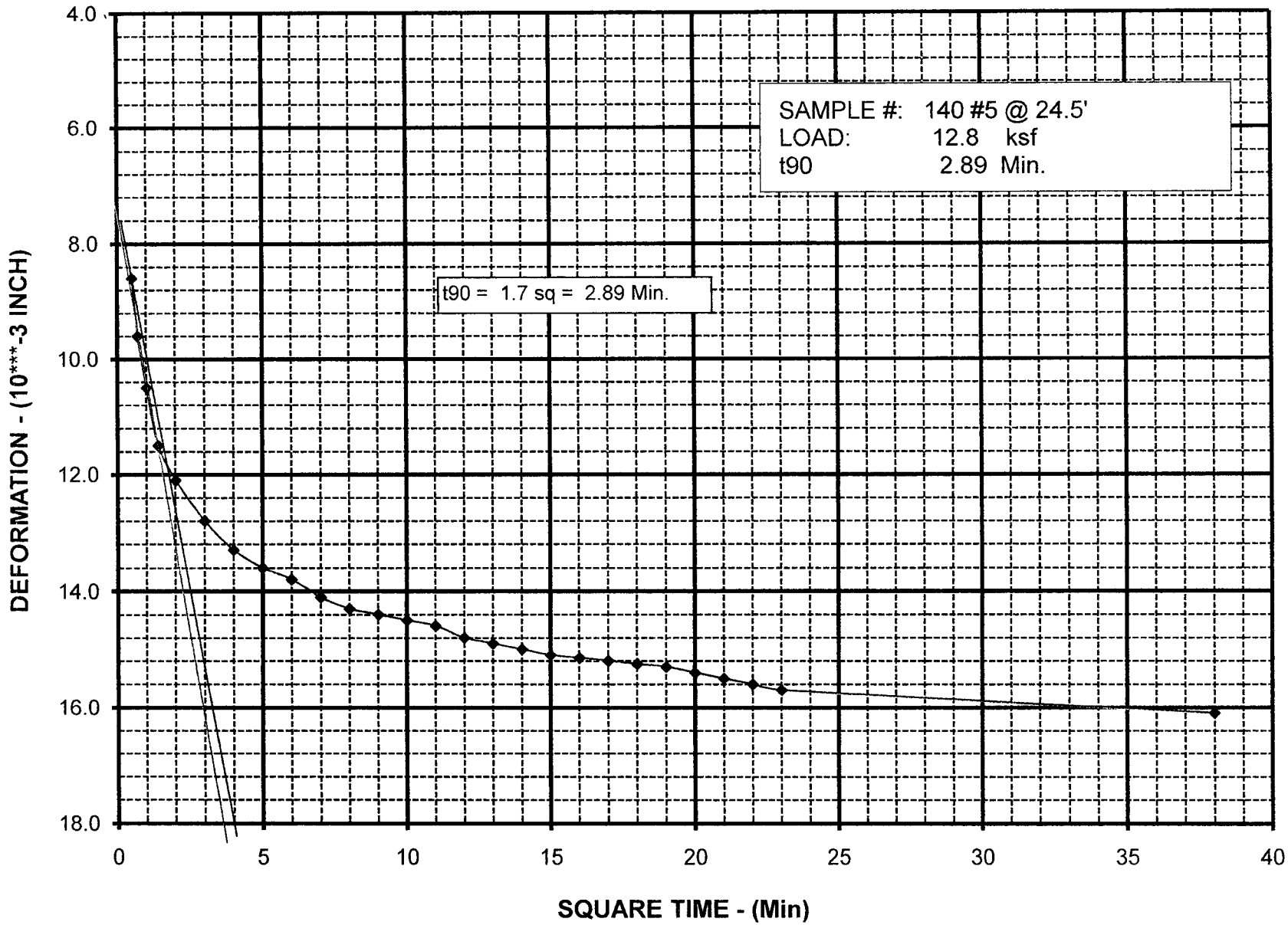
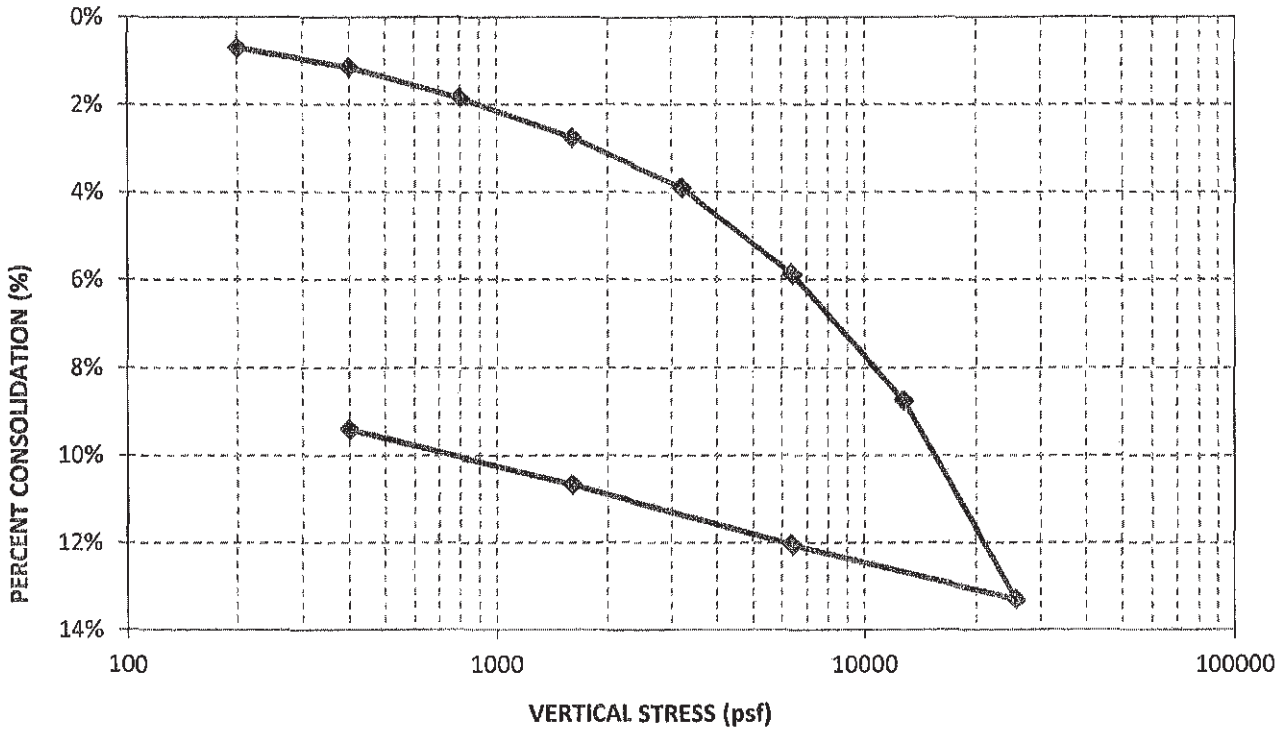
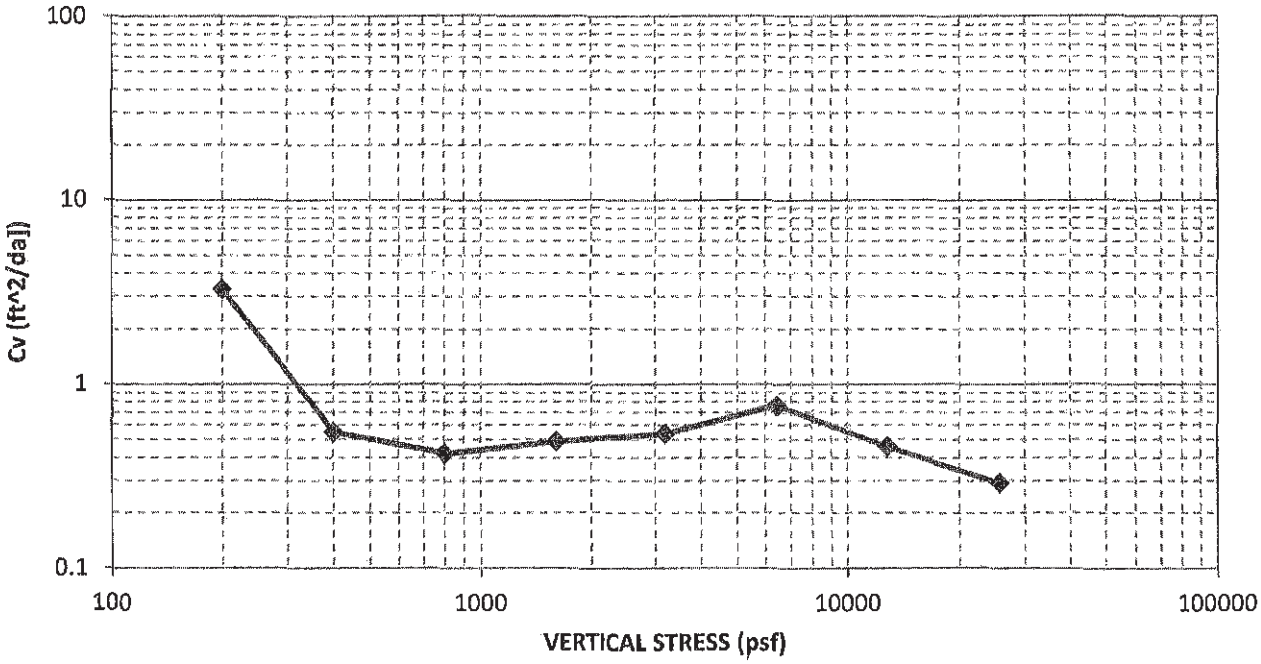


PLATE NO.: B-5AJ

CONSOLIDATION TEST RESULT





	Moisture Content (%)	Bulk Density (psf)	Dry Density (psf)
Initial	37.6	118.47	86.09
Final	32.1	125.56	95.02

Boring No.	R-12-151
Sample No.	7
Depth (ft)	30.0'
Soil Description:	SILT (ML), gray

PARIKH

Practicing in the Geosciences

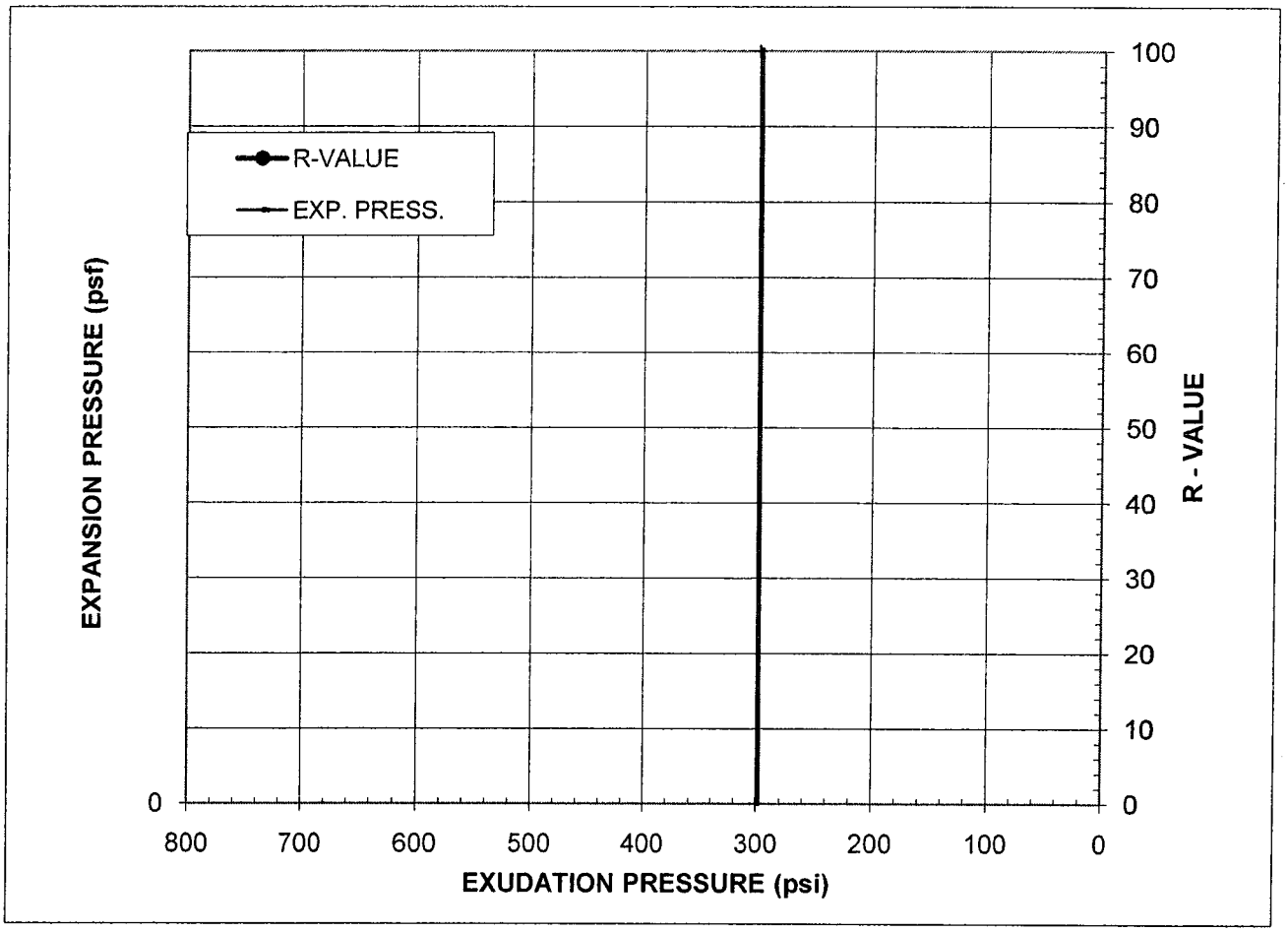
I-80/680/12 ICP PROJECT, SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR | **PLATE NO.:** B-5AK

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Rte 80 - 680 - 12 Interchange Project	Date:	1/4/2010
Client:	Mark Thomas & Co.	Project #:	209130.GDR
Sample #: B110	Depth: 0' - 5'	Lab #:	M770
Location / Source:	Onsite / Native	Sample Date:	
Material :	Fat clay, black	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi			
Expansion Pressure, psf			
R-Value			
Moisture Content at Test, %			
Dry Density at Test, pcf			

R-Value @ 300 psi Exudation Pressure = **< 5**	Expansion Pressure @300 psi Exudation, psf =
Minimum R-Value Requirement:	

Comments:

Test sample extruded from under the mold and around the follower ram during Exudation Test.
Test terminated - R-Valve = < 5

Report By: Prav Dayah

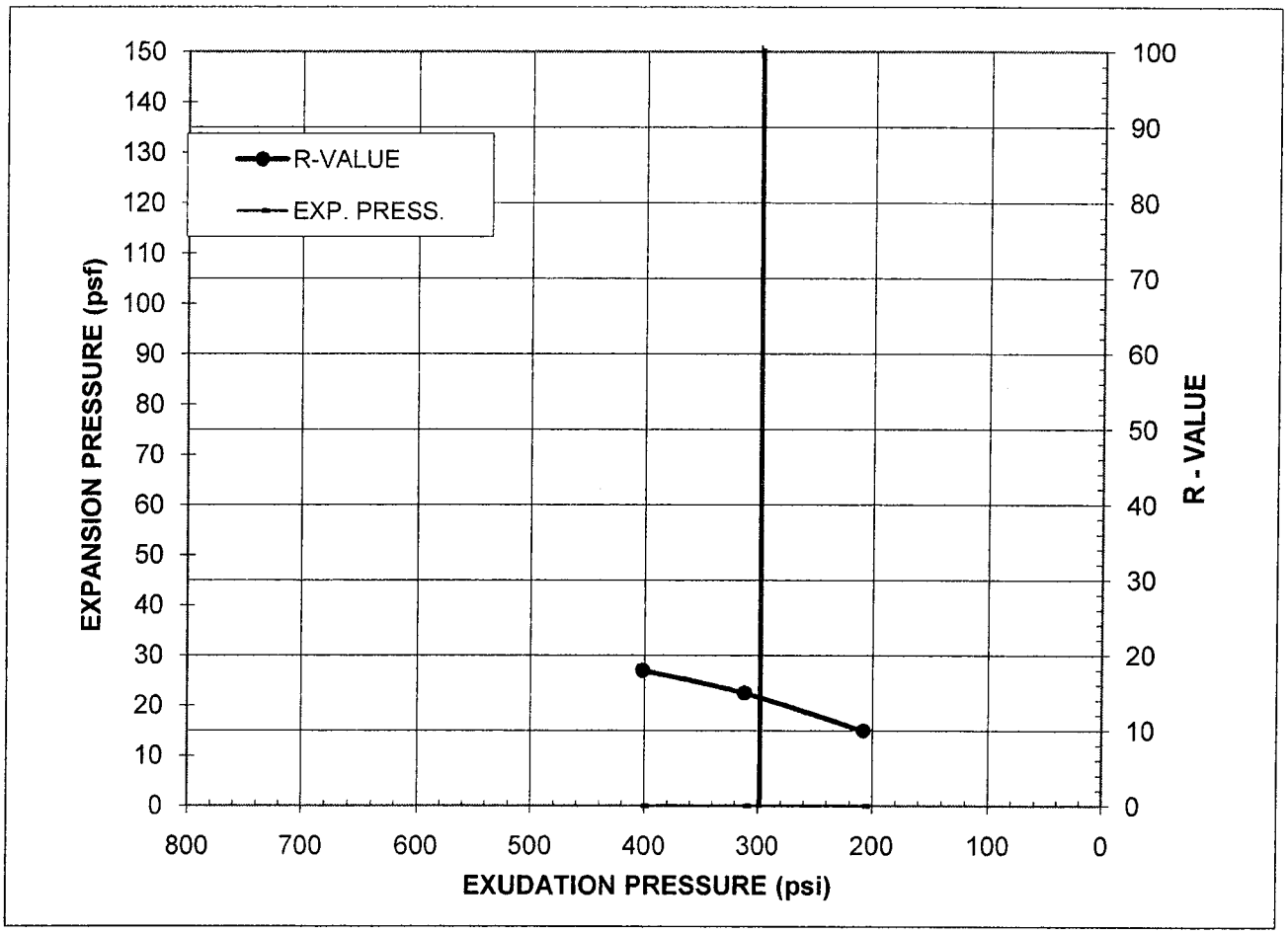
RVALUE with calcs pdp

PLATE NO.: B-6A

R-VALUE REPORT

Parikh Consultants, Inc. | ASTM D2844 or CTM 301 | (408) 452-9000

Project Name:	Rte 80 - 680 - 80 Interchange Project	Date:	1/4/2010
Client:	Mark Thomas & Co.	Project #:	209130.GDR
Sample #: B112	Depth: 0' - 5'	Lab #:	M770
Location / Source:	Onsite / Native	Sample Date:	
Material :	Sandy Fat Clay with Gravel, dark brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	208	312	402
Expansion Pressure, psf	0	0	0
R-Value	10	15	18
Moisture Content at Test, %	20.5	19.5	18.5
Dry Density at Test, pcf	100.0	102.4	105.7

R-Value @ 300 psi Exudation Pressure = 15

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

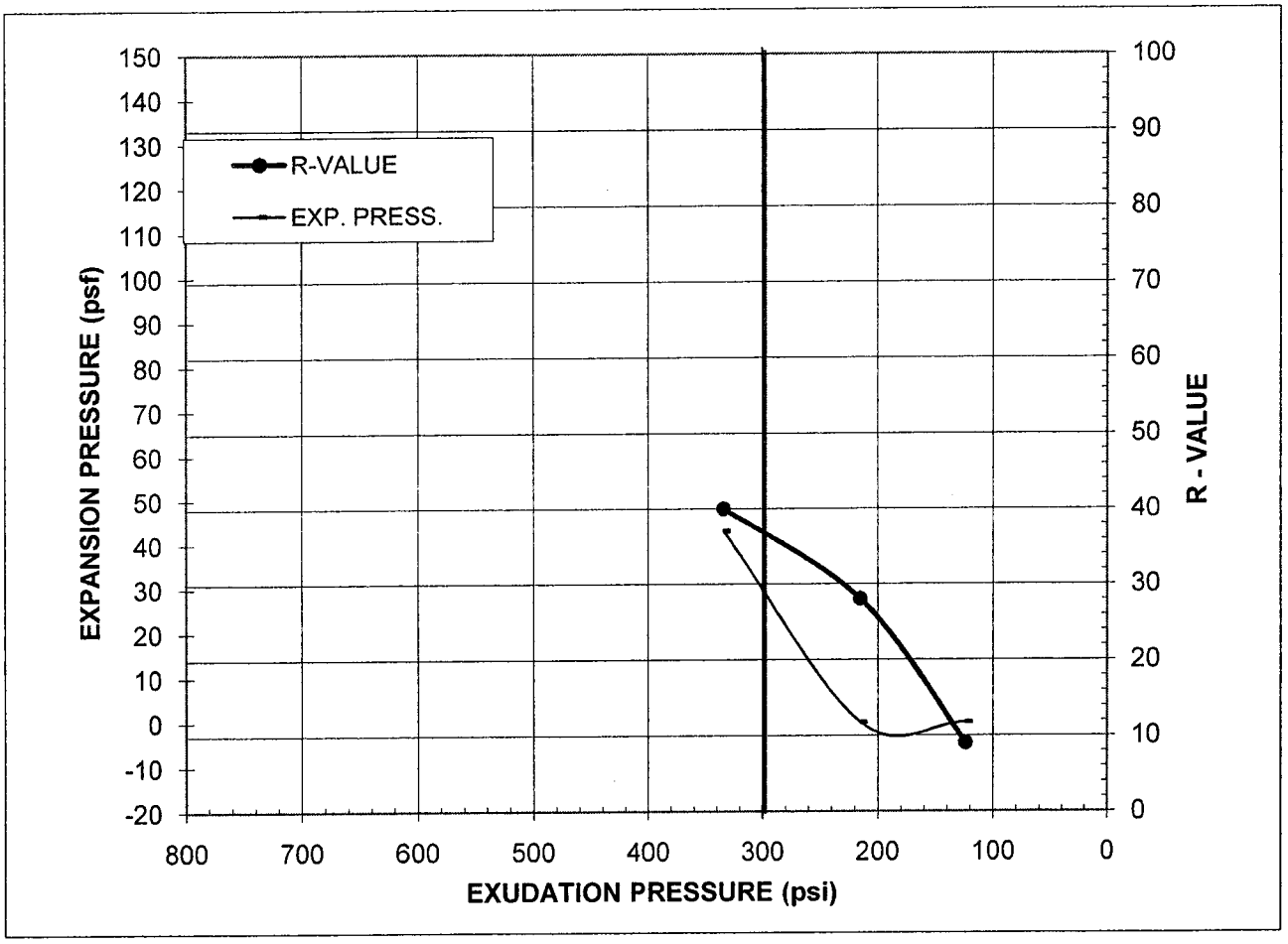
RVALUE with calcs pdp

PLATE NO.: B-6B

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 452-9000

Project Name:	Rte 80 - 680 - 80 Interchange Project	Date:	5/4/10
Client:	Mark Thomas & Co.	Project #:	209130.GDR
Sample #:	A-10-132 Depth: 0' - 3'	Lab #:	M770
Location / Source:	Onsite / Native	Sample Date:	
Material :	Clayey sand with some gravel,brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	124	215	334
Expansion Pressure, psf	0	0	43
R-Value	9	28	40
Moisture Content at Test, %	17.8	15.4	14.0
Dry Density at Test, pcf	109.3	113.2	112.8

R-Value @ 300 psi Exudation Pressure = 37

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

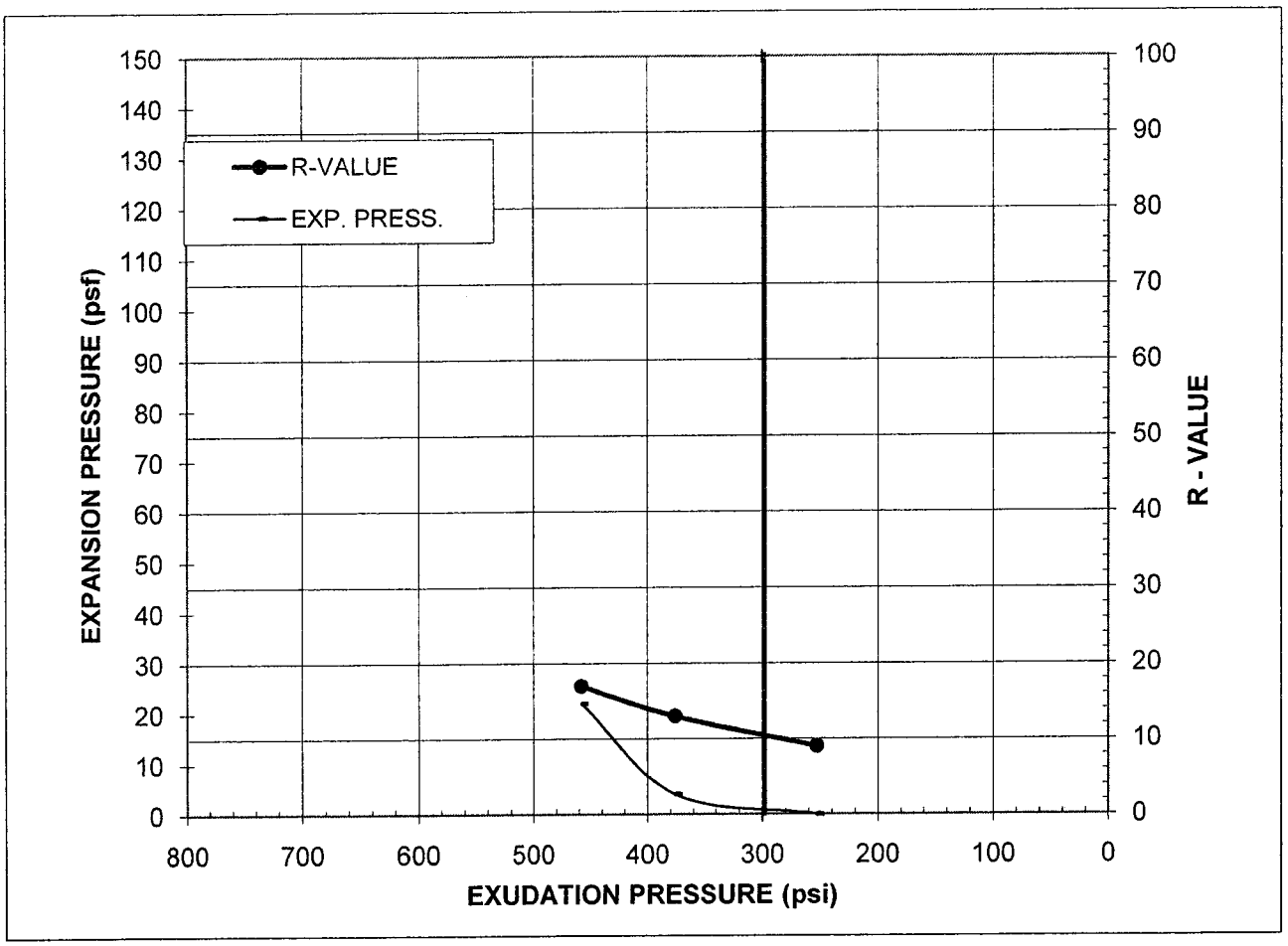
RVALUE with calcs pdp

PLATE NO.: B-6C

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 452-9000

Project Name:	Rte 80 - 680 - 80 Interchange Project	Date:	5/5/10
Client:	Mark Thomas & Co.	Project #:	209130.GDR
Sample #:	A-10-141 Depth: 0' - 2.5'	Lab #:	M770
Location / Source:	Onsite / Native	Sample Date:	
Material :	Lean clay with some gravel, dark brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	253	376	458
Expansion Pressure, psf	0	4	22
R-Value	9	13	17
Moisture Content at Test, %	25.2	23.1	21.6
Dry Density at Test, pcf	95.9	99.7	102.4

R-Value @ 300 psi Exudation Pressure = **11**

Expansion Pressure @300 psi Exudation, psf = **1**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

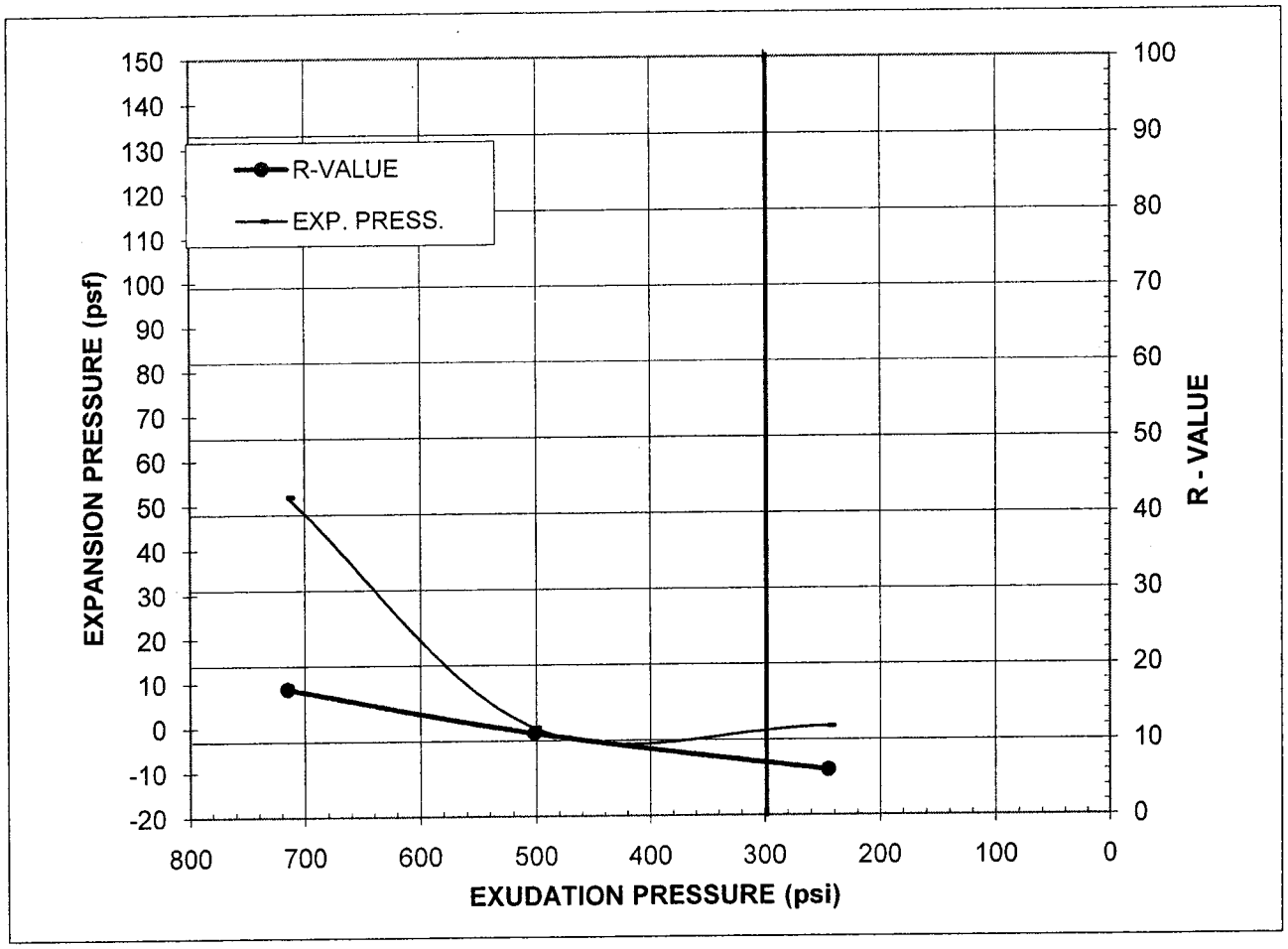
RVALUE with calcs pdp

PLATE NO.: B-6D

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 452-9000

Project Name:	Rte 80 - 680 - 80 Interchange Project	Date:	5/4/10
Client:	Mark Thomas & Co.	Project #:	209130.GDR
Sample #:	A-10-143 Depth: 0' - 3.5'	Lab #:	M770
Location / Source:	Onsite / Native	Sample Date:	
Material :	Lean clay, dark brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	245	502	715
Expansion Pressure, psf	0	0	52
R-Value	6	11	17
Moisture Content at Test, %	23.7	19.8	17.9
Dry Density at Test, pcf	97.5	102.0	106.4

R-Value @ 300 psi Exudation Pressure = 6

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

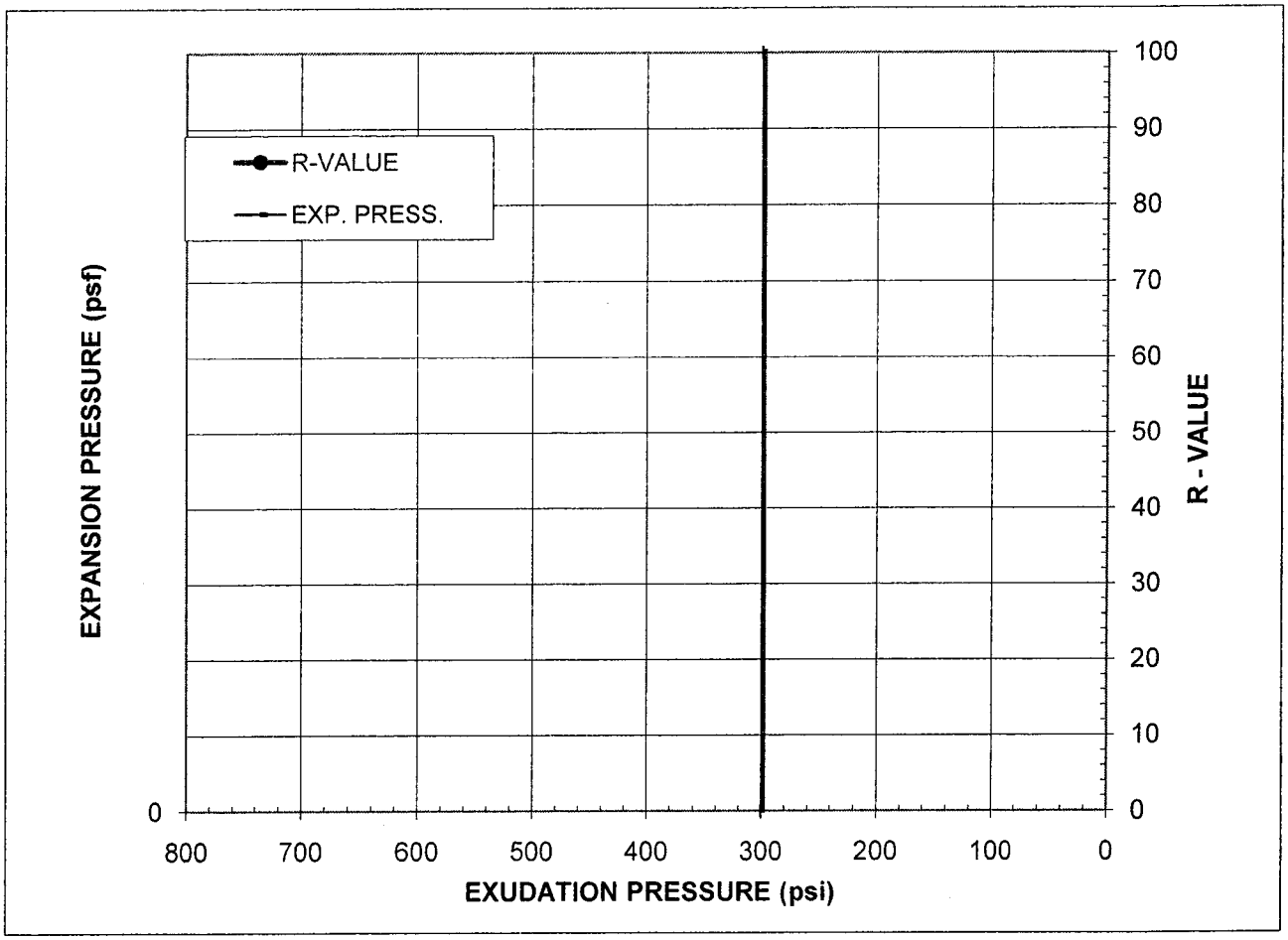
RVALUE with calcs pdp

PLATE NO.: B-6E

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 452-9000

Project Name:	Rte 80 - 680 - 12 Interchange Project	Date:	10/28/09
Client:	Mark Thomas & Co.	Project #:	209130.GDR
Sample #: R147	Depth: 0' - 5'	Lab #:	M768
Location / Source:	Onsite / Native	Sample Date:	
Material :	Fat clay, dark brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi			
Expansion Pressure, psf			
R-Value			
Moisture Content at Test, %			
Dry Density at Test, pcf			

R-Value @ 300 psi Exudation Pressure = **< 5**	Expansion Pressure @300 psi Exudation, psf =
Minimum R-Value Requirement:	

Comments:

Test sample extruded from under the mold and around the follower ram during Exudation Test.
Test terminated - R-Valve = < 5

Report By: Prav Dayah

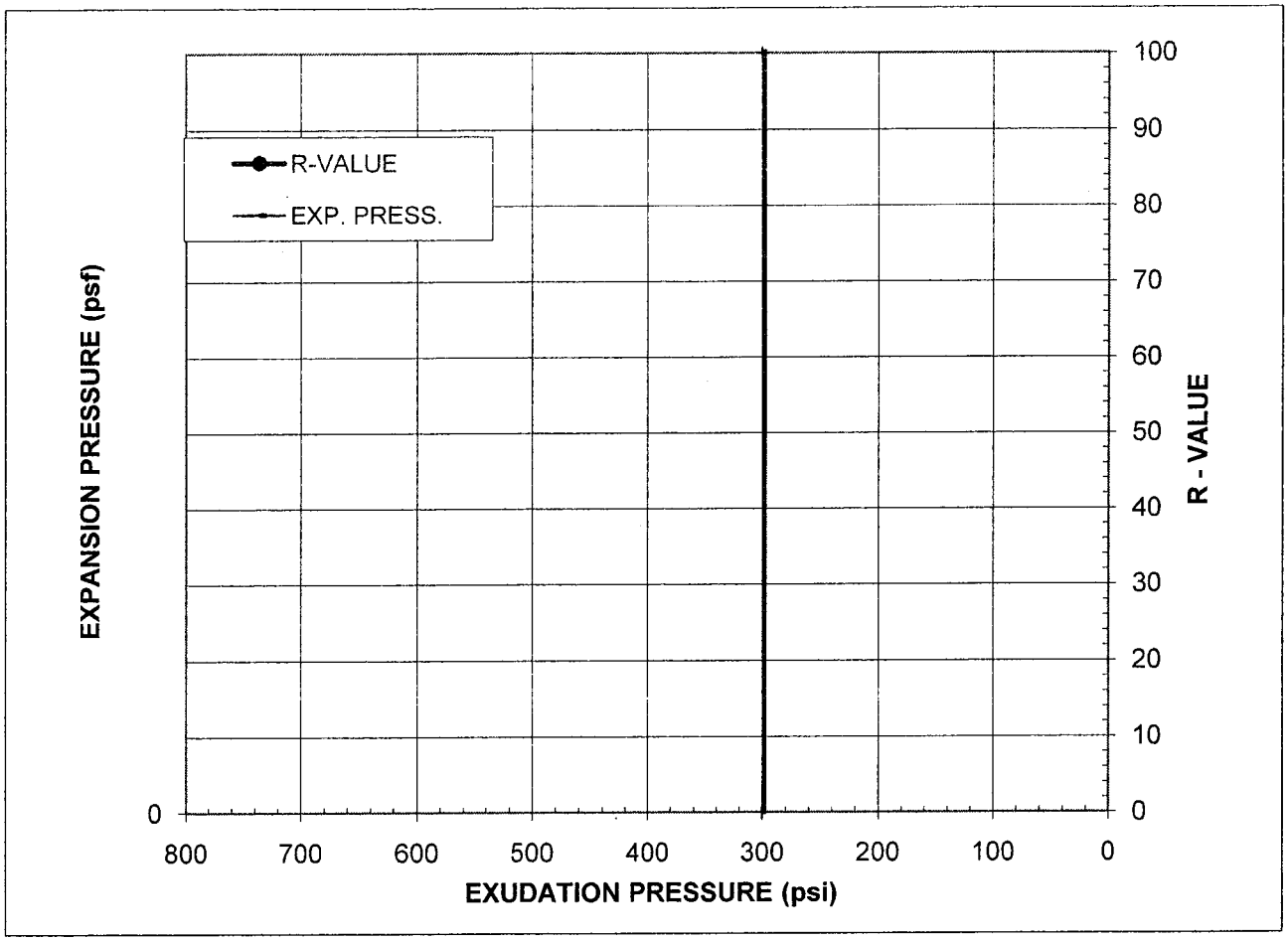
RVALUE with calcs pdp

PLATE NO.: B-6F

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 452-9000

Project Name:	Rte 80 - 680 - 12 Interchange Project	Date:	10/28/09
Client:	Mark Thomas & Co.	Project #:	209130.GDR
Sample #: R148	Depth: 0' - 5'	Lab #:	M768
Location / Source:	Onsite / Native	Sample Date:	
Material :	Fat clay, dark brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi			
Expansion Pressure, psf			
R-Value			
Moisture Content at Test, %			
Dry Density at Test, pcf			

R-Value @ 300 psi Exudation Pressure = **< 5**

Expansion Pressure @300 psi Exudation, psf =

Minimum R-Value Requirement:

Comments:

Test sample extruded from under the mold and around the follower ram during Exudation Test.
Test terminated - R-Valve = < 5

Report By: Prav Dayah

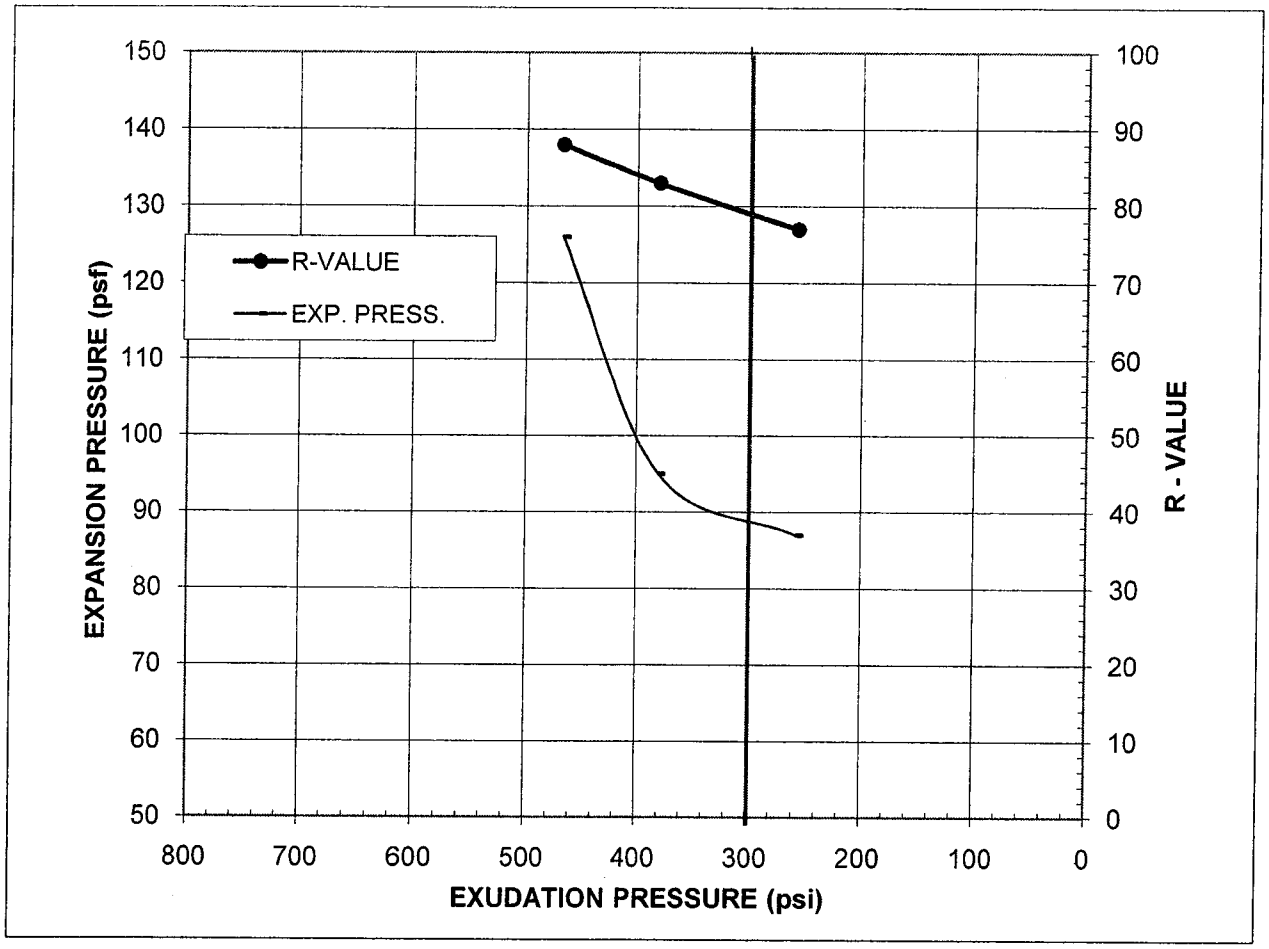
RVALUE with calcs pdp

PLATE NO.: B-6G

LIME TREATED R-VALUE REPORT

Parikh Consultants, Inc. ASTM D2844 or CTM 301 (408) 452-9000

Project Name:	Rte 80 - 680 - 12 Interchange Project	Date:	11/16/09
Client:	M T Co. / Nolte	Project #:	209130.GDR
Sample #:	148 Depth: 1' - 3'	Lab #:	M769
Location / Source:	Onsite / Native	Sample Date:	
Material :	Fat clay, black + 6% lime (SS)	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	257	380	467
Expansion Pressure, psf	87	95	126
R-Value	77	83	88
Moisture Content at Test, %	27.6	26.2	24.7
Dry Density at Test, pcf	93.3	95.5	98.1

R-Value @ 300 psi Exudation Pressure = 79

Expansion Pressure @300 psi Exudation, psf = **88**

The minimum percent of lime to use in the trial batch was 6%, this was established using pH values as described in the appendix of ASTM Designation : C 977

Report By: Prav Dayah

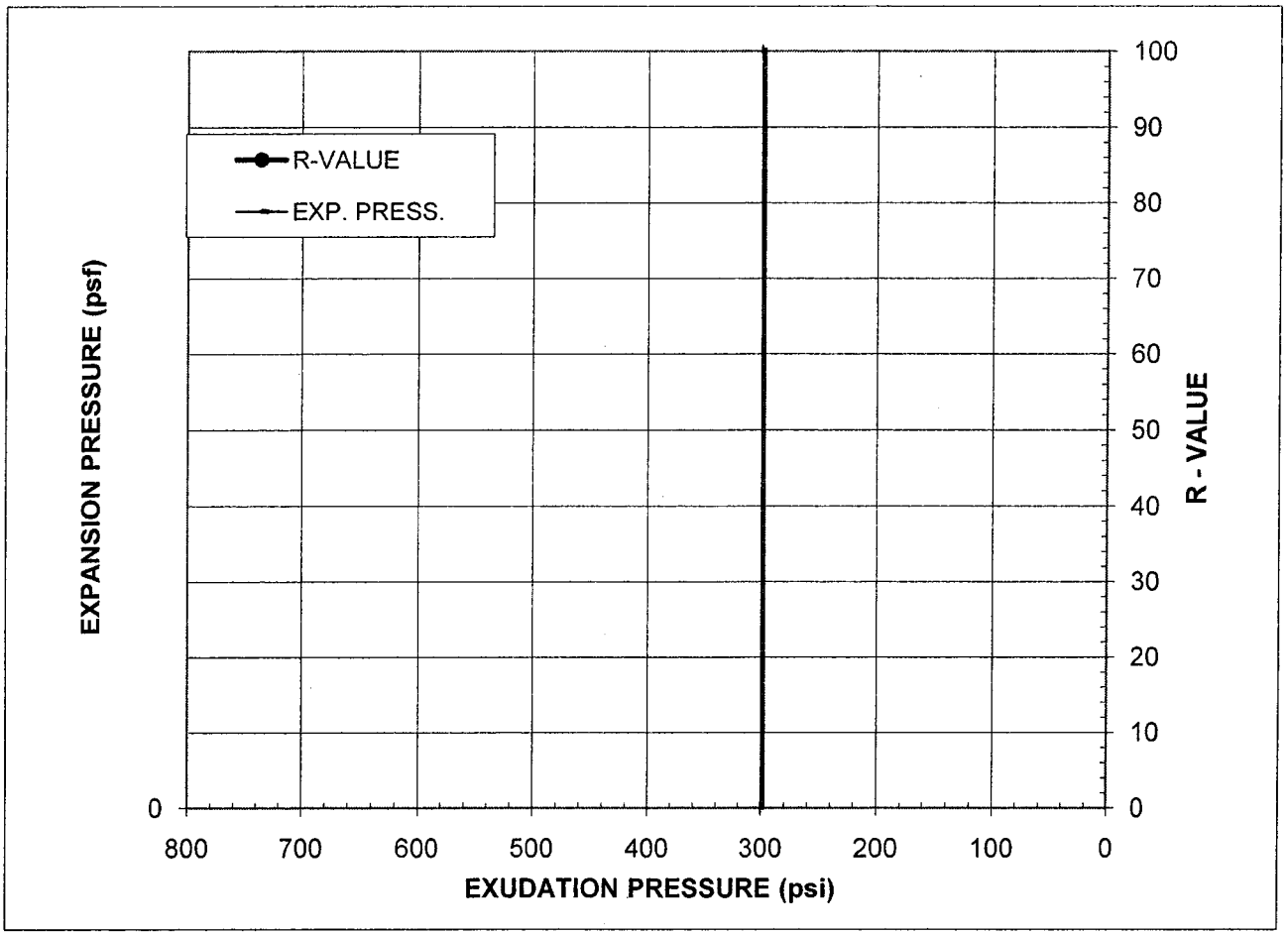
RVALUE with calcs pdp

PLATE NO.: B-6H

R-VALUE REPORT

Parikh Consultants, Inc. ASTM D2844 or CTM 301 (408) 452-9000

Project Name:	Rte 80 - 680 - 12 Interchange Project	Date:	10/28/09
Client:	Mark Thomas & Co.	Project #:	209130.GDR
Sample #: R149	Depth: 0' - 5'	Lab #:	M768
Location / Source:	Onsite / Native	Sample Date:	
Material :	Fat clay, dark brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi			
Expansion Pressure, psf			
R-Value			
Moisture Content at Test, %			
Dry Density at Test, pcf			

R-Value @ 300 psi Exudation Pressure = < 5	Expansion Pressure @300 psi Exudation, psf =
Minimum R-Value Requirement:	

Comments:

Test sample extruded from under the mold and around the follower ram during Exudation Test.
Test terminated - R-Valve = < 5

Report By: Prav Dayah

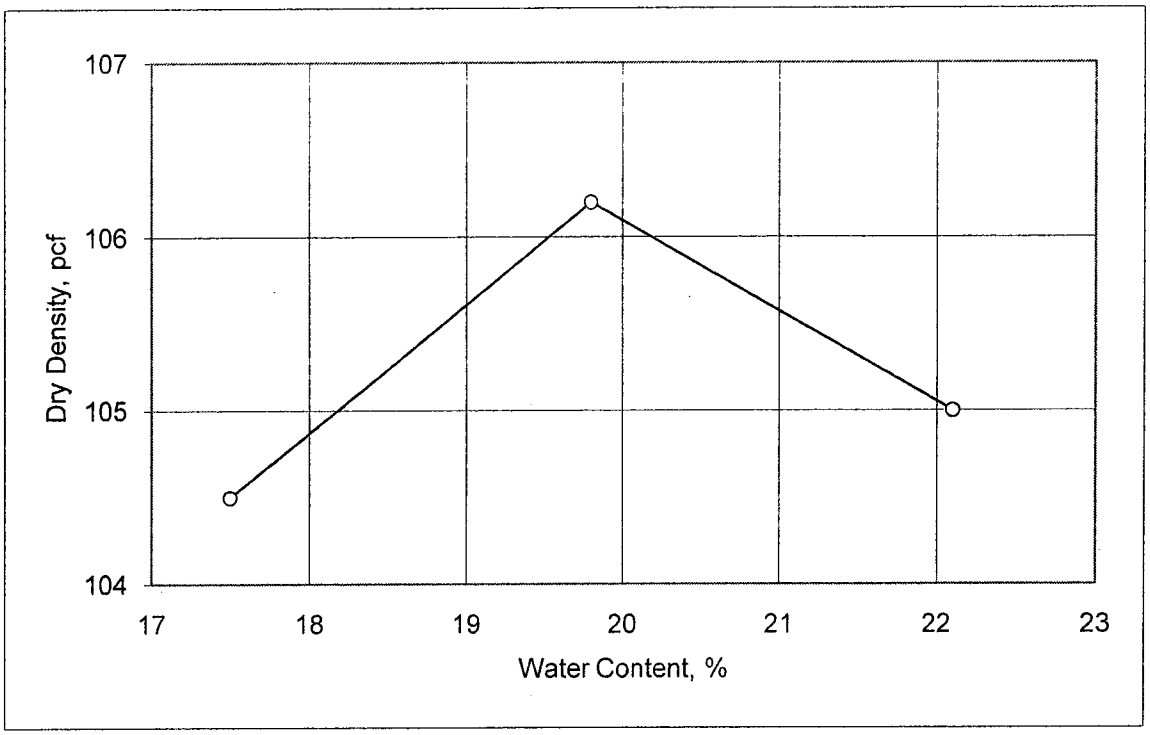
RVALUE with calcs pdp

PLATE NO.: B-61

UNCONFINED COMPRESSIVE STRENGTH REPORT

Parikh Consultants, Inc. **California Test 373** (408) 452-9000

Project Name:	Rte 80 - 680 - 80 Interchange Project	Date:	01/04/2010
Client:	Mark Thomas	Project #:	209130.GDR
Sample #:	B110 Depth: 0' - 5'	Lab #:	M770
Location / Source:	Onsite / Native	Sample Date:	
Material :	Fat clay, black + 6% lime (SS)	Sampled By:	



Moisture - Density Relationship

Trial #	1	2	3	4
Water Content,%		17.5	19.8	22.1
Dry Density, pcf		104.5	106.2	105
MAX. DRY DENSITY, pcf:	**106.2**	**OPTIMUM MOISTUR**		**19.8**

UNCONFINED COMPRESSION TEST RESULTS

Specimen Number	Cast Date	Test Date	Age Days	Total Load lbs.	Compressive Strength, psi
1	12/23/2009	12/30/2009	7	4,689	373
2	12/23/2009	12/30/2009	7	4,555	362
AVERAGE				**4,622**	**368**

Comments:

The minimum percent of lime to use in the trial batch was 6%, this was established using pH values as described in the appendix of ASTM Designation : C 977

Reported By: Prav D Dayah

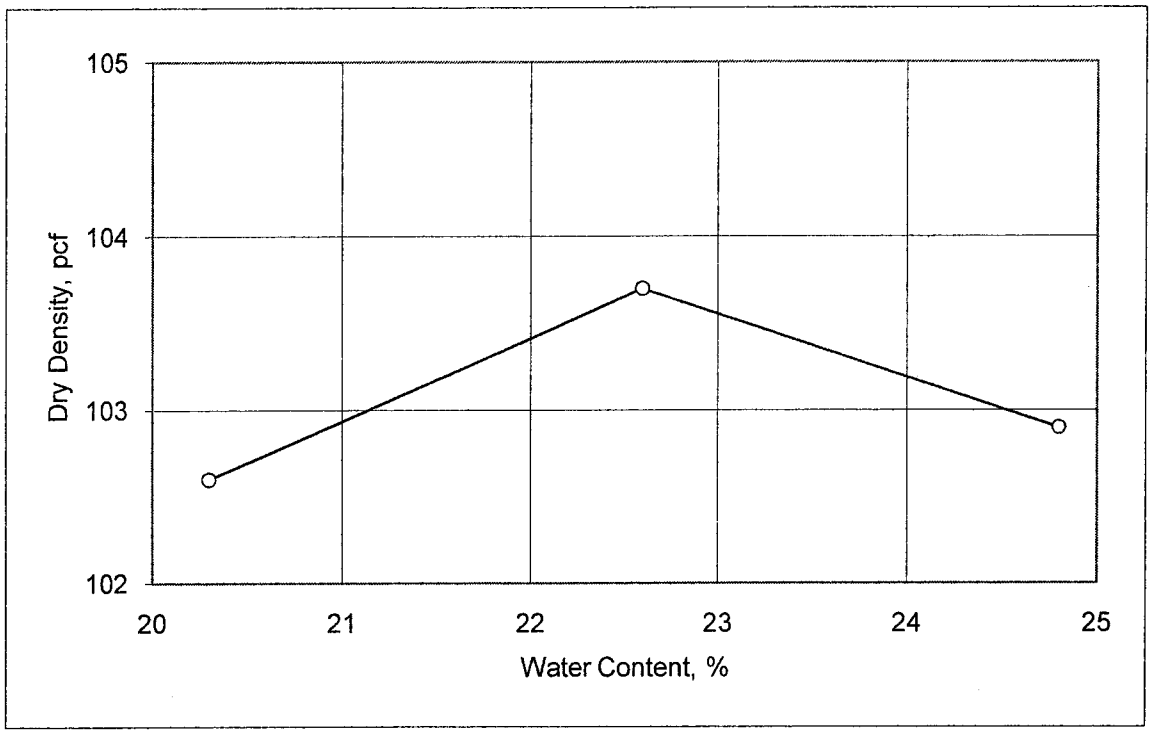
pdp 12/01/01

PLATE NO.: B-6J

UNCONFINED COMPRESSIVE STRENGTH REPORT

Parikh Consultants, Inc. **California Test 373** (408) 452-9000

Project Name:	Rte 80 - 680 - 80 Interchange Project	Date:	01/04/2010
Client:	Mark Thomas	Project #:	209130.GDR
Sample #:	B119 Depth: 0' - 5'	Lab #:	M770
Location / Source:	Onsite / Native	Sample Date:	
Material :	Fat clay, brown + 6% lime (SS)	Sampled By:	



Moisture - Density Relationship

Trial #	1	2	3	4
Water Content,%		20.3	22.6	24.8
Dry Density, pcf		102.6	103.7	102.9

MAX. DRY DENSITY, pcf:	**103.7**	**OPTIMUM MOISTUR**	**22.6**

UNCONFINED COMPRESSION TEST RESULTS

Specimen Number	Cast Date	Test Date	Age Days	Total Load lbs.	Compressive Strength, psi
1	12/23/2009	12/30/2009	7	4,739	377
2	12/23/2009	12/30/2009	7	4,100	326
AVERAGE				**4,420**	**352**

Comments:

The minimum percent of lime to use in the trial batch was 6%, this was established using pH values as described in the appendix of ASTM Designation : C 977

Reported By: Prav D Dayah

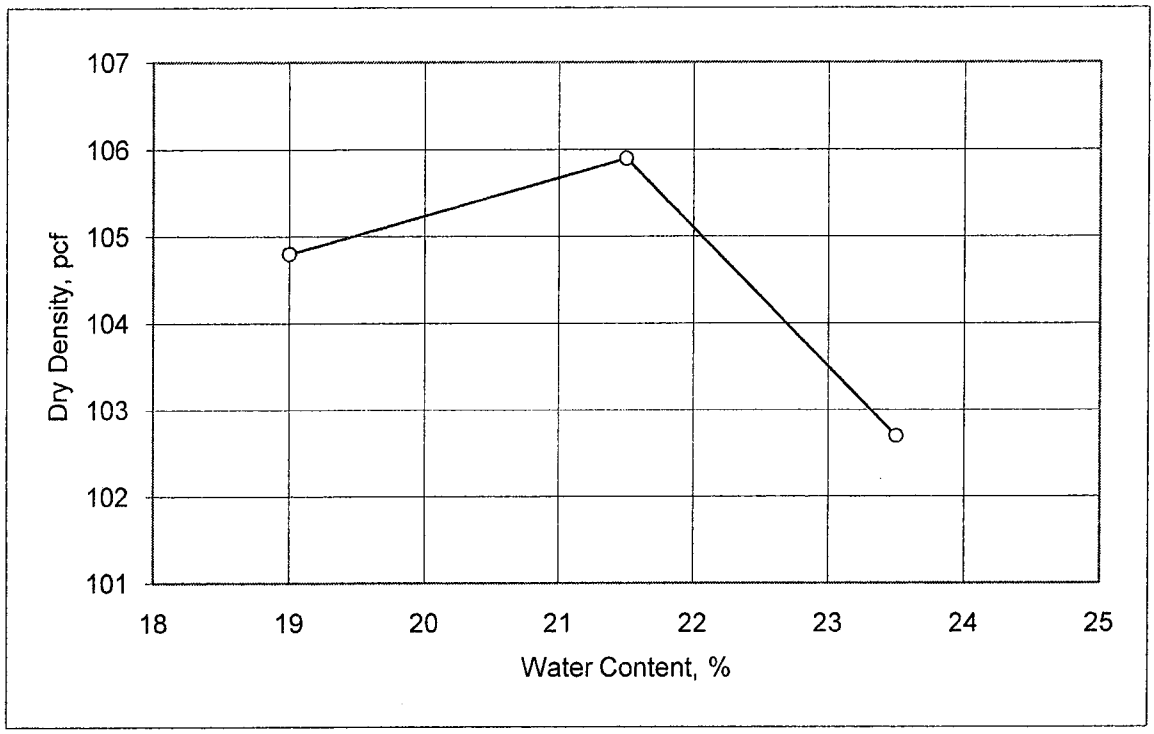
pdp 12/01/01

PLATE NO.: B-6K

UNCONFINED COMPRESSIVE STRENGTH REPORT

Parikh Consultants, Inc. **California Test 373** (408) 452-9000

Project Name:	Rte 80 - 680 - 80 Interchange Project	Date:	2/28/09
Client:	M T Co, / Nolte	Project #:	209130.GDR
Sample #:	150 Depth: 1'-3'	Lab #:	M769
Location / Source:	Onsite / Native	Sample Date:	
Material :	Fat clay, brown + 6% lime (SS)	Sampled By:	



Moisture - Density Relationship

Trial #	1	2	3	4
Water Content,%		19	21.5	23.5
Dry Density, pcf		104.8	105.9	102.7

MAX. DRY DENSITY, pcf:	**105.9**	**OPTIMUM MOISTUR**	**21.5**

UNCONFINED COMPRESSION TEST RESULTS

Specimen Number	Cast Date	Test Date	Age Days	Total Load lbs.	Compressive Strength, psi
1	11/12/2009	11/19/2009	7	3,891	310
2	11/12/2009	11/19/2009	7	4,065	323
AVERAGE				**3,978**	**316**

Comments:

The minimum percent of lime to use in the trial batch was 5%, this was established using pH values as described in the appendix of ASTM Designation : C 977

Reported By: Prav D Dayah

pdp 12/01/01

PLATE NO.: B-6L

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 06/11/2010
Date Submitted 06/07/2010

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR/80-680-12 Site ID : R-10-003A #2 @ 10'.
Thank you for your business.

* For future reference to this analysis please use SUN # 58040-117809.

EVALUATION FOR SOIL CORROSION

Soil pH	7.90	
Minimum Resistivity	1.55 ohm-cm (x1000)	
Chloride	98.8 ppm	00.00988 %
Sulfate	50.1 ppm	00.00501 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 05/26/2010
Date Submitted 05/21/2010

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR/80-680-12 Site ID R-10-004A#2 @ 11'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57970-117674.

EVALUATION FOR SOIL CORROSION

Soil pH	8.37		
Minimum Resistivity	1.66 ohm-cm (x1000)		
Chloride	102.2 ppm	00.01022	%
Sulfate	64.1 ppm	00.00641	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID :A-09-005 #1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115376.

EVALUATION FOR SOIL CORROSION

Soil pH	8.67		
Minimum Resistivity	0.19 ohm-cm (x1000)		
Chloride	2114.8 ppm	00.21148	%
Sulfate	142.3 ppm	00.01423	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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By

PLATE NO.: B-7C

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID A-09-006 #1 @ 6.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115374.

EVALUATION FOR SOIL CORROSION

Soil pH	6.76		
Minimum Resistivity	0.56 ohm-cm (x1000)		
Chloride	377.6 ppm	00.03776	%
Sulfate	188.9 ppm	00.01889	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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BY

PLATE NO.: B-7D

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID A-09-009 #1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115375.

EVALUATION FOR SOIL CORROSION

Soil pH	7.72		
Minimum Resistivity	0.56 ohm-cm (x1000)		
Chloride	176.1 ppm	00.01761	%
Sulfate	60.8 ppm	00.00608	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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PLATE NO.: B-7E

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/08/2010
Date Submitted 01/05/2010

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR/80-680-12 Site ID A-09-119 #1 @ 2'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57241-116035.

EVALUATION FOR SOIL CORROSION

Soil pH	6.49		
Minimum Resistivity	0.94 ohm-cm (x1000)		
Chloride	87.4 ppm	00.00874	%
Sulfate	27.8 ppm	00.00278	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID A-09-123 #1 @ 2.0'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115377.

EVALUATION FOR SOIL CORROSION

Soil pH	7.22		
Minimum Resistivity	0.80 ohm-cm (x1000)		
Chloride	24.2 ppm	00.00242	%
Sulfate	0.3 ppm	00.00003	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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PLATE NO.: B-7G

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 11/13/2009
Date Submitted 11/10/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR-RTE80-680 Site ID A-09-125#1 @ 4.5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57015-115378.

EVALUATION FOR SOIL CORROSION

Soil pH	8.29	
Minimum Resistivity	0.26 ohm-cm (x1000)	
Chloride	718.5 ppm	00.07185 %
Sulfate	606.1 ppm	00.06061 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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BY

PLATE NO.: B-7H

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

RECEIVED
By

Date Reported 12/02/2009
Date Submitted 11/23/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GRD-RTE680 Site ID A-09-127 #1 @ 2'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57095-115607.

EVALUATION FOR SOIL CORROSION

Soil pH	5.64	
Minimum Resistivity	0.78 ohm-cm (x1000)	
Chloride	70.9 ppm	00.00709 %
Sulfate	80.2 ppm	00.00802 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/08/2010
Date Submitted 01/05/2010

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR/80-680-12 Site ID A-09-128 #1 @ 2'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57241-116034.

EVALUATION FOR SOIL CORROSION

Soil pH	7.93	
Minimum Resistivity	1.23 ohm-cm (x1000)	
Chloride	18.0 ppm	00.00180 %
Sulfate	87.8 ppm	00.00878 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
JAN 11 2010
By

PLATE NO.: B-7J

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 06/11/2010
Date Submitted 06/07/2010

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GDR/80-680-12 Site ID : R-10-133A # 1 @ 5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 58040-117810.

EVALUATION FOR SOIL CORROSION

Soil pH	7.79	
Minimum Resistivity	0.48 ohm-cm (x1000)	
Chloride	317.6 ppm	00.03176 %
Sulfate	165.4 ppm	00.01654 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/23/2009
Date Submitted 12/16/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : RTE 80 209130.GDR Site ID A-09-135 #2 @ 10'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57202-115939.

EVALUATION FOR SOIL CORROSION

Soil pH	7.55		
Minimum Resistivity	0.96 ohm-cm (x1000)		
Chloride	71.9 ppm	00.00719	%
Sulfate	168.9 ppm	00.01689	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

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By

PLATE NO.: B-7L

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/02/2009
Date Submitted 11/23/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 209130.GRD-RTE680 Site ID : A-09-137 #2 @ 4.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 57095-115608.

EVALUATION FOR SOIL CORROSION

Soil pH	7.52	
Minimum Resistivity	0.22 ohm-cm (x1000)	
Chloride	1167.3 ppm	00.11673 %
Sulfate	576.4 ppm	00.05764 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 12/23/2009
Date Submitted 12/16/2009

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : RTE 80 209130.GDR Site ID A-09-140 #1 @ 4/5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 57202-115938.

EVALUATION FOR SOIL CORROSION

Soil pH	7.38	
Minimum Resistivity	0.48 ohm-cm (x1000)	
Chloride	190.5 ppm	00.01905 %
Sulfate	390.5 ppm	00.03905 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

RECEIVED
By

PLATE NO.: B-7N

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 03/14/2012
Date Submitted 03/08/2012

To: Prav Dayah
Parikh Consultants, Inc.
2360 Qume Dr, Ste.A
San Jose, CA 95131

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 2009-130-GDR/I80-680 Site ID : R12-151#2 @ 5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 61830-127116.

EVALUATION FOR SOIL CORROSION

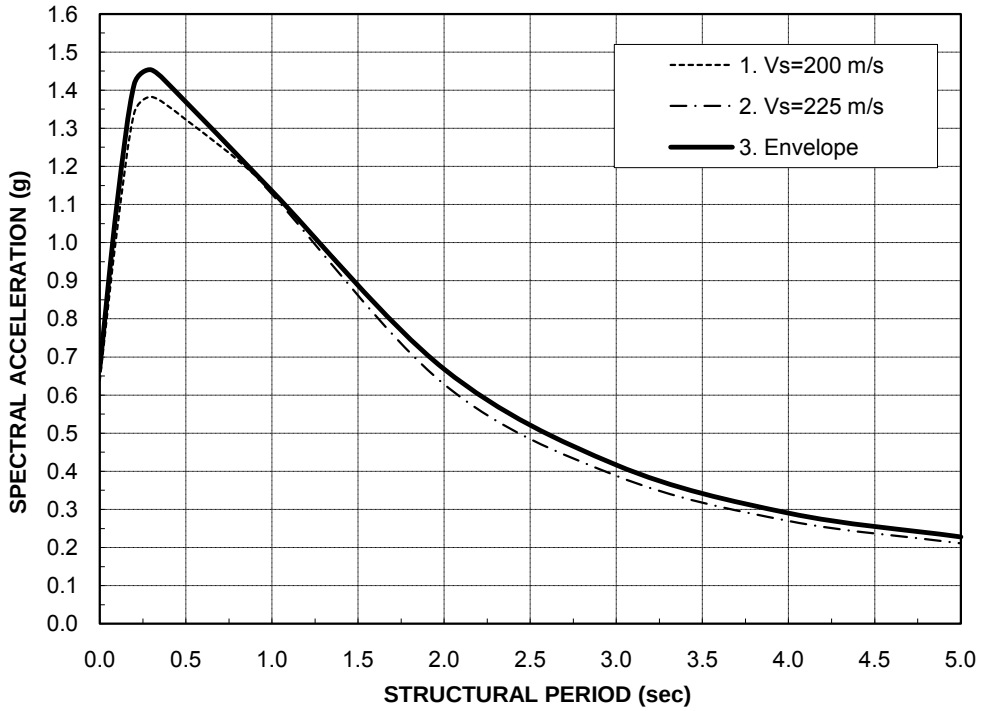
Soil pH	8.22	
Minimum Resistivity	0.56 ohm-cm (x1000)	
Chloride	158.8 ppm	00.01588 %
Sulfate	167.6 ppm	00.01676 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX C

ARS CURVES

ARS DESIGN CURVE
GREEN VALLEY ROAD OC
SOLANO COUNTY, CALIFORNIA



Period (sec)	Spectral Accel. (g)	
	1. Vs=200 m/s	2. Vs=225 m/s
0.000	0.638	0.669
0.100	1.031	1.101
0.200	1.340	1.416
0.300	1.383	1.453
0.500	1.323	1.369
1.000	1.136	1.127
2.000	0.668	0.628
3.000	0.417	0.388
4.000	0.291	0.269
5.000	0.228	0.211

Site Location: 38.21614885 N/122.1387434 W
Seismic design criteria is governed by USGS 2008 Deaggregation (beta)
1. Vs=200 m/s (liquefiable soils modeled as clay with residual strength per Seed & Harder (1990)
2. Vs=225 m/s (non-liquefied case)
3. Recommended Design Curve = Envelope of above two curves

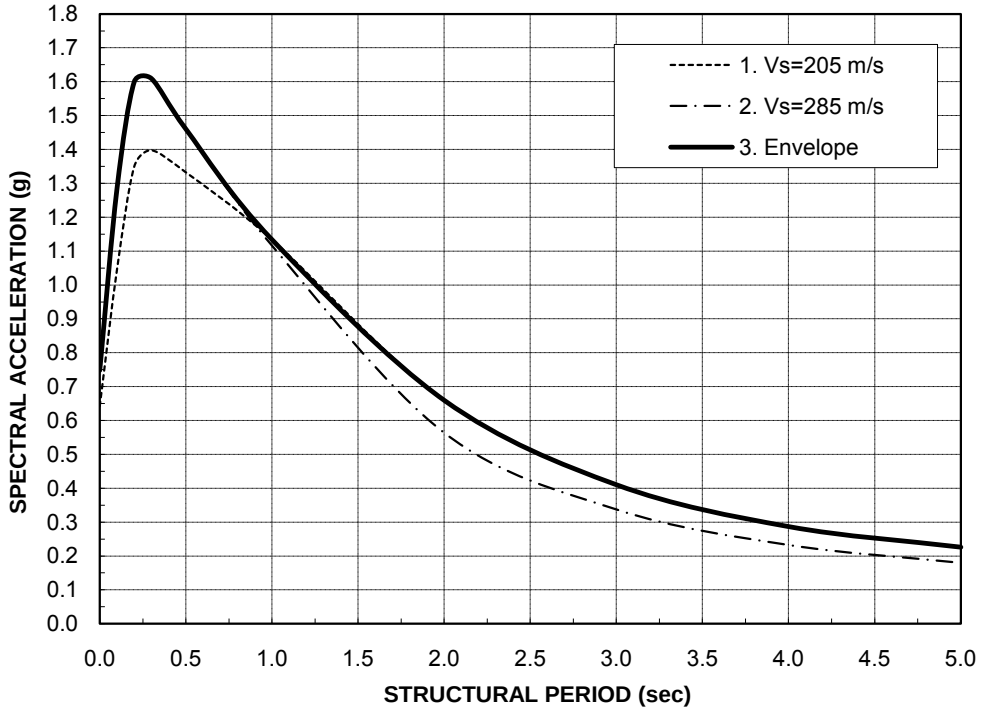
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.:

ARS DESIGN CURVE
GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA



Period (sec)	Spectral Accel. (g)	
	1. Vs=205 m/s	2. Vs=285 m/s
0.000	0.642	0.748
0.100	1.045	1.284
0.200	1.349	1.599
0.300	1.397	1.609
0.500	1.332	1.460
1.000	1.134	1.116
2.000	0.659	0.563
3.000	0.410	0.337
4.000	0.287	0.232
5.000	0.226	0.179

Site Location: 38.21537755 N/122.1383357 W
Seismic design criteria is governed by USGS 2008 Deaggregation (beta)
1. Vs=205 m/s (liquefiable soils modeled as clay with residual strength per Seed & Harder (1990)
2. Vs=285 m/s (non-liquefied case)
3. Recommended Design Curve = Envelope of above two curves

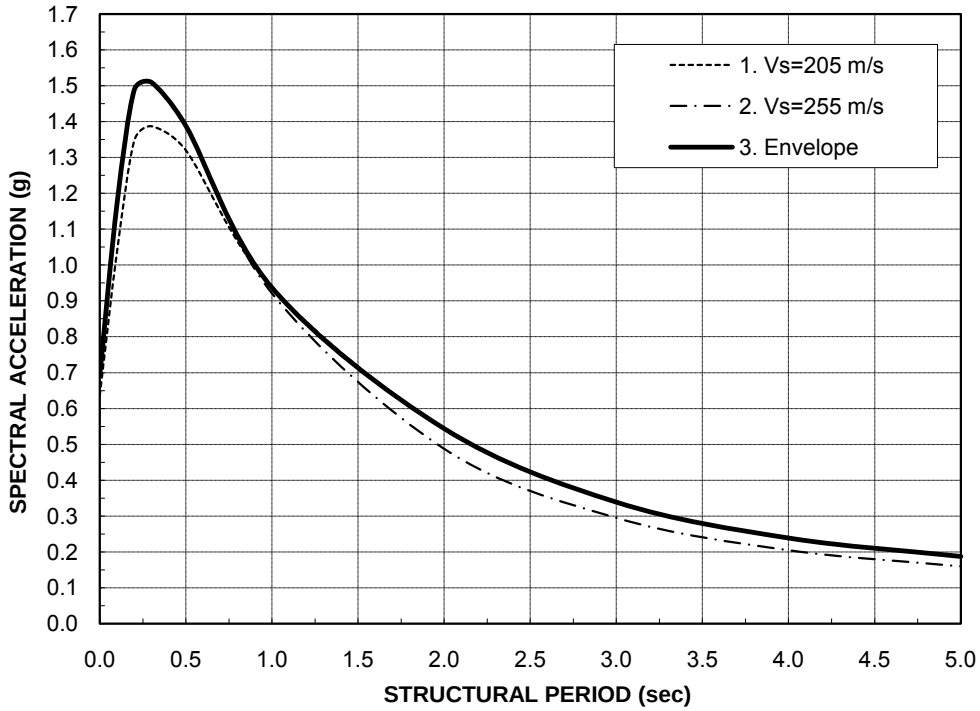
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

GREEN VALLEY ROAD OVERCROSSING (OVER SB 680 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.:

ARS DESIGN CURVE
WB 80 TO WB 12 GRADE SEPARATION
SOLANO COUNTY, CALIFORNIA



Period (sec)	Spectral Accel. (g)	
	1. Vs=205 m/s	2. Vs=255 m/s
0.000	0.636	0.692
0.100	1.036	1.170
0.200	1.347	1.488
0.300	1.387	1.509
0.500	1.320	1.388
1.000	0.937	0.921
2.000	0.544	0.488
3.000	0.339	0.295
4.000	0.239	0.205
5.000	0.188	0.160

Site Location: 38.21141977 N/122.1468437 W
Seismic design criteria is governed by USGS 2008 Deaggregation (beta)
1. Vs=205 m/s (liquefiable soils modeled as clay with residual strength per Seed & Harder (1990)
2. Vs=255 m/s (non-liquefied case)
3. Recommended Design Curve = Envelope of above two curves

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

WB 80 TO WB 12 SEPARATION (OVER WB 80 ON-RAMP)
SOLANO COUNTY, CALIFORNIA

JOB NO.: 2009-130-GDR

PLATE NO.:

LIQUEFACTION ANALYSIS

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-001***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	1	20	MC	562.5	563	0.99	0.45	13.0	0.92	1.00	1.0	1.05	12.5	1.49	18.6		18.6		1.00	1	
2	9.5	1	12	MC	1187.5	1188	0.98	0.45	7.8	0.92	1.00	1.0	1.05	7.5	1.23	9.2	38%	16.0	0.17	1.00	1	(0.47)
3	14.5	2	50	MC	1812.5	1531	0.97		32.5	0.92	1.00	1.0	1.05	31.3	1.12	35.0				1.00	1	
4	19.5	2	38	MC	2437.5	1844	0.96		24.7	0.92	1.00	1.0	1.05	23.8	1.04	24.6				1.00	1	
5	24.5	2	36	MC	3062.5	2156	0.94		23.4	0.92	1.00	1.0	1.05	22.5	0.97	21.8				0.97	1	
6	29.5	1	25	MC	3687.5	2469	0.92	0.63	16.3	0.92	1.00	1.0	1.05	15.6	0.90	14.1	64%	22.0	0.24	0.93	1	(0.44)
7	34.5	1	100	MC	4312.5	2781	0.89	0.63	65.0	0.92	1.00	1.0	1.05	62.6	0.85	53.1		53.1		0.88	1	NON-LIQ.
8	39.5	1	100	SPT	4937.5	3094	0.86	0.62	100.0	0.92	1.00	1.2	1.05	115.5	0.80	92.5		92.5		0.84	1	NON-LIQ.
9	44.5	1	100	SPT	5562.5	3406	0.81	0.60	100.0	0.92	1.00	1.2	1.05	115.5	0.76	87.5		87.5		0.81	1	NON-LIQ.
10	49.5	1	100	SPT	6187.5	3719	0.76	0.57	100.0	0.92	1.00	1.2	1.05	115.5	0.72	83.1		83.1		0.78	1	NON-LIQ.
11	54.5	1	69	SPT	6812.5	4031	0.71	0.54	69.0	0.92	1.00	1.2	1.05	79.7	0.68	54.5		54.5		0.76	1	NON-LIQ.
12	59.5	1	11	SPT	7437.5	4344	0.66	0.52	11.0	0.92	1.00	1.2	1.05	12.7	0.65	8.3	63%	14.9	0.16	0.81	1	(0.31)
13	69.5	2	100	MC	8687.5	4969	0.59		65.0	0.92	1.00	1.0	1.05	62.6	0.60	37.4				0.69	1	
14	79.5	2	100	MC	9937.5	5594	0.55		65.0	0.92	1.00	1.0	1.05	62.6	0.55	34.4				0.66	1	
15	89.5	2	62	SPT	11188	6219	0.52		62.0	0.92	1.00	1.2	1.05	71.6	0.51	36.6				0.64	1	
16	99.5	1	100	SPT	12438	6844	0.50	0.41	100.0	0.92	1.00	1.2	1.05	115.5	0.48	55.0		55.0		0.61	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-002***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	30	MC	562.5	563	0.99		19.5	0.92	1.00	1.0	1.05	18.8	1.49	27.9				1.00	1	
2	9.5	2	27	MC	1187.5	1188	0.98		17.6	0.92	1.00	1.0	1.05	16.9	1.23	20.7				1.00	1	
3	14.5	1	22	MC	1812.5	1531	0.97	0.52	14.3	0.92	1.00	1.0	1.05	13.8	1.12	15.4	35%	23.5	0.26	1.00	1	(0.63)
4	19.5	1	28	MC	2437.5	1844	0.96	0.58	18.2	0.92	1.00	1.0	1.05	17.5	1.04	18.2	37%	26.8	0.33	1.00	1	(0.71)
5	24.5	1	39	MC	3062.5	2156	0.94	0.61	25.4	0.92	1.00	1.0	1.05	24.4	0.97	23.6	51%	33.3		0.97	1	NON-LIQ.
6	29.5	2	65	MC	3687.5	2469	0.92		42.3	0.92	1.00	1.0	1.05	40.7	0.90	36.8				0.92	1	
7	34.5	2	65	MC	4312.5	2781	0.89		42.3	0.92	1.00	1.0	1.05	40.7	0.85	34.5				0.88	1	
8	39.5	1	31	MC	4937.5	3094	0.86	0.62	20.2	0.92	1.00	1.0	1.05	19.4	0.80	15.5	50%	23.6	0.27	0.85	1	(0.45)
9	44.5	1	23	SPT	5562.5	3406	0.81	0.60	23.0	0.92	1.00	1.2	1.05	26.6	0.76	20.1	20%	25.3	0.30	0.82	1	(0.50)
10	49.5	1	36	SPT	6187.5	3719	0.76	0.57	36.0	0.92	1.00	1.2	1.05	41.6	0.72	29.9	51%	40.9		0.78	1	NON-LIQ.
11	54.5	2	100	MC	6812.5	4031	0.71		65.0	0.92	1.00	1.0	1.05	62.6	0.68	42.8				0.76	1	
12	59.5	2	71	SPT	7437.5	4344	0.66		71.0	0.92	1.00	1.2	1.05	82.0	0.65	53.5				0.73	1	
13	69.5	1	64	MC	8687.5	4969	0.59	0.47	41.6	0.92	1.00	1.0	1.05	40.0	0.60	23.9	20%	29.4	0.43	0.69	1	(0.79)
14	79.5	1	33	SPT	9937.5	5594	0.55	0.44	33.0	0.92	1.00	1.2	1.05	38.1	0.55	21.0	20%	26.3	0.32	0.67	1	(0.60)
15	89.5	1	100	SPT	11188	6219	0.52	0.43	100.0	0.92	1.00	1.2	1.05	115.5	0.51	59.0		59.0		0.64	1	NON-LIQ.
16	99.5	2	100	SPT	12438	6844	0.50		100.0	0.92	1.00	1.2	1.05	115.5	0.48	55.0				0.61	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-003***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.66
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	18	MC	562.5	563	0.99		11.7	0.92	1.00	1.0	1.05	11.3	1.49	16.7				1.00	1	
2	9.5	2	17	MC	1187.5	1188	0.98		11.1	0.92	1.00	1.0	1.05	10.6	1.23	13.0				1.00	1	
3	14.5	1	100	MC	1812.5	1531	0.97	0.49	65.0	0.92	1.00	1.0	1.05	62.6	1.12	70.0		70.0		1.00	1	NON-LIQ.
4	19.5	2	23	MC	2437.5	1844	0.96		15.0	0.92	1.00	1.0	1.05	14.4	1.04	14.9				1.00	1	
5	24.5	2	29	MC	3062.5	2156	0.94		18.9	0.92	1.00	1.0	1.05	18.1	0.97	17.5				0.97	1	
6	29.5	1	28	MC	3687.5	2469	0.92	0.59	18.2	0.92	1.00	1.0	1.05	17.5	0.90	15.8	44%	24.0	0.27	0.93	1	(0.53)
7	34.5	1	50	MC	4312.5	2781	0.89	0.59	32.5	0.92	1.00	1.0	1.05	31.3	0.85	26.6	50%	36.9		0.88	1	NON-LIQ.
8	39.5	1	39	MC	4937.5	3094	0.86	0.59	25.4	0.92	1.00	1.0	1.05	24.4	0.80	19.5	46%	28.5	0.39	0.84	1	(0.69)
9	44.5	1	36	SPT	5562.5	3406	0.81	0.57	36.0	0.92	1.00	1.2	1.05	41.6	0.76	31.5	11%	33.6		0.81	1	NON-LIQ.
10	49.5	1	41	SPT	6187.5	3719	0.76	0.54	41.0	0.92	1.00	1.2	1.05	47.4	0.72	34.1	11%	36.2		0.78	1	NON-LIQ.
11	54.5	1	35	SPT	6812.5	4031	0.71	0.51	35.0	0.92	1.00	1.2	1.05	40.4	0.68	27.7	27%	35.7		0.76	1	NON-LIQ.
12	59.5	1	51	SPT	7437.5	4344	0.66	0.49	51.0	0.92	1.00	1.2	1.05	58.9	0.65	38.4	25%	47.1		0.73	1	NON-LIQ.
13	69.5	2	44	SPT	8687.5	4969	0.59		44.0	0.92	1.00	1.2	1.05	50.8	0.60	30.3				0.69	1	
14	79.5	1	80	SPT	9937.5	5594	0.55	0.42	80.0	0.92	1.00	1.2	1.05	92.4	0.55	50.9		50.9		0.66	1	NON-LIQ.
15	89.5	1	36	SPT	11188	6219	0.52	0.40	36.0	0.92	1.00	1.2	1.05	41.6	0.51	21.2	20%	26.5	0.33	0.65	1	(0.65)
16	99.5	1	100	SPT	12438	6844	0.50	0.39	100.0	0.92	1.00	1.2	1.05	115.5	0.48	55.0		55.0		0.61	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-003A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR $_{7.5}$)*												*F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6	2	8	SPT	750	750	0.99		8.0	1.42	0.75	1.2	1.05	10.7	1.40	15.0				1.00	1	
2	11	2	8	SPT	1375	1313	0.98		8.0	1.42	0.80	1.2	1.05	11.4	1.19	13.5				1.00	1	
3	14	1	8	SPT	1750	1500	0.97	0.52	8.0	1.42	0.85	1.2	1.05	12.1	1.13	13.7	19%	18.1	0.19	1.00	1	(0.46)
4	17	1	11	SPT	2125	1688	0.96	0.55	11.0	1.42	0.85	1.2	1.05	16.7	1.08	18.0	35%	26.6	0.33	1.00	1	(0.73)
5	21	1	16	SPT	2625	1938	0.95	0.59	16.0	1.42	0.95	1.2	1.05	27.1	1.01	27.5	10%	29.0	0.41	1.00	1	(0.86)
6	26	1	12	SPT	3250	2250	0.94	0.62	12.0	1.42	0.95	1.2	1.05	20.3	0.95	19.3	65%	28.1	0.37	0.96	1	(0.72)
7	31	1	13	SPT	3875	2563	0.92	0.63	13.0	1.42	1.00	1.2	1.05	23.2	0.89	20.6	35%	30.0		0.92	1	NON-LIQ.
8	36	1	12	SPT	4500	2875	0.88	0.63	12.0	1.42	1.00	1.2	1.05	21.4	0.83	17.9	49%	26.4	0.32	0.90	1	(0.57)
9	39	1	12	SPT	4875	3063	0.86	0.62	12.0	1.42	1.00	1.2	1.05	21.4	0.81	17.3	40%	25.7	0.31	0.88	1	(0.54)
10	42	1	33	SPT	5250	3250	0.83	0.61	33.0	1.42	1.00	1.2	1.05	58.9	0.78	45.9		45.9		0.82	1	NON-LIQ.
11	45	1	13	SPT	5625	3438	0.80	0.60	13.0	1.42	1.00	1.2	1.05	23.2	0.75	17.5	30%	24.9	0.29	0.85	1	
12	48	1	39	SPT	6000	3625	0.77	0.58	39.0	1.42	1.00	1.2	1.05	69.6	0.73	50.8		50.8		0.79	1	NON-LIQ.
13	51	2	10	SPT	6375	3813	0.74		10.0	1.42	1.00	1.2	1.05	17.9	0.71	12.6				0.84	1	
14	54	2	8	SPT	6750	4000	0.71		8.0	1.42	1.00	1.2	1.05	14.3	0.69	9.8				0.84	1	
15	57	2	19	SPT	7125	4188	0.68		19.0	1.42	1.00	1.2	1.05	33.9	0.67	22.7				0.78	1	
16	60	1	28	SPT	7500	4375	0.66	0.51	28.0	1.42	1.00	1.2	1.05	50.0	0.65	32.5		32.5		0.74	1	NON-LIQ.
17	63	1	29	SPT	7875	4563	0.64	0.50	29.0	1.42	1.00	1.2	1.05	51.8	0.63	32.7		32.7		0.73	1	NON-LIQ.
18	66	1	25	SPT	8250	4750	0.62	0.49	25.0	1.42	1.00	1.2	1.05	44.6	0.62	27.5	20%	33.3		0.73	1	NON-LIQ.
19	69	1	8	SPT	8625	4938	0.60	0.47	8.0	1.42	1.00	1.2	1.05	14.3	0.60	8.6		8.6	0.10	0.81	1	(0.21)
20	72	1	28	SPT	9000	5125	0.58	0.46	28.0	1.42	1.00	1.2	1.05	50.0	0.58	29.2		29.2	0.42	0.71	1	(0.79)
21	75	1	23	SPT	9375	5313	0.57	0.46	23.0	1.42	1.00	1.2	1.05	41.1	0.57	23.4	43%	33.1		0.72	1	NON-LIQ.
22	78	1	43	SPT	9750	5500	0.56	0.45	43.0	1.42	1.00	1.2	1.05	76.8	0.56	42.7		42.7		0.67	1	NON-LIQ.
23	81	1	33	SPT	10125	5688	0.54	0.44	33.0	1.42	1.00	1.2	1.05	58.9	0.54	32.0		32.0		0.67	1	NON-LIQ.

Notes:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001)
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$

   where α and β = coefficients determined from the following relationships

   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$

   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$

   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-004A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR $_{7.5}$)*											*F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6	2	7	SPT	750	750	0.99		7.0	1.42	0.75	1.2	1.05	9.4	1.40	13.1				1.00	1	
2	11	2	16	SPT	1375	1313	0.98		16.0	1.42	0.80	1.2	1.05	22.8	1.19	27.1				1.00	1	
3	14	2	7	SPT	1750	1500	0.97		7.0	1.42	0.85	1.2	1.05	10.6	1.13	12.0				1.00	1	
4	17	2	12	SPT	2125	1688	0.96		12.0	1.42	0.85	1.2	1.05	18.2	1.08	19.6				1.00	1	
5	21	2	9	SPT	2625	1938	0.95		9.0	1.42	0.95	1.2	1.05	15.3	1.01	15.5				1.00	1	
6	26	2	17	SPT	3250	2250	0.94		17.0	1.42	0.95	1.2	1.05	28.8	0.95	27.3				0.96	1	
7	31	1	10	SPT	3875	2563	0.92	0.63	10.0	1.42	1.00	1.2	1.05	17.9	0.89	15.8	16%	19.6	0.21	0.93	1	(0.38)
8	36	1	8	SPT	4500	2875	0.88	0.63	8.0	1.42	1.00	1.2	1.05	14.3	0.83	11.9	16%	15.3	0.16	0.91	1	(0.29)
9	39	1	32	SPT	4875	3063	0.86	0.62	32.0	1.42	1.00	1.2	1.05	57.1	0.81	46.0		46.0		0.84	1	NON-LIQ.
10	42	1	22	SPT	5250	3250	0.83	0.61	22.0	1.42	1.00	1.2	1.05	39.3	0.78	30.6		30.6		0.84	1	NON-LIQ.
11	45	1	17	SPT	5625	3438	0.80	0.60	17.0	1.42	1.00	1.2	1.05	30.3	0.75	22.9	18%	27.8	0.36	0.83	1	(0.62)
12	48	1	12	SPT	6000	3625	0.77	0.58	12.0	1.42	1.00	1.2	1.05	21.4	0.73	15.6	2%	15.6	0.17	0.84	1	(0.30)
13	51	2	11	SPT	6375	3813	0.74		11.0	1.42	1.00	1.2	1.05	19.6	0.71	13.9				0.84	1	
14	56	2	15	SPT	7000	4125	0.69		15.0	1.42	1.00	1.2	1.05	26.8	0.67	18.1				0.80	1	
15	61	1	17	SPT	7625	4438	0.65	0.51	17.0	1.42	1.00	1.2	1.05	30.3	0.64	19.5	30%	27.2	0.35	0.78	1	(0.65)
16	66	1	18	SPT	8250	4750	0.62	0.49	18.0	1.42	1.00	1.2	1.05	32.1	0.62	19.8	30%	27.5	0.35	0.76	1	(0.68)
17	71	2	21	SPT	8875	5063	0.59		21.0	1.42	1.00	1.2	1.05	37.5	0.59	22.1				0.74	1	
18	76	2	10	SPT	9500	5375	0.56		10.0	1.42	1.00	1.2	1.05	17.9	0.57	10.1				0.78	1	
19	101	2	25	SPT	12625	6938	0.50		25.0	1.42	1.00	1.2	1.05	44.6	0.47	21.0				0.67	1	
20	121	2	66	SPT	15125	8188	0.47		66.0	1.42	1.00	1.2	1.05	117.8	0.42	49.0				0.57	1	
21	141	2	36	SPT	17625	9438	0.45		36.0	1.42	1.00	1.2	1.05	64.3	0.37	23.9				0.59	1	
22	161	2	100	SPT	20125	10688	0.43		100.0	1.42	1.00	1.2	1.05	178.5	0.34	60.0				0.51	1	

Note:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001)
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-005***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	21	MC	562.5	563	0.99		13.7	0.92	1.00	1.0	1.05	13.1	1.49	19.5				1.00	1	
2	9.5	2	16	MC	1187.5	1188	0.98		10.4	0.92	1.00	1.0	1.05	10.0	1.23	12.3	48%			1.00	1	
3	14.5	2	38	MC	1812.5	1531	0.97		24.7	0.92	1.00	1.0	1.05	23.8	1.12	26.6	47%			1.00	1	
4	19.5	1	58	MC	2437.5	1844	0.96	0.58	37.7	0.92	1.00	1.0	1.05	36.3	1.04	37.6		37.6		1.00	1	NON-LIQ.
5	24.5	2	27	MC	3062.5	2156	0.94		17.6	0.92	1.00	1.0	1.05	16.9	0.97	16.3	75%			0.97	1	
6	29.5	1	42	MC	3687.5	2469	0.92	0.63	27.3	0.92	1.00	1.0	1.05	26.3	0.90	23.7	35%	33.5		0.92	1	NON-LIQ.
7	34.5	1	66	MC	4312.5	2781	0.89	0.63	42.9	0.92	1.00	1.0	1.05	41.3	0.85	35.1	16%	39.7		0.88	1	NON-LIQ.
8	39.5	1	100	SPT	4937.5	3094	0.86	0.62	100.0	0.92	1.00	1.2	1.05	115.5	0.80	92.5		92.5		0.84	1	NON-LIQ.
9	44.5	1	100	MC	5562.5	3406	0.81	0.60	65.0	0.92	1.00	1.0	1.05	62.6	0.76	47.4		47.4		0.81	1	NON-LIQ.
10	49.5	1	100	SPT	6187.5	3719	0.76	0.57	100.0	0.92	1.00	1.2	1.05	115.5	0.72	83.1		83.1		0.78	1	NON-LIQ.
11	54.5	1	27	MC	6812.5	4031	0.71	0.54	17.6	0.92	1.00	1.0	1.05	16.9	0.68	11.6		11.6	0.13	0.80	1	(0.23)
12	59.5	1	69	MC	7437.5	4344	0.66	0.52	44.9	0.92	1.00	1.0	1.05	43.2	0.65	28.2	15%	32.0		0.73	1	NON-LIQ.
13	69.5	1	30	MC	8687.5	4969	0.59	0.47	19.5	0.92	1.00	1.0	1.05	18.8	0.60	11.2	28%	17.3	0.18	0.74	1	(0.36)
14	79.5	1	65	SPT	9937.5	5594	0.55	0.44	65.0	0.92	1.00	1.2	1.05	75.1	0.55	41.3		41.3		0.66	1	NON-LIQ.
15	89.5	1	100	SPT	11188	6219	0.52	0.43	100.0	0.92	1.00	1.2	1.05	115.5	0.51	59.0		59.0		0.64	1	NON-LIQ.
16	99.5	2	49	SPT	12438	6844	0.50		49.0	0.92	1.00	1.2	1.05	56.6	0.48	26.9				0.61	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-006***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 12

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	39	MC	562.5	563	0.99		25.4	0.92	1.00	1.0	1.05	24.4	1.49	36.2				1.00	1	
2	9.5	2	40	MC	1187.5	1188	0.98		26.0	0.92	1.00	1.0	1.05	25.0	1.23	30.7				1.00	1	
3	14.5	2	43	MC	1812.5	1656	0.97		28.0	0.92	1.00	1.0	1.05	26.9	1.08	29.2				1.00	1	
4	19.5	2	20	MC	2437.5	1969	0.96		13.0	0.92	1.00	1.0	1.05	12.5	1.01	12.6				1.00	1	
5	24.5	2	27	MC	3062.5	2281	0.94		17.6	0.92	1.00	1.0	1.05	16.9	0.94	15.9				0.95	1	
6	29.5	2	15	MC	3687.5	2594	0.92		9.8	0.92	1.00	1.0	1.05	9.4	0.88	8.3				0.93	1	
7	34.5	2	26	MC	4312.5	2906	0.89		16.9	0.92	1.00	1.0	1.05	16.3	0.83	13.5				0.88	1	
8	39.5	2	22	MC	4937.5	3219	0.86		14.3	0.92	1.00	1.0	1.05	13.8	0.78	10.8				0.86	1	
9	44.5	2	19	MC	5562.5	3531	0.81		12.4	0.92	1.00	1.0	1.05	11.9	0.74	8.8				0.85	1	
10	49.5	2	28	MC	6187.5	3844	0.76		18.2	0.92	1.00	1.0	1.05	17.5	0.70	12.3				0.80	1	
11	54.5	1	27	MC	6812.5	4156	0.71	0.53	17.6	0.92	1.00	1.0	1.05	16.9	0.67	11.3	19%	15.6	0.17	0.79	1	(0.31)
12	59.5	2	22	MC	7437.5	4469	0.66		14.3	0.92	1.00	1.0	1.05	13.8	0.64	8.8				0.79	1	
13	69.5	1	27	MC	8687.5	5094	0.59	0.46	17.6	0.92	1.00	1.0	1.05	16.9	0.59	9.9	40%	16.9	0.18	0.75	1	(0.36)
14	79.5	2	19	MC	9937.5	5719	0.55		12.4	0.92	1.00	1.0	1.05	11.9	0.54	6.4				0.76	1	
15	89.5	1	34	MC	11188	6344	0.52	0.42	22.1	0.92	1.00	1.0	1.05	21.3	0.50	10.7	12%	12.6	0.14	0.69	1	(0.28)
16	99.5	2	76	MC	12438	6969	0.50		49.4	0.92	1.00	1.0	1.05	47.5	0.47	22.3				0.61	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-009***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 12

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	31	MC	562.5	563	0.99		20.2	0.92	1.00	1.0	1.05	19.4	1.49	28.8				1.00	1	
2	9.5	2	36	MC	1187.5	1188	0.98		23.4	0.92	1.00	1.0	1.05	22.5	1.23	27.6				1.00	1	
3	14.5	1	24	MC	1812.5	1656	0.97	0.48	15.6	0.92	1.00	1.0	1.05	15.0	1.08	16.3	35%	24.5	0.28	1.00	1	(0.73)
4	19.5	2	45	MC	2437.5	1969	0.96		29.3	0.92	1.00	1.0	1.05	28.2	1.01	28.4				1.00	1	
5	24.5	1	25	MC	3062.5	2281	0.94	0.58	16.3	0.92	1.00	1.0	1.05	15.6	0.94	14.7	46%	22.6	0.25	0.95	1	(0.52)
6	29.5	2	35	MC	3687.5	2594	0.92		22.8	0.92	1.00	1.0	1.05	21.9	0.88	19.3				0.90	1	
7	34.5	2	31	MC	4312.5	2906	0.89		20.2	0.92	1.00	1.0	1.05	19.4	0.83	16.1				0.87	1	
8	39.5	2	22	MC	4937.5	3219	0.86		14.3	0.92	1.00	1.0	1.05	13.8	0.78	10.8				0.86	1	
9	44.5	2	66	MC	5562.5	3531	0.81		42.9	0.92	1.00	1.0	1.05	41.3	0.74	30.6				0.80	1	
10	49.5	2	48	MC	6187.5	3844	0.76		31.2	0.92	1.00	1.0	1.05	30.0	0.70	21.2				0.77	1	
11	54.5	2	47	MC	6812.5	4156	0.71		30.6	0.92	1.00	1.0	1.05	29.4	0.67	19.7				0.75	1	
12	59.5	2	32	MC	7437.5	4469	0.66		20.8	0.92	1.00	1.0	1.05	20.0	0.64	12.8				0.76	1	
13	69.5	2	55	MC	8687.5	5094	0.59		35.8	0.92	1.00	1.0	1.05	34.4	0.59	20.2				0.69	1	
14	79.5	2	50	MC	9937.5	5719	0.55		32.5	0.92	1.00	1.0	1.05	31.3	0.54	17.0				0.67	1	
15	89.5	2	47	MC	11188	6344	0.52		30.6	0.92	1.00	1.0	1.05	29.4	0.50	14.8				0.66	1	
16	99.5	2	49	MC	12438	6969	0.50		31.9	0.92	1.00	1.0	1.05	30.7	0.47	14.4				0.64	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-10-009A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 12

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6.5	2	15	SPT	812.5	813	0.99		15.0	1.42	0.75	1.2	1.05	20.1	1.37	27.5				1.00	1	
2	11	2	11	SPT	1375	1375	0.98		11.0	1.42	0.80	1.2	1.05	15.7	1.17	18.3				1.00	1	
3	14	2	4	SPT	1750	1625	0.97		4.0	1.42	0.85	1.2	1.05	6.1	1.09	6.6				1.00	1	
4	17	1	5	SPT	2125	1813	0.96	0.51	5.0	1.42	0.85	1.2	1.05	7.6	1.04	7.9	33%	14.2	0.15	1.00	1	(0.37)
5	20	1	9	SPT	2500	2000	0.96	0.54	9.0	1.42	0.95	1.2	1.05	15.3	1.00	15.3	26%	21.5	0.24	1.00	1	(0.53)
6	23	2	7	SPT	2875	2188	0.95		7.0	1.42	0.95	1.2	1.05	11.9	0.96	11.4				0.98	1	
7	26	2	12	SPT	3250	2375	0.94		12.0	1.42	0.95	1.2	1.05	20.3	0.92	18.8				0.95	1	
8	29	2	14	SPT	3625	2563	0.93		14.0	1.42	0.95	1.2	1.05	23.7	0.89	21.0				0.92	1	
9	36	2	9	SPT	4500	3000	0.88		9.0	1.42	1.00	1.2	1.05	16.1	0.81	13.1				0.90	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-111***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	1	81	MC	562.5	563	0.99	0.45	52.7	0.92	1.00	1.0	1.05	50.7	1.49	75.3		75.3		1.00	1	
2	9.5	1	40	MC	1187.5	1188	0.98	0.45	26.0	0.92	1.00	1.0	1.05	25.0	1.23	30.7		30.7		1.00	1	
3	14.5	1	80	MC	1812.5	1531	0.97	0.52	52.0	0.92	1.00	1.0	1.05	50.1	1.12	56.0		56.0		1.00	1	NON-LIQ.
4	19.5	1	57	MC	2437.5	1844	0.96	0.58	37.1	0.92	1.00	1.0	1.05	35.7	1.04	37.0	57%	49.4		1.00	1	NON-LIQ.
5	24.5	1	100	MC	3062.5	2156	0.94	0.61	65.0	0.92	1.00	1.0	1.05	62.6	0.97	60.4		60.4		0.97	1	NON-LIQ.
6	29.5	1	100	SPT	3687.5	2469	0.92	0.63	100.0	0.92	1.00	1.2	1.05	115.5	0.90	104.4		104.4		0.92	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-112***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	1	80	MC	250	250	1.00	0.45	52.0	0.92	1.00	1.0	1.05	50.1	1.66	83.1		83.1		1.00	1	
2	4.5	1	41	MC	562.5	563	0.99	0.45	26.7	0.92	1.00	1.0	1.05	25.7	1.49	38.1		38.1		1.00	1	
3	9.5	1	39	MC	1187.5	1188	0.98	0.45	25.4	0.92	1.00	1.0	1.05	24.4	1.23	29.9		29.9		1.00	1	
4	14.5	1	53	MC	1812.5	1531	0.97	0.52	34.5	0.92	1.00	1.0	1.05	33.2	1.12	37.1		37.1		1.00	1	NON-LIQ.
5	19.5	1	100	MC	2437.5	1844	0.96	0.58	65.0	0.92	1.00	1.0	1.05	62.6	1.04	64.9		64.9		1.00	1	NON-LIQ.
6	24.5	1	45	MC	3062.5	2156	0.94	0.61	29.3	0.92	1.00	1.0	1.05	28.2	0.97	27.2	25%	34.6		0.97	1	NON-LIQ.
7	29.5	1	100	MC	3687.5	2469	0.92	0.63	65.0	0.92	1.00	1.0	1.05	62.6	0.90	56.5		56.5		0.92	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-114***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	100	MC	250	250	1.00		65.0	0.92	1.00	1.0	1.05	62.6	1.66	103.9				1.00	1	
2	4.5	2	13	MC	562.5	563	0.99		8.5	0.92	1.00	1.0	1.05	8.1	1.49	12.1				1.00	1	
3	9.5	2	63	MC	1187.5	1188	0.98		41.0	0.92	1.00	1.0	1.05	39.4	1.23	48.3				1.00	1	
4	14.5	2	50	MC	1812.5	1531	0.97		32.5	0.92	1.00	1.0	1.05	31.3	1.12	35.0				1.00	1	
5	19.5	2	39	MC	2437.5	1844	0.96		25.4	0.92	1.00	1.0	1.05	24.4	1.04	25.3				1.00	1	
6	24.5	1	50	MC	3062.5	2156	0.94	0.61	32.5	0.92	1.00	1.0	1.05	31.3	0.97	30.2		30.2		0.97	1	NON-LIQ.
7	29.5	1	100	SPT	3687.5	2469	0.92	0.63	100.0	0.92	1.00	1.2	1.05	115.5	0.90	104.4		104.4		0.92	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-119***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 45% *(spooling winch system, EGS B-53 (RED))*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	33	MC	250	250	1.00		21.5	0.75	1.00	1.0	1.05	16.9	1.66	28.0				1.00	1	
2	4.5	2	41	MC	562.5	563	0.99		26.7	0.75	1.00	1.0	1.05	21.0	1.49	31.2				1.00	1	
3	9.5	2	44	MC	1187.5	1188	0.98		28.6	0.75	1.00	1.0	1.05	22.5	1.23	27.6				1.00	1	
4	14.5	2	39	MC	1812.5	1531	0.97		25.4	0.75	1.00	1.0	1.05	20.0	1.12	22.3				1.00	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-120***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 45% *(spooling winch system, EGS B-53 (RED))*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	75	MC	250	250	1.00		48.8	0.75	1.00	1.0	1.05	38.4	1.66	63.7				1.00	1	
2	4.5	2	85	MC	562.5	563	0.99		55.3	0.75	1.00	1.0	1.05	43.5	1.49	64.6				1.00	1	
3	9.5	2	59	MC	1187.5	1188	0.98		38.4	0.75	1.00	1.0	1.05	30.2	1.23	37.0				1.00	1	
4	14.5	2	76	MC	1812.5	1531	0.97		49.4	0.75	1.00	1.0	1.05	38.9	1.12	43.5				1.00	1	
5	19.5	1	32	MC	2437.5	1844	0.96	0.58	20.8	0.75	1.00	1.0	1.05	16.4	1.04	17.0	30%	24.3	0.28	1.00	1	(0.60)
6	24.5	1	12	SPT	3062.5	2156	0.94	0.61	12.0	0.75	1.00	1.2	1.05	11.3	0.97	11.0	47%	18.1	0.19	0.98	1	(0.38)
7	29.5	1	11	SPT	3687.5	2469	0.92	0.63	11.0	0.75	1.00	1.2	1.05	10.4	0.90	9.4	25%	14.8	0.16	0.94	1	(0.29)
8	34.5	2	31	MC	4312.5	2781	0.89		20.2	0.75	1.00	1.0	1.05	15.9	0.85	13.5				0.89	1	
9	39.5	2	63	MC	4937.5	3094	0.86		41.0	0.75	1.00	1.0	1.05	32.2	0.80	25.8				0.84	1	
10	44.5	1	24	SPT	5562.5	3406	0.81	0.60	24.0	0.75	1.00	1.2	1.05	22.7	0.76	17.2	27%	23.9	0.27	0.82	1	(0.46)

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-121***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	16	MC	250	250	1.00		10.4	0.92	1.00	1.0	1.05	10.0	1.66	16.6				1.00	1	
2	4.5	2	71	MC	562.5	563	0.99		46.2	0.92	1.00	1.0	1.05	44.4	1.49	66.0				1.00	1	
3	9.5	2	42	MC	1187.5	1188	0.98		27.3	0.92	1.00	1.0	1.05	26.3	1.23	32.2				1.00	1	
4	14.5	2	30	MC	1812.5	1531	0.97		19.5	0.92	1.00	1.0	1.05	18.8	1.12	21.0				1.00	1	
5	19.5	2	37	MC	2437.5	1844	0.96		24.1	0.92	1.00	1.0	1.05	23.1	1.04	24.0				1.00	1	
6	24.5	1	19	SPT	3062.5	2156	0.94	0.61	19.0	0.92	1.00	1.2	1.05	21.9	0.97	21.2	33%	29.9	0.46	0.97	1	(0.91)
7	29.5	1	30	SPT	3687.5	2469	0.92	0.63	30.0	0.92	1.00	1.2	1.05	34.7	0.90	31.3	30%	40.9		0.92	1	NON-LIQ.
8	34.5	2	21	MC	4312.5	2781	0.89		13.7	0.92	1.00	1.0	1.05	13.1	0.85	11.2				0.90	1	
9	39.5	2	51	MC	4937.5	3094	0.86		33.2	0.92	1.00	1.0	1.05	31.9	0.80	25.6				0.84	1	
10	44.5	2	32	MC	5562.5	3406	0.81		20.8	0.92	1.00	1.0	1.05	20.0	0.76	15.2				0.83	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-122***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 45% *(spooling winch system, EGS B-40)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	23	MC	250	250	1.00		15.0	0.75	1.00	1.0	1.05	11.8	1.66	19.5				1.00	1	
2	4.5	2	53	MC	562.5	563	0.99		34.5	0.75	1.00	1.0	1.05	27.1	1.49	40.3				1.00	1	
3	9.5	2	37	MC	1187.5	1188	0.98		24.1	0.75	1.00	1.0	1.05	18.9	1.23	23.2				1.00	1	
4	14.5	2	36	MC	1812.5	1531	0.97		23.4	0.75	1.00	1.0	1.05	18.4	1.12	20.6				1.00	1	
5	19.5	2	26	MC	2437.5	1844	0.96		16.9	0.75	1.00	1.0	1.05	13.3	1.04	13.8				1.00	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-122***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 45% *(spooling winch system, EGS B-40)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR $_{7.5}$)*												*F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	30	MC	250	250	1.00		19.5	0.75	1.00	1.0	1.05	15.4	1.66	25.5				1.00	1	
2	4.5	2	29	MC	562.5	563	0.99		18.9	0.75	1.00	1.0	1.05	14.8	1.49	22.0				1.00	1	
3	9.5	2	28	MC	1187.5	1188	0.98		18.2	0.75	1.00	1.0	1.05	14.3	1.23	17.6				1.00	1	
4	14.5	1	29	MC	1812.5	1531	0.97	0.52	18.9	0.75	1.00	1.0	1.05	14.8	1.12	16.6	43%	24.9	0.29	1.00	1	(0.69)
5	19.5	2	23	MC	2437.5	1844	0.96		15.0	0.75	1.00	1.0	1.05	11.8	1.04	12.2				1.00	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-124***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	26	MC	250	250	1.00		16.9	0.92	1.00	1.0	1.05	16.3	1.66	27.0				1.00	1	
2	4.5	2	42	MC	562.5	563	0.99		27.3	0.92	1.00	1.0	1.05	26.3	1.49	39.0				1.00	1	
3	9.5	2	22	MC	1187.5	1188	0.98		14.3	0.92	1.00	1.0	1.05	13.8	1.23	16.9				1.00	1	
4	14.5	1	13	MC	1812.5	1531	0.97	0.52	8.5	0.92	1.00	1.0	1.05	8.1	1.12	9.1	33%	15.6	0.17	1.00	1	(0.39)
5	19.5	2	12	MC	2437.5	1844	0.96		7.8	0.92	1.00	1.0	1.05	7.5	1.04	7.8				1.00	1	
6	24.5	1	19	SPT	3062.5	2156	0.94	0.61	19.0	0.92	1.00	1.2	1.05	21.9	0.97	21.2	7%	21.5	0.23	0.97	1	(0.46)
7	29.5	1	12	SPT	3687.5	2469	0.92	0.63	12.0	0.92	1.00	1.2	1.05	13.9	0.90	12.5	19%	16.9	0.18	0.94	1	(0.33)
8	34.5	2	23	SPT	4312.5	2781	0.89		23.0	0.92	1.00	1.2	1.05	26.6	0.85	22.6				0.88	1	
9	39.5	2	27	MC	4937.5	3094	0.86		17.6	0.92	1.00	1.0	1.05	16.9	0.80	13.5				0.86	1	
10	44.5	2	10	MC	5562.5	3406	0.81		6.5	0.92	1.00	1.0	1.05	6.3	0.76	4.7				0.88	1	
11	49.5	2	37	MC	6187.5	3719	0.76		24.1	0.92	1.00	1.0	1.05	23.1	0.72	16.6				0.79	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-125***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	20	MC	562.5	563	0.99		13.0	0.92	1.00	1.0	1.05	12.5	1.49	18.6				1.00	1	
2	9.5	2	32	MC	1187.5	1188	0.98		20.8	0.92	1.00	1.0	1.05	20.0	1.23	24.6				1.00	1	
3	14.5	2	11	MC	1812.5	1531	0.97		7.2	0.92	1.00	1.0	1.05	6.9	1.12	7.7				1.00	1	
4	19.5	2	26	MC	2437.5	1844	0.96		16.9	0.92	1.00	1.0	1.05	16.3	1.04	16.9				1.00	1	
5	24.5	1	47	MC	3062.5	2156	0.94	0.61	30.6	0.92	1.00	1.0	1.05	29.4	0.97	28.4	19%	33.9		0.97	1	NON-LIQ.
6	29.5	1	23	MC	3687.5	2469	0.92	0.63	15.0	0.92	1.00	1.0	1.05	14.4	0.90	13.0	29%	19.5	0.21	0.93	1	(0.39)
7	34.5	2	58	MC	4312.5	2781	0.89		37.7	0.92	1.00	1.0	1.05	36.3	0.85	30.8				0.88	1	
8	39.5	2	21	MC	4937.5	3094	0.86		13.7	0.92	1.00	1.0	1.05	13.1	0.80	10.5				0.87	1	
9	44.5	1	28	MC	5562.5	3406	0.81	0.60	18.2	0.92	1.00	1.0	1.05	17.5	0.76	13.3	40%	20.9	0.23	0.83	1	(0.39)
10	49.5	1	46	MC	6187.5	3719	0.76	0.57	29.9	0.92	1.00	1.0	1.05	28.8	0.72	20.7	40%	29.8	0.46	0.78	1	(0.77)

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-126***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	15	MC	562.5	563	0.99		9.8	0.92	1.00	1.0	1.05	9.4	1.49	13.9				1.00	1	
2	9.5	2	26	MC	1187.5	1188	0.98		16.9	0.92	1.00	1.0	1.05	16.3	1.23	20.0				1.00	1	
3	14.5	2	18	MC	1812.5	1531	0.97		11.7	0.92	1.00	1.0	1.05	11.3	1.12	12.6				1.00	1	
4	19.5	2	10	MC	2437.5	1844	0.96		6.5	0.92	1.00	1.0	1.05	6.3	1.04	6.5				1.00	1	
5	24.5	2	30	MC	3062.5	2156	0.94		19.5	0.92	1.00	1.0	1.05	18.8	0.97	18.1				0.97	1	
6	29.5	2	19	MC	3687.5	2469	0.92		12.4	0.92	1.00	1.0	1.05	11.9	0.90	10.7				0.94	1	
7	34.5	2	32	MC	4312.5	2781	0.89		20.8	0.92	1.00	1.0	1.05	20.0	0.85	17.0				0.88	1	
8	39.5	2	57	MC	4937.5	3094	0.86		37.1	0.92	1.00	1.0	1.05	35.7	0.80	28.6				0.84	1	
9	44.5	1	45	MC	5562.5	3406	0.81	0.60	29.3	0.92	1.00	1.0	1.05	28.2	0.76	21.3	30%	29.3	0.43	0.81	1	(0.71)
10	49.5	1	72	MC	6187.5	3719	0.76	0.57	46.8	0.92	1.00	1.0	1.05	45.0	0.72	32.4		32.4		0.78	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-127***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	21	MC	250	250	1.00		13.7	0.92	1.00	1.0	1.05	13.1	1.66	21.8				1.00	1	
2	4.5	2	33	MC	562.5	563	0.99		21.5	0.92	1.00	1.0	1.05	20.6	1.49	30.7				1.00	1	
3	9.5	2	27	MC	1187.5	1188	0.98		17.6	0.92	1.00	1.0	1.05	16.9	1.23	20.7				1.00	1	
4	14.5	2	25	MC	1812.5	1531	0.97		16.3	0.92	1.00	1.0	1.05	15.6	1.12	17.5				1.00	1	
5	19.5	2	34	MC	2437.5	1844	0.96		22.1	0.92	1.00	1.0	1.05	21.3	1.04	22.1				1.00	1	
6	24.5	2	51	MC	3062.5	2156	0.94		33.2	0.92	1.00	1.0	1.05	31.9	0.97	30.8				0.97	1	
7	29.5	1	39	MC	3687.5	2469	0.92	0.63	25.4	0.92	1.00	1.0	1.05	24.4	0.90	22.1	35%	31.5		0.92	1	NON-LIQ.
8	34.5	1	35	MC	4312.5	2781	0.89	0.63	22.8	0.92	1.00	1.0	1.05	21.9	0.85	18.6	21%	24.0	0.27	0.88	1	(0.47)
9	39.5	1	34	MC	4937.5	3094	0.86	0.62	22.1	0.92	1.00	1.0	1.05	21.3	0.80	17.0	20%	22.0	0.24	0.85	1	(0.41)
10	44.5	1	51	MC	5562.5	3406	0.81	0.60	33.2	0.92	1.00	1.0	1.05	31.9	0.76	24.2	20%	29.7	0.45	0.81	1	(0.75)

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-128***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 45% *(spooling winch system, EGS B-53 (RED))*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	25	MC	250	250	1.00		16.3	0.75	1.00	1.0	1.05	12.8	1.66	21.2				1.00	1	
2	4.5	2	36	MC	562.5	563	0.99		23.4	0.75	1.00	1.0	1.05	18.4	1.49	27.4				1.00	1	
3	9.5	2	47	MC	1187.5	1188	0.98		30.6	0.75	1.00	1.0	1.05	24.1	1.23	29.5				1.00	1	
4	14.5	2	32	MC	1812.5	1531	0.97		20.8	0.75	1.00	1.0	1.05	16.4	1.12	18.3				1.00	1	
5	19.5	1	47	MC	2437.5	1844	0.96	0.58	30.6	0.75	1.00	1.0	1.05	24.1	1.04	24.9	15%	28.6	0.39	1.00	1	(0.85)
6	24.5	1	100	MC	3062.5	2156	0.94	0.61	65.0	0.75	1.00	1.0	1.05	51.2	0.97	49.4		49.4		0.97	1	NON-LIQ.
7	29.5	2	29	SPT	3687.5	2469	0.92		29.0	0.75	1.00	1.2	1.05	27.4	0.90	24.8				0.92	1	
8	34.5	1	44	SPT	4312.5	2781	0.89	0.63	44.0	0.75	1.00	1.2	1.05	41.6	0.85	35.3		35.3		0.88	1	NON-LIQ.
9	39.5	1	31	SPT	4937.5	3094	0.86	0.62	31.0	0.75	1.00	1.2	1.05	29.3	0.80	23.5	35%	33.2		0.84	1	NON-LIQ.
10	44.5	1	46	MC	5562.5	3406	0.81	0.60	29.9	0.75	1.00	1.0	1.05	23.5	0.76	17.8	45%	26.4	0.32	0.81	1	(0.54)

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-128A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6	2	9	SPT	750	750	0.99		9.0	1.42	0.75	1.2	1.05	12.0	1.40	16.8				1.00	1	
2	11	2	12	SPT	1375	1313	0.98		12.0	1.42	0.80	1.2	1.05	17.1	1.19	20.3				1.00	1	
3	16	1	21	SPT	2000	1625	0.97	0.54	21.0	1.42	0.85	1.2	1.05	31.9	1.09	34.8		34.8		1.00	1	NON-LIQ.
4	21	1	15	SPT	2625	1938	0.95	0.59	15.0	1.42	0.95	1.2	1.05	25.4	1.01	25.8	20%	31.5		1.00	1	NON-LIQ.
5	26	1	14	SPT	3250	2250	0.94	0.62	14.0	1.42	0.95	1.2	1.05	23.7	0.95	22.5	45%	32.0		0.96	1	NON-LIQ.
6	31	1	15	SPT	3875	2563	0.92	0.63	15.0	1.42	1.00	1.2	1.05	26.8	0.89	23.7	12%	26.0	0.31	0.92	1	(0.57)
7	36	1	5	SPT	4500	2875	0.88	0.63	5.0	1.42	1.00	1.2	1.05	8.9	0.83	7.4	20%	11.7	0.13	0.92	1	(0.23)
8	39	1	15	SPT	4875	3063	0.86	0.62	15.0	1.42	1.00	1.2	1.05	26.8	0.81	21.6	24%	28.1	0.37	0.87	1	(0.64)
9	42	1	15	SPT	5250	3250	0.83	0.61	15.0	1.42	1.00	1.2	1.05	26.8	0.78	20.9	24%	27.3	0.35	0.86	1	(0.60)
10	45	1	12	SPT	5625	3438	0.80	0.60	12.0	1.42	1.00	1.2	1.05	21.4	0.75	16.1	13%	18.6	0.20	0.85	1	(0.35)
11	48	1	35	SPT	6000	3625	0.77	0.58	35.0	1.42	1.00	1.2	1.05	62.5	0.73	45.6		45.6		0.79	1	NON-LIQ.
12	51	1	38	SPT	6375	3813	0.74	0.56	38.0	1.42	1.00	1.2	1.05	67.8	0.71	48.0		48.0		0.77	1	NON-LIQ.
13	54	1	29	SPT	6750	4000	0.71	0.55	29.0	1.42	1.00	1.2	1.05	51.8	0.69	35.6		35.6		0.76	1	NON-LIQ.
14	57	1	15	SPT	7125	4188	0.68	0.53	15.0	1.42	1.00	1.2	1.05	26.8	0.67	17.9	17%	22.0	0.24	0.80	1	(0.45)
15	60	1	19	SPT	7500	4375	0.66	0.51	19.0	1.42	1.00	1.2	1.05	33.9	0.65	22.0	17%	26.4	0.32	0.77	1	(0.60)
16	65	1	12	SPT	8125	4688	0.62	0.49	12.0	1.42	1.00	1.2	1.05	21.4	0.62	13.3	52%	21.0	0.23	0.79	1	(0.45)
17	70	2	20	SPT	8750	5000	0.59		20.0	1.42	1.00	1.2	1.05	35.7	0.59	21.2				0.74	1	
18	80	2	37	SPT	10000	5625	0.55		37.0	1.42	1.00	1.2	1.05	66.0	0.55	36.2				0.66	1	

Note:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-129***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	18	MC	250	250	1.00		11.7	0.92	1.00	1.0	1.05	11.3	1.66	18.7				1.00	1	
2	4.5	2	32	MC	562.5	563	0.99		20.8	0.92	1.00	1.0	1.05	20.0	1.49	29.7				1.00	1	
3	9.5	2	18	MC	1187.5	1188	0.98		11.7	0.92	1.00	1.0	1.05	11.3	1.23	13.8				1.00	1	
4	14.5	1	28	MC	1812.5	1531	0.97	0.52	18.2	0.92	1.00	1.0	1.05	17.5	1.12	19.6	44%	28.5	0.39	1.00	1	(0.92)
5	19.5	2	25	MC	2437.5	1844	0.96		16.3	0.92	1.00	1.0	1.05	15.6	1.04	16.2				1.00	1	
6	24.5	2	23	MC	3062.5	2156	0.94		15.0	0.92	1.00	1.0	1.05	14.4	0.97	13.9				0.97	1	
7	29.5	1	62	MC	3687.5	2469	0.92	0.63	40.3	0.92	1.00	1.0	1.05	38.8	0.90	35.1		35.1		0.92	1	NON-LIQ.
8	34.5	1	19	SPT	4312.5	2781	0.89	0.63	19.0	0.92	1.00	1.2	1.05	21.9	0.85	18.6	30%	26.2	0.32	0.89	1	(0.55)
9	39.5	1	35	MC	4937.5	3094	0.86	0.62	22.8	0.92	1.00	1.0	1.05	21.9	0.80	17.5	26%	24.1	0.27	0.85	1	(0.46)
10	44.5	1	65	SPT	5562.5	3406	0.81	0.60	65.0	0.92	1.00	1.2	1.05	75.1	0.76	56.9	25%	67.7		0.81	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-130***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR $_{7.5}$)*											*F.S.=(CRR $_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	6	2	12	MC	750	750	0.99		7.8	0.92	1.00	1.0	1.05	7.5	1.40	10.5				1.00	1	
2	9.5	2	10	MC	1187.5	1188	0.98		6.5	0.92	1.00	1.0	1.05	6.3	1.23	7.7				1.00	1	
3	14.5	2	14	MC	1812.5	1531	0.97		9.1	0.92	1.00	1.0	1.05	8.8	1.12	9.8				1.00	1	
4	19.5	2	16	MC	2437.5	1844	0.96		10.4	0.92	1.00	1.0	1.05	10.0	1.04	10.4				1.00	1	
5	24.5	2	18	MC	3062.5	2156	0.94		11.7	0.92	1.00	1.0	1.05	11.3	0.97	10.9				0.98	1	
6	29.5	1	17	MC	3687.5	2469	0.92	0.63	11.1	0.92	1.00	1.0	1.05	10.6	0.90	9.6	49%	16.5	0.18	0.94	1	(0.33)
7	34.5	1	22	MC	4312.5	2781	0.89	0.63	14.3	0.92	1.00	1.0	1.05	13.8	0.85	11.7	35%	19.0	0.20	0.90	1	(0.36)
8	39.5	1	100	SPT	4937.5	3094	0.86	0.62	100.0	0.92	1.00	1.2	1.05	115.5	0.80	92.5		92.5		0.84	1	NON-LIQ.
9	44.5	1	73	SPT	5562.5	3406	0.81	0.60	73.0	0.92	1.00	1.2	1.05	84.3	0.76	63.9		63.9		0.81	1	NON-LIQ.
10	49.5	1	67	SPT	6187.5	3719	0.76	0.57	67.0	0.92	1.00	1.2	1.05	77.4	0.72	55.6	27%	67.4		0.78	1	NON-LIQ.
11	54.5	1	54	SPT	6812.5	4031	0.71	0.54	54.0	0.92	1.00	1.2	1.05	62.4	0.68	42.7		42.7		0.76	1	NON-LIQ.
12	59.5	2	38	SPT	7437.5	4344	0.66		38.0	0.92	1.00	1.2	1.05	43.9	0.65	28.6				0.73	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-133***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 60% *(spooling winch system, EGS B-60)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	15	MC	250	250	1.00		9.8	1.00	1.00	1.0	1.05	10.2	1.66	17.0				1.00	1	
2	4.5	2	26	MC	562.5	563	0.99		16.9	1.00	1.00	1.0	1.05	17.7	1.49	26.4				1.00	1	
3	9.5	2	24	MC	1187.5	1188	0.98		15.6	1.00	1.00	1.0	1.05	16.4	1.23	20.1				1.00	1	
4	14.5	1	20	MC	1812.5	1531	0.97	0.52	13.0	1.00	1.00	1.0	1.05	13.7	1.12	15.3	35%	23.3	0.26	1.00	1	(0.62)
5	19.5	2	16	MC	2437.5	1844	0.96		10.4	1.00	1.00	1.0	1.05	10.9	1.04	11.3				1.00	1	
6	24.5	2	34	MC	3062.5	2156	0.94		22.1	1.00	1.00	1.0	1.05	23.2	0.97	22.4				0.97	1	
7	29.5	2	21	MC	3687.5	2469	0.92		13.7	1.00	1.00	1.0	1.05	14.3	0.90	13.0				0.93	1	
8	34.5	2	22	MC	4312.5	2781	0.89		14.3	1.00	1.00	1.0	1.05	15.0	0.85	12.8				0.90	1	
9	39.5	2	38	MC	4937.5	3094	0.86		24.7	1.00	1.00	1.0	1.05	25.9	0.80	20.8				0.84	1	
10	44.5	1	49	MC	5562.5	3406	0.81	0.60	31.9	1.00	1.00	1.0	1.05	33.4	0.76	25.3	23%	31.9		0.81	1	NON-LIQ.
11	49.5	1	86	MC	6187.5	3719	0.76	0.57	55.9	1.00	1.00	1.0	1.05	58.7	0.72	42.2		42.2		0.78	1	NON-LIQ.
12	54.5	1	40	MC	6812.5	4031	0.71	0.54	26.0	1.00	1.00	1.0	1.05	27.3	0.68	18.7	15%	22.1	0.24	0.77	1	(0.42)
13	59.5	1	25	MC	7437.5	4344	0.66	0.52	16.3	1.00	1.00	1.0	1.05	17.1	0.65	11.1	17%	14.8	0.16	0.79	1	(0.30)

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-133A***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 85% *(Automatic Hammer, Technicon)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} (g)= 0.7
FAULT M_w = 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	5	2	9	SPT	625	625	0.99		9.0	1.42	0.75	1.2	1.05	12.0	1.45	17.5				1.00	1	
2	10	2	11	SPT	1250	1250	0.98		11.0	1.42	0.80	1.2	1.05	15.7	1.21	18.9				1.00	1	
3	13	2	11	SPT	1625	1438	0.97		11.0	1.42	0.85	1.2	1.05	16.7	1.15	19.1				1.00	1	
4	16	2	16	SPT	2000	1625	0.97		16.0	1.42	0.85	1.2	1.05	24.3	1.09	26.5				1.00	1	
5	20	2	16	SPT	2500	1875	0.96		16.0	1.42	0.95	1.2	1.05	27.1	1.03	27.9				1.00	1	
6	25	2	18	SPT	3125	2188	0.94		18.0	1.42	0.95	1.2	1.05	30.5	0.96	29.3				0.97	1	
7	30	2	16	SPT	3750	2500	0.92		16.0	1.42	1.00	1.2	1.05	28.6	0.90	25.6				0.93	1	
8	35	2	6	SPT	4375	2813	0.89		6.0	1.42	1.00	1.2	1.05	10.7	0.84	9.0				0.92	1	
9	40	2	15	SPT	5000	3125	0.85		15.0	1.42	1.00	1.2	1.05	26.8	0.80	21.3				0.87	1	
10	43	1	14	SPT	5375	3313	0.82	0.61	14.0	1.42	1.00	1.2	1.05	25.0	0.77	19.2	40%	28.1	0.37	0.85	1	(0.65)
11	46	1	14	SPT	5750	3500	0.79	0.59	14.0	1.42	1.00	1.2	1.05	25.0	0.75	18.6	35%	27.4	0.35	0.84	1	(0.61)
12	49	1	17	SPT	6125	3688	0.76	0.58	17.0	1.42	1.00	1.2	1.05	30.3	0.72	21.9	35%	31.3		0.82	1	NON-LIQ.
13	52	1	25	SPT	6500	3875	0.73	0.56	25.0	1.42	1.00	1.2	1.05	44.6	0.70	31.3		31.3		0.78	1	NON-LIQ.
14	55	1	45	SPT	6875	4063	0.70	0.54	45.0	1.42	1.00	1.2	1.05	80.3	0.68	54.7		54.7		0.75	1	NON-LIQ.
15	58	1	27	SPT	7250	4250	0.68	0.52	27.0	1.42	1.00	1.2	1.05	48.2	0.66	31.9		31.9		0.75	1	NON-LIQ.
16	61	1	33	SPT	7625	4438	0.65	0.51	33.0	1.42	1.00	1.2	1.05	58.9	0.64	37.9		37.9		0.73	1	NON-LIQ.
17	64	1	30	SPT	8000	4625	0.63	0.50	30.0	1.42	1.00	1.2	1.05	53.6	0.63	33.5		33.5		0.72	1	NON-LIQ.
18	70	1	21	SPT	8750	5000	0.59	0.47	21.0	1.42	1.00	1.2	1.05	37.5	0.59	22.3		22.3	0.25	0.74	1	(0.48)

Note:

1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:

Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-134***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	19	MC	562.5	563	0.99		12.4	0.92	1.00	1.0	1.05	11.9	1.49	17.7				1.00	1	
2	9.5	2	30	MC	1187.5	1188	0.98		19.5	0.92	1.00	1.0	1.05	18.8	1.23	23.0				1.00	1	
3	14.5	2	25	MC	1812.5	1531	0.97		16.3	0.92	1.00	1.0	1.05	15.6	1.12	17.5				1.00	1	
4	19.5	2	13	MC	2437.5	1844	0.96		8.5	0.92	1.00	1.0	1.05	8.1	1.04	8.4				1.00	1	
5	24.5	2	16	MC	3062.5	2156	0.94		10.4	0.92	1.00	1.0	1.05	10.0	0.97	9.7				0.98	1	
6	29.5	2	10	MC	3687.5	2469	0.92		6.5	0.92	1.00	1.0	1.05	6.3	0.90	5.7				0.95	1	
7	34.5	1	35	MC	4312.5	2781	0.89	0.63	22.8	0.92	1.00	1.0	1.05	21.9	0.85	18.6	29%	26.0	0.31	0.88	1	(0.54)
8	39.5	2	22	MC	4937.5	3094	0.86		14.3	0.92	1.00	1.0	1.05	13.8	0.80	11.0				0.87	1	
9	44.5	2	51	MC	5562.5	3406	0.81		33.2	0.92	1.00	1.0	1.05	31.9	0.76	24.2				0.81	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-135***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 60% *(spooling winch system, EGS B-61)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	17	MC	562.5	563	0.99		11.1	1.00	1.00	1.0	1.05	11.6	1.49	17.2				1.00	1	
2	9.5	2	22	MC	1187.5	1188	0.98		14.3	1.00	1.00	1.0	1.05	15.0	1.23	18.4				1.00	1	
3	14.5	1	15	MC	1812.5	1531	0.97	0.52	9.8	1.00	1.00	1.0	1.05	10.2	1.12	11.5	26%	17.3	0.18	1.00	1	(0.43)
4	19.5	1	15	MC	2437.5	1844	0.96	0.58	9.8	1.00	1.00	1.0	1.05	10.2	1.04	10.6	26%	16.3	0.17	1.00	1	(0.37)
5	24.5	2	24	MC	3062.5	2156	0.94		15.6	1.00	1.00	1.0	1.05	16.4	0.97	15.8				0.97	1	
6	29.5	2	27	MC	3687.5	2469	0.92		17.6	1.00	1.00	1.0	1.05	18.4	0.90	16.7				0.93	1	
7	34.5	1	18	MC	4312.5	2781	0.89	0.63	11.7	1.00	1.00	1.0	1.05	12.3	0.85	10.4	34%	17.3	0.18	0.91	1	(0.33)
8	39.5	1	17	MC	4937.5	3094	0.86	0.62	11.1	1.00	1.00	1.0	1.05	11.6	0.80	9.3	34%	16.0	0.17	0.88	1	(0.30)
9	44.5	1	18	MC	5562.5	3406	0.81	0.60	11.7	1.00	1.00	1.0	1.05	12.3	0.76	9.3	34%	16.0	0.17	0.86	1	(0.30)

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-136***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	25	MC	250	250	1.00		16.3	0.92	1.00	1.0	1.05	15.6	1.66	26.0				1.00	1	
2	4.5	1	25	MC	562.5	563	0.99	0.45	16.3	0.92	1.00	1.0	1.05	15.6	1.49	23.2	35%	32.9		1.00	1	
3	9.5	1	34	MC	1187.5	1188	0.98	0.45	22.1	0.92	1.00	1.0	1.05	21.3	1.23	26.1	35%	36.3		1.00	1	
4	14.5	2	33	MC	1812.5	1531	0.97		21.5	0.92	1.00	1.0	1.05	20.6	1.12	23.1				1.00	1	
5	19.5	2	21	MC	2437.5	1844	0.96		13.7	0.92	1.00	1.0	1.05	13.1	1.04	13.6				1.00	1	
6	24.5	2	38	MC	3062.5	2156	0.94		24.7	0.92	1.00	1.0	1.05	23.8	0.97	23.0				0.97	1	
7	29.5	1	26	MC	3687.5	2469	0.92	0.63	16.9	0.92	1.00	1.0	1.05	16.3	0.90	14.7	18%	18.9	0.20	0.93	1	(0.37)
8	34.5	1	12	MC	4312.5	2781	0.89	0.63	7.8	0.92	1.00	1.0	1.05	7.5	0.85	6.4	21%	10.7	0.12	0.92	1	(0.21)
9	39.5	2	23	MC	4937.5	3094	0.86		15.0	0.92	1.00	1.0	1.05	14.4	0.80	11.5				0.87	1	
10	44.5	1	63	MC	5562.5	3406	0.81	0.60	41.0	0.92	1.00	1.0	1.05	39.4	0.76	29.9	10%	31.4		0.81	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-137***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	17	MC	250	250	1.00		11.1	0.92	1.00	1.0	1.05	10.6	1.66	17.7				1.00	1	
2	4.5	2	18	MC	562.5	563	0.99		11.7	0.92	1.00	1.0	1.05	11.3	1.49	16.7				1.00	1	
3	9.5	1	17	MC	1187.5	1188	0.98	0.45	11.1	0.92	1.00	1.0	1.05	10.6	1.23	13.0		13.0		1.00	1	
4	14.5	2	27	MC	1812.5	1531	0.97		17.6	0.92	1.00	1.0	1.05	16.9	1.12	18.9				1.00	1	
5	19.5	2	23	MC	2437.5	1844	0.96		15.0	0.92	1.00	1.0	1.05	14.4	1.04	14.9				1.00	1	
6	24.5	2	36	MC	3062.5	2156	0.94		23.4	0.92	1.00	1.0	1.05	22.5	0.97	21.8				0.97	1	
7	29.5	1	26	MC	3687.5	2469	0.92	0.63	16.9	0.92	1.00	1.0	1.05	16.3	0.90	14.7	59%	22.6	0.25	0.93	1	(0.46)
8	34.5	1	28	MC	4312.5	2781	0.89	0.63	18.2	0.92	1.00	1.0	1.05	17.5	0.85	14.9		14.9	0.16	0.89	1	(0.28)
9	39.5	1	45	MC	4937.5	3094	0.86	0.62	29.3	0.92	1.00	1.0	1.05	28.2	0.80	22.5		22.5	0.25	0.84	1	(0.42)
10	44.5	1	100	MC	5562.5	3406	0.81	0.60	65.0	0.92	1.00	1.0	1.05	62.6	0.76	47.4		47.4		0.81	1	NON-LIQ.

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-138***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	15	MC	562.5	563	0.99		9.8	0.92	1.00	1.0	1.05	9.4	1.49	13.9				1.00	1	
2	9.5	2	29	MC	1187.5	1188	0.98		18.9	0.92	1.00	1.0	1.05	18.1	1.23	22.3				1.00	1	
3	14.5	2	17	MC	1812.5	1531	0.97		11.1	0.92	1.00	1.0	1.05	10.6	1.12	11.9				1.00	1	
4	19.5	2	21	MC	2437.5	1844	0.96		13.7	0.92	1.00	1.0	1.05	13.1	1.04	13.6				1.00	1	
5	24.5	2	18	MC	3062.5	2156	0.94		11.7	0.92	1.00	1.0	1.05	11.3	0.97	10.9				0.98	1	
6	29.5	2	25	MC	3687.5	2469	0.92		16.3	0.92	1.00	1.0	1.05	15.6	0.90	14.1				0.93	1	
7	34.5	2	19	MC	4312.5	2781	0.89		12.4	0.92	1.00	1.0	1.05	11.9	0.85	10.1				0.90	1	
8	39.5	2	46	MC	4937.5	3094	0.86		29.9	0.92	1.00	1.0	1.05	28.8	0.80	23.0				0.84	1	
9	44.5	2	21	MC	5562.5	3406	0.81		13.7	0.92	1.00	1.0	1.05	13.1	0.76	10.0				0.85	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-139***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	1	39	MC	562.5	563	0.99	0.45	25.4	0.92	1.00	1.0	1.05	24.4	1.49	36.2		36.2		1.00	1	
2	9.5	2	25	MC	1187.5	1188	0.98		16.3	0.92	1.00	1.0	1.05	15.6	1.23	19.2				1.00	1	
3	14.5	2	14	MC	1812.5	1531	0.97		9.1	0.92	1.00	1.0	1.05	8.8	1.12	9.8				1.00	1	
4	19.5	2	22	MC	2437.5	1844	0.96		14.3	0.92	1.00	1.0	1.05	13.8	1.04	14.3				1.00	1	
5	24.5	2	17	SPT	3062.5	2156	0.94		17.0	0.92	1.00	1.2	1.05	19.6	0.97	19.0				0.97	1	
6	29.5	2	43	MC	3687.5	2469	0.92		28.0	0.92	1.00	1.0	1.05	26.9	0.90	24.3				0.92	1	
7	34.5	1	21	SPT	4312.5	2781	0.89	0.63	21.0	0.92	1.00	1.2	1.05	24.3	0.85	20.6	23%	26.7	0.33	0.88	1	(0.57)
8	39.5	2	30	SPT	4937.5	3094	0.86		30.0	0.92	1.00	1.2	1.05	34.7	0.80	27.8				0.84	1	
9	44.5	2	43	MC	5562.5	3406	0.81		28.0	0.92	1.00	1.0	1.05	26.9	0.76	20.4				0.81	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-140***

BOREHOLE DIA (in)= 6
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 55% *(spooling winch system, EGS B-56)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE (CRR 7.5)*											*F.S.=(CRR 7.5/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sample Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60,CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	4.5	2	32	MC	562.5	563	0.99		20.8	0.92	1.00	1.0	1.05	20.0	1.49	29.7				1.00	1	
2	9.5	2	40	MC	1187.5	1188	0.98		26.0	0.92	1.00	1.0	1.05	25.0	1.23	30.7				1.00	1	
3	14.5	2	28	MC	1812.5	1531	0.97		18.2	0.92	1.00	1.0	1.05	17.5	1.12	19.6				1.00	1	
4	19.5	2	13	SPT	2437.5	1844	0.96		13.0	0.92	1.00	1.2	1.05	15.0	1.04	15.6				1.00	1	
5	24.5	1	17	MC	3062.5	2156	0.94	0.61	11.1	0.92	1.00	1.0	1.05	10.6	0.97	10.3	45%	17.3	0.18	0.98	1	(0.37)
6	29.5	1	17	SPT	3687.5	2469	0.92	0.63	17.0	0.92	1.00	1.2	1.05	19.6	0.90	17.7	45%	26.3	0.32	0.93	1	(0.59)
7	34.5	2	42	MC	4312.5	2781	0.89		27.3	0.92	1.00	1.0	1.05	26.3	0.85	22.3				0.88	1	
8	39.5	1	13	SPT	4937.5	3094	0.86	0.62	13.0	0.92	1.00	1.2	1.05	15.0	0.80	12.0		12.0	0.13	0.87	1	(0.23)
9	44.5	2	35	MC	5562.5	3406	0.81		22.8	0.92	1.00	1.0	1.05	21.9	0.76	16.6				0.82	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\,(N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

LIQUEFACTION POTENTIAL ANALYSIS (SPT procedures per Youd et al, 2001)

PROJECT NAME ***80-680-12 INTERCHANGE***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-12-151***

BOREHOLE DIA (in)= 5
GW DEPTH (ft)= 10

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS

HAMMER ENERGY = 60% *(Automatic Hammer, Woodward Drilling)*

FAULT INFO
GREEN VALLEY FAULT
a_{max} *(g)=* 0.7
FAULT M_w *=* 6.9

MSF = 1.24

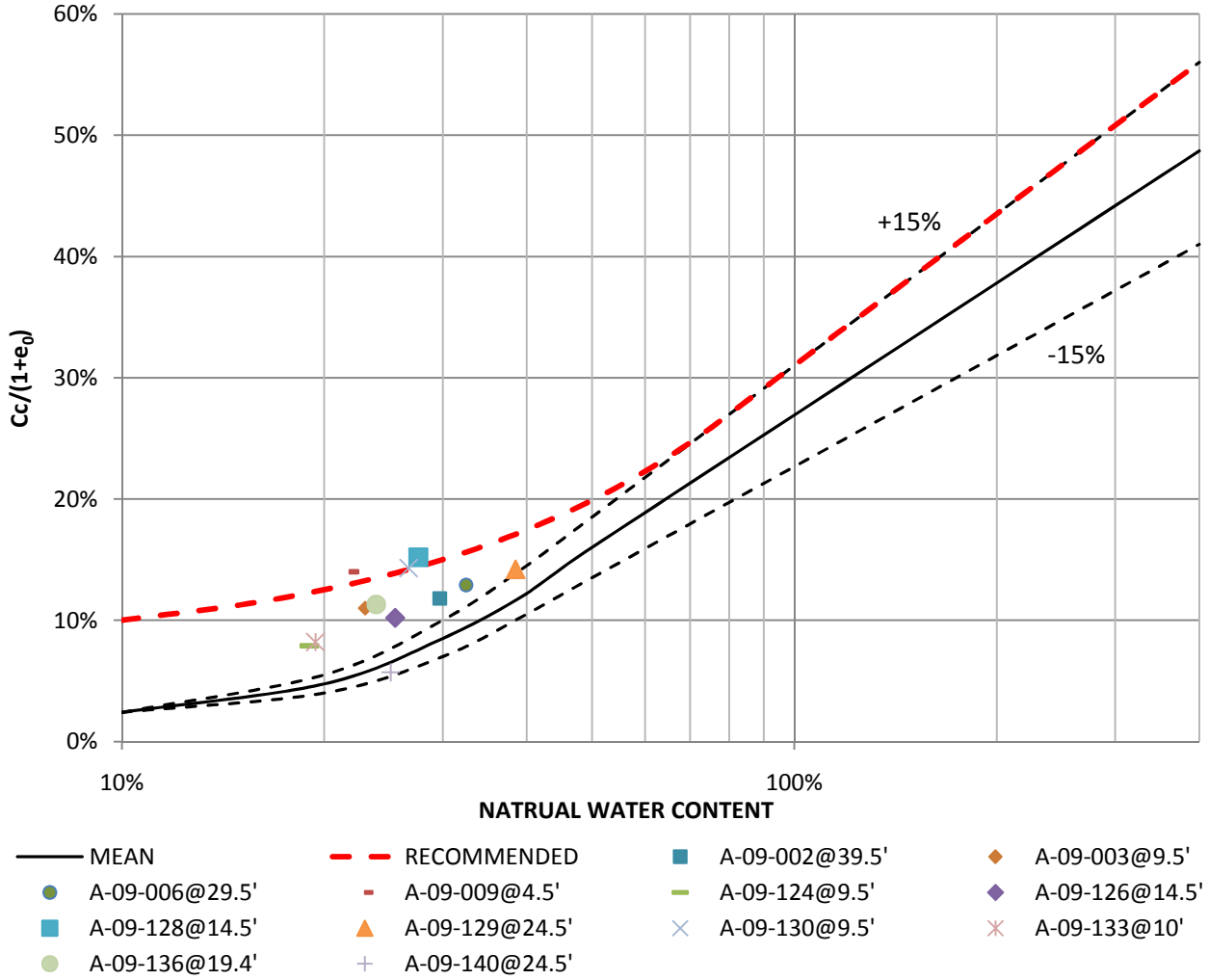
					CYCLIC STRESS RATIO (CSR)				*LIQUEFACTION RESISTANCE ($CRR_{7.5}$)*											*F.S.=($CRR_{7.5}$/CSR)*MSF*K σ*K α*		
Sample No	Depth (ft)	Soil Type	Blow Count	Sampler Type	σ_v (psf)	σ_v' (psf)	r_d	CSR	Eqiv. SPT-N	C_E	C_R	C_S	C_B	N_{60}	C_N	$(N_1)_{60}$	F.C.	$(N_1)_{60, CS}$	$CRR_{7.5}$	Kσ	Kα	F.S.
1	2	2	21	MC	250	250	1.00		13.7	1.00	1.00	1.0	1.05	14.3	1.66	23.8				1.00	1	
2	5	2	15	MC	625	625	0.99		9.8	1.00	1.00	1.0	1.05	10.2	1.45	14.9				1.00	1	
3	10	2	26	MC	1250	1250	0.98		16.9	1.00	1.00	1.0	1.05	17.7	1.21	21.4				1.00	1	
4	15	2	70	MC	1875	1563	0.97		45.5	1.00	1.00	1.0	1.05	47.8	1.11	53.0				1.00	1	
5	20	1	37	MC	2500	1875	0.96	0.58	24.1	1.00	1.00	1.0	1.05	25.3	1.03	26.0	27%	33.9		1.00	1	NON-LIQ.
6	25	2	36	MC	3125	2188	0.94		23.4	1.00	1.00	1.0	1.05	24.6	0.96	23.6				0.96	1	
7	30	2	16	MC	3750	2500	0.92		10.4	1.00	1.00	1.0	1.05	10.9	0.90	9.8				0.94	1	
8	35	1	92	MC	4375	2813	0.89	0.63	59.8	1.00	1.00	1.0	1.05	62.8	0.84	53.0		53.0		0.87	1	NON-LIQ.
9	40	1	89	MC	5000	3125	0.85	0.62	57.9	1.00	1.00	1.0	1.05	60.7	0.80	48.4		48.4		0.84	1	NON-LIQ.
10	45	1	92	MC	5625	3438	0.80	0.60	59.8	1.00	1.00	1.0	1.05	62.8	0.75	47.3		47.3		0.81	1	NON-LIQ.
11	50	2	64	MC	6250	3750	0.75		41.6	1.00	1.00	1.0	1.05	43.7	0.72	31.3				0.78	1	
12	60	2	59	MC	7500	4375	0.66		38.4	1.00	1.00	1.0	1.05	40.3	0.65	26.2				0.73	1	
13	70	2	68	MC	8750	5000	0.59		44.2	1.00	1.00	1.0	1.05	46.4	0.59	27.6				0.69	1	
14	80	1	100	MC	10000	5625	0.55	0.44	65.0	1.00	1.00	1.0	1.05	68.3	0.55	37.4		37.4		0.66	1	NON-LIQ.
15	90	1	100	MC	11250	6250	0.52	0.43	65.0	1.00	1.00	1.0	1.05	68.3	0.51	34.7		34.7		0.63	1	NON-LIQ.
16	100	2	51	MC	12500	6875	0.50		33.2	1.00	1.00	1.0	1.05	34.8	0.47	16.5				0.64	1	

Note:
1. The correction factors C_E (Energy Ratio), C_B (Borehole Diameter), C_R (Rod Length) and C_S (Sampling Method-liner) are per Youd et al. (2001).
2. For correction of overburden, $C_N = 2.2/(1.2 + \sigma_v'/P_a)$ with a maximum value of 1.7 per Kayen et al. (1992) as cited in Youd et al. (2001).
3. The influence of Fines Contents are expressed by the following correction: $(N_1)_{60cs} = \alpha + \beta\ (N_1)_{60}$
   where α and β = coefficients determined from the following relationships
   for FC $\leq$ 5% $\alpha = 0$, $\beta = 1.0$
   for 5% < FC < 35% $\alpha = \exp(1.76-(190/FC^2))$, $\beta = (0.99+(FC^{1.5}/1000))$
   for FC $\geq$ 35% $\alpha = 5.0$, $\beta = 1.2$
4. For $(N_1)_{60,cs}$ greater than 30, clean granular soils are too dense to liquefy and are classed as non-liquefiable.
5. PGA of 0.66g was based on USGS 2008 Deaggregation.

Reference:
Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER Workshops on Evaluation of Liquefaction Resistance of Soils, Youd, et al., ASCE Journal of Geotechnical and Geoenvironmental Engineering, October 2001, Vol. 127 No. 10

SETTLEMENT ANALYSIS

Modified Compression Index v.s. Natural Moisture Content



Boring	Sample No.	Depth	Moisture Content	Cc/(1+e0)	Cr/(1+e0)	Cr/Cc
A-09-002	8	39.5	29.7%	11.8%	1.6%	13.6%
A-09-003	2	9.5	23.0%	11.0%	2.6%	23.6%
A-09-006	6	29.5	32.5%	12.9%	1.7%	13.2%
A-09-009	1	4.5	21.8%	14.0%	4.1%	29.3%
A-09-124	3	9.5	19.0%	7.9%	1.4%	17.7%
A-09-126	3	14.5	25.5%	10.2%	3.2%	31.4%
A-09-128	4	14.5	27.6%	15.2%	3.0%	19.7%
A-09-129	6	24.5	38.5%	14.2%	2.5%	17.6%
A-09-130	2	9.5	26.7%	14.3%	3.0%	21.0%
A-09-133	3	10.0	19.4%	8.2%	1.8%	22.0%
A-09-136	5	19.4	23.9%	11.3%	2.3%	20.4%
A-09-140	5	24.5	25.1%	5.7%	1.0%	17.5%

PARIKH
Practicing in the Geosciences

I-80/680/12 INTERCHANGE PROJECT
SOLANO COUNTY, CALIFORNIA

JOB NO.: 209130.GDR | **PLATE NO.:**

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-120*** *(RW#2)*

Embankment H (ft)= 35 *Contact Pressure (psf)=* 4375 *Contact Area, B (ft)=* 100 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 18 *Contact Area, L (ft)=* 500
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	4	37	SPT	37	125.0	125.0	14.3%	250	4289.2	18281	0.0222	0.1109	1.340		1.340
2	4	8	49	SPT	49	125.0	125.0	21.2%	750	4127.4	24375	0.0256	0.1282	1.000		1.000
2	8	13	29	SPT	29	125.0	125.0	19.8%	1313	3959.3	14381	0.0249	0.1247	0.903		0.903
2	13	18.5	37	SPT	37	125.0	62.6	20.6%	1797	3779.7	18525	0.0253	0.1267	0.822		0.822
1	18.5	22.5	16	SPT	16	125.0	62.6	25.7%	2095	3630.7						
1	22.5	27.5	9	SPT	9	125.0	62.6	29.8%	2376	3500.0						
1	27.5	32	8	SPT	8	125.0	62.6	33.2%	2674	3371.9						
2	32	38	23	SPT	23	125.0	62.6	28.3%	3002	3240.7	11625	0.0292	0.1458	0.668		0.668
2	38	42	31	SPT	31	125.0	62.6	23.0%	3315	3125.0	15356	0.0265	0.1327	0.367		0.367
1	42	47	12	SPT	12	125.0	62.6	26.2%	3597	3027.7						

Estimated Settlement (in)= *5.1* *0.0* ***5.1***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-121*** *(RW#2)*

Embankment H (ft)= 35 *Contact Pressure (psf)=* 4375 *Contact Area, B (ft)=* 100 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 15 *Contact Area, L (ft)=* 500
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	4	10	SPT	10	125.0	125.0	11.7%	250	4289.2	4767	0.0209	0.1043	1.261		1.261
2	4	8	42	SPT	42	125.0	125.0	13.5%	750	4127.4	21152	0.0218	0.1089	0.850		0.850
2	8	13	25	SPT	25	125.0	125.0	16.8%	1313	3959.3	12513	0.0234	0.1172	0.849		0.849
2	13	18	18	SPT	18	125.0	62.6	17.2%	1782	3787.9	8938	0.0236	0.1182	0.702		0.702
2	18	22	22	SPT	22	125.0	62.6	19.9%	2063	3645.8	11023	0.0250	0.1249	0.530		0.530
1	22	28	11	SPT	11	125.0	62.6	27.2%	2376	3500.0						
1	28	33	18	SPT	18	125.0	62.6	25.6%	2721	3352.5						
2	33	38.5	19	SPT	19	125.0	62.6	22.2%	3049	3222.8	9625	0.0261	0.1307	0.540		0.540
2	38.5	43	30	SPT	30	125.0	62.6	21.0%	3362	3108.3	15194	0.0255	0.1277	0.392		0.392
2	43	47	19	SPT	19	125.0	62.6	27.4%	3628	3017.2	9533	0.0287	0.1436	0.362		0.362

Estimated Settlement (in)= *5.5* *0.0* ***5.5***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-006*** *(ABUTMENT 1 OF WB80 TO WB12/RW#2)*

Embankment H (ft)= 35 *Contact Pressure (psf)=* 4375 *Contact Area, B (ft)=* 100 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 18 *Contact Area, L (ft)=*
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	8	14	SPT	14	125.0	125.0	17.7%	500	4206.7	7202	0.0239	0.1194	2.233		2.233
2	8	13	20	SPT	20	125.0	125.0	15.8%	1313	3959.3	10029	0.0229	0.1146	0.831		0.831
2	13	16.5	21	SPT	21	125.0	125.0	18.2%	1844	3812.6	10644	0.0241	0.1207	0.493		0.493
2	16.5	23	12	SPT	12	125.0	62.6	28.7%	2266	3653.4	6148	0.0294	0.1468	0.955		0.955
2	23	28	15	SPT	15	125.0	62.6	30.0%	2626	3486.1	7558	0.0300	0.1500	0.661		0.661
2	28	33	9	SPT	9	125.0	62.6	32.5%	2939	3352.5	4312	0.0312	0.1562	0.312	1.538	1.850
2	33	38	15	SPT	15	125.0	62.6	25.1%	3252	3228.8	7583	0.0276	0.1379	0.496		0.496
2	38	40	15	SPT	15	125.0	62.6	29.3%	3471	3147.5	7437	0.0297	0.1483	0.200		0.200
2	40	48.5	13	SPT	13	125.0	62.6	32.1%	3800	3032.9	6453	0.0310	0.1552	0.728	0.393	1.121
2	48.5	52	19	SPT	19	125.0	62.6	24.5%	4175	2911.8	9543	0.0273	0.1364	0.263		0.263
1	52	57	18	SPT	18	125.0	62.6	23.3%	4441	2831.7						
2	57	65	15	SPT	15	125.0	62.6	24.5%	4848	2717.4	7540	0.0273	0.1364	0.502	0.020	0.522
2	65	74	19	SPT	19	125.0	62.6	22.2%	5380	2581.1	9250	0.0261	0.1307	0.480		0.480
2	74	84	13	SPT	13	125.0	62.6	26.0%	5975	2444.1	6509	0.0280	0.1401	0.125	1.878	2.004
1	84	94	23	SPT	23	125.0	62.6	23.3%	6601	2314.8						
2	94	100	52	SPT	52	125.0	62.6	21.7%	7102	2220.8	26038	0.0259	0.1294	0.220		0.220
													Estimated Settlement (in)=	*8.5*	*3.8*	***12.3***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-009*** *(ABUTMENT 4 OF WB80 TO WB 12/RW#4)*

Embankment H (ft)= 25 *Contact Pressure (psf)=* 3125 *Contact Area, B (ft)=* 100 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 15 *Contact Area, L (ft)=*
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	8	11	SPT	11	125.0	125.0	21.8%	500	3004.8	5725	0.0259	0.1297	2.105		2.105
2	8	12	18	SPT	18	125.0	125.0	19.4%	1250	2840.9	9026	0.0247	0.1237	0.611		0.611
1	12	16.5	12	SPT	12	125.0	62.6	26.6%	1641	2735.2						
2	16.5	24.5	28	SPT	28	125.0	62.6	21.0%	2032	2593.4	13834	0.0255	0.1277	0.876		0.876
1	24.5	28	14	SPT	14	125.0	62.6	19.1%	2392	2475.2						
2	28	32	20	SPT	20	125.0	62.6	19.6%	2627	2403.8	10060	0.0248	0.1242	0.336		0.336
2	32	37	18	SPT	18	125.0	62.6	31.4%	2909	2323.4	9042	0.0307	0.1535	0.470		0.470
2	37	42	15	SPT	15	125.0	62.6	31.5%	3222	2240.1	7437	0.0307	0.1537	0.423		0.423
2	42	47	45	SPT	45	125.0	62.6	23.8%	3535	2162.6	22416	0.0269	0.1346	0.335		0.335
2	47	52	33	SPT	33	125.0	62.6	18.1%	3848	2090.3	16360	0.0241	0.1204	0.272		0.272
2	52	57	32	SPT	32	125.0	62.6	25.6%	4161	2022.7	16070	0.0278	0.1391	0.287		0.287
2	57	65	22	SPT	22	125.0	62.6	29.4%	4567	1941.0	10967	0.0297	0.1485	0.439		0.439
2	65	75	38	SPT	38	125.0	62.6	24.6%	5131	1838.2	18843	0.0273	0.1366	0.436		0.436
2	75	85	34	SPT	34	125.0	62.6	21.1%	5757	1736.1	17130	0.0256	0.1279	0.351		0.351
2	85	95	32	SPT	32	125.0	62.6	21.1%	6383	1644.7	16102	0.0256	0.1279	0.306		0.306
2	95	100	34	SPT	34	125.0	62.6	27.4%	6852	1582.3	16788	0.0287	0.1436	0.155		0.155
													Estimated Settlement (in)=	*7.4*	*0.0*	***7.4***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-124*** *(RW#4)*

Embankment H (ft)= 20 *Contact Pressure (psf)=* 2500 *Contact Area, B (ft)=* 60 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 15 *Contact Area, L (ft)=* 500
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	8	15	SPT	15	125.0	125.0	20.0%	500	2343.8	7746	0.0250	0.1252	1.814		1.814
2	8	12	25	SPT	25	125.0	125.0	19.5%	1250	2142.9	12513	0.0248	0.1239	0.516		0.516
2	12	16.5	13	SPT	13	125.0	62.6	19.0%	1641	2020.2	6554	0.0245	0.1227	0.462		0.462
1	16.5	24.5	8	SPT	8	125.0	62.6	24.9%	2032	1863.4						
2	24.5	28	7	SPT	7	125.0	62.6	29.9%	2392	1739.1	3575	0.0300	0.1498	0.220	0.395	0.615
1	28	32	17	SPT	17	125.0	62.6	27.0%	2627	1666.7						
1	32	37	11	SPT	11	125.0	62.6	23.1%	2909	1587.3						
2	37	42	14	SPT	14	125.0	62.6	22.8%	3222	1507.5	6852	0.0264	0.1322	0.264		0.264
2	42	47	16	SPT	16	125.0	62.6	21.8%	3535	1435.4	8044	0.0259	0.1297	0.230		0.230
2	47	52	6	SPT	6	125.0	62.6	29.0%	3848	1369.9	3848	0.0295	0.1476			
2	52	57	22	SPT	22	125.0	62.6	20.5%	4161	1310.0	11023	0.0253	0.1264			

Estimated Settlement (in)= *3.5* *0.4* ***3.9***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-125*** *(RW#4)*

Embankment H (ft)= 10 *Contact Pressure (psf)=* 1250 *Contact Area, B (ft)=* 60 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 15 *Contact Area, L (ft)=* 500
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	8	12	SPT	12	125.0	125.0	20.5%	500	1171.9	5958	0.0253	0.1264	1.272		1.272
2	8	13	19	SPT	19	125.0	125.0	22.9%	1313	1063.8	9533	0.0265	0.1324	0.410		0.410
2	13	18	7	SPT	7	125.0	62.6	25.3%	1782	993.4	3277	0.0277	0.1384	0.320		0.320
2	18	22	15	SPT	15	125.0	62.6	21.6%	2063	937.5	7746	0.0258	0.1292	0.202		0.202
1	22	27	28	SPT	28	125.0	62.6	24.6%	2345	887.6						
1	27	31.5	14	SPT	14	125.0	62.6	24.1%	2642	840.3						
2	31.5	38	35	SPT	35	125.0	62.6	22.8%	2987	791.6	17279	0.0264	0.1322	0.211		0.211
2	38	41	13	SPT	13	125.0	62.6	24.8%	3284	753.8	6256	0.0274	0.1371	0.089		0.089
1	41	48	17	SPT	17	125.0	62.6	23.4%	3597	717.7						
1	48	53	27	SPT	27	125.0	62.6	19.7%	3973	678.7						
													Estimated Settlement (in)=	*2.5*	*0.0*	***2.5***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-128*** *(RW#5 and RW#6)*

Embankment H (ft)=	15	*Contact Pressure (psf)=*	1875	*Contact Area, B (ft)=*	50	*Cr/Cc=*	20%
Unit Weight (pcf)=	125	*GW Level (ft)=*	15	*Contact Area, L (ft)=*	60		
				Plane Strain? (Y/N)=	Y		

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	4	12	SPT	12	125.0	125.0	24.1%	250	1802.9	6094	0.0271	0.1354	1.189		1.189
2	4	8	18	SPT	18	125.0	125.0	18.8%	750	1674.1	8775	0.0244	0.1222	0.598		0.598
2	8	12	23	SPT	23	125.0	125.0	23.0%	1250	1562.5	11456	0.0265	0.1327	0.448		0.448
2	12	17	16	SPT	16	125.0	62.6	27.6%	1657	1453.5	7800	0.0288	0.1441	0.473		0.473
1	17	22	23	SPT	23	125.0	62.6	20.2%	1970	1348.9						
1	22	27	49	SPT	49	125.0	62.6	20.9%	2283	1258.4						
2	27	32	22	SPT	22	125.0	62.6	40.0%	2596	1179.2	10875	0.0349	0.1746	0.341		0.341
1	32	37	33	SPT	33	125.0	62.6	36.6%	2909	1109.5						
1	37	42	23	SPT	23	125.0	62.6	28.4%	3222	1047.5						
1	42	47	22	SPT	22	125.0	62.6	31.6%	3535	992.1						

	OC	NC	Sum
Estimated Settlement (in)=	*3.0*	*0.0*	***3.0***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-129*** *(RW#5 and RW#6)*

Embankment H (ft)=	15	*Contact Pressure (psf)=*	1875	*Contact Area, B (ft)=*	50	*Cr/Cc=*	20%
Unit Weight (pcf)=	125	*GW Level (ft)=*	20	*Contact Area, L (ft)=*	60		
				Plane Strain? (Y/N)=	Y		

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	4	11	SPT	11	125.0	125.0	18.2%	250	1802.9	5363	0.0241	0.1207	1.059		1.059
2	4	8	19	SPT	19	125.0	125.0	18.3%	750	1674.1	9533	0.0242	0.1209	0.591		0.591
2	8	12	11	SPT	11	125.0	125.0	21.7%	1250	1562.5	5363	0.0259	0.1294	0.438		0.438
1	12	17	17	SPT	17	125.0	125.0	21.9%	1813	1453.5						
2	17	22	15	SPT	15	125.0	62.6	25.1%	2282	1348.9	7448	0.0276	0.1379	0.334		0.334
2	22	26.5	14	SPT	14	125.0	62.6	38.5%	2579	1262.6	6852	0.0342	0.1709	0.319		0.319
1	26.5	33	37	SPT	37	125.0	62.6	23.8%	2923	1175.5						
1	33	38	17	SPT	17	125.0	62.6	26.3%	3283	1096.5						
1	38	43	21	SPT	21	125.0	62.6	27.5%	3596	1035.9						
1	43	48	60	SPT	60	125.0	62.6	19.5%	3909	981.7						
														Estimated Settlement (in)=	*2.7*	*0.0*	***2.7***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***R-10-004*** *(RW#5 and RW#6)*

Embankment H (ft)= 20 *Contact Pressure (psf)=* 2500 *Contact Area, B (ft)=* 70 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 10 *Contact Area, L (ft)=* 60
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	8	7	SPT	7	125.0	125.0	24.4%	500	2364.9	3653	0.0272	0.1361	1.982		1.982
2	8	12	23	SPT	23	125.0	62.6	20.4%	1125	2187.5	11574	0.0252	0.1262	0.568		0.568
2	12	14	9	SPT	9	125.0	62.6	20.0%	1313	2108.4	4487	0.0250	0.1252	0.250		0.250
2	14	17	19	SPT	19	125.0	62.6	25.0%	1470	2046.8	9499	0.0275	0.1376	0.375		0.375
1	17	22	13	SPT	13	125.0	62.6	21.7%	1720	1955.3						
2	22	30	27	SPT	27	125.0	62.6	30.1%	2127	1822.9	13365	0.0301	0.1503	0.776		0.776
1	30	33	16	SPT	16	125.0	62.6	26.7%	2471	1724.1						
1	33	36	14	SPT	14	125.0	62.6	29.7%	2659	1674.6						
1	36	40	67	SPT	67	125.0	62.6	34.8%	2878	1620.4						
1	40	43.5	43	SPT	43	125.0	62.6	28.8%	3113	1566.0						
1	43.5	46.5	32	SPT	32	125.0	62.6	31.6%	3316	1521.7						
1	46.5	50	22	SPT	22	125.0	62.6	27.2%	3520	1479.9						
2	50	53	20	SPT	20	125.0	62.6	24.2%	3723	1440.3	9905	0.0271	0.1356	0.139		0.139
2	53	58.5	28	SPT	28	125.0	62.6	14.7%	3989	1391.7	14035	0.0224	0.1119	0.192		0.192
2	58.5	63	32	SPT	32	125.0	62.6	14.6%	4302	1338.4	16211	0.0223	0.1116	0.142		0.142
2	63	68	35	SPT	35	125.0	62.6	32.3%	4600	1291.5	17302	0.0311	0.1557	0.201		0.201
2	68	73	41	SPT	41	125.0	62.6	27.5%	4913	1245.6	20699	0.0288	0.1438	0.169		0.169
2	73	80	18	SPT	18	125.0	62.6	29.9%	5288	1194.5	8960	0.0300	0.1498	0.223		0.223
1	80	90	85	SPT	85	125.0	62.6	32.3%	5820	1129.0						
1	90	100	85	SPT	85	125.0	62.6	34.8%	6446	1060.6						
													Estimated Settlement (in)=	*5.0*	*0.0*	***5.0***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-133*** *(RW#7)*

Embankment H (ft)= 15 *Contact Pressure (psf)=* 1875 *Contact Area, B (ft)=* 80 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 20 *Contact Area, L (ft)=* 60
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	3.5	10	SPT	10	125.0	125.0	45.5%	219	1834.9	4875	0.0376	0.1880	1.536		1.536
2	3.5	8.5	17	SPT	17	125.0	125.0	18.1%	750	1744.2	8450	0.0241	0.1204	0.754		0.754
2	8.5	13	16	SPT	16	125.0	125.0	19.0%	1344	1652.9	7800	0.0245	0.1227	0.461		0.461
2	13	18	13	SPT	13	125.0	125.0	18.9%	1938	1570.7	6500	0.0245	0.1224	0.379		0.379
2	18	23	10	SPT	10	125.0	62.6	25.0%	2407	1492.5	5200	0.0275	0.1376	0.346		0.346
2	23	28	22	SPT	22	125.0	62.6	26.1%	2720	1421.8	11050	0.0281	0.1404	0.308		0.308
2	28	33	14	SPT	14	125.0	62.6	23.3%	3033	1357.5	6825	0.0267	0.1334	0.257		0.257
2	33	38	14	SPT	14	125.0	62.6	22.3%	3346	1298.7	7150	0.0262	0.1309	0.224		0.224
2	38	42	25	SPT	25	125.0	62.6	19.6%	3627	1250.0	12350	0.0248	0.1242	0.153		0.153
1	42	47	32	SPT	32	125.0	62.6	20.1%	3909	1204.8						
1	47	52	86	SPT	86	125.0	62.6	14.2%	4222	1158.3						
1	52	57	40	SPT	40	125.0	62.6	35.9%	4535	1115.2						
1	57	62	16	SPT	16	125.0	62.6	27.0%	4848	1075.3						
													Estimated Settlement (in)=	*4.4*	*0.0*	***4.4***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-001*** *(RW#7)*

Embankment H (ft)= 32.5 *Contact Pressure (psf)=* 4062.5 *Contact Area, B (ft)=* 80 *Cr/Cc=* 20%
Unit Weight (pcf)= 125 *GW Level (ft)=* 20 *Contact Area, L (ft)=* 60
Plane Strain? (Y/N)= Y

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
1	0	8	13	SPT	13	125.0	125.0	45.5%	500	3869.0						
1	8	12	8	SPT	8	125.0	125.0	18.1%	1250	3611.1						
2	12	17	33	SPT	33	125.0	125.0	19.0%	1813	3439.2	16250	0.0245	0.1227	0.680		0.680
2	17	22	25	SPT	25	125.0	62.6	18.9%	2282	3266.3	12350	0.0245	0.1224	0.567		0.567
2	22	26.5	23	SPT	23	125.0	62.6	25.0%	2579	3117.5	11700	0.0275	0.1376	0.512		0.512
2	26.5	31.5	16	SPT	16	125.0	62.6	26.1%	2876	2981.7	8125	0.0281	0.1404	0.520		0.520
1	31.5	36.5	65	SPT	65	125.0	62.6	23.3%	3189	2850.9						
1	36.5	41.5	100	SPT	100	125.0	62.6	22.3%	3502	2731.1						
1	41.5	46.5	100	SPT	100	125.0	62.6	19.6%	3815	2621.0						
1	46.5	51.5	100	SPT	100	125.0	62.6	20.1%	4128	2519.4						
1	51.5	57	59	SPT	59	125.0	62.6	14.2%	4457	2420.9						
2	57	63.5	11	SPT	11	125.0	62.6	35.9%	4832	2317.3	5500	0.0329	0.1646	0.144	1.462	1.607
2	63.5	74	65	SPT	65	125.0	62.6	27.0%	5365	2184.9	32500	0.0285	0.1426	0.533		0.533
2	74	84	65	SPT	65	125.0	62.6	22.3%	6006	2044.0	32500	0.0262	0.1309	0.400		0.400
2	84	93.5	62	SPT	62	125.0	62.6	27.0%	6617	1925.9	31000	0.0285	0.1426	0.361		0.361
1	93.5	100	100	SPT	100	125.0	62.6	10.7%	7117	1838.8						
													Estimated Settlement (in)=	*3.7*	*1.5*	***5.2***

SETTLEMENT ANALYSIS

PROJECT NAME ***I-80/680/12 INTERCHANGE PROJECT***
PROJECT NO. ***209130.GDR***
BORING NO. ***A-09-130*** *(GREEN VALLEY ROAD OC, NORTH EMBANKMENT)*

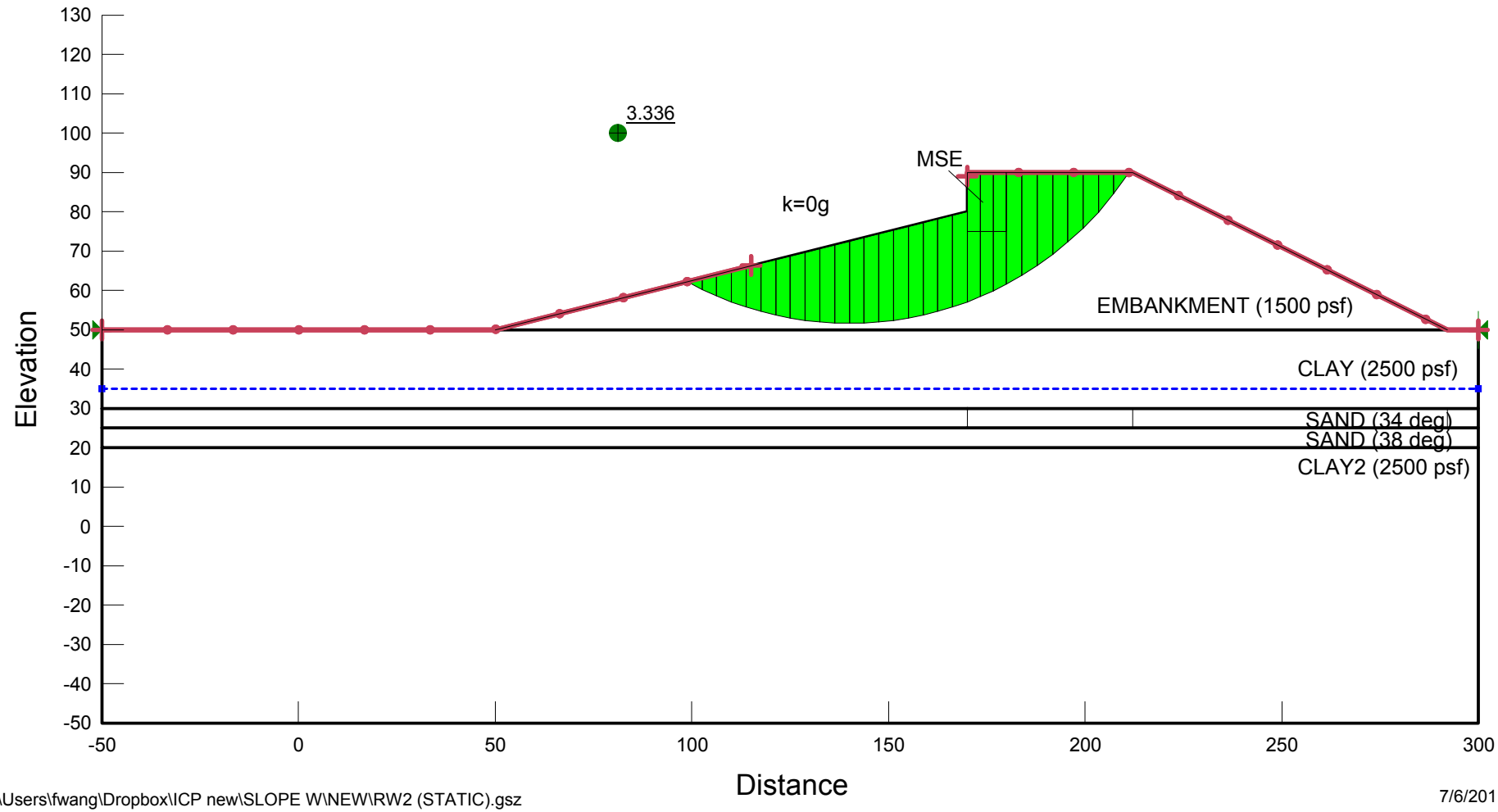
Embankment H (ft)=	20	*Contact Pressure (psf)=*	2500	*Contact Area, B (ft)=*	150	*Cr/Cc=*	20%
Unit Weight (pcf)=	125	*GW Level (ft)=*	10	*Contact Area, L (ft)=*	60		
				Plane Strain? (Y/N)=	Y		

GROUPS
1. GRAVELS AND SANDS
2. CLAYS AND SILTS

Soil Type	Depth From	Depth To	BLOW COUNT	SAMPLER TYPE	AVG SPT-N	γ_T (pcf)	γ' (pcf)	ω	σ_v' (psf)	$\Delta\sigma_v'$ (psf)	Pp (psf)	$Cr/1+e_0$	$Cc/1+e_0$	Settlements (in) OC	Settlements (in) NC	Settlements (in) Sum
2	0	7	7	SPT	7	125.0	125.0	22.5%	438	2443.0	3575	0.0263	0.1314	1.807		1.807
2	7	12	6	SPT	6	125.0	62.6	26.7%	1032	2351.1	2979	0.0284	0.1419	0.784	0.469	1.254
2	12	17	8	SPT	8	125.0	62.6	21.6%	1345	2279.6	4171	0.0258	0.1292	0.667		0.667
2	17	22	10	SPT	10	125.0	62.6	28.8%	1658	2212.4	4767	0.0294	0.1471	0.650		0.650
2	22	26.5	11	SPT	11	125.0	62.6	31.1%	1955	2152.1	5363	0.0305	0.1527	0.532		0.532
1	26.5	31.5	10	SPT	10	125.0	62.6	34.6%	2252	2095.0						
1	31.5	36.5	13	SPT	13	125.0	62.6	29.2%	2565	2038.0						
1	36.5	41.5	92	SPT	92	125.0	62.6	15.8%	2878	1984.1						
1	41.5	46.5	67	SPT	67	125.0	62.6	10.9%	3191	1933.0						
1	46.5	51.5	61	SPT	61	125.0	62.6	14.7%	3504	1884.4						
1	51.5	56.5	50	SPT	50	125.0	62.6	17.1%	3817	1838.2						
2	56.5	64	35	SPT	35	125.0	62.6	31.5%	4208	1783.6	17417	0.0307	0.1537	0.425		0.425
													Estimated Settlement (in)=	*4.9*	*0.5*	***5.3***

SLOPE STABILITY ANALYSIS

I-80/680/12 INTERCHANGE PROJECT
RETAINING WALL NO. 2
(STATIC CONDITION, SHORT-TERM, IMMEDIATELY AFTER CONSTRUCTION)



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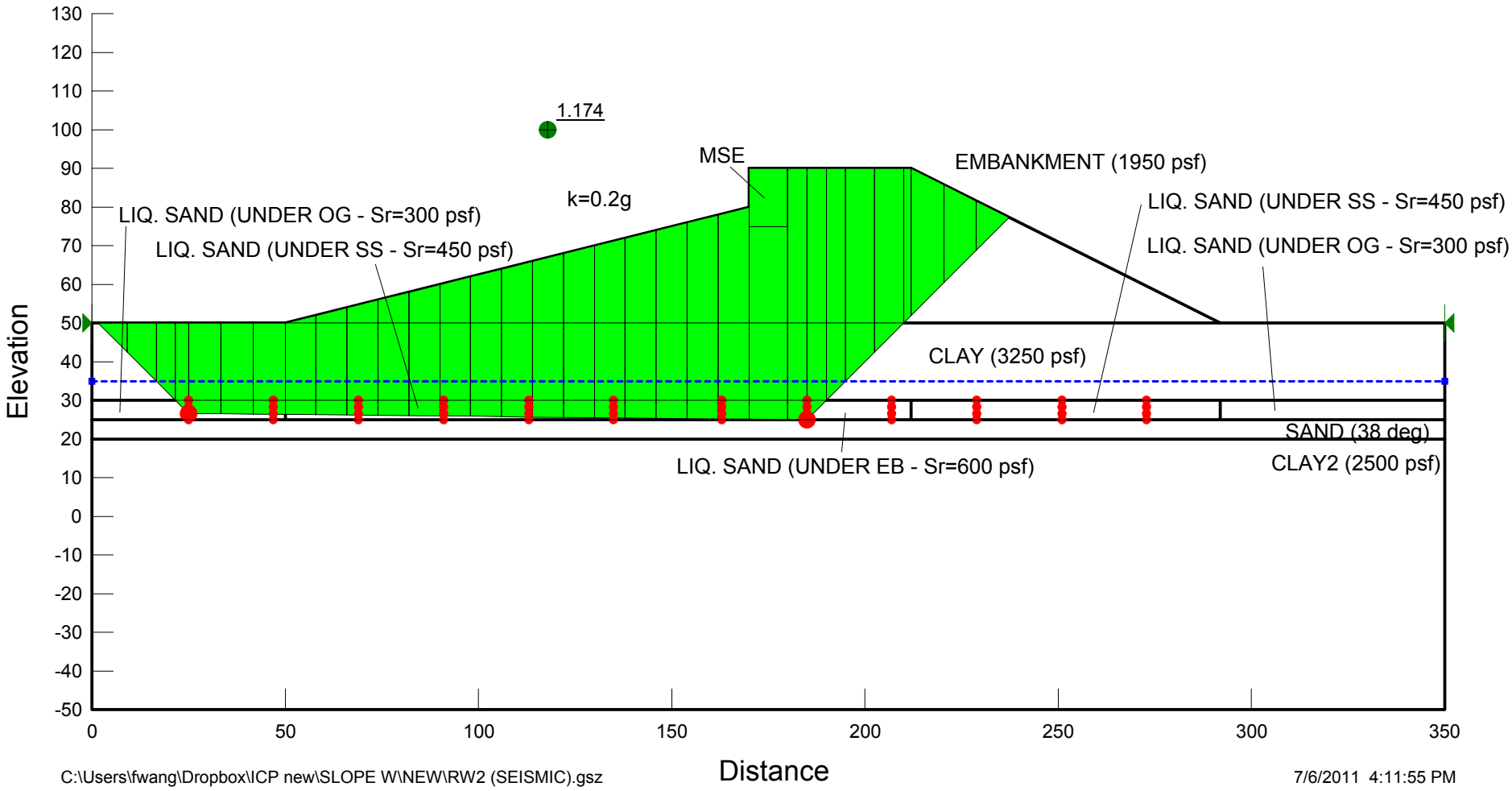
I-80/680/12 INTERCHANGE PROJECT
RETAINING WALL NO. 2

(PSEUDO-STATIC, k=0.2g+RESIDUAL SHEAR STRENGTH)



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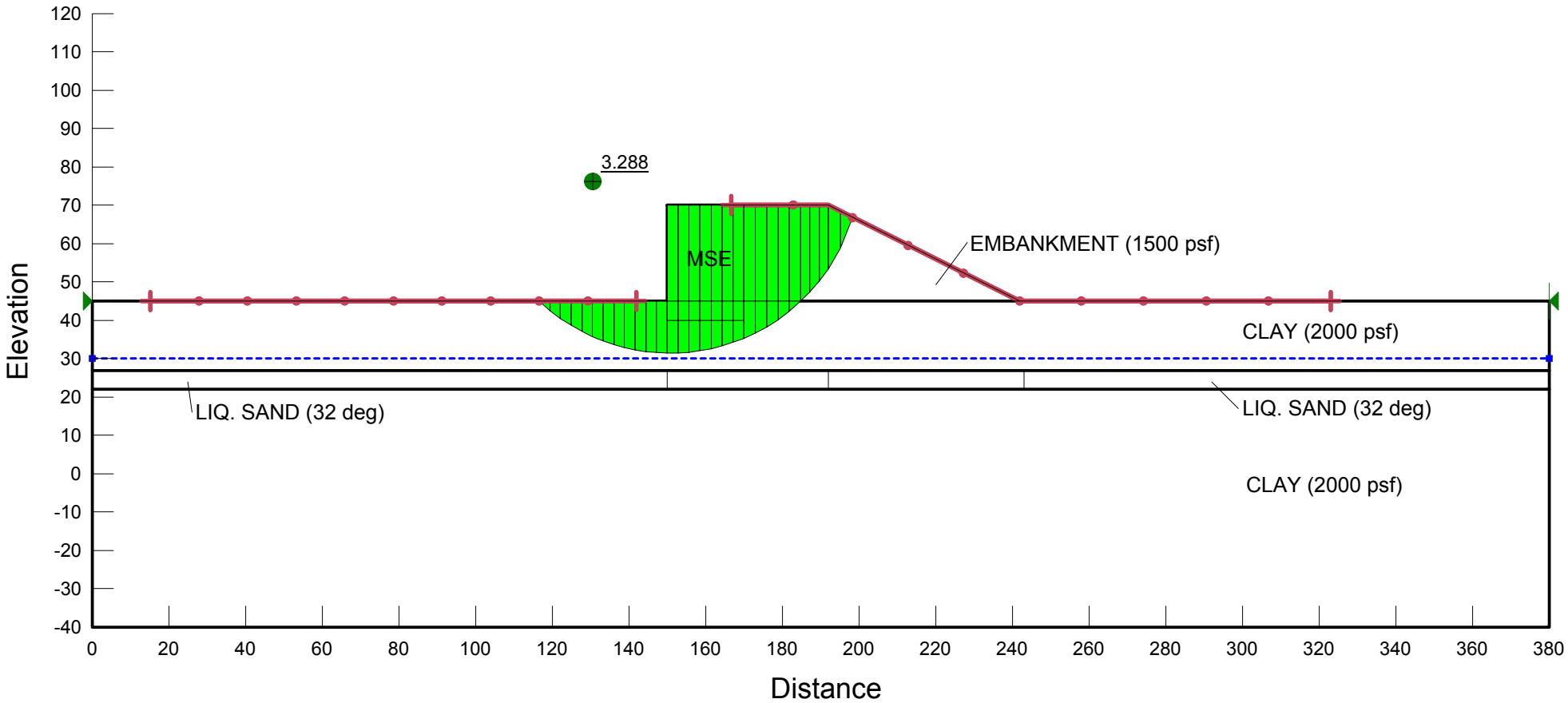
I-80/680/12 INTERCHANGE PROJECT
RETAINING WALL NO. 4
(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUCTION)



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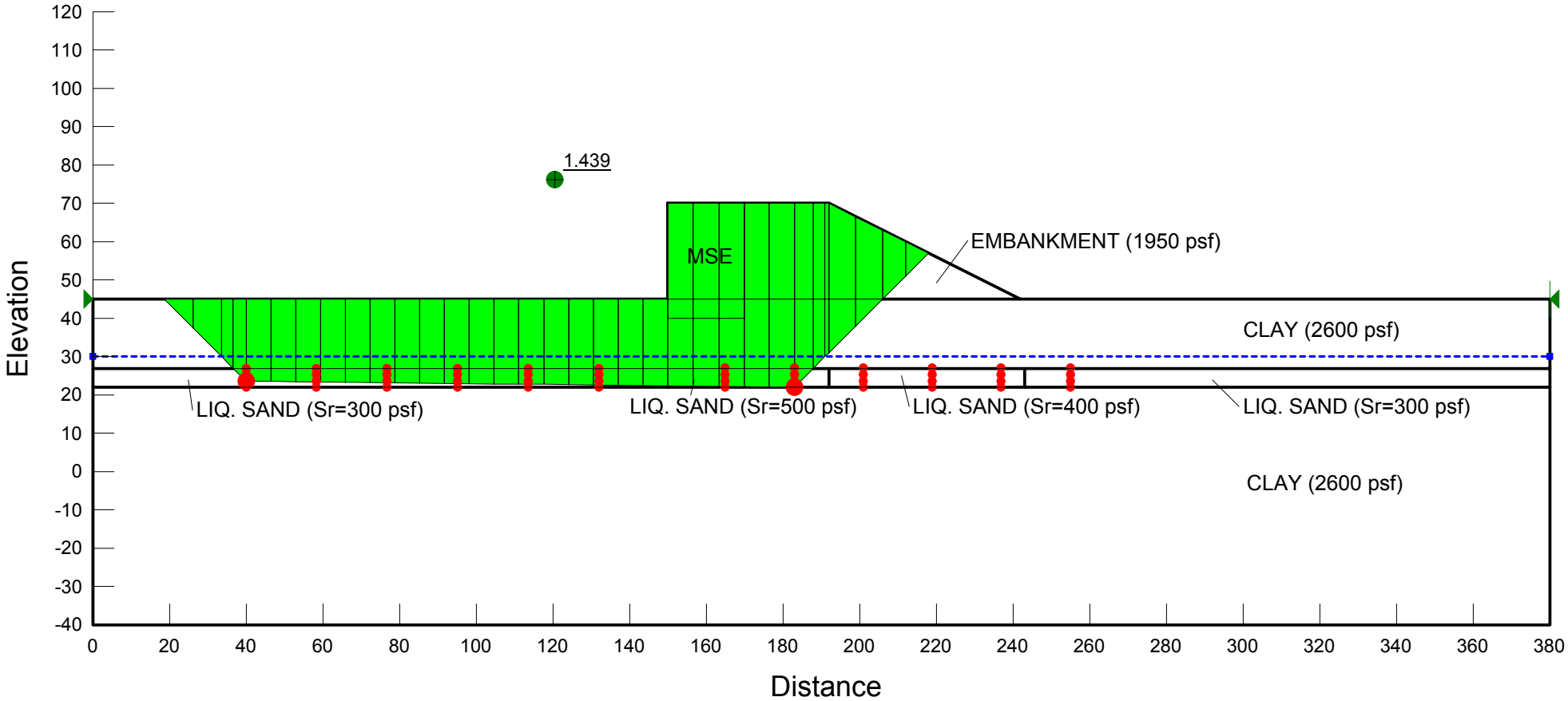
I-80/680/12 INTERCHANGE PROJECT
RETAINING WALL NO. 4

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTH)



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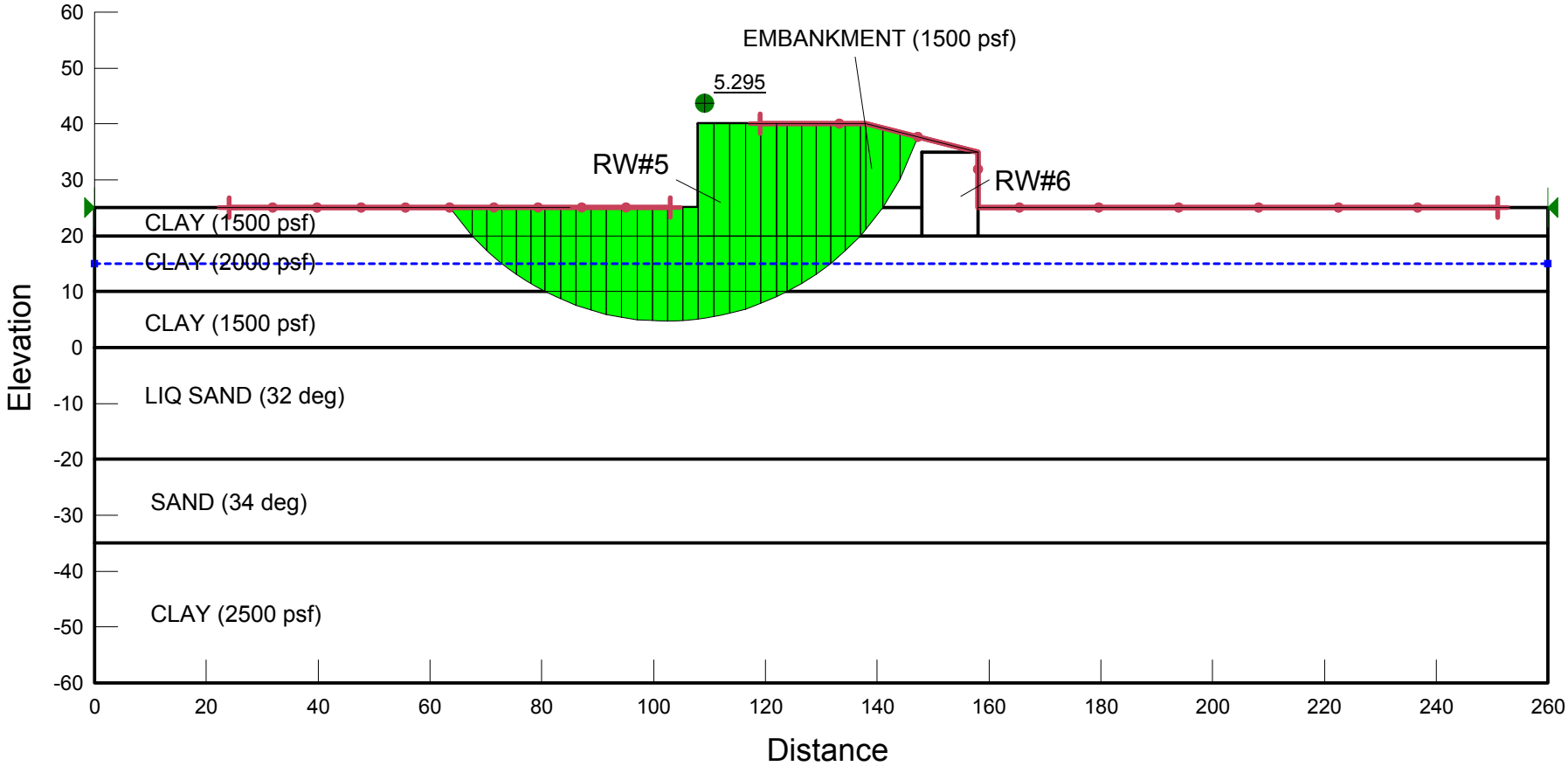
I-80/680/12 INTERCHANGE PROJECT
RETAINING WALLS NO. 5 AND 6
(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUTION)



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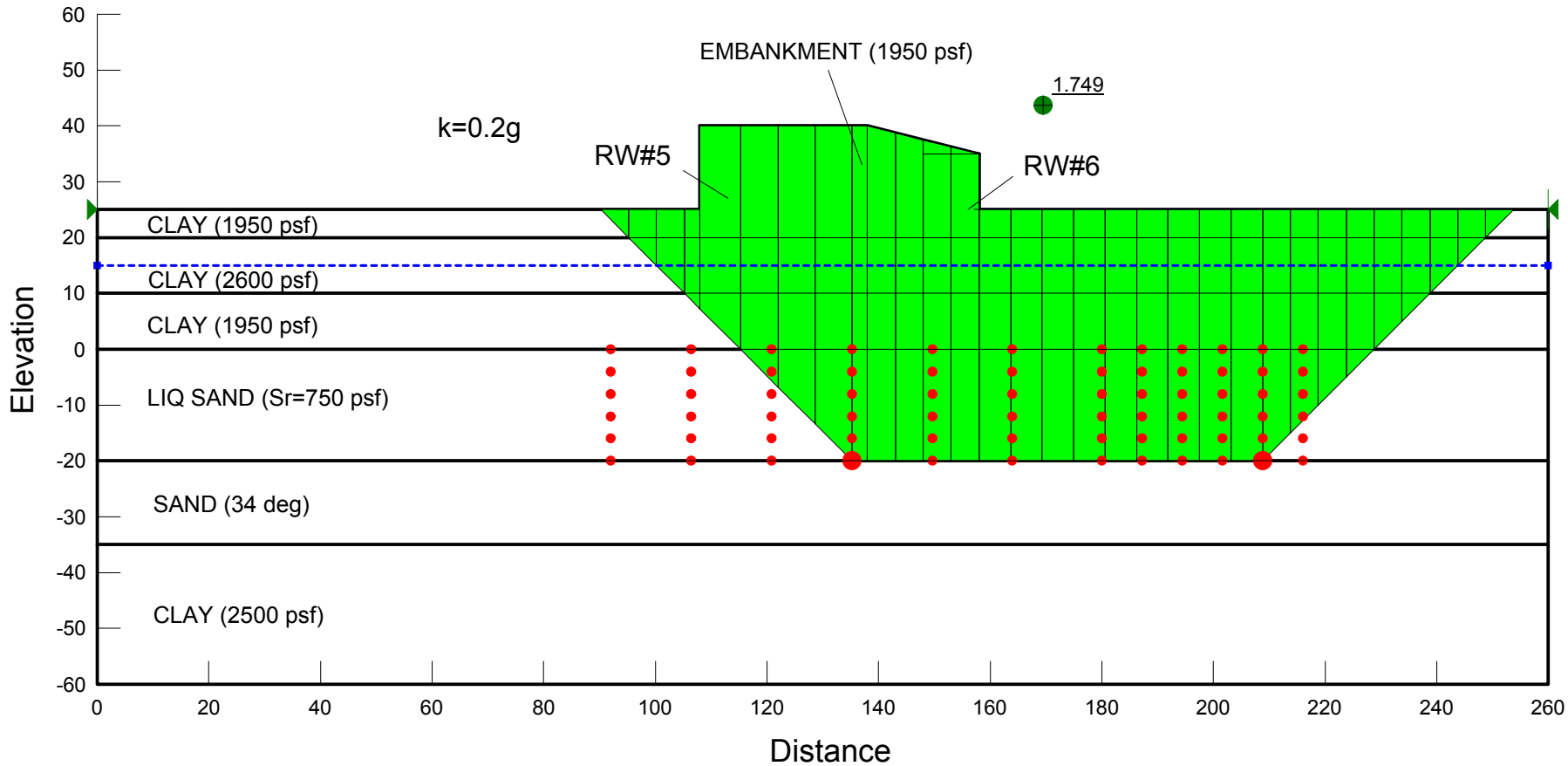
I-80/680/12 INTERCHANGE PROJECT

RETAINING WALL NO. 6

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTH)



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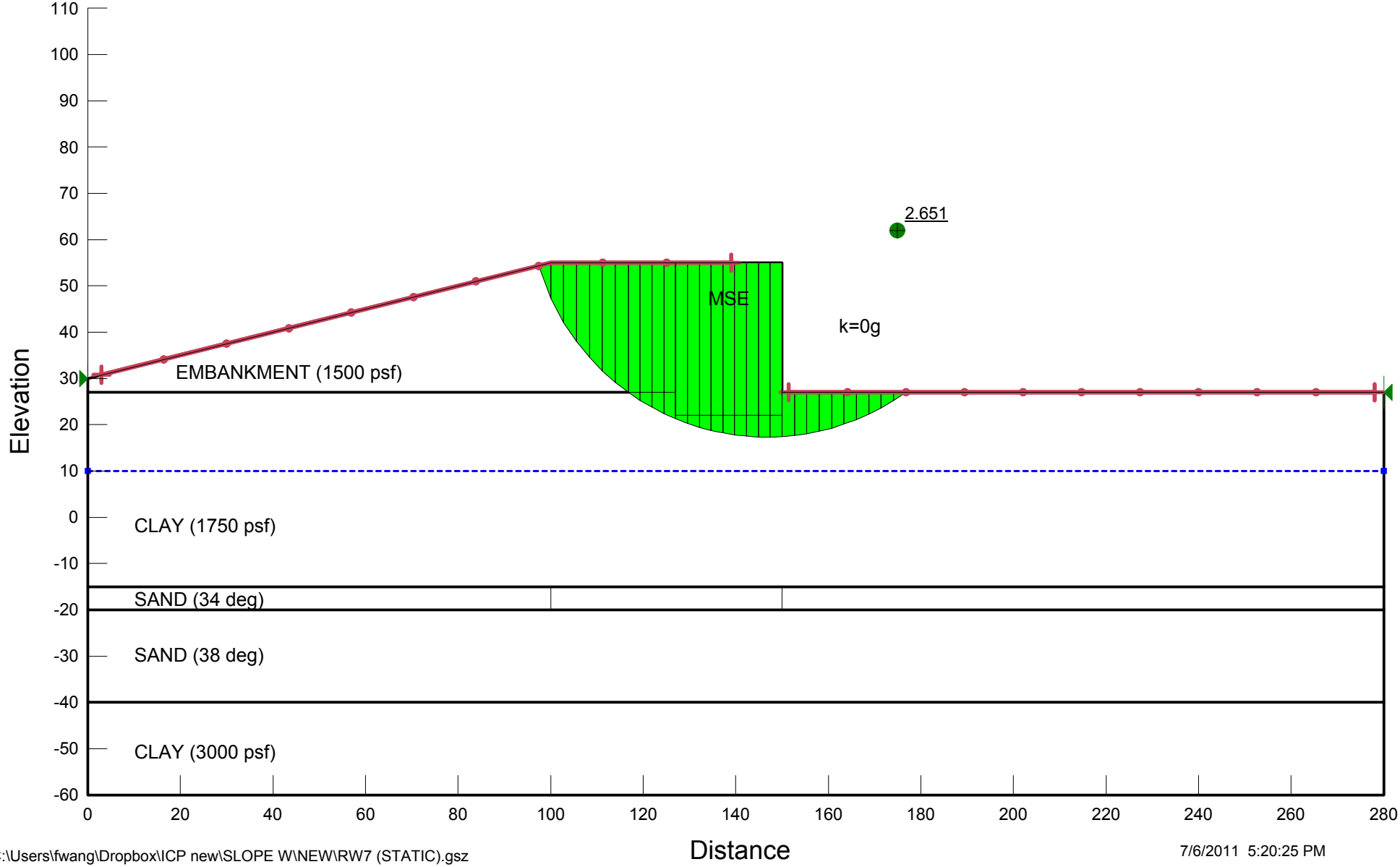
80/680/12 INTERCHANGE PROJECT
RETAINING WALL NO. 7

(STATIC CONDITION, SHORT-TERM, IMMEDIATELY AFTER CONSTRUCTION)



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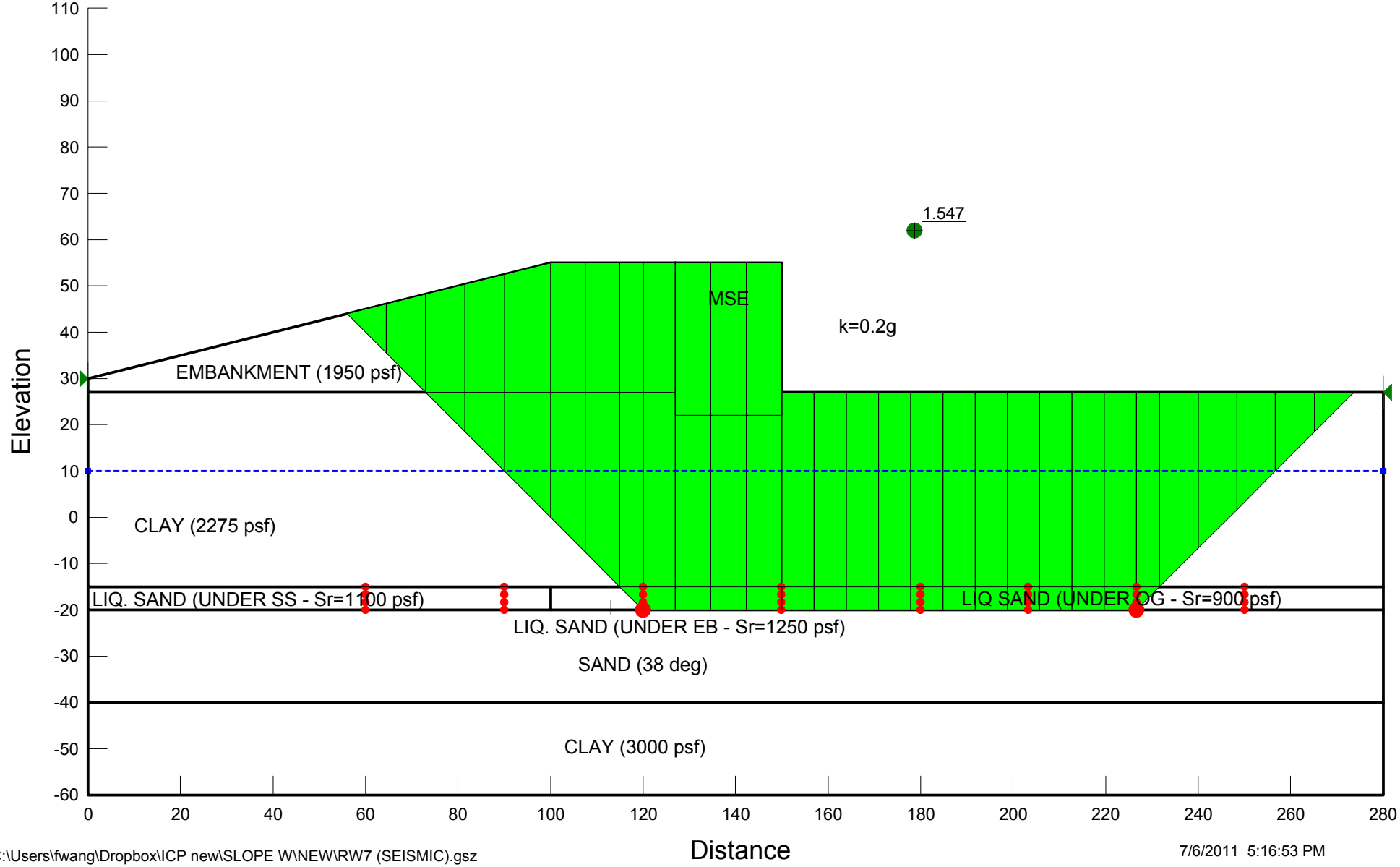
80/680/12 INTERCHANGE PROJECT
RETAINING WALL NO. 7

(PSEUDO-STATIC k=0.2g+RESIDUAL STRENGTH)



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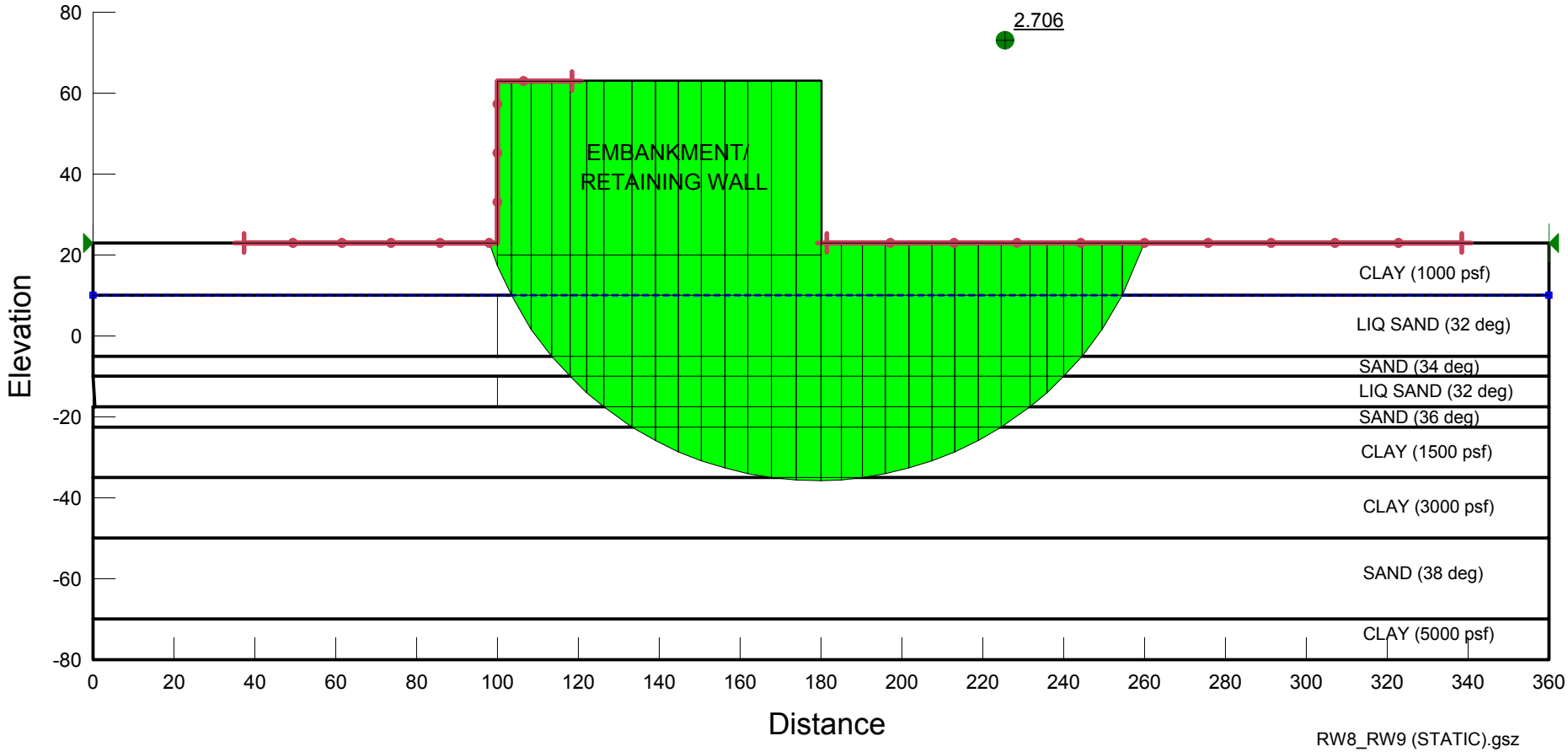
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9

(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUCTION)



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RW8_RW9 (STATIC).gsz
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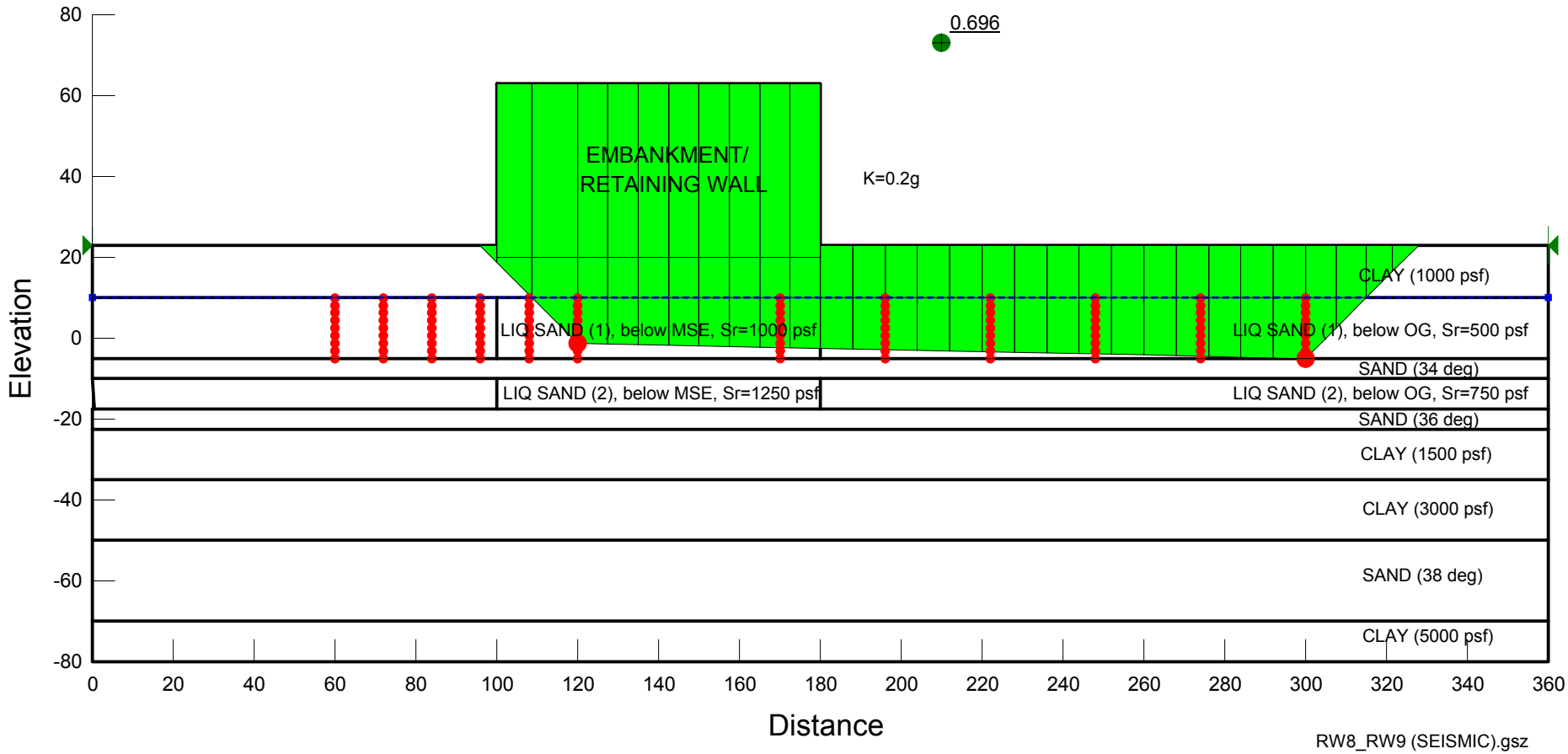
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTH)



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RW8_RW9 (SEISMIC).gsz
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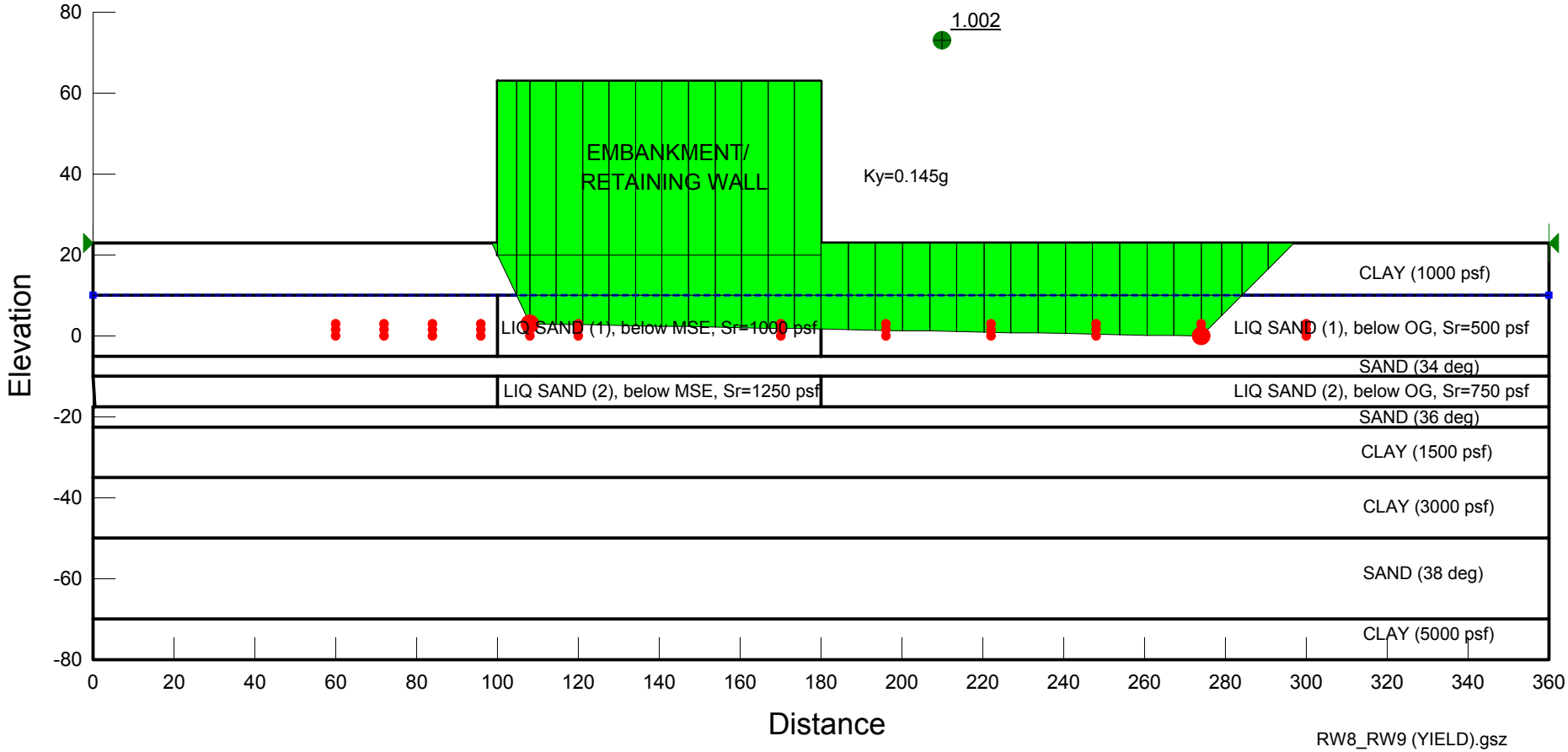
GREEN VALLEY ROAD OVERCROSSING/ABUTMENT 1 (SOUTH ABUT)
GREEN VALLEY ROAD OVERCROSSING (OVER SB-680 ON-RAMP)/ABUTMENT 2 (NORTH ABUT)
RETAINING WALLS NO. 8 & 9



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RW8_RW9 (YIELD).gsz
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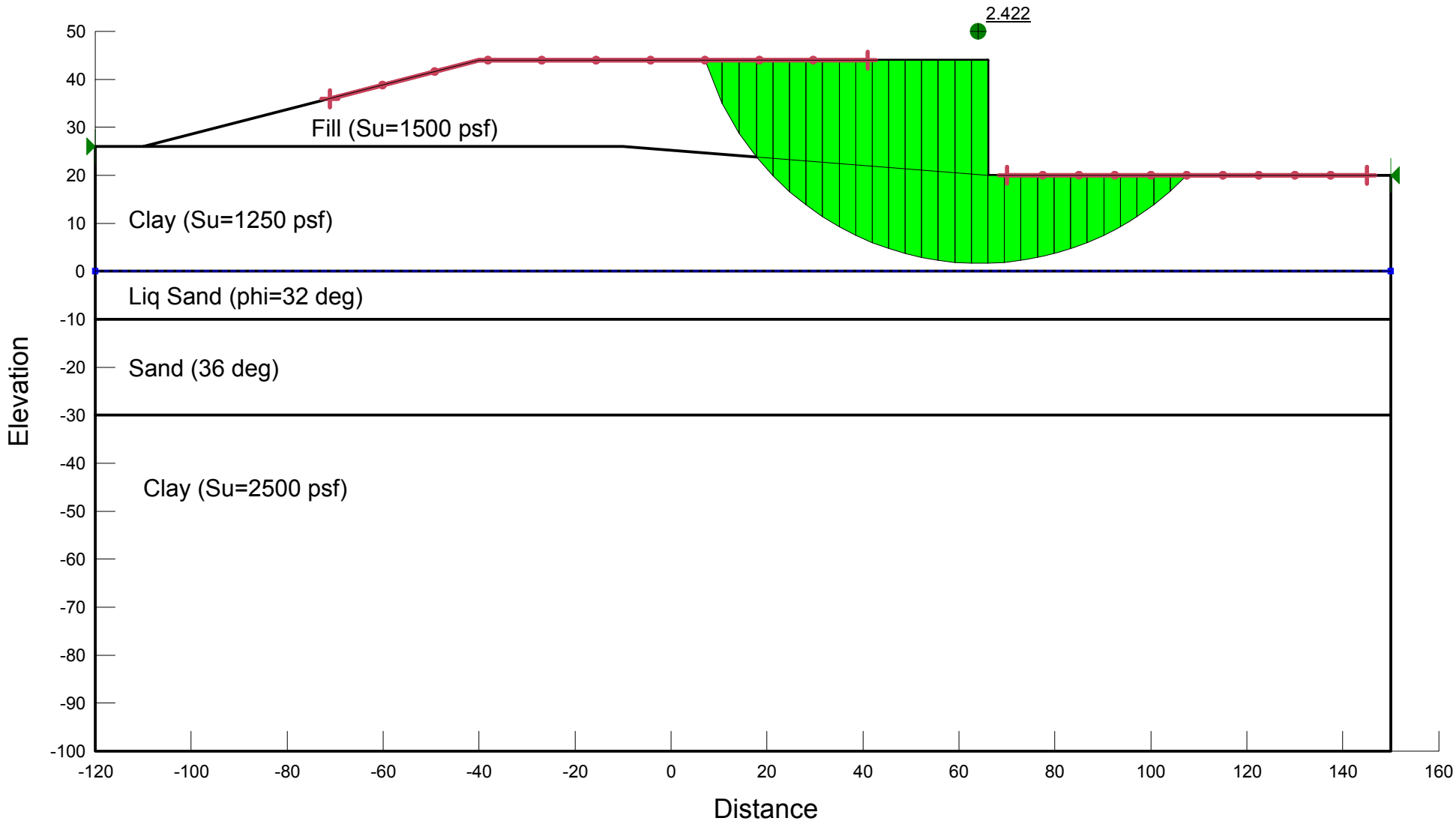
80/680/12 INTERCHANGE PROJECT
RETAINING WALL NO. 10
(STATIC CONDITION)



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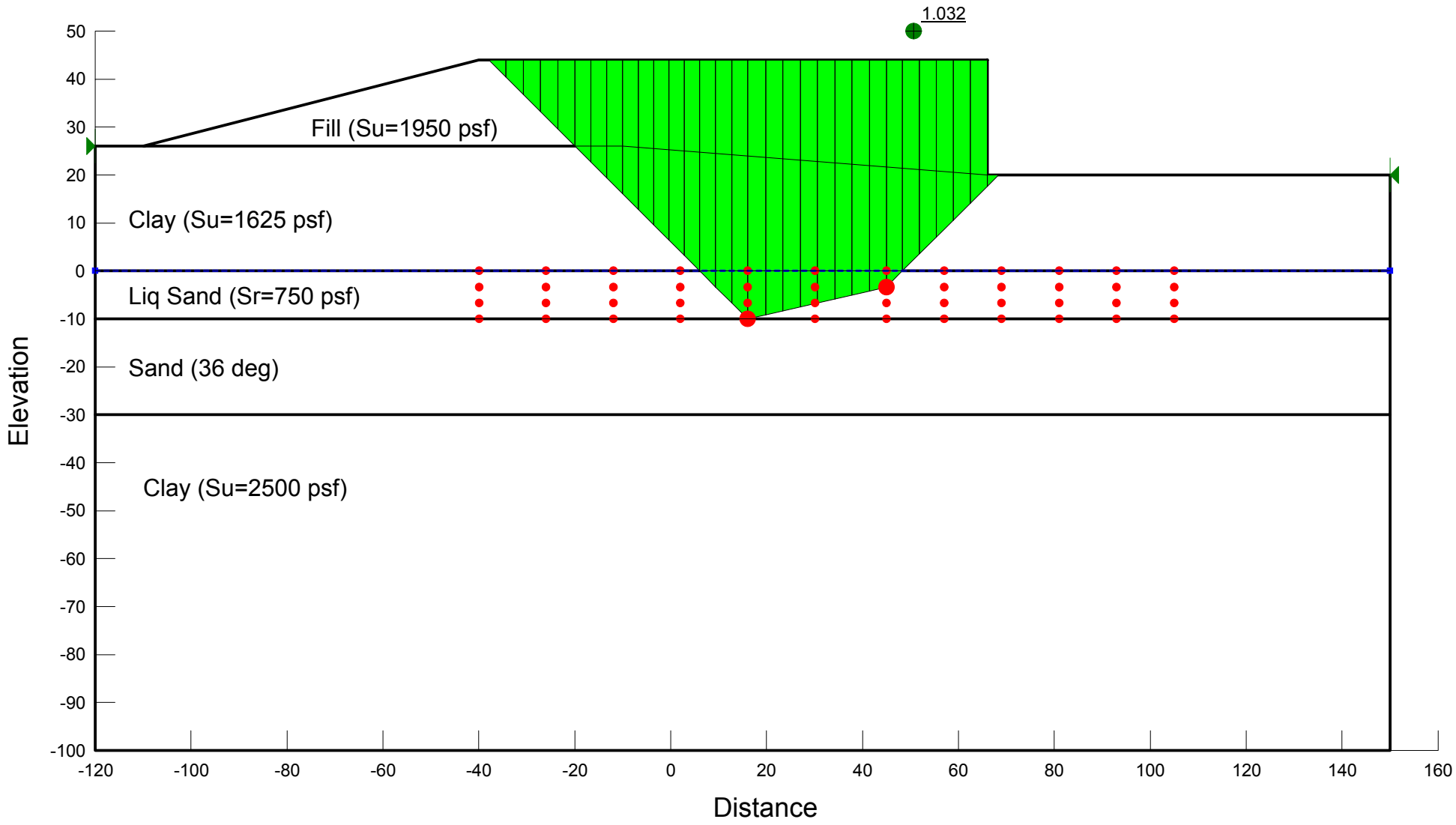
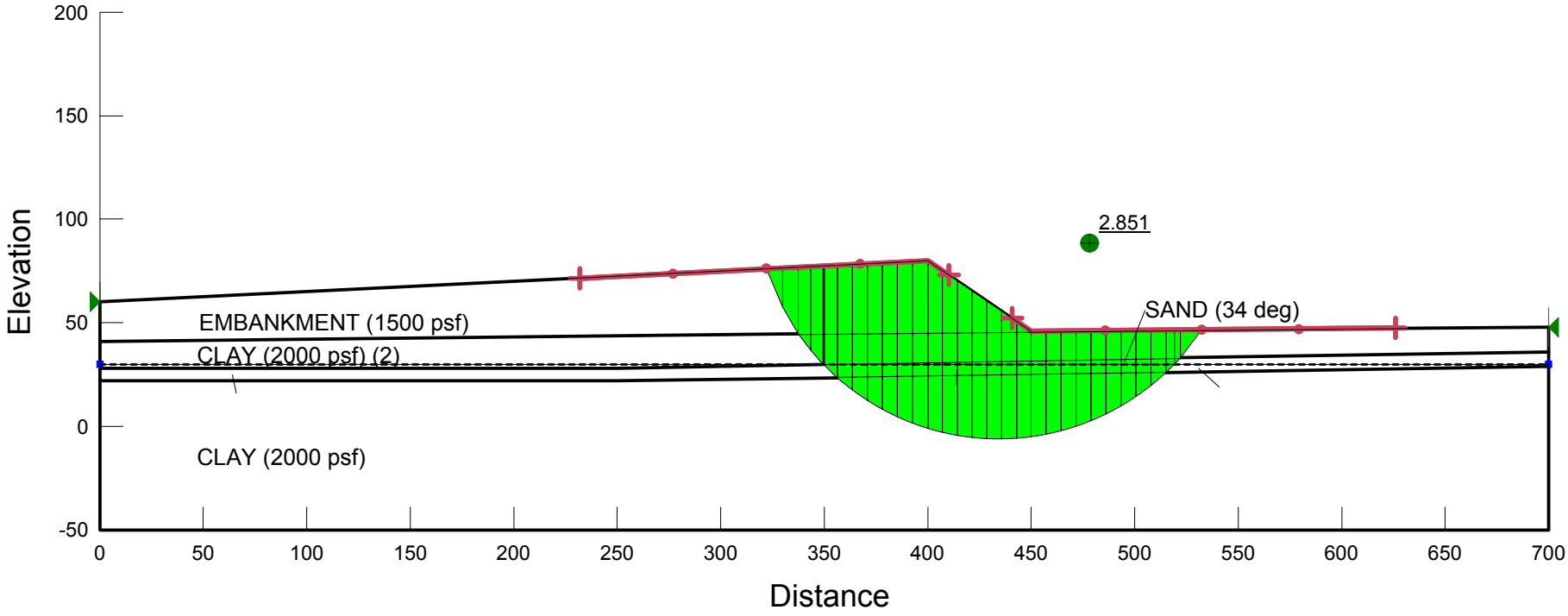
80/680/12 INTERCHANGE PROJECT
RETAINING WALL NO. 10
(PSEODO-STATIC K=0.2g+RESIDUAL STRENGTH)



WB 80 TO WB 12 GRADE SEPARATION
ABUTMENT 4

(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUCTION)



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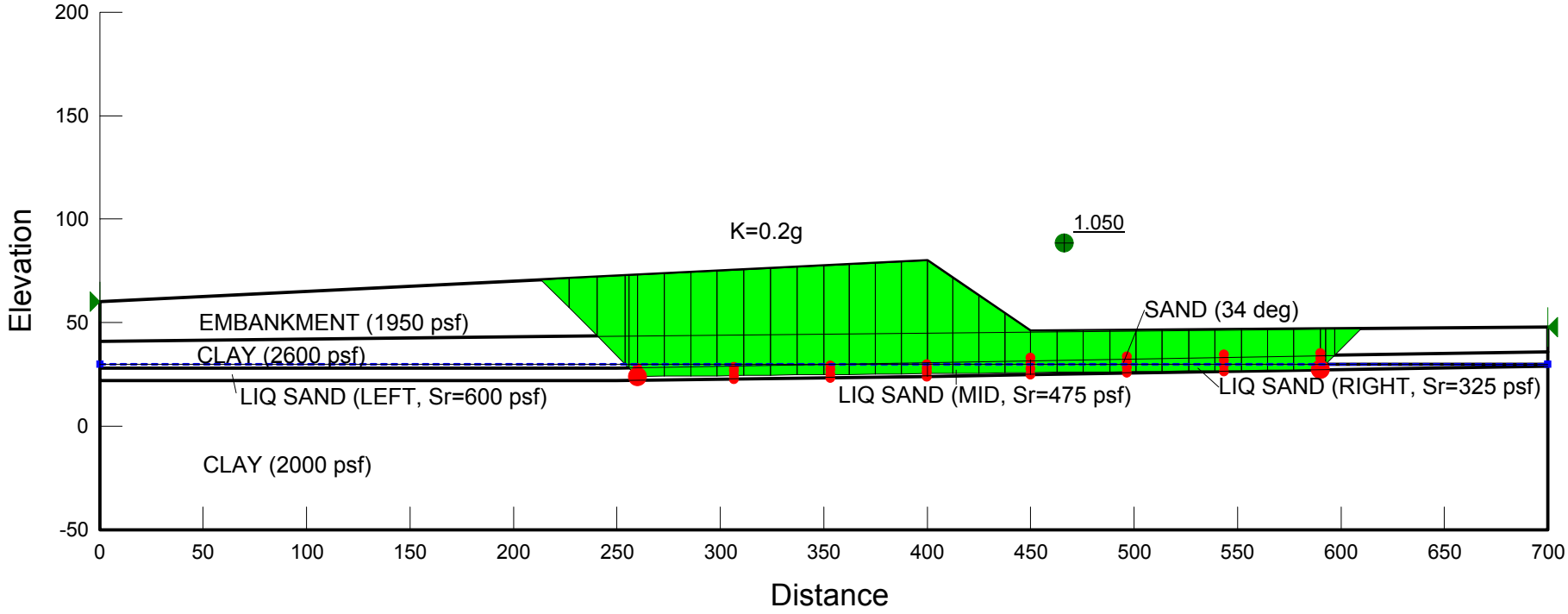
WB 80 TO WB 12 GRADE SEPARATION
ABUTMENT 4

(SEISMIC CONDITION, PSEUDO-STATIC+RESIDUAL SHEAR STRENGTH)



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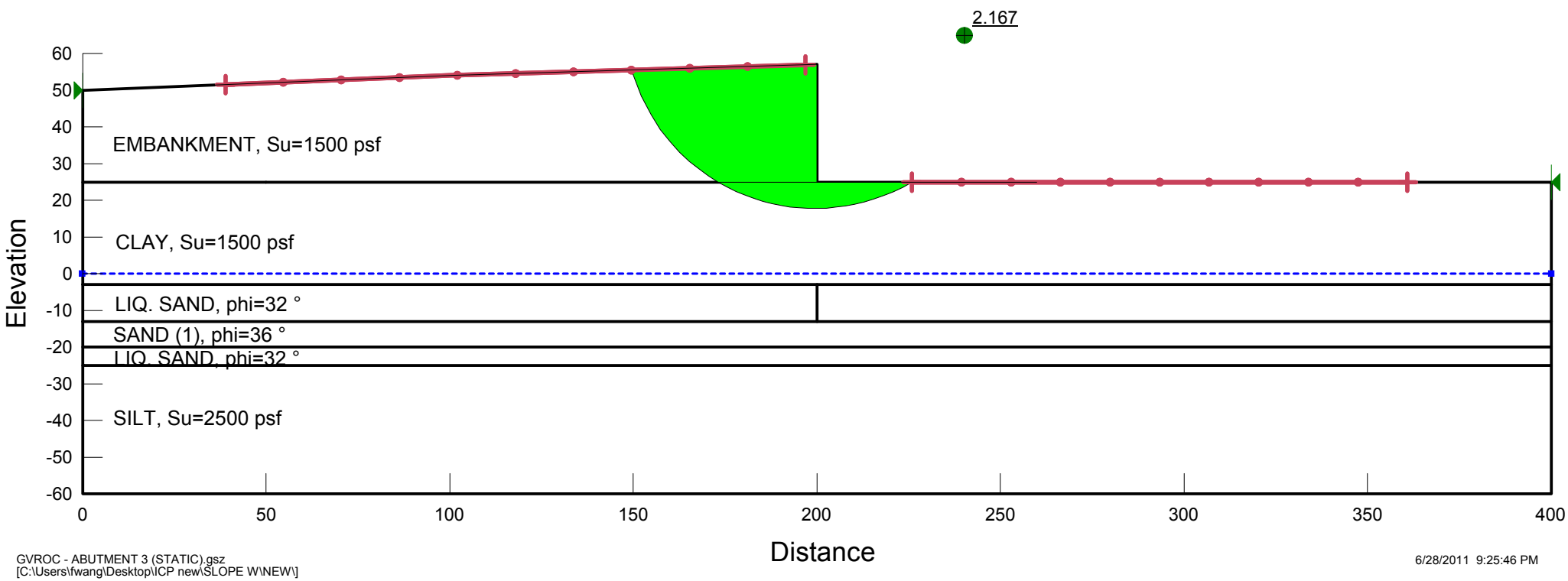
I-80/680/12 INTERCHANGE PROJECT
GREEN VALLEY ROAD OVERCROSSING
ABUTMENT 3 (NORTH)

(STATIC CONDITION, IMMEDIATELY AFTER CONSTRUCTION)



GVROC - ABUTMENT 3 (STATIC).gsz
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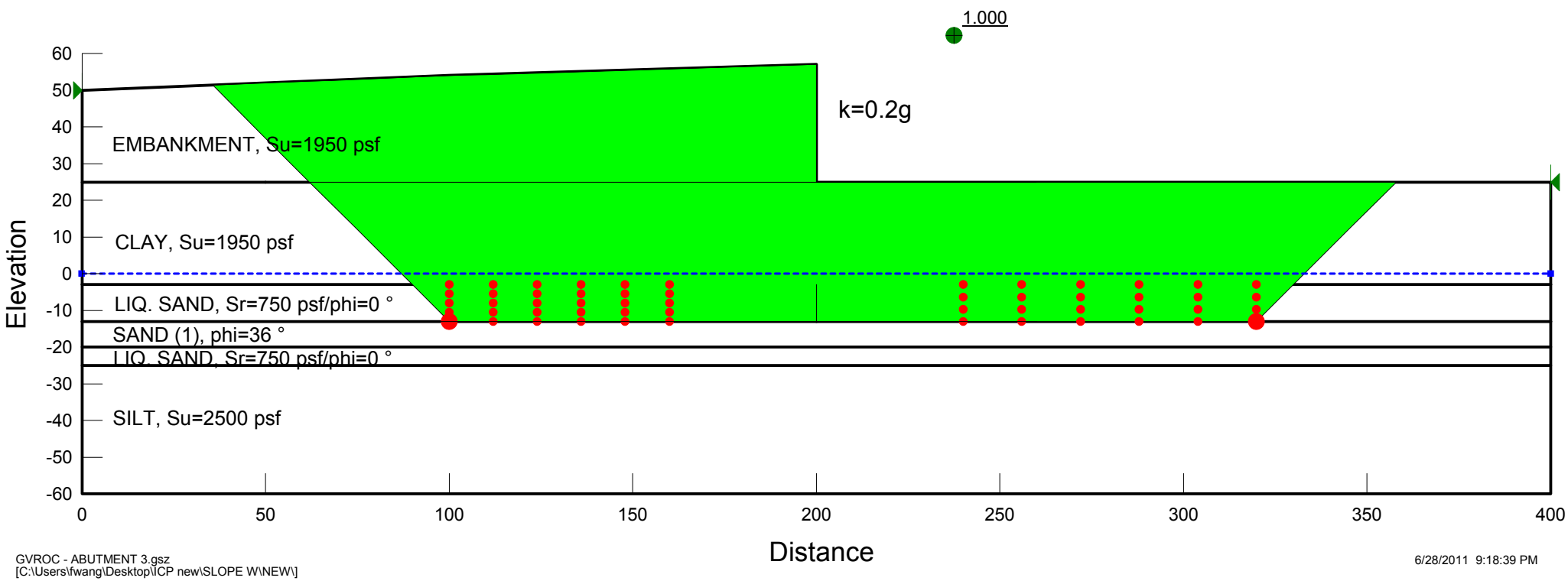
I-80/680/12 INTERCHANGE PROJECT
GREEN VALLEY ROAD OVERCROSSING
ABUTMENT 3 (NORTH)

(SEISMIC CONDITION, PSEUDO-STATIC (0.2g)+RESIDUAL SHEAR STRENGTHS)



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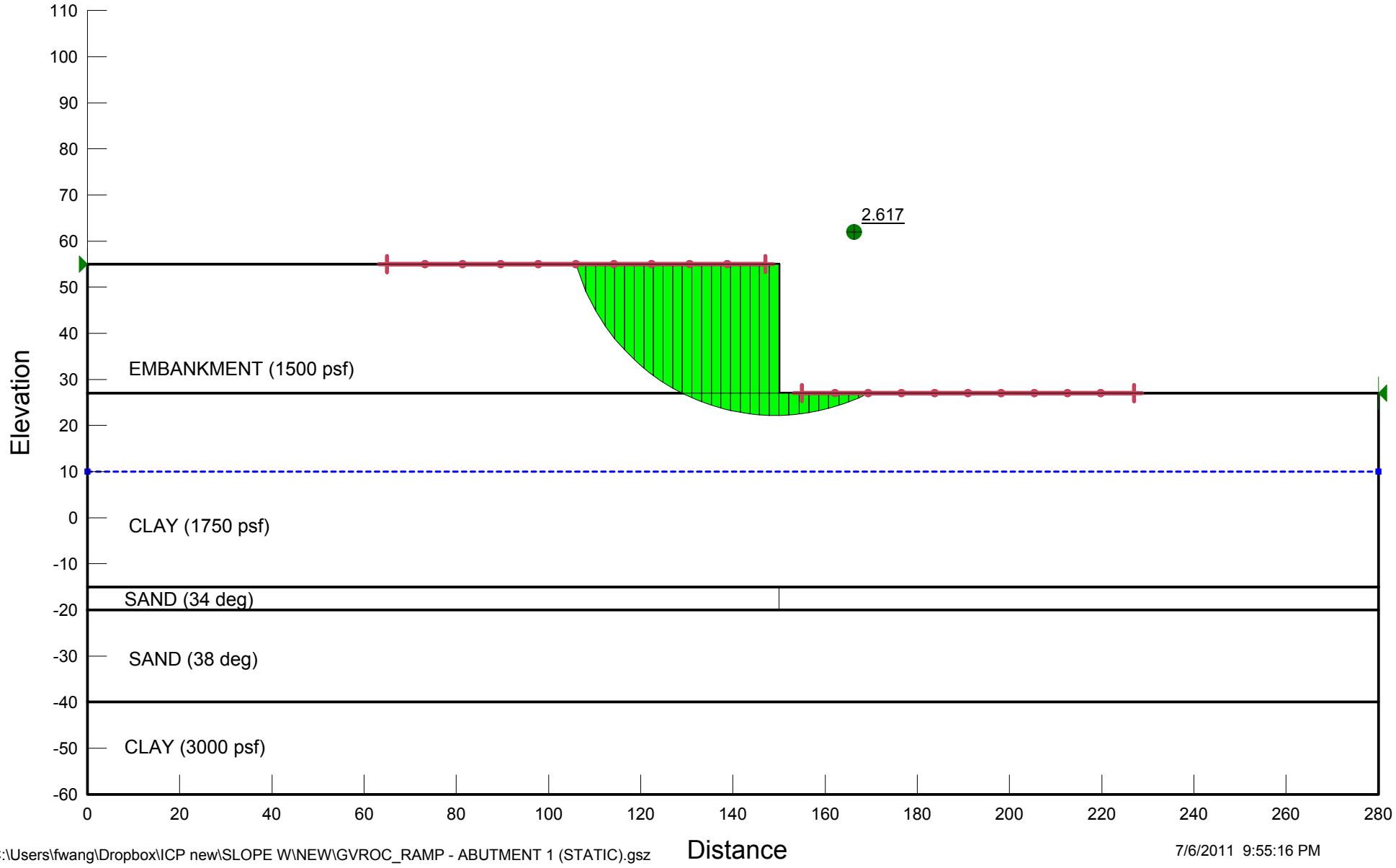
80/680/12 INTERCHANGE PROJECT
GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
ABUTMENT 1 (SOUTH)
(STATIC CONDITION, SHORT-TERM, IMMEDIATELY AFTER CONSTRUCTION)



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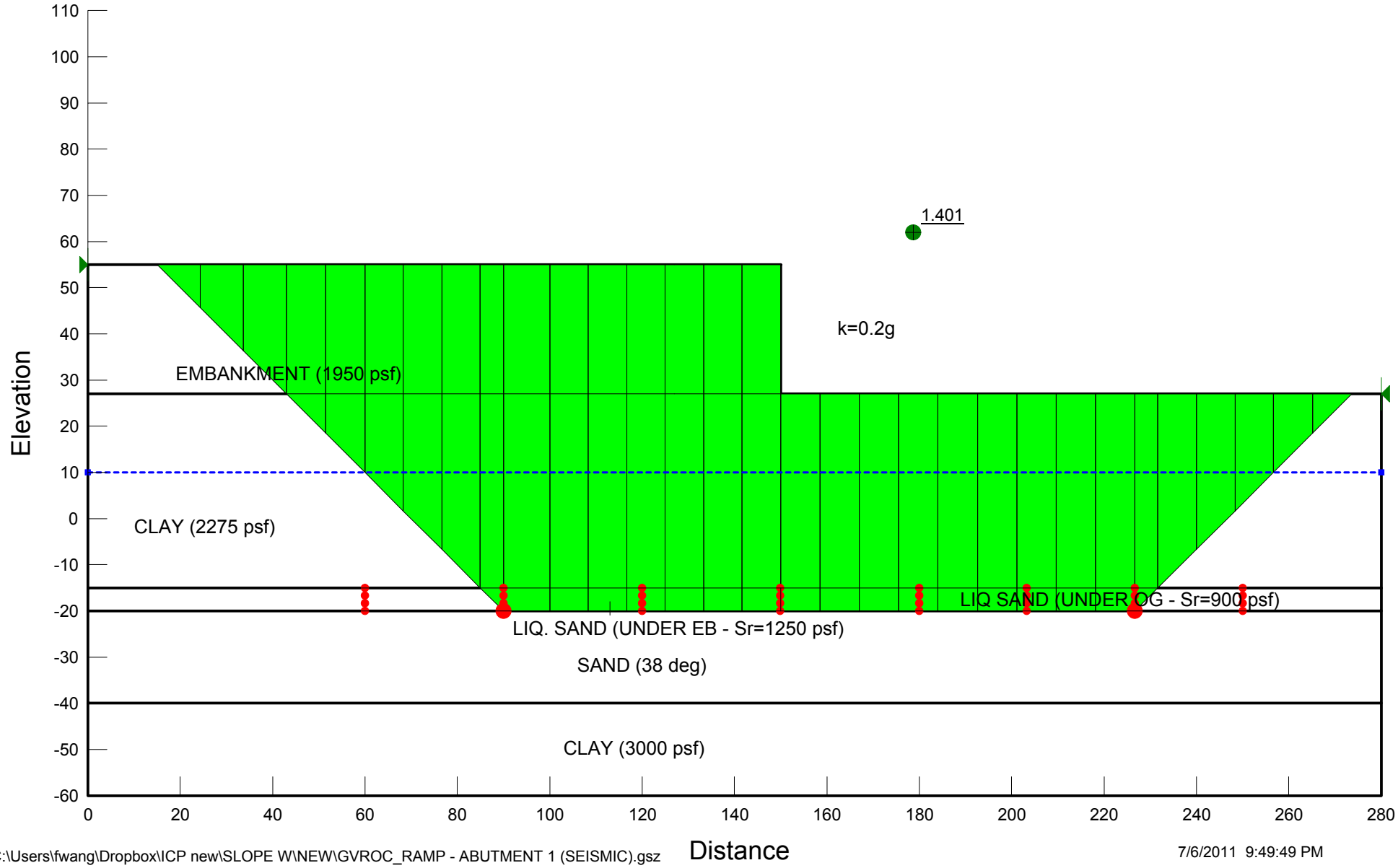
80/680/12 INTERCHANGE PROJECT
GREEN VALLEY ROAD OC (OVER SB 680 ON-RAMP)
ABUTMENT 1 (SOUTH)
(PSEUDO-STATIC k=0.2g+RESIDUAL STRENGTH)



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BEARING CAPACITY

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 1 (Type 1A, Loading Case 1)*

PARAMETERS

c' (psf) =	2000	γ_T (pcf) =	125
ϕ' (deg) =	0	γ' (pcf) =	65
ϕ' (rad) =	0.00	GW Depth, d (ft) =	15

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	12	Nc =	5.53
Footing Embedment, Df (ft) =	2	Nq =	1.00
		Nγ =	0.00

Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Strength	3.9	3.0	5.0	1.0	10.0	0.65	6.5 ksf (>3.9 ksf)
Extreme I	4.5	2.7	5.6	1.0	10.0	1	10 ksf (>4.5 ksf)
Extreme II	3.6	3.4	4.4	1.0	10.0	1	10 ksf (>3.6 ksf)

Notes:

(1) The Ultimate Bearing Capacity, qult, is calculated per traditional Terzaghi equation where qult=c*Nc+γD*Nq+γB/2*Nγ. The Bearing Capacity Factors (Nc, Nq & Nγ) were calculated per Meyerhof (1963).

(2) Strength Reduction Factors are based on Table 10.5.5.2.2-1 (Strength Limit) and Section 10.5.5.3.3 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) The Unit Weight Factor, F, is determined based on d/B and the friction angle per DM 7.2 (page 7.2-132) to account for high groundwater condition.

BEARING CAPACITY CALCULATION

- for footing above groundwater with sloping ground

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 2 (MSE, Loading Case 1)*

PARAMETERS

c' (psf) =	250	γ_T (pcf) =	125
ϕ' (deg) =	28	γ' (pcf) =	65
ϕ' (rad) =	0.49	GW Depth, d (ft) =	25

		Bearing Capacity Factors (Meyerhof, 1963)		*Reduced Bearing Capacity Factors (due to Sloping Ground)*	
Slope (nH:1V), n=	4				
Set-Back (ft)=	2.67	Nc =	25.8	Nc' =	23.1
Wall Height (ft) =	25	Nq =	14.7	Nq' =	14.7
Footing Embedment, Df (ft) =	0	Nγ =	11.2		

Limit State	**q (ksf)** *per BDA 3-8*	**B' (ft)** *per BDA 3-8*	**d/B'**	**F**	**Nγ'**	**Recommended q_{ult} (ksf)**	**Strength Reduction Factor, φ_b**	**Nominal Bearing Resistance (ksf)**
Service	4.33	14.04	1.8	1.0	6.8	10.0	0.5	5 ksf (>4.33 ksf)
Strength	6.52	13.82	1.8	1.0	6.9	11.5	0.65	7.48 ksf (>6.52 ksf)
Extreme	6.16	9.87	2.5	1.0	7.0	10.0	1	10 ksf (>6.16 ksf)

Notes:

(1) The Ultimate Bearing Capacity, qult, is calculated per traditional Terzaghi equation where qult=c*Nc+γD*Nq+γB/2*Nγ. The Bearing Capacity Factors (Nc, Nq & Nγ) were calculated per Meyerhof (1963).

(2) Strength Reduction Factors are based on Table 11.5.6-1 (Strength Limit) and Section 11.5.7 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) The Unit Weight Factor, F, is determined based on d/B and the friction angle per DM 7.2 (page 7.2-132) to account for high groundwater condition.

(4) The reduced bearing capacity factors (Nc', Nq' & Nγ') are estimated based on the slope ratio and friction angle per Bowles, Section 4-9 (5th Edition, 1996).

(5) For Service Limit State, a FS of 2 (i.e. reduction factor=0.5) is adopted per Caltrans BDS (Section 5).

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 3 (Type 1A, Loading Case 1)*

PARAMETERS

c' (psf) =	1500	γ_T (pcf) =	125
ϕ' (deg) =	0	γ' (pcf) =	65
ϕ' (rad) =	0.00	GW Depth, d (ft) =	15

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	8	Nc =	5.53
Footing Embedment, Df (ft) =	2	Nq =	1.00
		Nγ =	0.00

Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Strength	2.2	3.7	4.1	1.0	7.5	0.45	3.4 ksf (>2.2 ksf)
Extreme I	2.0	4.1	3.7	1.0	7.5	1	7.5 ksf (>2 ksf)
Extreme II	3.0	2.8	5.4	1.0	7.5	1	7.5 ksf (>3 ksf)

Notes:

(1) The Ultimate Bearing Capacity, qult, is calculated per traditional Terzaghi equation where qult=c*Nc+γD*Nq+γB/2*Nγ. The Bearing Capacity Factors (Nc, Nq & Nγ) were calculated per Meyerhof (1963).

(2) Strength Reduction Factors are based on Table 10.5.5.2.2-1 (Strength Limit) and Section 10.5.5.3.3 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) The Unit Weight Factor, F, is determined based on d/B and the friction angle per DM 7.2 (page 7.2-132) to account for high groundwater condition.

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 4 (MSE, Loading Case 1)*

PARAMETERS

c' (psf) =	250	γ_T (pcf) =	125
ϕ' (deg) =	28	γ' (pcf) =	65
ϕ' (rad) =	0.49	GW Depth, d (ft) =	7.5

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	30	Nc =	25.80
Footing Embedment, Df (ft) =	0	Nq =	14.72
		Nγ =	11.19

Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Service	5.21	16.1	0.5	0.9	15.0	0.5	7.5 ksf (>5.21 ksf)
Strength	7.76	15.7	0.5	0.9	15.0	0.65	9.8 ksf (>7.76 ksf)
Extreme	7.72	10.8	0.7	1.0	14.0	1	14 ksf (>7.72 ksf)

Notes:

(1) The Ultimate Bearing Capacity, qult, is calculated per traditional Terzaghi equation where qult=c*Nc+γD*Nq+γB/2*Nγ. The Bearing Capacity Factors (Nc, Nq & Nγ) were calculated per Meyerhof (1963).

(2) Strength Reduction Factors are based on Table 11.5.6-1 (Strength Limit) and Section 11.5.7 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) The Unit Weight Factor, F, is determined based on d/B and the friction angle per DM 7.2 (page 7.2-132) to account for high groundwater condition.

(4) For Service Limit State, a FS of 2 (i.e. reduction factor=0.5) is adopted per Caltrans BDS (Section 5).

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 5 (Type 1, Loading Case 1)*

PARAMETERS

c' (psf) =	1750	γ_T (pcf) =	125
ϕ' (deg) =	0	γ' (pcf) =	65
ϕ' (rad) =	0.00	GW Depth, d (ft) =	8

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	14	Nc =	5.53
Footing Embedment, Df (ft) =	2	Nq =	1.00
		Nγ =	0.00

Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Strength	3.8	4.3	1.9	1.0	9.0	0.45	4.1 ksf (>3.8 ksf)
Extreme I	5.3	3.2	2.5	1.0	9.0	1	9 ksf (>5.3 ksf)
Extreme II	3.3	5.2	1.5	1.0	9.0	1	9 ksf (>3.3 ksf)

Notes:

(1) The Ultimate Bearing Capacity, qult, is calculated per traditional Terzaghi equation where qult=c*Nc+γD*Nq+γB/2*Nγ. The Bearing Capacity Factors (Nc, Nq & Nγ) were calculated per Meyerhof (1963).

(2) Strength Reduction Factors are based on Table 10.5.5.2.2-1 (Strength Limit) and Section 10.5.5.3.3 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) The Unit Weight Factor, F, is determined based on d/B and the friction angle per DM 7.2 (page 7.2-132) to account for high groundwater condition.

(4) For Service Limit State, a FS of 2 (i.e. reduction factor=0.5) is adopted per Caltrans BDS (Section 5).

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 5 (Type 1, Loading Case 1)*

PARAMETERS

c' (psf) =	1750	γ_T (pcf) =	125
ϕ' (deg) =	0	γ' (pcf) =	65
ϕ' (rad) =	0.00	GW Depth, d (ft) =	8

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	8	Nc =	5.53
Footing Embedment, Df (ft) =	2	Nq =	1.00
		Nγ =	0.00

Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Strength	2.3	3.6	2.2	1.0	9.0	0.45	4.1 ksf (>2.3 ksf)
Extreme I	2.2	3.9	2.1	1.0	9.0	1	9 ksf (>2.2 ksf)
Extreme II	3.1	2.8	2.9	1.0	9.0	1	9 ksf (>3.1 ksf)

Notes:

(1) The Ultimate Bearing Capacity, qult, is calculated per traditional Terzaghi equation where qult=c*Nc+γD*Nq+γB/2*Nγ. The Bearing Capacity Factors (Nc, Nq & Nγ) were calculated per Meyerhof (1963).

(2) Strength Reduction Factors are based on Table 10.5.5.2.2-1 (Strength Limit) and Section 10.5.5.3.3 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) The Unit Weight Factor, F, is determined based on d/B and the friction angle per DM 7.2 (page 7.2-132) to account for high groundwater condition.

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 6 (MSE, Loading Case 2)*

PARAMETERS

c' (psf) =	250	γ_T (pcf) =	125
ϕ' (deg) =	28	γ' (pcf) =	65
ϕ' (rad) =	0.49	GW Depth, d (ft) =	8

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	22.5	Nc =	25.80
Footing Embedment, Df (ft) =	0	Nq =	14.72
		Nγ =	11.19

Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Service	4.68	19.7	0.4	0.78	15.0	0.5	7.5 ksf (>4.68 ksf)
Strength	6.57	19.4	0.4	0.78	15.0	0.65	9.8 ksf (>6.57 ksf)
Extreme	7.89	12.9	0.6	0.95	15.0	1	15 ksf (>7.89 ksf)

Notes:

(1) The Ultimate Bearing Capacity, qult, is calculated per traditional Terzaghi equation where qult=c*Nc+γD*Nq+γB/2*Nγ. The Bearing Capacity Factors (Nc, Nq & Nγ) were calculated per Meyerhof (1963).

(2) Strength Reduction Factors are based on Table 11.5.6-1 (Strength Limit) and Section 11.5.7 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) The Unit Weight Factor, F, is determined based on d/B and the friction angle per DM 7.2 (page 7.2-132) to account for high groundwater condition.

(4) For Service Limit State, a FS of 2 (i.e. reduction factor=0.5) is adopted per Caltrans BDS (Section 5).

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 7 (MSE, Loading Case 1)*

PARAMETERS

c' (psf) =	200	γ_T (pcf) =	125
ϕ' (deg) =	30	γ' (pcf) =	65
ϕ' (rad) =	0.52	GW Depth, d (ft) =	10

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	32.5	Nc =	30.14
Footing Embedment, Df (ft) =	0	Nq =	18.40
		Nγ =	15.67

Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Service	5.54	17.8	0.6	0.95	15.0	0.5	7.5 ksf (>5.54 ksf)
Strength	8.22	17.4	0.6	0.95	15.0	0.65	9.8 ksf (>8.22 ksf)
Extreme	8.13	12.1	0.8	1.00	15.0	1	15 ksf (>8.13 ksf)

Notes:

(1) The Ultimate Bearing Capacity, qult, is calculated per traditional Terzaghi equation where qult=c*Nc+γD*Nq+γB/2*Nγ. The Bearing Capacity Factors (Nc, Nq & Nγ) were calculated per Meyerhof (1963).

(2) Strength Reduction Factors are based on Table 11.5.6-1 (Strength Limit) and Section 11.5.7 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) The Unit Weight Factor, F, is determined based on d/B and the friction angle per DM 7.2 (page 7.2-132) to account for high groundwater condition.

(4) For Service Limit State, a FS of 2 (i.e. reduction factor=0.5) is adopted per Caltrans BDS (Section 5).

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 8 (MSE, Loading Case 1)*

PARAMETERS

c' (psf) =	(with ground treatment)	γ_T (pcf) =	125
ϕ' (deg) =	(with ground treatment)	γ' (pcf) =	65
ϕ' (rad) =	-	GW Depth, d (ft) =	10

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	40	Nc =	-
Footing Embedment, Df (ft) =	0	Nq =	-
		Nγ =	-

Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Strength	6.74	21.5	0.5	-	16.5	0.5	8.3 ksf (>6.74 ksf)
Strength	9.90	21.0	0.5	-	16.5	0.65	10.7 ksf (>9.9 ksf)
Extreme	10.11	14.3	0.7	-	16.5	1	16.5 ksf (>10.11 ksf)

Notes:

(1) Ground treatment is recommended under the wall to mitigate the potential hazard due to lateral spreading. The Ultimate Bearing Capacity, qult, is governed by the strength of the CLSM, which is provided by Acacia CE.

(2) Strength Reduction Factors are based on Table 11.5.6-1 (Strength Limit) and Section 11.5.7 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

(3) For Service Limit State, a FS of 2 (i.e. reduction factor=0.5) is adopted per Caltrans BDS (Section 5).

BEARING CAPACITY CALCULATION

- for footing above groundwater

PROJECT NAME: *80/680/12 ICP* ***PROJECT NO.:*** *2009-130-GDR*

STRUCTURE: *Retaining Wall No. 9 (Caltrans Type 1, Case 1)*

PARAMETERS

c' (psf) =	(with ground treatment)	γ_T (pcf) =	125
ϕ' (deg) =	(with ground treatment)	γ' (pcf) =	65
ϕ' (rad) =	-	GW Depth, d (ft) =	10

		Bearing Capacity Factors (per Meyerhof, 1963)	
Wall Height (ft) =	36	Nc =	-
Footing Embedment, Df (ft) =	0	Nq =	-
		Nγ =	-

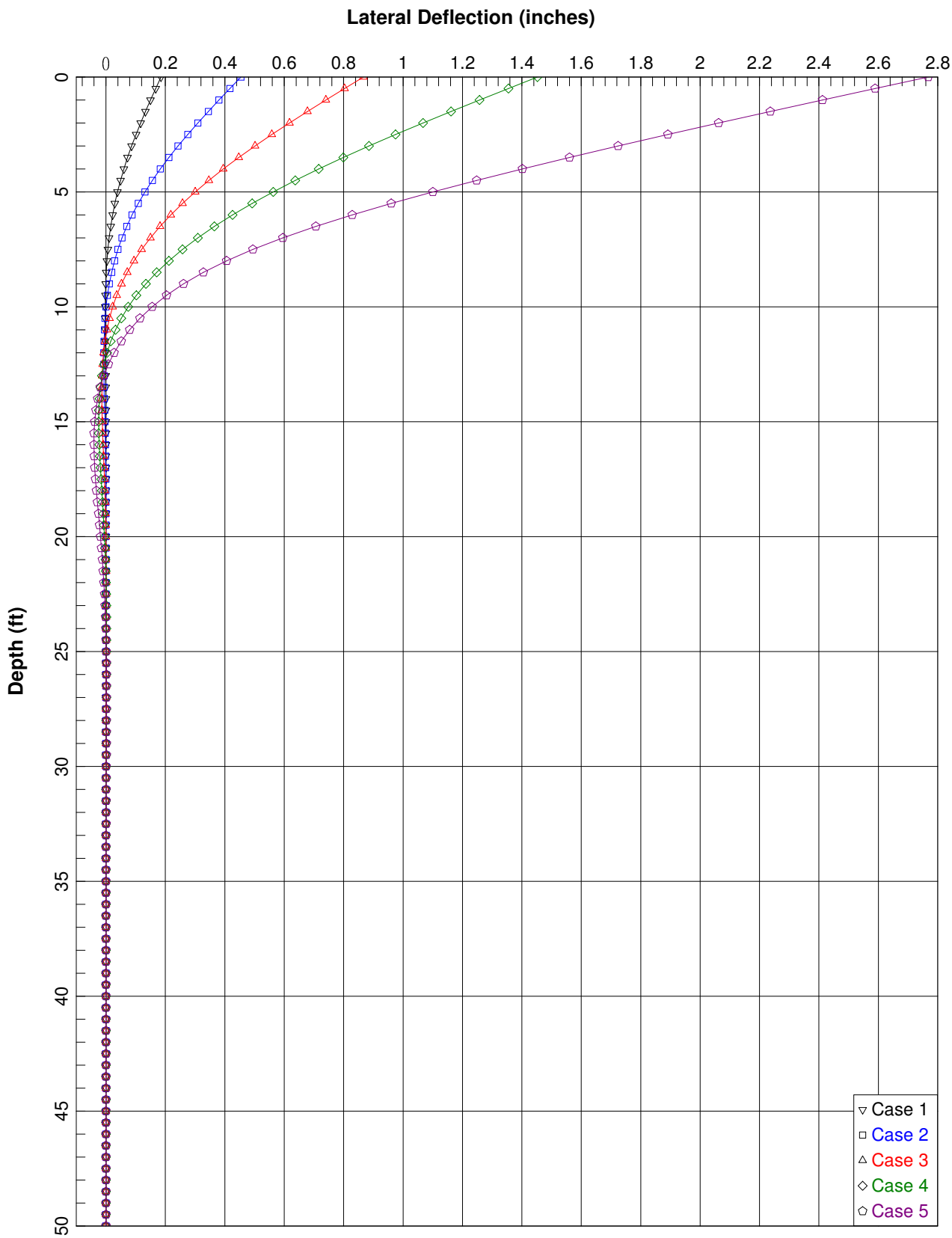
Limit State	q (ksf)	B' (ft)	d/B'	F	Recommended q_{ult} (ksf)	Strength Reduction Factor, φ_b	Nominal Bearing Resistance (ksf)
Strength	5.90	14.6	0.7	-	18.0	0.45	8.1 ksf (>5.9 ksf)
Extreme I	10.90	8.2	1.2	-	18.0	1	18 ksf (>10.9 ksf)
Extreme II	4.30	20.8	0.5	-	18.0	1	18 ksf (>4.3 ksf)

Notes:

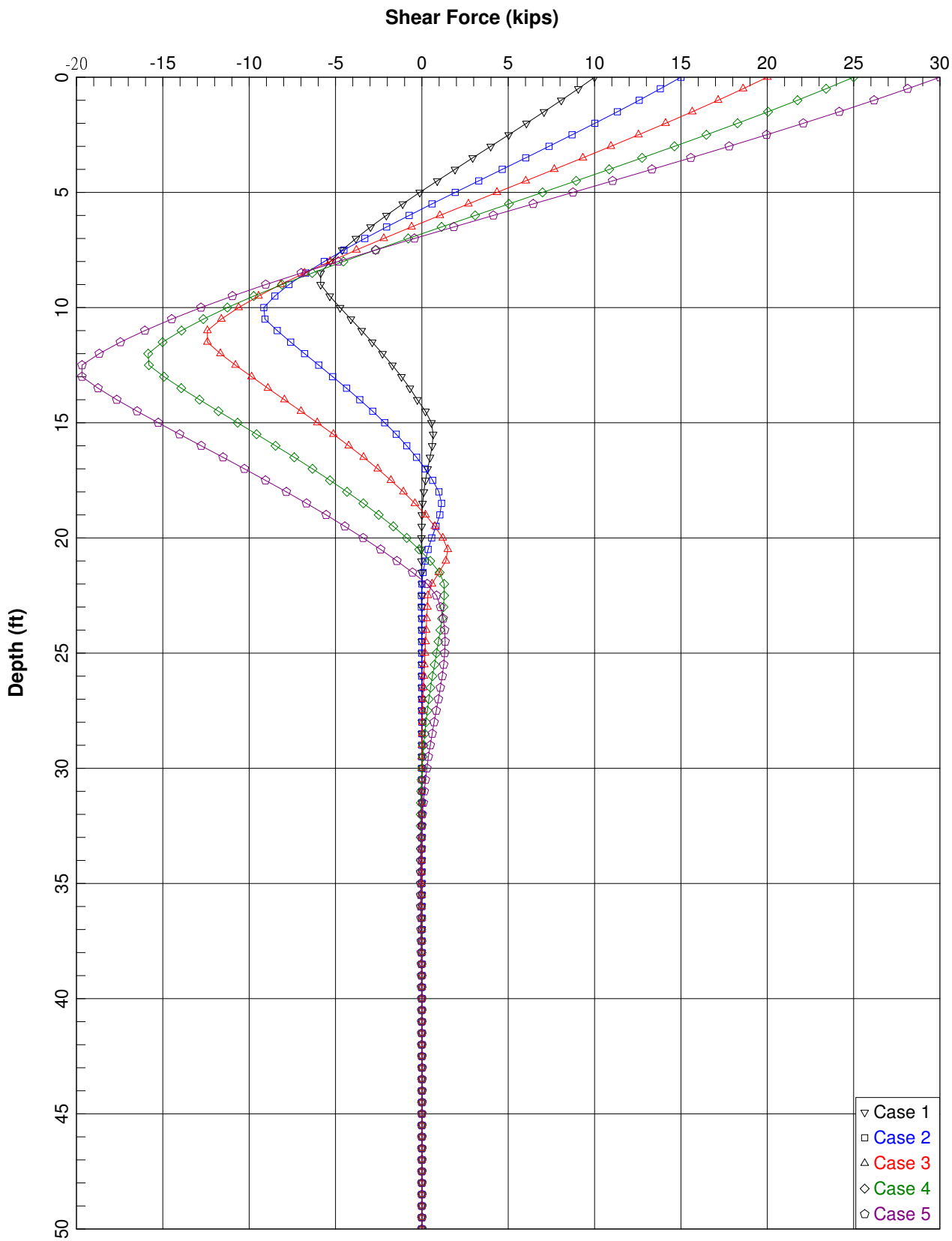
(1) Ground treatment is recommended under the wall to mitigate the potential hazard due to lateral spreading. The Ultimate Bearing Capacity, qult, is governed by the strength of the CLSM, which is provided by Acacia CE.

(2) Strength Reduction Factors are based on Table 10.5.5.2.2-1 (Strength Limit) and Section 10.5.5.3.3 (Extreme Limit) per AASHTO LRFD BDS - 4th Edition & Caltrans Amendments.

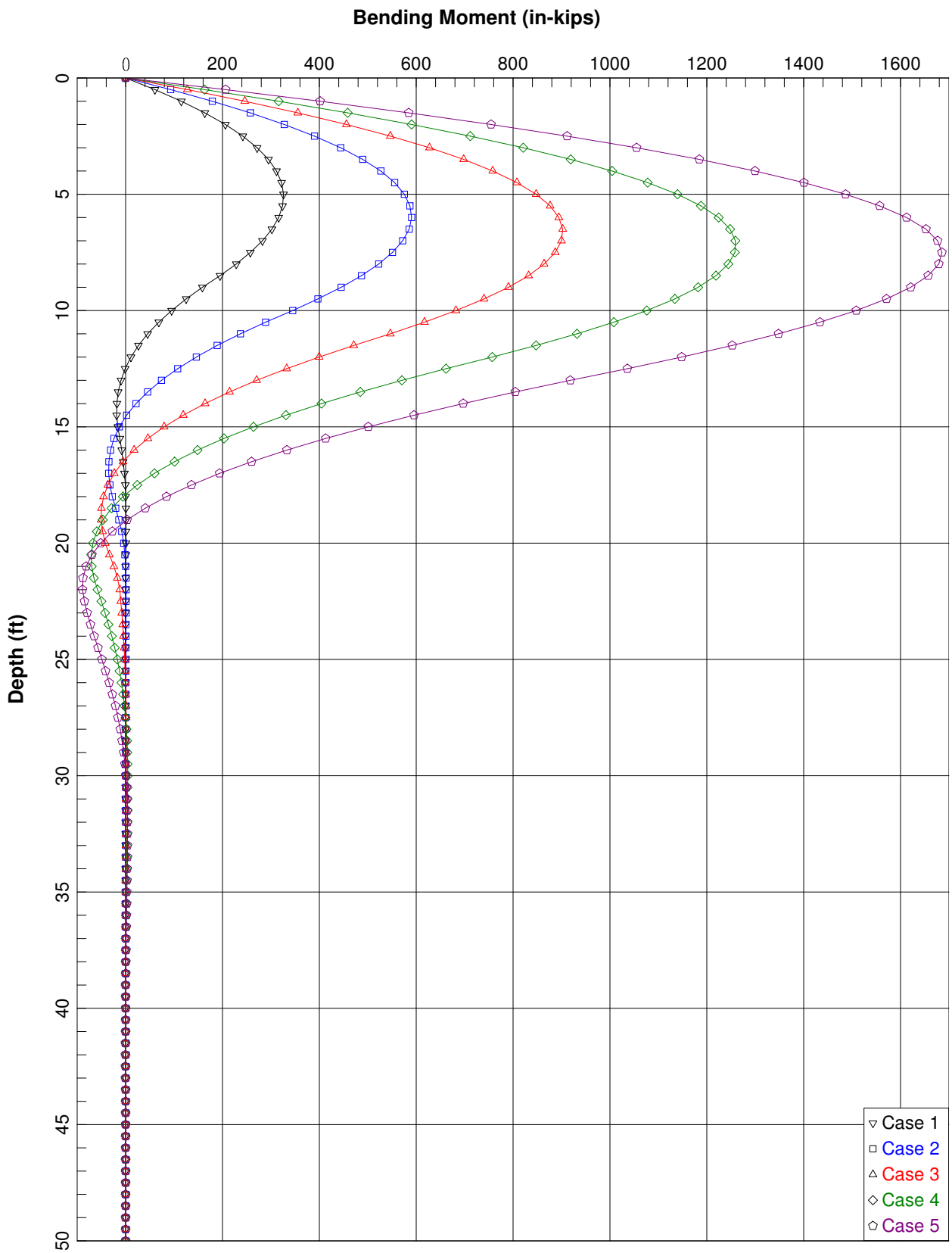
LATERAL CAPACITY ANALYSES



80/680/12 ICP, RW NO. 10 (CLASS 90 ALT. "W')



80/680/12 ICP, RW NO. 10 (CLASS 90 ALT. "W')



80/680/12 ICP, RW NO. 10 (CLASS 90 ALT. "W')

==

LPile Plus for Windows, Version 6.0 (6.0.09)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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This program is licensed to:

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Files Used for Analysis

```
Path to file locations:      T:\Ongoing Projects\2009\209130.GDR M T Co Rte 80-680-12
Interchange Project\REPORTS\GDMR\
Name of input data file:     Retaining Wall No. 10.lp6d
Name of output file:         Retaining Wall No. 10.lp6o
Name of plot output file:    Retaining Wall No. 10.lp6p
Name of runtime file:        Retaining Wall No. 10.lp6r
```

Date and Time of Analysis

Date: August 27, 2012   Time: 23:49:24

Problem Title

Project Name: 80/680/12 ICP (RETAINING WALL NO. 10)

Job Number: 2009-130-GDR

Client: MTCO

Engineer: LT

Description:

Program Options

Units Used - US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal Moment
  Capacity with Pile Response Computed Using Nonlinear EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multiplers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:

```
- Number of pile increments                          =          100
- Maximum number of iterations allowed               =          100
- Deflection tolerance for convergence               =   1.0000E-05  in
- Maximum allowable deflection                       =     100.0000  in
```

Pile Response Output Options:
- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

```
Total Number of Sections                             =         1

Total Pile Length                                    =     50.00 ft

Depth of ground surface below top of pile            =     -3.00 ft

Slope angle of ground surface                        =      0.00 deg.
```

Pile dimensions used for p-y curve computations defined using 2 points.
p-y curves are computed using values of pile diameter interpolated over
the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	14.0000000
2	50.000000	14.0000000

Input Structural Properties:

Section No. 1:

```
   Section Type = Steel Pipe Pile
   Section Length                                    =          50.000 ft
   Pile Diameter                                     =          14.000  in
```

Ground Slope and Pile Batter Angles

```
Ground Slope Angle                                   =        0.000 degrees
                                                     =        0.000 radians

Pile Batter Angle                                    =        0.000 degrees
                                                     =        0.000 radians
```

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is stiff clay without free water

```
Distance from top of pile to top of layer             =       -3.000 ft
Distance from top of pile to bottom of layer          =        7.500 ft
```

Layer 2 is stiff clay without free water

```
Distance from top of pile to top of layer             =        7.500 ft
Distance from top of pile to bottom of layer          =       22.500 ft
```

Layer 3 is sand, p-y criteria by Reese et al., 1974

```
Distance from top of pile to top of layer             =       22.500 ft
Distance from top of pile to bottom of layer          =       42.500 ft
p-y subgrade modulus k for top of soil layer          =        0.000 lbs/in**3
p-y subgrade modulus k for bottom of layer            =        0.000 lbs/in**3
```

NOTE: Internal default values for p-y subgrade modulus will be computed for
the above soil layer.

Layer 4 is stiff clay without free water

```
Distance from top of pile to top of layer             =       42.500 ft
Distance from top of pile to bottom of layer          =       57.500 ft
```

Layer 5 is sand, p-y criteria by Reese et al., 1974

```
Distance from top of pile to top of layer             =       57.500 ft
Distance from top of pile to bottom of layer          =       77.500 ft
p-y subgrade modulus k for top of soil layer          =        0.000 lbs/in**3
p-y subgrade modulus k for bottom of layer            =        0.000 lbs/in**3
```

NOTE: Internal default values for p-y subgrade modulus will be computed for
the above soil layer.

(Depth of lowest layer extends   27.50 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 10 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	-3.00	125.00000
2	7.50	125.00000
3	7.50	62.60000
4	22.50	62.60000
5	22.50	62.60000
6	42.50	62.60000
7	42.50	62.60000
8	57.50	62.60000
9	57.50	62.60000
10	77.50	62.60000

Summary of Soil Properties

```
Layer              Soil Type                    Depth     Eff. Unit     Cohesion     Friction
      qu          RQD      Epsilon 50      kpy        Rock Emass      krm       Test Type
Test Prop.   Elas. Subgr.
 Num.          (p-y Curve Criteria)              ft       Wt., pcf         psf      Ang.,
deg.       psi        percent                    pci          psi
                     pci
-----   ----------------------------------   ----------   ----------   ----------
----------   ----------   ----------   ----------   ----------   ----------   ----------
----------   ----------   ------------
  1     Stiff Clay w/o Free Water             -3.000      125.000     1250.000      --
     --           --            0.00       --           --           --           --
   --           --
                                               7.500      125.000     1250.000      --
     --           --            0.00       --           --           --           --
   --           --
  2     Stiff Clay w/o Free Water              7.500       62.600     1250.000      --
     --           --            0.00       --           --           --           --
   --           --
                                              22.500       62.600     1250.000      --
     --           --            0.00       --           --           --           --
   --           --
  3     Sand (Reese, et al.)                  22.500       62.600        --
36.000      --           --            --        default        --           --           --
      --           --
                                              42.500       62.600        --
36.000      --           --            --        default        --           --           --
      --           --
  4     Stiff Clay w/o Free Water             42.500       62.600     2500.000      --
     --           --            0.00       --           --           --           --
   --           --
                                              57.500       62.600     2500.000      --
     --           --            0.00       --           --           --           --
   --           --
  5     Sand (Reese, et al.)                  57.500       62.600        --
40.000      --           --            --        default        --           --           --
      --           --
                                              77.500       62.600        --
40.000      --           --            --        default        --           --           --
      --           --
```

----
p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	-3.000	0.6000	1.0000
2	50.000	0.6000	1.0000

Loading Type
----

p-y criteria for static loading was used for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 5

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	1	V = 10000.000 lbs	M = 0.000 in-lbs	180000.000
2	1	V = 15000.000 lbs	M = 0.000 in-lbs	180000.000
3	1	V = 20000.000 lbs	M = 0.000 in-lbs	180000.000
4	1	V = 25000.000 lbs	M = 0.000 in-lbs	180000.000
5	1	V = 30000.000 lbs	M = 0.000 in-lbs	180000.000

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

---

Axial thrust values were determined from pile-head loading conditions

Number of Sections = 1

Section No. 1:

Dimensions and Properties of Steel Pipe Pile:

Length of Section	=	600.00000000 in
Outer Diameter of Pipe	=	14.00000000 in
Pipe Wall Thickness	=	0.32500000 in
Yield Stress of Pipe	=	36.00000000 ksi
Elastic Modulus	=	29000. ksi
Cross-sectional Area	=	13.96241585 sq. in.
Moment of Inertia	=	326.56563533 in^4
Elastic Bending Stiffness	=	9470403. lb-in^2
Plastic Modulus, Z	=	60.78827083 in^3
Plastic Moment Capacity = Fy Z	=	2188.37775000 in-kip
Nom. Axial Structural Capacity = Fy As	=	502.647 kips
Nominal Axial Tensile Capacity	=	-502.647 kips

Number of Axial Thrust Force Values Determined from Pile-head Loadings = 1

Number	Axial Thrust Force kips
1	180.000

Definition of Run Messages:

Y = part of pipe section has yielded

Axial Thrust Force = 180.000 kips

Bending Curvature rad/in.	Bending Moment in-kip	Bending Stiffness kip-in2	Depth to N Axis in	Max Total Stress psi	Run Msg
0.000002975	28.1688270	9469640.	156.4440605	13.4895664	
0.000005949	56.3376541	9469640.	81.7220303	14.0873809	
0.000008924	84.5064811	9469640.	56.8146868	14.6851958	
0.0000119	112.6753081	9469640.	44.3610151	15.2830101	
0.0000149	140.8441351	9469640.	36.8888121	15.8808249	
0.0000178	169.0129622	9469640.	31.9073434	16.4786393	
0.0000208	197.1817892	9469640.	28.3491515	17.0764540	
0.0000238	225.3506162	9469640.	25.6805076	17.6742685	
0.0000268	253.5194433	9469640.	23.6048956	18.2720832	
0.0000297	281.6882703	9469640.	21.9444061	18.8698979	

0.0000327	309.8570973	9469640.	20.5858237	19.4677124	
0.0000357	338.0259243	9469640.	19.4536717	20.0655271	
0.0000387	366.1947514	9469640.	18.4956970	20.6633416	
0.0000416	394.3635784	9469640.	17.6745758	21.2611562	
0.0000446	422.5324054	9469640.	16.9629374	21.8589709	
0.0000476	450.7012324	9469640.	16.3402538	22.4567854	
0.0000506	478.8700595	9469640.	15.7908271	23.0546001	
0.0000535	507.0388865	9469640.	15.3024478	23.6524147	
0.0000565	535.2077135	9469640.	14.8654769	24.2502293	
0.0000595	563.3765406	9469640.	14.4722030	24.8480438	
0.0000625	591.5453676	9469640.	14.1163838	25.4458585	
0.0000654	619.7141946	9469640.	13.7929118	26.0436730	
0.0000684	647.8830216	9469640.	13.4975678	26.6414877	
0.0000714	676.0518487	9469640.	13.2268359	27.2393022	
0.0000744	704.2206757	9469640.	12.9777624	27.8371168	
0.0000773	732.3895027	9469640.	12.7478485	28.4349314	
0.0000803	760.5583298	9469640.	12.5349652	29.0327461	
0.0000833	788.7271568	9469640.	12.3372879	29.6305607	
0.0000863	816.8959838	9469640.	12.1532435	30.2283753	
0.0000892	845.0648108	9469640.	11.9814687	30.8261899	
0.0000922	873.2336379	9469640.	11.8207761	31.4240045	
0.0000952	901.4024649	9469640.	11.6701269	32.0218191	
0.0000982	929.5712919	9469640.	11.5286079	32.6196337	
0.0001011	957.7401189	9469640.	11.3954135	33.2174483	
0.0001041	985.9089460	9469640.	11.2698303	33.8152629	
0.0001071	1014.0777730	9469640.	11.1512239	34.4130775	
0.0001101	1042.2466000	9469640.	11.0390287	35.0108921	
0.0001130	1070.4154271	9469640.	10.9327384	35.6087067	
0.0001160	1098.2042691	9466365.	10.8330663	36.0000000	Y
0.0001220	1147.5561105	9409245.	10.6668789	36.0000000	Y
0.0001279	1188.9383270	9295133.	10.5395883	36.0000000	Y
0.0001339	1225.7222704	9156812.	10.4372055	36.0000000	Y
0.0001398	1258.8797594	9004324.	10.3542714	36.0000000	Y
0.0001458	1289.0159975	8843556.	10.2870759	36.0000000	Y
0.0001517	1316.6962555	8679209.	10.2324591	36.0000000	Y
0.0001577	1342.2691527	8513898.	10.1882401	36.0000000	Y
0.0001636	1365.9313398	8348932.	10.1529395	36.0000000	Y
0.0001696	1387.9680970	8185955.	10.1249810	36.0000000	Y
0.0001755	1408.6195091	8026134.	10.1030627	36.0000000	Y
0.0001815	1427.9202390	7869350.	10.0866260	36.0000000	Y
0.0001874	1446.1098008	7716590.	10.0745673	36.0000000	Y
0.0001934	1463.1948684	7567519.	10.0665662	36.0000000	Y
0.0001993	1479.3962391	7422914.	10.0616983	36.0000000	Y
0.0002053	1494.6892133	7282266.	10.0598440	36.0000000	Y
0.0002112	1509.1688357	7145690.	10.0605447	36.0000000	Y
0.0002171	1522.9441537	7013355.	10.0633313	36.0000000	Y
0.0002231	1536.0602553	6885123.	10.0679572	36.0000000	Y
0.0002290	1548.5602086	6760862.	10.0742012	36.0000000	Y
0.0002350	1560.4852096	6640447.	10.0818645	36.0000000	Y
0.0002409	1571.8747124	6523755.	10.0907672	36.0000000	Y
0.0002469	1582.7665453	6410671.	10.1007462	36.0000000	Y
0.0002528	1593.1970131	6301084.	10.1116527	36.0000000	Y
0.0002588	1603.2009889	6194888.	10.1233500	36.0000000	Y
0.0002647	1612.8119967	6091980.	10.1357122	36.0000000	Y
0.0002707	1622.0622844	5992263.	10.1486230	36.0000000	Y
0.0002766	1630.9828907	5895643.	10.1619734	36.0000000	Y
0.0002826	1639.5004212	5801665.	10.1759836	36.0000000	Y
0.0002885	1647.7150385	5710513.	10.1903405	36.0000000	Y
0.0002945	1655.6728030	5622171.	10.2048983	36.0000000	Y
0.0003004	1663.3920849	5536534.	10.2195983	36.0000000	Y
0.0003064	1670.7420422	5453018.	10.2348505	36.0000000	Y
0.0003123	1677.9022292	5372075.	10.2501034	36.0000000	Y
0.0003183	1684.8782687	5293580.	10.2653409	36.0000000	Y
0.0003242	1691.5218062	5216940.	10.2810319	36.0000000	Y
0.0003302	1698.0374448	5142674.	10.2965499	36.0000000	Y
0.0003361	1704.3222649	5070351.	10.3122172	36.0000000	Y
0.0003421	1710.4060012	4999955.	10.3279561	36.0000000	Y
0.0003480	1716.2197519	4931190.	10.3427956	36.0000000	Y
0.0003540	1721.5958440	4863501.	10.3569498	36.0000000	Y
0.0003778	1740.5391059	4607282.	10.4062041	36.0000000	Y

0.0004016	1755.1777814	4370711.	10.4416880	36.0000000	Y
0.0004254	1766.6567905	4153181.	10.4687894	36.0000000	Y
0.0004492	1776.0939082	3954155.	10.4899122	36.0000000	Y
0.0004730	1783.9593600	3771834.	10.5070103	36.0000000	Y
0.0004968	1790.6082729	3604532.	10.5213776	36.0000000	Y
0.0005206	1796.3239112	3450733.	10.5339500	36.0000000	Y
0.0005444	1801.2496554	3308930.	10.5447200	36.0000000	Y
0.0005682	1805.4704195	3177765.	10.5531427	36.0000000	Y

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip
1	180.000	1805.5

Note that the values in the above table are not factored by a strength reduction factor for LRFD.

The value of the strength reduction factor depends on the provisions of the LRFD code being followed.

The above values should be multiplied by the appropriate strength reduction factor to compute ultimate moment capacity according to the LRFD structural design standard being followed.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (BC Type 1)

Horizontal shear force at pile head	=	10000.000 lbs
Applied moment at pile head	=	0.000 in-lbs
Axial thrust load on pile head	=	180000.000 lbs

Depth X inches	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/in	Soil Spr. Distrib. Es*h lb/inch	Lat. Load lb/inch
0.00	0.1851	1.168E-07	10000.	-0.002943	0.000	9.470E+09	-155.8784	2526.2857	0.000
6.000	0.1675	60372.	9050.0176	-0.002923	0.000	9.470E+09	-160.7824	5761.0018	0.000
12.000	0.1500	114915.	8072.8206	-0.002868	0.000	9.470E+09	-164.9500	6596.8215	0.000
18.000	0.1330	163441.	7072.9509	-0.002780	0.000	9.470E+09	-168.3400	7592.1244	0.000
24.000	0.1167	205794.	6055.2010	-0.002663	0.000	9.470E+09	-170.9100	8789.3846	0.000
30.000	0.1011	241855.	5024.6246	-0.002521	0.000	9.470E+09	-172.6155	10246.	0.000
36.000	0.0864	271535.	3986.5511	-0.002358	0.000	9.470E+09	-173.4090	12040.	0.000
42.000	0.0728	294787.	2946.6080	-0.002179	0.000	9.470E+09	-173.2387	14281.	0.000
48.000	0.0603	311601.	1910.7517	-0.001987	0.000	9.470E+09	-172.0467	17127.	0.000
54.000	0.0489	322007.	885.3152	-0.001786	0.000	9.470E+09	-169.7655	20811.	0.000
60.000	0.0388	326082.	-122.9220	-0.001581	0.000	9.470E+09	-166.3136	25692.	0.000
66.000	0.0300	323947.	-1106.6222	-0.001375	0.000	9.470E+09	-161.5865	32343.	0.000
72.000	0.0223	315772.	-2057.7053	-0.001172	0.000	9.470E+09	-155.4412	41742.	0.000
78.000	0.0159	301786.	-2967.0197	-0.000976	0.000	9.470E+09	-147.6636	55685.	0.000
84.000	0.0106	282277.	-3823.6986	-0.000791	0.000	9.470E+09	-137.8960	77867.	0.000
90.000	0.006413	257611.	-4609.9142	-0.000620	0.000	9.470E+09	-124.1758	116171.	0.000
96.000	0.003181	228298.	-5304.0327	-0.000466	0.000	9.470E+09	-107.1970	202215.	0.000
102.000	0.000816	194970.	-5861.2674	-0.000332	0.000	9.470E+09	-78.5479	577677.	0.000
108.000	-0.000808	158681.	-5861.6277	-0.000220	0.000	9.470E+09	78.4278	582519.	0.000
114.000	-0.001828	125107.	-5337.3117	-0.000130	0.000	9.470E+09	96.3442	316191.	0.000
120.000	-0.002373	94915.	-4739.6707	-6.073E-05	0.000	9.470E+09	102.8694	260099.	0.000
126.000	-0.002557	68362.	-4116.5961	-9.003E-06	0.000	9.470E+09	104.8221	245968.	0.000
132.000	-0.002481	45535.	-3490.0022	2.708E-05	0.000	9.470E+09	104.0426	251610.	0.000
138.000	-0.002232	26423.	-2873.8803	4.988E-05	0.000	9.470E+09	101.3314	272396.	0.000
144.000	-0.001883	10941.	-2278.5552	6.171E-05	0.000	9.470E+09	97.1103	309512.	0.000
150.000	-0.001491	-1052.6259	-1712.3667	6.485E-05	0.000	9.470E+09	91.6192	368581.	0.000
156.000	-0.001104	-9747.3536	-1182.5408	6.143E-05	0.000	9.470E+09	84.9894	461748.	0.000
162.000	-0.000754	-15376.	-695.7806	5.347E-05	0.000	9.470E+09	77.2640	614558.	0.000
168.000	-0.000463	-18212.	-258.8510	4.283E-05	0.000	9.470E+09	68.3792	886568.	0.000
174.000	-0.000240	-18575.	205.3138	3.117E-05	0.000	9.470E+09	86.3424	2154663.	0.000
180.000	-8.871E-05	-15816.	559.9151	2.028E-05	0.000	9.470E+09	31.8580	2154663.	0.000
186.000	2.881E-06	-11899.	652.3852	1.150E-05	0.000	9.470E+09	-1.0346	2154663.	0.000
192.000	4.924E-05	-8011.9808	596.2343	5.188E-06	0.000	9.470E+09	-17.6823	2154663.	0.000
198.000	6.514E-05	-4755.7189	473.0112	1.143E-06	0.000	9.470E+09	-23.3920	2154663.	0.000
204.000	6.296E-05	-2338.3160	335.0074	-1.104E-06	0.000	9.470E+09	-22.6092	2154663.	0.000
210.000	5.189E-05	-733.2449	211.2774	-2.077E-06	0.000	9.470E+09	-18.6341	2154663.	0.000
216.000	3.803E-05	201.4990	114.4009	-2.246E-06	0.000	9.470E+09	-13.6580	2154663.	0.000
222.000	2.494E-05	644.4162	46.5558	-1.978E-06	0.000	9.470E+09	-8.9570	2154663.	0.000
228.000	1.430E-05	764.4407	4.2777	-1.531E-06	0.000	9.470E+09	-5.1357	2154663.	0.000
234.000	6.566E-06	699.0561	-18.2037	-1.068E-06	0.000	9.470E+09	-2.3581	2154663.	0.000
240.000	1.489E-06	548.3024	-26.8822	-6.725E-07	0.000	9.470E+09	-0.5348	2154663.	0.000
246.000	-1.504E-06	377.9218	-26.8666	-3.791E-07	0.000	9.470E+09	0.5400	2154663.	0.000
252.000	-3.060E-06	226.7219	-21.9503	-1.875E-07	0.000	9.470E+09	1.0988	2154663.	0.000
258.000	-3.754E-06	114.9237	-14.6096	-7.929E-08	0.000	9.470E+09	1.3481	2154663.	0.000
264.000	-4.011E-06	51.5783	-6.2438	-2.654E-08	0.000	9.470E+09	1.4405		

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2154663.      0.000
   270.000 -4.073E-06    40.0553    -1.8092  2.486E-09      0.000  9.470E+09     0.0377
55565.      0.000
   276.000 -3.981E-06    29.8627    -1.5815  2.464E-08      0.000  9.470E+09     0.0382
57509.      0.000
   282.000 -3.777E-06    21.0235    -1.3548  4.076E-08      0.000  9.470E+09     0.0374
59453.      0.000
   288.000 -3.492E-06    13.5172    -1.1353  5.170E-08      0.000  9.470E+09     0.0357
61397.      0.000
   294.000 -3.156E-06     7.2882    -0.9281  5.829E-08      0.000  9.470E+09     0.0333
63341.      0.000
   300.000 -2.793E-06     2.2537    -0.7370  6.131E-08      0.000  9.470E+09     0.0304
65285.      0.000
   306.000 -2.421E-06    -1.6883    -0.5645  6.149E-08      0.000  9.470E+09     0.0271
67229.      0.000
   312.000 -2.055E-06    -4.6526    -0.4120  5.948E-08      0.000  9.470E+09     0.0237
69173.      0.000
   318.000 -1.707E-06    -6.7609    -0.2802  5.587E-08      0.000  9.470E+09     0.0202
71117.      0.000
   324.000 -1.385E-06    -8.1362    -0.1690  5.115E-08      0.000  9.470E+09     0.0169
73061.      0.000
   330.000 -1.093E-06    -8.8990    -0.0774  4.575E-08      0.000  9.470E+09     0.0137
75005.      0.000
   336.000 -8.355E-07    -9.1638  -0.004252  4.003E-08      0.000  9.470E+09     0.0107
76949.      0.000
   342.000 -6.128E-07    -9.0365     0.0521  3.426E-08      0.000  9.470E+09    0.008057
78893.      0.000
   348.000 -4.244E-07    -8.6130     0.0934  2.867E-08      0.000  9.470E+09    0.005718
80837.      0.000
   354.000 -2.687E-07    -7.9777     0.1217  2.342E-08      0.000  9.470E+09    0.003708
82781.      0.000
   360.000 -1.434E-07    -7.2035     0.1389  1.861E-08      0.000  9.470E+09    0.002025
84725.      0.000
   366.000 -4.545E-08    -6.3515     0.1469  1.431E-08      0.000  9.470E+09    0.000656
86669.      0.000
   372.000  2.835E-08    -5.4715     0.1476  1.057E-08      0.000  9.470E+09   -0.000419
88613.      0.000
   378.000  8.135E-08    -4.6029     0.1427  7.375E-09      0.000  9.470E+09   -0.001228
90557.      0.000
   384.000  1.169E-07    -3.7753     0.1336  4.721E-09      0.000  9.470E+09   -0.001802
92501.      0.000
   390.000  1.380E-07    -3.0099     0.1217  2.571E-09      0.000  9.470E+09   -0.002172
94445.      0.000
   396.000  1.477E-07    -2.3207     0.1080  8.827E-10      0.000  9.470E+09   -0.002373
96389.      0.000
   402.000  1.486E-07    -1.7154     0.0936 -3.960E-10      0.000  9.470E+09   -0.002435
98333.      0.000
   408.000  1.430E-07    -1.1965     0.0791 -1.318E-09      0.000  9.470E+09   -0.002389
100277.      0.000
   414.000  1.328E-07    -0.7629     0.0652 -1.939E-09      0.000  9.470E+09   -0.002262
102221.      0.000
   420.000  1.197E-07    -0.4101     0.0522 -2.311E-09      0.000  9.470E+09   -0.002078
104165.      0.000
   426.000  1.050E-07    -0.1319     0.0404 -2.483E-09      0.000  9.470E+09   -0.001858
106109.      0.000
   432.000  8.990E-08     0.0795     0.0299 -2.499E-09      0.000  9.470E+09   -0.001619
108053.      0.000
   438.000  7.506E-08     0.2326     0.0209 -2.400E-09      0.000  9.470E+09   -0.001376
109997.      0.000
   444.000  6.110E-08     0.3360     0.0134 -2.220E-09      0.000  9.470E+09   -0.001140
111941.      0.000
   450.000  4.841E-08     0.3982   0.007219 -1.988E-09      0.000  9.470E+09   -0.000919
113885.      0.000
   456.000  3.725E-08     0.4270   0.002305 -1.726E-09      0.000  9.470E+09   -0.000719
115829.      0.000
   462.000  2.770E-08     0.4296  -0.001483 -1.455E-09      0.000  9.470E+09   -0.000544
117773.      0.000
   468.000  1.979E-08     0.4123  -0.004299 -1.188E-09      0.000  9.470E+09   -0.000395
119717.      0.000
   474.000  1.344E-08     0.3805  -0.006301 -9.369E-10      0.000  9.470E+09   -0.000273
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121661.      0.000
   480.000  8.546E-09     0.3387  -0.007647 -7.090E-10      0.000  9.470E+09  -0.000176
123605.      0.000
   486.000  4.935E-09     0.2903  -0.008382 -5.098E-10      0.000  9.470E+09 -6.885E-05
83699.      0.000
   492.000  2.429E-09     0.2392  -0.008692 -3.420E-10      0.000  9.470E+09 -3.440E-05
84995.      0.000
   498.000  8.313E-10     0.1867  -0.008831 -2.071E-10      0.000  9.470E+09 -1.196E-05
86291.      0.000
   504.000 -5.614E-11     0.1337  -0.008864 -1.055E-10      0.000  9.470E+09  8.195E-07
87587.      0.000
   510.000 -4.352E-10     0.0806  -0.007841 -3.765E-11      0.000  9.470E+09   0.000340
4687500.      0.000
   516.000 -5.079E-10     0.0397  -0.005631      0.000      0.000  9.470E+09   0.000397
4687500.      0.000
   522.000 -4.297E-10     0.0130  -0.003434  1.717E-11      0.000  9.470E+09   0.000336
4687500.      0.000
   528.000 -3.019E-10  -0.001549  -0.001719  2.081E-11      0.000  9.470E+09   0.000236
4687500.      0.000
   534.000 -1.800E-10  -0.007641  -0.000590  1.790E-11      0.000  9.470E+09   0.000141
4687500.      0.000
   540.000 -8.713E-11  -0.008666  3.623E-05  1.273E-11      0.000  9.470E+09  6.807E-05
4687500.      0.000
   546.000 -2.723E-11  -0.007234   0.000304  7.692E-12      0.000  9.470E+09  2.127E-05
4687500.      0.000
   552.000  5.175E-12  -0.005031   0.000356  3.807E-12      0.000  9.470E+09 -4.043E-06
4687500.      0.000
   558.000  1.845E-11  -0.002971   0.000301  1.272E-12      0.000  9.470E+09 -1.442E-05
4687500.      0.000
   564.000  2.043E-11  -0.001427   0.000209      0.000      0.000  9.470E+09 -1.596E-05
4687500.      0.000
   570.000  1.699E-11  -0.000457   0.000122      0.000      0.000  9.470E+09 -1.328E-05
4687500.      0.000
   576.000  1.181E-11  3.484E-05  5.419E-05      0.000      0.000  9.470E+09 -9.227E-06
4687500.      0.000
   582.000  6.762E-12   0.000195  1.066E-05      0.000      0.000  9.470E+09 -5.283E-06
4687500.      0.000
   588.000  2.454E-12   0.000164 -1.094E-05      0.000      0.000  9.470E+09 -1.917E-06
4687500.      0.000
   594.000 -1.229E-12  6.498E-05 -1.381E-05      0.000      0.000  9.470E+09  9.599E-07
4687500.      0.000
   600.000 -4.665E-12      0.000      0.000      0.000      0.000  9.470E+09  3.644E-06
2343750.      0.000

* This analysis makes computations of pile response using nonlinear moment-curvature
relationships.
  The above values of total stress are computed for combined axial stress and do not equal
the
  actual stresses in concrete and steel in the range of nonlinear bending.


Output Verification: Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No. 1:

Pile-head deflection              =      0.1851078 inches
Computed slope at pile head       =     -0.0029425 radians
Maximum bending moment            =         326082. inch-lbs
Maximum shear force               =          10000. lbs
Depth of maximum bending moment   =     60.0000000 inches below pile head
Depth of maximum shear force      =       0.000000 inches below pile head
Number of iterations              =             28
Number of zero deflection points  =              7


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                    Computed Values of Pile Loading and Deflection
                      for Lateral Loading for Load Case Number 2
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Pile-head conditions are Shear and Moment (BC Type 1)

Horizontal shear force at pile head                    =       15000.000 lbs
Applied moment at pile head                            =           0.000 in-lbs
Axial thrust load on pile head                         =      180000.000 lbs

   Depth    Deflect.    Bending    Shear       Slope      Total    Bending   Soil Res.  Soil
Spr.   Distrib.
     X          y         Moment     Force          S       Stress   Stiffness       p
Es*h    Lat. Load
   inches     inches     in-lbs      lbs       radians     psi*      lb-in^2    lb/in
lb/inch     lb/inch
---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
      0.00     0.4546      0.000     15000.  -0.006205      0.000  9.470E+09  -195.1295
1287.7301      0.000
      6.000    0.4174     93190.     13809.  -0.006176      0.000  9.470E+09  -202.0133
2904.1797      0.000
     12.000    0.3805    179043.     12578.  -0.006090      0.000  9.470E+09  -208.1513
3282.4632      0.000
     18.000    0.3443    257280.     11313.  -0.005951      0.000  9.470E+09  -213.5045
3720.8730      0.000
     24.000    0.3091    327655.     10018.  -0.005766      0.000  9.470E+09  -218.0330
4232.8050      0.000
     30.000    0.2751    389957.  8699.3115  -0.005539      0.000  9.470E+09  -221.6958
4835.4544      0.000
     36.000    0.2426    444011.  7360.8743  -0.005275      0.000  9.470E+09  -224.4499
5551.1892      0.000
     42.000    0.2118    489680.  6008.7763  -0.004979      0.000  9.470E+09  -226.2495
6409.5421      0.000
     48.000    0.1829    526870.  4648.8919  -0.004657      0.000  9.470E+09  -227.0453
7450.1642      0.000
     54.000    0.1559    555526.  3287.4071  -0.004314      0.000  9.470E+09  -226.7830
8727.3240      0.000
     60.000    0.1311    575637.  1930.8560  -0.003955      0.000  9.470E+09  -225.4007
10317.      0.000
     66.000    0.1084    587240.   586.1751  -0.003587      0.000  9.470E+09  -222.8263
12328.      0.000
     72.000    0.0880    590419.  -739.2189  -0.003214      0.000  9.470E+09  -218.9717
14923.      0.000
     78.000    0.0699    585311. -2037.3080  -0.002842      0.000  9.470E+09  -213.7246
18351.      0.000
     84.000    0.0539    572109. -3299.2810  -0.002475      0.000  9.470E+09  -206.9330
23017.      0.000
     90.000    0.0402    551066. -4509.2077  -0.002119      0.000  9.470E+09  -196.3758
29324.      0.000
     96.000    0.0285    522576. -5654.3671  -0.001779      0.000  9.470E+09  -185.3440
39000.      0.000
    102.000    0.0188    487056. -6725.4742  -0.001459      0.000  9.470E+09  -171.6917
54695.      0.000
    108.000    0.0110    445021. -7693.7543  -0.001164      0.000  9.470E+09  -151.0683
82356.      0.000
    114.000    0.004869  397244. -8516.5844  -0.000897      0.000  9.470E+09  -123.2084
151813.      0.000
    120.000    0.000243  344760. -9148.1017  -0.000662      0.000  9.470E+09   -87.2974
2154663.      0.000
    126.000   -0.003073  288897. -9080.5654  -0.000461      0.000  9.470E+09   109.8095
214427.      0.000
    132.000   -0.005290  236789. -8373.7784  -0.000295      0.000  9.470E+09   125.7862
142666.      0.000
    138.000   -0.006607  189047. -7597.4879  -0.000160      0.000  9.470E+09   132.9773
120753.      0.000
    144.000   -0.007206  145964. -6790.8773 -5.352E-05      0.000  9.470E+09   135.8928
113150.      0.000
    150.000   -0.007250  107673. -5974.9005  2.683E-05      0.000  9.470E+09   136.0994
112639.      0.000
    156.000   -0.006884   74207. -5163.5486  8.445E-05      0.000  9.470E+09   134.3512
117098.      0.000
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    162.000   -0.006236     45528. -4367.2730   0.000122      0.000  9.470E+09   131.0741
126108.      0.000
    168.000   -0.005415     21536. -3594.4556   0.000144      0.000  9.470E+09   126.5317
140189.      0.000
    174.000   -0.004513  2083.8599 -2852.1757   0.000151      0.000  9.470E+09   120.8949
160737.      0.000
    180.000   -0.003602    -13017. -2146.6706   0.000148      0.000  9.470E+09   114.2735
190341.      0.000
    186.000   -0.002741    -23995. -1483.6550   0.000136      0.000  9.470E+09   106.7317
233631.      0.000
    192.000   -0.001971    -31114.  -868.5922   0.000118      0.000  9.470E+09    98.2893
299187.      0.000
    198.000   -0.001320    -34674.  -306.9962  9.762E-05      0.000  9.470E+09    88.9094
404285.      0.000
    204.000   -0.000800    -35009.   195.0871  7.554E-05      0.000  9.470E+09    78.4517
588609.      0.000
    210.000   -0.000413    -32496.   629.9778  5.416E-05      0.000  9.470E+09    66.5119
966309.      0.000
    216.000   -0.000150    -27567.   990.9087  3.513E-05      0.000  9.470E+09    53.7984
2154663.      0.000
    222.000   8.567E-06    -20681.  1143.0739  1.984E-05      0.000  9.470E+09    -3.0767
2154663.      0.000
    228.000   8.832E-05    -13892.  1038.6906  8.891E-06      0.000  9.470E+09   -31.7177
2154663.      0.000
    234.000   0.000115 -8236.1043   819.3591  1.881E-06      0.000  9.470E+09   -41.3928
2154663.      0.000
    240.000   0.000111 -4064.2327   575.7094 -2.016E-06      0.000  9.470E+09   -39.8238
2154663.      0.000
    246.000   9.108E-05 -1323.2377   358.1187 -3.722E-06      0.000  9.470E+09   -32.7064
2154663.      0.000
    252.000   6.623E-05   241.2326   188.6521 -4.065E-06      0.000  9.470E+09   -23.7825
2154663.      0.000
    258.000   4.229E-05   949.3688    71.7411 -3.688E-06      0.000  9.470E+09   -15.1879
2154663.      0.000
    264.000   2.197E-05  1110.0916     2.5093 -3.036E-06      0.000  9.470E+09    -7.8894
2154663.      0.000
    270.000   5.866E-06   986.0371   -21.3218 -2.372E-06      0.000  9.470E+09    -0.0543
55565.      0.000
    276.000 -6.490E-06   859.3524   -21.2982 -1.787E-06      0.000  9.470E+09     0.0622
57509.      0.000
    282.000 -1.558E-05   734.3189   -20.6485 -1.282E-06      0.000  9.470E+09     0.1544
59453.      0.000
    288.000 -2.187E-05   614.3398   -19.5139 -8.548E-07      0.000  9.470E+09     0.2238
61397.      0.000
    294.000 -2.584E-05   501.9985   -18.0242 -5.012E-07      0.000  9.470E+09     0.2727
63341.      0.000
    300.000 -2.789E-05   399.1323   -16.2956 -2.157E-07      0.000  9.470E+09     0.3034
65285.      0.000
    306.000 -2.842E-05   306.9171   -14.4298  8.002E-09      0.000  9.470E+09     0.3185
67229.      0.000
    312.000 -2.779E-05   225.9573   -12.5131  1.768E-07      0.000  9.470E+09     0.3204
69173.      0.000
    318.000 -2.630E-05   156.3777   -10.6166  2.979E-07      0.000  9.470E+09     0.3118
71117.      0.000
    324.000 -2.422E-05    97.9141    -8.7967  3.785E-07      0.000  9.470E+09     0.2949
73061.      0.000
    330.000 -2.176E-05    49.9994    -7.0960  4.254E-07      0.000  9.470E+09     0.2720
75005.      0.000
    336.000 -1.911E-05    11.8431    -5.5446  4.450E-07      0.000  9.470E+09     0.2451
76949.      0.000
    342.000 -1.642E-05   -17.4971    -4.1615  4.432E-07      0.000  9.470E+09     0.2159
78893.      0.000
    348.000 -1.379E-05   -39.0526    -2.9563  4.252E-07      0.000  9.470E+09     0.1859
80837.      0.000
    354.000 -1.132E-05   -53.8907    -1.9303  3.958E-07      0.000  9.470E+09     0.1561
82781.      0.000
    360.000 -9.045E-06   -63.0707    -1.0787  3.587E-07      0.000  9.470E+09     0.1277
84725.      0.000
    366.000 -7.012E-06   -67.6094    -0.3916  3.173E-07      0.000  9.470E+09     0.1013
86669.      0.000
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   372.000 -5.237E-06   -68.4553     0.1443  2.742E-07      0.000  9.470E+09     0.0773
88613.      0.000
   378.000 -3.722E-06   -66.4700     0.5448  2.315E-07      0.000  9.470E+09     0.0562
90557.      0.000
   384.000 -2.459E-06   -62.4172     0.8271  1.907E-07      0.000  9.470E+09     0.0379
92501.      0.000
   390.000 -1.434E-06   -56.9569     1.0085  1.528E-07      0.000  9.470E+09     0.0226
94445.      0.000
   396.000 -6.247E-07   -50.6453     1.1063  1.188E-07      0.000  9.470E+09     0.0100
96389.      0.000
   402.000 -8.433E-09   -43.9377     1.1368  8.880E-08      0.000  9.470E+09   0.000138
98333.      0.000
   408.000  4.408E-07   -37.1951     1.1151  6.309E-08      0.000  9.470E+09  -0.007368
100277.      0.000
   414.000  7.487E-07   -30.6922     1.0548  4.159E-08      0.000  9.470E+09    -0.0128
102221.      0.000
   420.000  9.399E-07   -24.6276     0.9676  2.406E-08      0.000  9.470E+09    -0.0163
104165.      0.000
   426.000  1.037E-06   -19.1335     0.8636  1.020E-08      0.000  9.470E+09    -0.0183
106109.      0.000
   432.000  1.062E-06   -14.2868     0.7511 -3.896E-10      0.000  9.470E+09    -0.0191
108053.      0.000
   438.000  1.033E-06   -10.1190     0.6369 -8.121E-09      0.000  9.470E+09    -0.0189
109997.      0.000
   444.000  9.648E-07    -6.6259     0.5261 -1.343E-08      0.000  9.470E+09    -0.0180
111941.      0.000
   450.000  8.716E-07    -3.7762     0.4225 -1.672E-08      0.000  9.470E+09    -0.0165
113885.      0.000
   456.000  7.641E-07    -1.5196     0.3286 -1.840E-08      0.000  9.470E+09    -0.0148
115829.      0.000
   462.000  6.508E-07     0.2071     0.2460 -1.882E-08      0.000  9.470E+09    -0.0128
117773.      0.000
   468.000  5.384E-07     1.4737     0.1755 -1.828E-08      0.000  9.470E+09    -0.0107
119717.      0.000
   474.000  4.315E-07     2.3525     0.1170 -1.707E-08      0.000  9.470E+09  -0.008749
121661.      0.000
   480.000  3.335E-07     2.9148     0.0702 -1.540E-08      0.000  9.470E+09  -0.006870
123605.      0.000
   486.000  2.466E-07     3.2278     0.0392 -1.346E-08      0.000  9.470E+09  -0.003441
83699.      0.000
   492.000  1.720E-07     3.4147     0.0216 -1.135E-08      0.000  9.470E+09  -0.002437
84995.      0.000
   498.000  1.104E-07     3.5116   0.009528 -9.157E-09      0.000  9.470E+09  -0.001588
86291.      0.000
   504.000  6.215E-08     3.5489   0.002043 -6.920E-09      0.000  9.470E+09  -0.000907
87587.      0.000
   510.000  2.737E-08     3.5510    -0.0648 -4.671E-09      0.000  9.470E+09    -0.0214
4687500.      0.000
   516.000  6.094E-09     2.7810    -0.1433 -2.665E-09      0.000  9.470E+09  -0.004761
4687500.      0.000
   522.000 -4.611E-09     1.8376    -0.1467 -1.202E-09      0.000  9.470E+09   0.003602
4687500.      0.000
   528.000 -8.330E-09     1.0227    -0.1164 -2.959E-10      0.000  9.470E+09   0.006508
4687500.      0.000
   534.000 -8.161E-09     0.4413    -0.0778  1.679E-10      0.000  9.470E+09   0.006376
4687500.      0.000
   540.000 -6.315E-09     0.0892    -0.0438  3.360E-10      0.000  9.470E+09   0.004933
4687500.      0.000
   546.000 -4.129E-09    -0.0853    -0.0194  3.373E-10      0.000  9.470E+09   0.003226
4687500.      0.000
   552.000 -2.268E-09    -0.1437  -0.004358  2.647E-10      0.000  9.470E+09   0.001772
4687500.      0.000
   558.000 -9.528E-10    -0.1382   0.003190  1.754E-10      0.000  9.470E+09   0.000744
4687500.      0.000
   564.000 -1.633E-10    -0.1058   0.005806  9.807E-11      0.000  9.470E+09   0.000128
4687500.      0.000
   570.000  2.240E-10    -0.0688   0.005663  4.276E-11      0.000  9.470E+09  -0.000175
4687500.      0.000
   576.000  3.499E-10    -0.0379   0.004318  8.959E-12      0.000  9.470E+09  -0.000273
4687500.      0.000
```



```
   582.000  3.315E-10    -0.0170   0.002721 -8.436E-12      0.000  9.470E+09  -0.000259
4687500.      0.000
   588.000  2.487E-10  -0.005279   0.001361 -1.548E-11      0.000  9.470E+09  -0.000194
4687500.      0.000
   594.000  1.458E-10  -0.000590   0.000437 -1.734E-11      0.000  9.470E+09  -0.000114
4687500.      0.000
   600.000  4.060E-11      0.000      0.000 -1.753E-11      0.000  9.470E+09 -3.172E-05
2343750.      0.000

* This analysis makes computations of pile response using nonlinear moment-curvature
relationships.
  The above values of total stress are computed for combined axial stress and do not equal
the
  actual stresses in concrete and steel in the range of nonlinear bending.


Output Verification: Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No. 2:

Pile-head deflection              =      0.4545895 inches
Computed slope at pile head       =     -0.0062054 radians
Maximum bending moment            =         590419. inch-lbs
Maximum shear force               =          15000. lbs
Depth of maximum bending moment   =     72.0000000 inches below pile head
Depth of maximum shear force      =       0.000000 inches below pile head
Number of iterations              =             27
Number of zero deflection points  =              7


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                    Computed Values of Pile Loading and Deflection
                      for Lateral Loading for Load Case Number 3
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Pile-head conditions are Shear and Moment (BC Type 1)

Horizontal shear force at pile head                    =       20000.000 lbs
Applied moment at pile head                            =           0.000 in-lbs
Axial thrust load on pile head                         =      180000.000 lbs

   Depth    Deflect.    Bending    Shear       Slope      Total    Bending   Soil Res.  Soil
Spr.   Distrib.
     x        y         Moment     Force         S       Stress   Stiffness      p
Es*h    Lat. Load
   inches    inches     in-lbs      lbs       radians     psi*      lb-in^2     lb/in
lb/inch    lb/inch
---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
----------
      0.00     0.8669  5.841E-08     20000.    -0.0106      0.000  9.470E+09  -229.2991
793.5574      0.000
      6.000     0.8033    127307.     18598.    -0.0105      0.000  9.470E+09  -237.9436
1777.1855      0.000
     12.000     0.7403    245961.     17147.    -0.0104      0.000  9.470E+09  -245.8353
1992.4889      0.000
     18.000     0.6782    355597.     15651.    -0.0102      0.000  9.470E+09  -252.9372
2237.7888      0.000
     24.000     0.6174    455884.     14114.  -0.009981      0.000  9.470E+09  -259.2120
2518.9625      0.000
     30.000     0.5584    546527.     12543.  -0.009664      0.000  9.470E+09  -264.6213
2843.3302      0.000
     36.000     0.5015    627269.     10941.  -0.009292      0.000  9.470E+09  -269.1258
3220.1028      0.000
     42.000     0.4469    697894.  9315.9973  -0.008872      0.000  9.470E+09  -272.6846
3661.0007      0.000
     48.000     0.3950    758225.  7672.1801  -0.008411      0.000  9.470E+09  -275.2544
4181.1224      0.000
     54.000     0.3460    808128.  6016.0497  -0.007915      0.000  9.470E+09  -276.7891
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4800.1895      0.000
     60.000     0.3000    847513.  4353.9677  -0.007390      0.000  9.470E+09  -277.2383
5544.3669      0.000
     66.000     0.2573    876338.  2692.6146  -0.006844      0.000  9.470E+09  -276.5461
6448.9933      0.000
     72.000     0.2179    894607.  1039.0297  -0.006283      0.000  9.470E+09  -274.6489
7562.7976      0.000
     78.000     0.1819    902377.  -599.3315  -0.005714      0.000  9.470E+09  -271.4715
8954.6328      0.000
     84.000     0.1493    899756. -2214.5136  -0.005143      0.000  9.470E+09  -266.9225
10725.      0.000
     90.000     0.1202    886911. -3790.0439  -0.004577      0.000  9.470E+09  -258.2543
12893.      0.000
     96.000     0.0944    864161. -5314.8621  -0.004022      0.000  9.470E+09  -250.0184
15889.      0.000
    102.000     0.0719    831820. -6784.9547  -0.003485      0.000  9.470E+09  -240.0124
20022.      0.000
    108.000     0.0526    790269. -8175.0852  -0.002971      0.000  9.470E+09  -223.3644
25480.      0.000
    114.000     0.0363    740136. -9455.8468  -0.002486      0.000  9.470E+09  -203.5561
33669.      0.000
    120.000     0.0228    682168.    -10610.  -0.002035      0.000  9.470E+09  -181.1853
47752.      0.000
    126.000     0.0119    617211.    -11615.  -0.001624      0.000  9.470E+09  -153.9148
77926.      0.000
    132.000   0.003282    546291.    -12412.  -0.001255      0.000  9.470E+09  -111.7129
204223.      0.000
    138.000  -0.003210    470975.    -12415.  -0.000933      0.000  9.470E+09   110.9356
207364.      0.000
    144.000  -0.007911    399331.    -11665.  -0.000657      0.000  9.470E+09   139.0592
105463.      0.000
    150.000    -0.0111    332419.    -10793.  -0.000425      0.000  9.470E+09   151.3405
81844.      0.000
    156.000    -0.0130    270728. -9866.8616  -0.000234      0.000  9.470E+09   157.5064
72615.      0.000
    162.000    -0.0139    214523. -8913.9305 -8.045E-05      0.000  9.470E+09   160.1373
69100.      0.000
    168.000    -0.0140    163935. -7952.4552  3.945E-05      0.000  9.470E+09   160.3545
68823.      0.000
    174.000    -0.0134    119008. -6995.1127   0.000129      0.000  9.470E+09   158.7597
70920.      0.000
    180.000    -0.0124     79715. -6051.6832   0.000192      0.000  9.470E+09   155.7168
75161.      0.000
    186.000    -0.0111     45973. -5130.1437   0.000232      0.000  9.470E+09   151.4630
81674.      0.000
    192.000  -0.009648     17652. -4237.2765   0.000252      0.000  9.470E+09   146.1594
90891.      0.000
    198.000  -0.008103 -5418.8462 -3379.0469   0.000256      0.000  9.470E+09   139.9171
103607.      0.000
    204.000  -0.006578    -23449. -2560.8658   0.000247      0.000  9.470E+09   132.8099
121146.      0.000
    210.000  -0.005142    -36682. -1787.7993   0.000228      0.000  9.470E+09   124.8789
145722.      0.000
    216.000  -0.003845    -45395. -1064.7745   0.000202      0.000  9.470E+09   116.1294
181201.      0.000
    222.000  -0.002721    -49895.  -396.8451   0.000172      0.000  9.470E+09   106.5138
234832.      0.000
    228.000  -0.001787    -50527.   210.3492   0.000140      0.000  9.470E+09    95.8844
321896.      0.000
    234.000  -0.001045    -47673.   749.5435   0.000109      0.000  9.470E+09    83.8471
481360.      0.000
    240.000  -0.000484    -41767.  1208.6103  8.025E-05      0.000  9.470E+09    69.1752
857107.      0.000
    246.000 -8.215E-05    -33343.  1504.6356  5.645E-05      0.000  9.470E+09    29.4999
2154663.      0.000
    252.000   0.000193    -23833.  1384.9999  3.834E-05      0.000  9.470E+09   -69.3785
2154663.      0.000
    258.000   0.000378    -16806.   981.7971  2.547E-05      0.000  9.470E+09   -65.0225
1032288.      0.000
    264.000   0.000499    -12107.   577.6550  1.631E-05      0.000  9.470E+09   -69.6916
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838344.      0.000
    270.000   0.000574 -9908.8989   352.6442  9.331E-06      0.000  9.470E+09    -5.3120
55565.      0.000
    276.000   0.000611 -7895.3376   319.1462  3.691E-06      0.000  9.470E+09    -5.8540
57509.      0.000
    282.000   0.000618 -6087.1165   283.2166 -7.388E-07      0.000  9.470E+09    -6.1226
59453.      0.000
    288.000   0.000602 -4495.1428   246.3718 -4.091E-06      0.000  9.470E+09    -6.1590
61397.      0.000
    294.000   0.000569 -3121.8177   209.8807 -6.504E-06      0.000  9.470E+09    -6.0047
63341.      0.000
    300.000   0.000524 -1962.5248   174.7674 -8.115E-06      0.000  9.470E+09    -5.6998
65285.      0.000
    306.000   0.000471 -1007.0806   141.8217 -9.056E-06      0.000  9.470E+09    -5.2821
67229.      0.000
    312.000   0.000415  -241.1037   111.6162 -9.451E-06      0.000  9.470E+09    -4.7864
69173.      0.000
    318.000   0.000358   352.7287    84.5272 -9.416E-06      0.000  9.470E+09    -4.2433
71117.      0.000
    324.000   0.000302   793.5606    60.7586 -9.053E-06      0.000  9.470E+09    -3.6795
73061.      0.000
    330.000   0.000249  1101.3864    40.3682 -8.452E-06      0.000  9.470E+09    -3.1173
75005.      0.000
    336.000   0.000201  1296.2362    23.2927 -7.693E-06      0.000  9.470E+09    -2.5745
76949.      0.000
    342.000   0.000157  1397.5160     9.3740 -6.840E-06      0.000  9.470E+09    -2.0650
78893.      0.000
    348.000   0.000119  1423.4978    -1.6176 -5.946E-06      0.000  9.470E+09    -1.5988
80837.      0.000
    354.000  8.570E-05  1390.9472    -9.9614 -5.054E-06      0.000  9.470E+09    -1.1824
82781.      0.000
    360.000  5.802E-05  1314.8777   -15.9666 -4.197E-06      0.000  9.470E+09    -0.8193
84725.      0.000
    366.000  3.534E-05  1208.4133   -19.9559 -3.398E-06      0.000  9.470E+09    -0.5105
86669.      0.000
    372.000  1.725E-05  1082.7453   -22.2516 -2.672E-06      0.000  9.470E+09    -0.2548
88613.      0.000
    378.000  3.278E-06   947.1648   -23.1643 -2.029E-06      0.000  9.470E+09    -0.0495
90557.      0.000
    384.000 -7.094E-06   809.1552   -22.9847 -1.472E-06      0.000  9.470E+09     0.1094
92501.      0.000
    390.000 -1.439E-05   674.5290   -21.9771 -1.002E-06      0.000  9.470E+09     0.2265
94445.      0.000
    396.000 -1.912E-05   547.5953   -20.3761 -6.151E-07      0.000  9.470E+09     0.3072
96389.      0.000
    402.000 -2.177E-05   431.3449   -18.3842 -3.049E-07      0.000  9.470E+09     0.3568
98333.      0.000
    408.000 -2.278E-05   327.6436   -16.1717 -6.448E-08      0.000  9.470E+09     0.3807
100277.      0.000
    414.000 -2.254E-05   237.4239   -13.8773  1.145E-07      0.000  9.470E+09     0.3841
102221.      0.000
    420.000 -2.141E-05   160.8685   -11.6102  2.407E-07      0.000  9.470E+09     0.3716
104165.      0.000
    426.000 -1.966E-05    97.5811    -9.4526  3.226E-07      0.000  9.470E+09     0.3476
106109.      0.000
    432.000 -1.753E-05    46.7406    -7.4625  3.683E-07      0.000  9.470E+09     0.3158
108053.      0.000
    438.000 -1.524E-05     7.2360    -5.6772  3.854E-07      0.000  9.470E+09     0.2793
109997.      0.000
    444.000 -1.291E-05   -22.2183    -4.1167  3.807E-07      0.000  9.470E+09     0.2408
111941.      0.000
    450.000 -1.067E-05   -42.9869    -2.7867  3.600E-07      0.000  9.470E+09     0.2025
113885.      0.000
    456.000 -8.589E-06   -56.4366    -1.6818  3.285E-07      0.000  9.470E+09     0.1658
115829.      0.000
    462.000 -6.726E-06   -63.8783    -0.7883  2.904E-07      0.000  9.470E+09     0.1320
117773.      0.000
    468.000 -5.105E-06   -66.5238    -0.0867  2.491E-07      0.000  9.470E+09     0.1019
119717.      0.000
    474.000 -3.737E-06   -65.4569     0.4461  2.073E-07      0.000  9.470E+09     0.0758
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121661.      0.000
   480.000 -2.617E-06   -61.6177     0.8352  1.670E-07      0.000  9.470E+09     0.0539
123605.      0.000
   486.000 -1.733E-06   -55.7951     1.0695  1.298E-07      0.000  9.470E+09     0.0242
83699.       0.000
   492.000 -1.060E-06   -49.0642     1.1870  9.659E-08      0.000  9.470E+09     0.0150
84995.       0.000
   498.000 -5.734E-07   -41.7593     1.2568  6.782E-08      0.000  9.470E+09   0.008247
86291.       0.000
   504.000 -2.459E-07   -34.1290     1.2923  4.378E-08      0.000  9.470E+09   0.003589
87587.       0.000
   510.000 -4.804E-08   -26.3461     1.4157  2.462E-08      0.000  9.470E+09     0.0375
4687500.       0.000
   516.000  4.961E-08   -17.1940     1.4120  1.083E-08      0.000  9.470E+09    -0.0388
4687500.       0.000
   522.000  8.190E-08    -9.4255     1.1038  2.395E-09      0.000  9.470E+09    -0.0640
4687500.       0.000
   528.000  7.835E-08    -3.9538     0.7282 -1.843E-09      0.000  9.470E+09    -0.0612
4687500.       0.000
   534.000  5.978E-08    -0.6832     0.4045 -3.312E-09      0.000  9.470E+09    -0.0467
4687500.       0.000
   540.000  3.860E-08     0.9068     0.1739 -3.242E-09      0.000  9.470E+09    -0.0302
4687500.       0.000
   546.000  2.088E-08     1.4103     0.0345 -2.508E-09      0.000  9.470E+09    -0.0163
4687500.       0.000
   552.000  8.512E-09     1.3258    -0.0344 -1.641E-09      0.000  9.470E+09  -0.006650
4687500.       0.000
   558.000  1.188E-09     1.0010    -0.0571 -9.036E-10      0.000  9.470E+09  -0.000928
4687500.       0.000
   564.000 -2.331E-09     0.6420    -0.0545 -3.831E-10      0.000  9.470E+09   0.001821
4687500.       0.000
   570.000 -3.409E-09     0.3482    -0.0410 -6.939E-11      0.000  9.470E+09   0.002663
4687500.       0.000
   576.000 -3.164E-09     0.1500    -0.0256  8.846E-11      0.000  9.470E+09   0.002472
4687500.       0.000
   582.000 -2.348E-09     0.0407    -0.0127  1.489E-10      0.000  9.470E+09   0.001834
4687500.       0.000
   588.000 -1.377E-09  -0.002551  -0.003960  1.610E-10      0.000  9.470E+09   0.001076
4687500.       0.000
   594.000 -4.156E-10  -0.007123   0.000241  1.579E-10      0.000  9.470E+09   0.000325
4687500.       0.000
   600.000  5.185E-10      0.000      0.000  1.557E-10      0.000  9.470E+09  -0.000405
2343750.       0.000

* This analysis makes computations of pile response using nonlinear moment-curvature
relationships.
  The above values of total stress are computed for combined axial stress and do not equal
the
  actual stresses in concrete and steel in the range of nonlinear bending.


Output Verification: Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No. 3:

Pile-head deflection              =      0.8668526 inches
Computed slope at pile head       =     -0.0105875 radians
Maximum bending moment            =         902377. inch-lbs
Maximum shear force               =          20000. lbs
Depth of maximum bending moment   =     78.0000000 inches below pile head
Depth of maximum shear force      =      0.0000000 inches below pile head
Number of iterations              =             34
Number of zero deflection points  =              6


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                    Computed Values of Pile Loading and Deflection
                      for Lateral Loading for Load Case Number 4
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Pile-head conditions are Shear and Moment (BC Type 1)

Horizontal shear force at pile head                        =       25000.000 lbs
Applied moment at pile head                                =           0.000 in-lbs
Axial thrust load on pile head                             =      180000.000 lbs

   Depth    Deflect.    Bending    Shear       Slope      Total    Bending   Soil Res.  Soil
Spr.   Distrib.
   X          y         Moment     Force         S       Stress   Stiffness      p
Es*h   Lat. Load
   inches    inches     in-lbs      lbs       radians     psi*      lb-in^2    lb/in
lb/inch    lb/inch
---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
      0.00     1.4525  1.168E-07     25000.    -0.0163      0.000  9.470E+09  -260.8830
538.8175      0.000
     6.000     1.3546     162927.     23404.    -0.0163      0.000  9.470E+09  -271.1467
1200.9793     0.000
    12.000     1.2573     315980.     21749.    -0.0161      0.000  9.470E+09  -280.6443
1339.2237     0.000
    18.000     1.1613     458715.     20039.    -0.0159      0.000  9.470E+09  -289.3392
1494.9550     0.000
    24.000     1.0669     590719.     18279.    -0.0155      0.000  9.470E+09  -297.1942
1671.3137     0.000
    30.000     0.9748     711620.     16475.    -0.0151      0.000  9.470E+09  -304.1710
1872.1450     0.000
    36.000     0.8854     821084.     14632.    -0.0146      0.000  9.470E+09  -310.2303
2102.2003     0.000
    42.000     0.7992     918818.     12755.    -0.0141      0.000  9.470E+09  -315.3305
2367.4096     0.000
    48.000     0.7164    1004571.     10851.    -0.0135      0.000  9.470E+09  -319.4281
2675.2552     0.000
    54.000     0.6375    1078138.  8925.0187    -0.0128      0.000  9.469E+09  -322.4758
3035.2951     0.000
    60.000     0.5626    1139357.  6984.3238    -0.0121      0.000  9.418E+09  -324.4225
3459.9075     0.000
    66.000     0.4921    1188113.  5035.4136    -0.0114      0.000  9.297E+09  -325.2143
3965.2411     0.000
    72.000     0.4262    1224334.  3085.3742    -0.0106      0.000  9.162E+09  -324.7988
4572.5023     0.000
    78.000     0.3651    1247996.  1141.6086  -0.009768      0.000  9.053E+09  -323.1230
5310.0108     0.000
    84.000     0.3090    1259132.  -788.1471  -0.008935      0.000  9.003E+09  -320.1289
6216.4094     0.000
    90.000     0.2579    1257837. -2686.2205  -0.008096      0.000  9.009E+09  -312.5622
7271.8864     0.000
    96.000     0.2118    1244385. -4541.8665  -0.007266      0.000  9.069E+09  -305.9864
8666.9712     0.000
   102.000     0.1707    1219028. -6353.5150  -0.006456      0.000  9.181E+09  -297.8964
10471.     0.000
   108.000     0.1344    1182087. -8094.3268  -0.005677      0.000  9.313E+09  -282.3742
12610.     0.000
   114.000     0.1026    1134158. -9733.3143  -0.004935      0.000  9.424E+09  -263.9550
15438.     0.000
   120.000     0.0751    1075947.    -11258.  -0.004233      0.000  9.469E+09  -244.1925
19499.     0.000
   126.000     0.0518    1008208.    -12658.  -0.003573      0.000  9.470E+09  -222.4983
25778.     0.000
   132.000     0.0323     931770.    -13918.  -0.002958      0.000  9.470E+09  -197.6851
36758.     0.000
   138.000     0.0163     847577.    -15011.  -0.002394      0.000  9.470E+09  -166.6450
61377.     0.000
   144.000   0.003535     756805.    -15853.  -0.001886      0.000  9.470E+09  -113.7914
193120.      0.000
   150.000  -0.006343     661419.    -15799.  -0.001437      0.000  9.470E+09   131.5800
124466.      0.000
   156.000    -0.0137     570317.    -14926.  -0.001047      0.000  9.470E+09   159.5607
69846.     0.000
```



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   162.000    -0.0189    484569.    -13928.  -0.000712      0.000  9.470E+09   172.9181
54888.       0.000
   168.000    -0.0223    404715.    -12869.  -0.000431      0.000  9.470E+09   180.1278
48561.       0.000
   174.000    -0.0241    331068.    -11778.  -0.000198      0.000  9.470E+09   183.6949
45789.       0.000
   180.000    -0.0246    263807.    -10673. -9.151E-06      0.000  9.470E+09   184.7485
45011.       0.000
   186.000    -0.0242    203017. -9566.5546    0.000139      0.000  9.470E+09   183.9061
45633.       0.000
   192.000    -0.0230    148709. -8470.2014    0.000250      0.000  9.470E+09   181.5450
47437.       0.000
   198.000    -0.0212    100835. -7391.8297    0.000329      0.000  9.470E+09   177.9122
50403.       0.000
   204.000    -0.0190     59296. -6338.5662    0.000380      0.000  9.470E+09   173.1756
54654.       0.000
   210.000    -0.0166     23951. -5316.6898    0.000406      0.000  9.470E+09   167.4499
60454.       0.000
   216.000    -0.0141 -5382.0530 -4331.9115    0.000412      0.000  9.470E+09   160.8096
68257.       0.000
   222.000    -0.0117    -28922. -3389.6007    0.000401      0.000  9.470E+09   153.2940
78796.       0.000
   228.000   -0.009320   -46924. -2495.0051    0.000377      0.000  9.470E+09   144.9045
93290.       0.000
   234.000   -0.007145   -59677. -1653.5177    0.000344      0.000  9.470E+09   135.5913
113863.      0.000
   240.000   -0.005197   -67508.  -871.0849    0.000303      0.000  9.470E+09   125.2197
144563.      0.000
   246.000   -0.003506   -70785.  -154.9754    0.000259      0.000  9.470E+09   113.4835
194210.      0.000
   252.000   -0.002084   -69929.   484.4053    0.000215      0.000  9.470E+09    99.6434
286891.      0.000
   258.000   -0.000928   -65437.  1027.5076    0.000172      0.000  9.470E+09    81.3907
526403.      0.000
   264.000 -2.024E-05   -57970.  1293.4830    0.000133      0.000  9.470E+09     7.2678
2154663.      0.000
   270.000    0.000667   -50202.  1296.7598  9.861E-05      0.000  9.470E+09    -6.1755
55565.       0.000
   276.000    0.001163   -42622.  1244.7897  6.920E-05      0.000  9.470E+09   -11.1479
57509.       0.000
   282.000    0.001497   -35414.  1166.8374  4.448E-05      0.000  9.470E+09   -14.8362
59453.       0.000
   288.000    0.001697   -28716.  1070.2381  2.416E-05      0.000  9.470E+09   -17.3635
61397.       0.000
   294.000    0.001787   -22623.   961.5444  7.900E-06      0.000  9.470E+09   -18.8677
63341.       0.000
   300.000    0.001792   -17194.   846.4573 -4.714E-06      0.000  9.470E+09   -19.4947
65285.       0.000
   306.000    0.001731   -12456.   729.7972 -1.411E-05      0.000  9.470E+09   -19.3920
67229.       0.000
   312.000    0.001622 -8406.2839   615.5090 -2.072E-05      0.000  9.470E+09   -18.7040
69173.       0.000
   318.000    0.001482 -5024.6530   506.6958 -2.497E-05      0.000  9.470E+09   -17.5670
71117.       0.000
   324.000    0.001323 -2271.9967   405.6752 -2.728E-05      0.000  9.470E+09   -16.1065
73061.       0.000
   330.000    0.001155   -97.6208   314.0512 -2.803E-05      0.000  9.470E+09   -14.4348
75005.       0.000
   336.000    0.000986  1557.1693   232.7986 -2.757E-05      0.000  9.470E+09   -12.6494
76949.       0.000
   342.000    0.000824  2755.5149   162.3520 -2.620E-05      0.000  9.470E+09   -10.8328
78893.       0.000
   348.000    0.000672  3561.9953   102.6978 -2.420E-05      0.000  9.470E+09    -9.0520
80837.       0.000
   354.000    0.000533  4040.1671    53.4633 -2.179E-05      0.000  9.470E+09    -7.3595
82781.       0.000
   360.000    0.000410  4250.6316    14.0020 -1.917E-05      0.000  9.470E+09    -5.7942
84725.       0.000
   366.000    0.000303  4249.5950   -16.5285 -1.648E-05      0.000  9.470E+09    -4.3826
86669.       0.000
```



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   372.000   0.000213  4087.8767   -39.0971 -1.383E-05      0.000  9.470E+09    -3.1403
88613.       0.000
   378.000   0.000137  3810.3110   -54.7390 -1.133E-05      0.000  9.470E+09    -2.0737
90557.       0.000
   384.000  7.665E-05  3455.4854   -64.5050 -9.030E-06      0.000  9.470E+09    -1.1817
92501.       0.000
   390.000  2.904E-05  3055.7557   -69.4211 -6.967E-06      0.000  9.470E+09    -0.4570
94445.       0.000
   396.000 -6.960E-06  2637.4817   -70.4568 -5.164E-06      0.000  9.470E+09     0.1118
96389.       0.000
   402.000 -3.293E-05  2221.4280   -68.5024 -3.624E-06      0.000  9.470E+09     0.5397
98333.       0.000
   408.000 -5.045E-05  1823.2818   -64.3538 -2.343E-06      0.000  9.470E+09     0.8432
100277.      0.000
   414.000 -6.104E-05  1454.2427   -58.7043 -1.305E-06      0.000  9.470E+09     1.0400
102221.      0.000
   420.000 -6.611E-05  1121.6481   -52.1413 -4.886E-07      0.000  9.470E+09     1.1477
104165.      0.000
   426.000 -6.691E-05   829.6023   -45.1486  1.296E-07      0.000  9.470E+09     1.1832
106109.      0.000
   432.000 -6.455E-05   579.5849   -38.1114  5.760E-07      0.000  9.470E+09     1.1625
108053.      0.000
   438.000 -5.999E-05   371.0211   -31.3243  8.772E-07      0.000  9.470E+09     1.0999
109997.      0.000
   444.000 -5.403E-05   201.7985   -25.0009  1.059E-06      0.000  9.470E+09     1.0080
111941.      0.000
   450.000 -4.729E-05    68.7241   -19.2842  1.144E-06      0.000  9.470E+09     0.8976
113885.      0.000
   456.000 -4.029E-05   -32.0833   -14.2577  1.156E-06      0.000  9.470E+09     0.7779
115829.      0.000
   462.000 -3.342E-05  -104.8657    -9.9562  1.113E-06      0.000  9.470E+09     0.6560
117773.      0.000
   468.000 -2.694E-05  -153.9611    -6.3755  1.031E-06      0.000  9.470E+09     0.5376
119717.      0.000
   474.000 -2.105E-05  -183.5981    -3.4822  9.236E-07      0.000  9.470E+09     0.4269
121661.      0.000
   480.000 -1.586E-05  -197.7421    -1.2214  8.028E-07      0.000  9.470E+09     0.3267
123605.      0.000
   486.000 -1.142E-05  -199.9890     0.2366  6.768E-07      0.000  9.470E+09     0.1593
83699.       0.000
   492.000 -7.737E-06  -196.3649     1.0433  5.513E-07      0.000  9.470E+09     0.1096
84995.       0.000
   498.000 -4.803E-06  -188.6604     1.5793  4.293E-07      0.000  9.470E+09     0.0691
86291.       0.000
   504.000 -2.586E-06  -178.3401     1.8998  3.130E-07      0.000  9.470E+09     0.0378
87587.       0.000
   510.000 -1.047E-06  -166.5386     4.4671  2.038E-07      0.000  9.470E+09     0.8180
4687500.       0.000
   516.000 -1.411E-07  -125.1751     7.2517  1.113E-07      0.000  9.470E+09     0.1102
4687500.       0.000
   522.000  2.890E-07   -79.7584     6.9049  4.642E-08      0.000  9.470E+09    -0.2258
4687500.       0.000
   528.000  4.159E-07   -42.4162     5.2527  7.712E-09      0.000  9.470E+09    -0.3249
4687500.       0.000
   534.000  3.816E-07   -16.7430     3.3835 -1.103E-08      0.000  9.470E+09    -0.2981
4687500.       0.000
   540.000  2.836E-07    -1.7902     1.8246 -1.690E-08      0.000  9.470E+09    -0.2215
4687500.       0.000
   546.000  1.788E-07     5.1885     0.7410 -1.583E-08      0.000  9.470E+09    -0.1397
4687500.       0.000
   552.000  9.367E-08     7.1362     0.1025 -1.192E-08      0.000  9.470E+09    -0.0732
4687500.       0.000
   558.000  3.571E-08     6.4446    -0.2007 -7.618E-09      0.000  9.470E+09    -0.0279
4687500.       0.000
   564.000  2.250E-09     4.7443    -0.2897 -4.073E-09      0.000  9.470E+09  -0.001758
4687500.       0.000
   570.000 -1.317E-08     2.9774    -0.2641 -1.627E-09      0.000  9.470E+09     0.0103
4687500.       0.000
   576.000 -1.728E-08     1.5790    -0.1927 -1.837E-10      0.000  9.470E+09     0.0135
4687500.       0.000
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   582.000 -1.538E-08     0.6655    -0.1162  5.274E-10      0.000  9.470E+09     0.0120
4687500.      0.000
   588.000 -1.095E-08     0.1839    -0.0545  7.964E-10      0.000  9.470E+09    0.008553
4687500.      0.000
   594.000 -5.820E-09     0.0101    -0.0152  8.579E-10      0.000  9.470E+09    0.004547
4687500.      0.000
   600.000 -6.529E-10      0.000      0.000  8.611E-10      0.000  9.470E+09    0.000510
2343750.      0.000

* This analysis makes computations of pile response using nonlinear moment-curvature
relationships.
  The above values of total stress are computed for combined axial stress and do not equal
the
  actual stresses in concrete and steel in the range of nonlinear bending.


Output Verification: Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No. 4:

Pile-head deflection              =      1.4525306 inches
Computed slope at pile head       =     -0.0163171 radians
Maximum bending moment            =       1259132. inch-lbs
Maximum shear force               =         25000. lbs
Depth of maximum bending moment   =     84.0000000 inches below pile head
Depth of maximum shear force      =       0.000000 inches below pile head
Number of iterations              =             36
Number of zero deflection points  =              6


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                    Computed Values of Pile Loading and Deflection
                      for Lateral Loading for Load Case Number 5
--------------------------------------------------------------------------------

Pile-head conditions are Shear and Moment (BC Type 1)

Horizontal shear force at pile head                     =       30000.000 lbs
Applied moment at pile head                             =           0.000 in-lbs
Axial thrust load on pile head                          =      180000.000 lbs

   Depth    Deflect.    Bending    Shear       Slope      Total    Bending   Soil Res.  Soil
Spr.  Distrib.
    X          y         Moment     Force         S       Stress   Stiffness      p
Es*h    Lat. Load
   inches    inches      in-lbs      lbs       radians     psi*      lb-in^2    lb/in
lb/inch    lb/inch
---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
      0.00     2.7677  7.009E-07     30000.    -0.0297      0.000  9.470E+09  -306.5078
332.2384      0.000
      6.000    2.5893    206582.     28124.    -0.0297      0.000  9.470E+09  -318.8197
738.7680      0.000
     12.000    2.4118    401544.     26177.    -0.0295      0.000  9.470E+09  -330.2755
821.6508      0.000
     18.000    2.2358    584342.     24163.    -0.0292      0.000  9.470E+09  -340.8243
914.6451      0.000
     24.000    2.0620    754471.     22090.    -0.0287      0.000  9.470E+09  -350.4103
1019.6286      0.000
     30.000    1.8911    911468.     19962.    -0.0282      0.000  9.470E+09  -358.9718
1138.9520      0.000
     36.000    1.7236   1054919.     17785.    -0.0276      0.000  9.470E+09  -366.4388
1275.6016      0.000
     42.000    1.5602   1184456.     15568.    -0.0269      0.000  9.307E+09  -372.7306
1433.4362      0.000
     48.000    1.4013   1299750.     13316.    -0.0260      0.000  8.778E+09  -377.7573
1617.4719      0.000
     54.000    1.2478   1400485.     11039.    -0.0251      0.000  8.088E+09  -381.4299
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1834.1638      0.000
     60.000    1.1004   1486367.  8743.5349    -0.0239      0.000  7.358E+09  -383.6640
2091.8612      0.000
     66.000    0.9604   1557128.  6439.3825    -0.0226      0.000  6.674E+09  -384.3868
2401.3752      0.000
     72.000    0.8288   1612539.  4135.5817    -0.0211      0.000  6.095E+09  -383.5468
2776.6907      0.000
     78.000    0.7067   1652427.  1841.5776    -0.0195      0.000  5.658E+09  -381.1212
3235.8804      0.000
     84.000    0.5951   1676703.  -433.1492    -0.0177      0.000  5.386E+09  -377.1210
3802.3518      0.000
     90.000    0.4947   1685386. -2668.0253    -0.0158      0.000  5.288E+09  -367.8377
4461.3317      0.000
     96.000    0.4058   1678760. -4851.4685    -0.0139      0.000  5.362E+09  -359.9767
5322.5928      0.000
    102.000    0.3282   1657147. -6983.6887    -0.0121      0.000  5.606E+09  -350.7634
6413.4545      0.000
    108.000    0.2612   1620991. -9036.1931    -0.0104      0.000  6.004E+09  -333.4047
7659.9829      0.000
    114.000    0.2039   1571082.    -10977.  -0.008825      0.000  6.532E+09  -313.3928
9223.0713      0.000
    120.000    0.1553   1508333.    -12795.  -0.007471      0.000  7.153E+09  -292.7591
11314.      0.000
    126.000    0.1142   1433678.    -14487.  -0.006288      0.000  7.820E+09  -271.1388
14242.      0.000
    132.000    0.0798   1348074.    -16044.  -0.005261      0.000  8.472E+09  -247.8847
18638.      0.000
    138.000    0.0511   1252515.    -17453.  -0.004367      0.000  9.033E+09  -221.7459
26036.      0.000
    144.000    0.0274   1148075.    -18687.  -0.003585      0.000  9.408E+09  -189.7406
41558.      0.000
    150.000   0.008080  1036013.    -19676.  -0.002891      0.000  9.470E+09  -139.8270
103837.      0.000
    156.000  -0.007296   918209.    -19686.  -0.002272      0.000  9.470E+09   136.3097
112093.      0.000
    162.000   -0.0192    804684.    -18757.  -0.001726      0.000  9.470E+09   173.5679
54293.      0.000
    168.000   -0.0280    696856.    -17664.  -0.001250      0.000  9.470E+09   190.7950
40874.      0.000
    174.000   -0.0342    595420.    -16490.  -0.000841      0.000  9.470E+09   200.5419
35199.      0.000
    180.000   -0.0381    500796.    -15270.  -0.000494      0.000  9.470E+09   206.0500
32451.      0.000
    186.000   -0.0401    413247.    -14026.  -0.000204      0.000  9.470E+09   208.7149
31224.      0.000
    192.000   -0.0405    332929.    -12772.  3.240E-05      0.000  9.470E+09   209.2829
30970.      0.000
    198.000   -0.0397    259918.    -11519.  0.000220      0.000  9.470E+09   208.2071
31453.      0.000
    204.000   -0.0379    194224.    -10277.  0.000364      0.000  9.470E+09   205.7861
32576.      0.000
    210.000   -0.0353    135805. -9053.1207   0.000469      0.000  9.470E+09   202.2287
34325.      0.000
    216.000   -0.0323     84574. -7853.3729   0.000538      0.000  9.470E+09   197.6872
36746.      0.000
    222.000   -0.0289     40402. -6683.4820   0.000578      0.000  9.470E+09   192.2764
39936.      0.000
    228.000   -0.0253  3123.6471 -5548.3990   0.000592      0.000  9.470E+09   186.0846
44057.      0.000
    234.000   -0.0218    -27457. -4452.6046   0.000584      0.000  9.470E+09   179.1802
49349.      0.000
    240.000   -0.0183    -51569. -3400.2184   0.000559      0.000  9.470E+09   171.6152
56167.      0.000
    246.000   -0.0151    -69468. -2395.0937   0.000521      0.000  9.470E+09   163.4263
65040.      0.000
    252.000   -0.0121    -81435. -1440.9187   0.000473      0.000  9.470E+09   154.6320
76780.      0.000
    258.000  -0.009401   -87780.  -541.3477   0.000419      0.000  9.470E+09   145.2250
92688.      0.000
    264.000  -0.007052   -88837.   299.7837   0.000363      0.000  9.470E+09   135.1522
```



```
114995.      0.000
    270.000  -0.005040    -84968.   845.2717   0.000308      0.000  9.470E+09    46.6772
55565.      0.000
    276.000  -0.003352    -79360.  1081.6842   0.000256      0.000  9.470E+09    32.1270
57509.      0.000
    282.000  -0.001965    -72541.  1236.4816   0.000208      0.000  9.470E+09    19.4721
59453.      0.000
    288.000  -0.000854    -64972.  1321.1200   0.000165      0.000  9.470E+09     8.7406
61397.      0.000
    294.000  9.781E-06    -57043.  1347.0321   0.000126      0.000  9.470E+09    -0.1033
63341.      0.000
    300.000   0.000657    -49079.  1325.2801  9.230E-05      0.000  9.470E+09    -7.1474
65285.      0.000
    306.000   0.001117    -41339.  1266.2768  6.366E-05      0.000  9.470E+09   -12.5203
67229.      0.000
    312.000   0.001421    -34022.  1179.5764  3.978E-05      0.000  9.470E+09   -16.3798
69173.      0.000
    318.000   0.001595    -27270.  1073.7284  2.037E-05      0.000  9.470E+09   -18.9029
71117.      0.000
    324.000   0.001665    -21181.   956.1908  5.016E-06      0.000  9.470E+09   -20.2763
73061.      0.000
    330.000   0.001655    -15807.   833.2954 -6.701E-06      0.000  9.470E+09   -20.6888
75005.      0.000
    336.000   0.001585    -11167.   710.2570 -1.525E-05      0.000  9.470E+09   -20.3240
76949.      0.000
    342.000   0.001472 -7250.7614   591.2185 -2.108E-05      0.000  9.470E+09   -19.3555
78893.      0.000
    348.000   0.001332 -4026.6010   479.3241 -2.465E-05      0.000  9.470E+09   -17.9426
80837.      0.000
    354.000   0.001176 -1445.6192   376.8134 -2.639E-05      0.000  9.470E+09   -16.2276
82781.      0.000
    360.000   0.001015   552.1579   285.1280 -2.667E-05      0.000  9.470E+09   -14.3342
84725.      0.000
    366.000   0.000856  2033.5259   205.0252 -2.585E-05      0.000  9.470E+09   -12.3667
86669.      0.000
    372.000   0.000705  3068.3002   136.6938 -2.424E-05      0.000  9.470E+09   -10.4104
88613.      0.000
    378.000   0.000565  3726.1997    79.8661 -2.208E-05      0.000  9.470E+09    -8.5322
90557.      0.000
    384.000   0.000440  4074.3921    33.9242 -1.961E-05      0.000  9.470E+09    -6.7818
92501.      0.000
    390.000   0.000330  4175.6507    -2.0034 -1.700E-05      0.000  9.470E+09    -5.1940
94445.      0.000
    396.000   0.000236  4087.0666   -28.9557 -1.438E-05      0.000  9.470E+09    -3.7900
96389.      0.000
    402.000   0.000157  3859.2442   -48.0650 -1.186E-05      0.000  9.470E+09    -2.5797
98333.      0.000
    408.000  9.357E-05  3535.9103   -60.4955 -9.520E-06      0.000  9.470E+09    -1.5638
100277.      0.000
    414.000  4.317E-05  3153.8614   -67.3931 -7.401E-06      0.000  9.470E+09    -0.7354
102221.      0.000
    420.000  4.757E-06  2743.1789   -69.8471 -5.533E-06      0.000  9.470E+09    -0.0826
104165.      0.000
    426.000 -2.322E-05  2327.6463   -68.8627 -3.926E-06      0.000  9.470E+09     0.4107
106109.      0.000
    432.000 -4.236E-05  1925.3069   -65.3421 -2.579E-06      0.000  9.470E+09     0.7628
108053.      0.000
    438.000 -5.417E-05  1549.1110   -60.0744 -1.478E-06      0.000  9.470E+09     0.9931
109997.      0.000
    444.000 -6.009E-05  1207.6067   -53.7316 -6.048E-07      0.000  9.470E+09     1.1212
111941.      0.000
    450.000 -6.143E-05   905.6385   -46.8702  6.468E-08      0.000  9.470E+09     1.1660
113885.      0.000
    456.000 -5.932E-05   645.0250   -39.9369  5.559E-07      0.000  9.470E+09     1.1451
115829.      0.000
    462.000 -5.476E-05   425.1951   -33.2770  8.950E-07      0.000  9.470E+09     1.0748
117773.      0.000
    468.000 -4.858E-05   243.7677   -27.1447  1.107E-06      0.000  9.470E+09     0.9693
119717.      0.000
    474.000 -4.147E-05    97.0679   -21.7139  1.215E-06      0.000  9.470E+09     0.8410
```



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121661.      0.000
    480.000 -3.400E-05   -19.4236   -17.0897  1.239E-06      0.000  9.470E+09     0.7004
123605.      0.000
    486.000 -2.660E-05  -110.6860   -13.8752  1.198E-06      0.000  9.470E+09     0.3711
83699.      0.000
    492.000 -1.962E-05  -188.5141   -11.9281  1.103E-06      0.000  9.470E+09     0.2780
84995.      0.000
    498.000 -1.336E-05  -256.2068   -10.5179  9.626E-07      0.000  9.470E+09     0.1921
86291.      0.000
    504.000 -8.070E-06  -316.8078    -9.5881  7.811E-07      0.000  9.470E+09     0.1178
87587.      0.000
    510.000 -3.986E-06  -372.9508     0.1079  5.625E-07      0.000  9.470E+09     3.1142
4687500.      0.000
    516.000 -1.320E-06  -316.7278    12.5439  3.440E-07      0.000  9.470E+09     1.0311
4687500.      0.000
    522.000  1.424E-07  -223.1674    15.3035  1.730E-07      0.000  9.470E+09    -0.1112
4687500.      0.000
    528.000  7.562E-07  -133.4592    13.1974  6.003E-08      0.000  9.470E+09    -0.5908
4687500.      0.000
    534.000  8.627E-07   -64.9289     9.4029 -2.823E-09      0.000  9.470E+09    -0.6740
4687500.      0.000
    540.000  7.224E-07   -20.6179     5.6879 -2.992E-08      0.000  9.470E+09    -0.5643
4687500.      0.000
    546.000  5.036E-07     3.3908     2.8145 -3.538E-08      0.000  9.470E+09    -0.3935
4687500.      0.000
    552.000  2.978E-07    13.2329     0.9363 -3.012E-08      0.000  9.470E+09    -0.2326
4687500.      0.000
    558.000  1.422E-07    14.6911    -0.0950 -2.127E-08      0.000  9.470E+09    -0.1111
4687500.      0.000
    564.000  4.254E-08    12.1389    -0.5281 -1.277E-08      0.000  9.470E+09    -0.0332
4687500.      0.000
    570.000 -1.100E-08     8.3819    -0.6020 -6.268E-09      0.000  9.470E+09   0.008594
4687500.      0.000
    576.000 -3.268E-08     4.9285    -0.4996 -2.052E-09      0.000  9.470E+09     0.0255
4687500.      0.000
    582.000 -3.562E-08     2.3909    -0.3395  2.671E-10      0.000  9.470E+09     0.0278
4687500.      0.000
    588.000 -2.947E-08     0.8535    -0.1870  1.295E-09      0.000  9.470E+09     0.0230
4687500.      0.000
    594.000 -2.008E-08     0.1444    -0.0708  1.611E-09      0.000  9.470E+09     0.0157
4687500.      0.000
    600.000 -1.014E-08      0.000      0.000  1.657E-09      0.000  9.470E+09    0.007922
2343750.      0.000

* This analysis makes computations of pile response using nonlinear moment-curvature
relationships.
  The above values of total stress are computed for combined axial stress and do not equal
the
  actual stresses in concrete and steel in the range of nonlinear bending.


Output Verification: Computed forces and moments are within specified convergence limits.


Output Summary for Load Case No. 5:

Pile-head deflection              =      2.7676614 inches
Computed slope at pile head       =     -0.0297210 radians
Maximum bending moment            =       1685386. inch-lbs
Maximum shear force               =         30000. lbs
Depth of maximum bending moment   =     90.0000000 inches below pile head
Depth of maximum shear force      =       0.000000 inches below pile head
Number of iterations              =             66
Number of zero deflection points  =              5


--------------------------------------------------------------------------------
                              Summary of Pile Response(s)
```

Definitions of Pile-Head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs
Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian
Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Condition 1 V(lbs) or y(inches)	Condition 2 in-lb, rad., or in-lb/rad.	Axial Load lbs	Pile-Head Deflection inches	Maximum Moment in-lbs	Maximum Pile-Head Shear lbs	Maximum Pile-Head Rotation radians
1	1	V = 10000.0000	M = 0.000	180000.	0.18510781	326082.	10000.	0.00000000
2	1	V = 15000.	M = 0.000	180000.	0.45458950	590419.	15000.	0.00000000
3	1	V = 20000.	M = 0.000	180000.	0.86685259	902377.	20000.	0.00000000
4	1	V = 25000.	M = 0.000	180000.	1.45253058	1259132.	25000.	0.00000000
5	1	V = 30000.	M = 0.000	180000.	2.76766141	1685386.	30000.	0.00000000

The analysis ended normally.

ALTPIPE RESULTS

AltPipe Analysis Results

(west of Sta. 80+00)

AltPipe

Project EA: **04-0A5341**
Project Engineer:
Location: **Solano County, CA**
Description: **80/680/12 ICP Project**

Steel Pipes

DSN/U		1	2	3	4	5	6	7
Pipe Diameter (in)		12	18	24	30	36	42	48
Pipe Type	Coat	Minimum Thickness (in)						
Steel Spiral Rib Pipe - ¾" X ¾" Ribs At 7½" Pitch	CSS				0.064	0.064	0.064	0.064

Plastic Pipes

DSN/U	1	2	3	4	5	6	7
Pipe Diameter (in)	12	18	24	30	36	42	48
Pipe Type	Availability						
PVC Corrugated	Allowable	Allowable	Allowable	Allowable	Allowable		
PVC Ribbed		Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
HDPE Corrugated - Type S		Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
HDPE Ribbed		Allowable	Allowable				
HDPE Corrugated - Type C		Allowable	Allowable				

Reinforced Concrete Pipes

Reinforced Concrete Pipes

DSN/U	1	2	3	4	5	6	7
Pipe Diameter (in)	**12**	**18**	**24**	**30**	**36**	**42**	**48**
Steel Cover (in)	0.75	0.75	1	1	1	1	1
Sacks of Cement	5	5	5	5	5	5	5
Percentage Water	10.0	10.0	10.0	10.0	10.0	10.0	10.0

Other Information

DSN/U	1	2	3	4	5	6	7
Soil pH	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Minimum Soil Resistivity (ohm-cm)	940	940	940	940	940	940	940
Sulfate Concentration (ppm)	27.8	27.8	27.8	27.8	27.8	27.8	27.8
Chloride Concentration (ppm)	87.4	87.4	87.4	87.4	87.4	87.4	87.4
Abrasion Level	2	2	2	2	2	2	2
2–5 Year Flow Velocity (ft/sec)	12	12	12	12	12	12	12
Design Service Life (years)	50	50	50	50	50	50	50
Height of Cover (ft)	2	2	2	2	2	2	2

AltPipe Version 6.08 © State of California

AltPipe Analysis Results

(Sta. 80+00 to Sta. 95+00)

AltPipe

Project EA: **04-0A5341**
Project Engineer:
Location: **Solano County, CA**
Description: **80/680/12 ICP Project**

Steel Pipes

DSN/U		1	2	3	4	5	6	7
Pipe Diameter (in)		**12**	**18**	**24**	**30**	**36**	**42**	**48**
Pipe Type	**Coat**	**Minimum Thickness (in)**						
Corrugated Steel Pipe - Helical Corrugations - 2⅔" X ½" Corrugations	PA							0.168
Corrugated Steel Pipe - Helical Corrugations - 3" X 1" Corrugations	PA							0.168
Corrugated Steel Pipe - Annular Corrugations - 2⅔" X ½" Corrugations	PA							0.168
Steel Spiral Rib Pipe - ¾" X ¾" Ribs At 7½" Pitch	CSS				0.064	0.064	0.064	0.064

Plastic Pipes

DSN/U	1	2	3	4	5	6	7
Pipe Diameter (in)	**12**	**18**	**24**	**30**	**36**	**42**	**48**
Pipe Type	**Availability**						
PVC Corrugated	Allowable	Allowable	Allowable	Allowable	Allowable		
PVC							

Ribbed		Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
HDPE Corrugated - Type S		Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
HDPE Ribbed		Allowable	Allowable				
HDPE Corrugated - Type C		Allowable	Allowable				

Reinforced Concrete Pipes

DSN/U	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Pipe Diameter (in)	**12**	**18**	**24**	**30**	**36**	**42**	**48**
Steel Cover (in)	0.75	0.75	1	1	1	1	1
Sacks of Cement	5	5	5	5	5	5	5
Percentage Water	10.0	10.0	10.0	10.0	10.0	10.0	10.0

Other Information

DSN/U	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Soil pH	7	7	7	7	7	7	7
Minimum Soil Resistivity (ohm-cm)	560	560	560	560	560	560	560
Sulfate Concentration (ppm)	200	200	200	200	200	200	200
Chloride Concentration (ppm)	400	400	400	400	400	400	400
Abrasion Level	2	2	2	2	2	2	2
2–5 Year Flow Velocity (ft/sec)	12	12	12	12	12	12	12
Design Service Life (years)	50	50	50	50	50	50	50
Height of Cover (ft)	2	2	2	2	2	2	2

AltPipe Analysis Results

(east of Sta. 95+00)

AltPipe

Project EA: **04-0A5341**
Project Engineer:
Location: **Solano County, CA**
Description: **80/680/12 ICP Project**

Steel Pipes

DSN/U		1	2	3	4	5	6	7
Pipe Diameter (in)		12	18	24	30	36	42	48
Pipe Type	Coat	Minimum Thickness (in)						
Steel Spiral Rib Pipe - ¾" X ¾" Ribs At 7½" Pitch	CSS				0.064	0.064	0.064	0.064

Plastic Pipes

DSN/U	1	2	3	4	5	6	7
Pipe Diameter (in)	12	18	24	30	36	42	48
Pipe Type	Availability						
PVC Corrugated	Allowable	Allowable	Allowable	Allowable	Allowable		
PVC Ribbed		Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
HDPE Corrugated - Type S		Allowable	Allowable	Allowable	Allowable	Allowable	Allowable
HDPE Ribbed		Allowable	Allowable				
HDPE Corrugated - Type C		Allowable	Allowable				

Reinforced Concrete Pipes

Reinforced Concrete Pipes

DSN/U	1	2	3	4	5	6	7
Pipe Diameter (in)	**12**	**18**	**24**	**30**	**36**	**42**	**48**
Steel Cover (in)	1	1	1	1	1	1	1
Sacks of Cement	5	5	5	5	5	5	5
Percentage Water	10.0	10.0	10.0	10.0	10.0	10.0	10.0

Other Information

DSN/U	1	2	3	4	5	6	7
Soil pH	8	8	8	8	8	8	8
Minimum Soil Resistivity (ohm-cm)	200	200	200	200	200	200	200
Sulfate Concentration (ppm)	600	600	600	600	600	600	600
Chloride Concentration (ppm)	2000	2000	2000	2000	2000	2000	2000
Abrasion Level	2	2	2	2	2	2	2
2–5 Year Flow Velocity (ft/sec)	12	12	12	12	12	12	12
Design Service Life (years)	50	50	50	50	50	50	50
Height of Cover (ft)	2	2	2	2	2	2	2

AltPipe Version 6.08 © State of California

PAVEMENT DESIGN CALCULATIONS

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

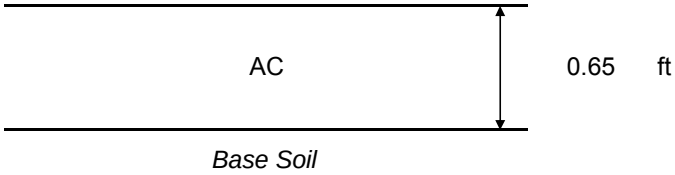
Design Case: Full depth AC

Design TI= ***5***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$ 1.52
=> GE'_{AC}= 1.62 (add 0.1 ft safety factor)
=> AC Thickness= 0.61

=> AC Thickness= **0.65** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

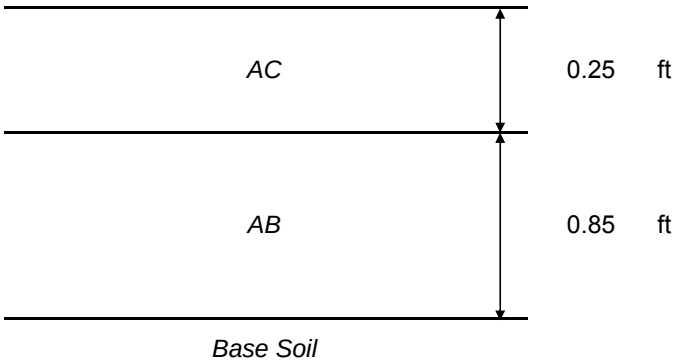
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=		***5***	
R_{BS}=		***5***	
R_{AB}=		78	
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		1.52	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.35	
=>	GE'_{AC} =	0.55	(add 0.2 ft safety factor)
	AC Thickness =	0.22	ft
=>	AC Thickness =	**0.25**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$ =	2.54	
	GE_{AC} =	0.63	
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		0.89	
	AB thickness=	0.81	ft
=>	AB Thickness=	**0.85**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	0.94	$G_{f,\,AB}$=1.1

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

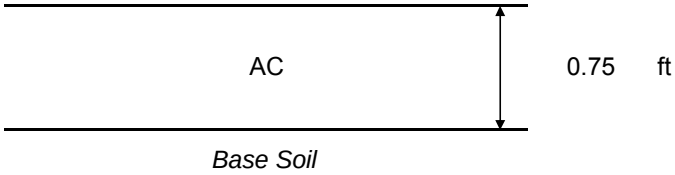
Design Case: Full depth AC

Design TI= ***6***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$ 1.82
=> GE'_{AC}= 1.92 (add 0.1 ft safety factor)
=> AC Thickness= 0.74

=> AC Thickness= **0.75** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

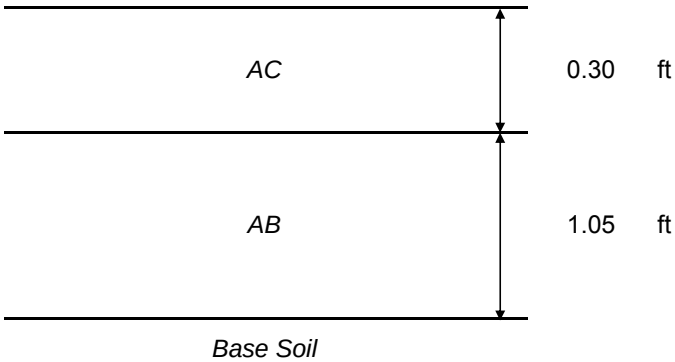
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=		***6***	
R_{BS}=		***5***	
R_{AB}=		78	
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		1.82	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.42	
=>	GE'_{AC} =	0.62	(add 0.2 ft safety factor)
	AC Thickness =	0.27	ft
=>	AC Thickness =	**0.30**	ft (round up to the nearest 0.05 ft)
	$G_{f, AC}$ =	2.31	
	GE_{AC} =	0.69	
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		1.13	
	AB thickness=	1.03	ft
=>	AB Thickness=	**1.05**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.16	$G_{f, AB}$=1.1

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

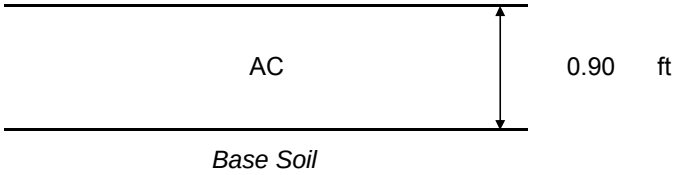
Design Case: Full depth AC

Design TI= ***7***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$ 2.13
=> GE'_{AC}= 2.23 (add 0.1 ft safety factor)
=> AC Thickness= 0.88

=> AC Thickness= **0.90** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

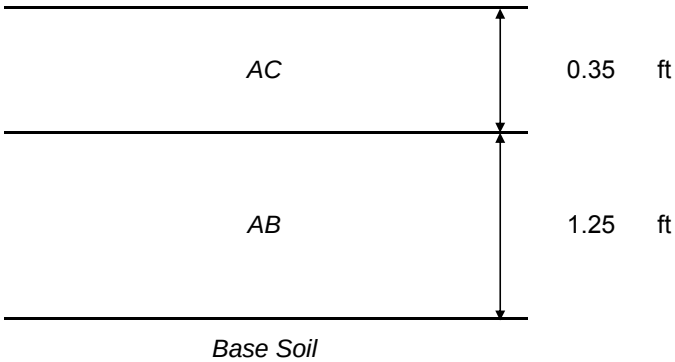
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=		***7***	
R_{BS}=		***5***	
R_{AB}=		78	
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		2.13	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.49	
=>	GE'_{AC} =	0.69	(add 0.2 ft safety factor)
	AC Thickness =	0.32	ft
=>	AC Thickness =	**0.35**	ft (round up to the nearest 0.05 ft)
	$G_{f, AC}$ =	2.14	
	GE_{AC} =	0.75	
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		1.38	
	AB thickness=	1.25	ft
=>	AB Thickness=	**1.25**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.38	$G_{f, AB}$=1.1

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

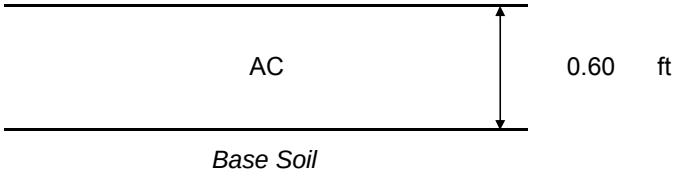
Design Case: Full depth AC

Design TI= ***5***
R_{BS}= ***15***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$ 1.36
=> GE'_{AC}= 1.46 (add 0.1 ft safety factor)
=> AC Thickness= 0.56

=> AC Thickness= **0.60** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

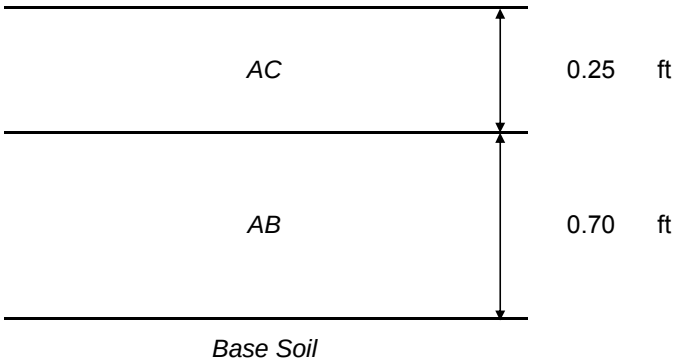
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=		***5***	
R_{BS}=		***15***	
R_{AB}=		78	
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		1.36	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.35	
=>	GE'_{AC} =	0.55	(add 0.2 ft safety factor)
	AC Thickness =	0.22	ft
=>	AC Thickness =	**0.25**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$ =	2.54	
	GE_{AC} =	0.63	
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		0.73	
	AB thickness=	0.66	ft
=>	AB Thickness=	**0.70**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	0.77	$G_{f,\,AB}$=1.1

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

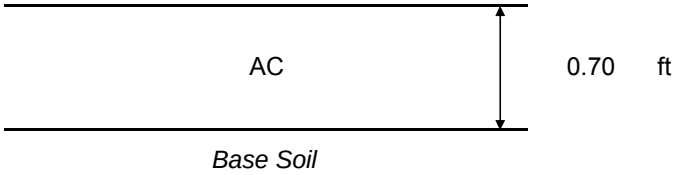
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***6***
R_{BS}= ***15***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		1.63	
=>	GE'_{AC}=	1.73	(add 0.1 ft safety factor)
=>	AC Thickness=	0.69	
=>	AC Thickness=	**0.70**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

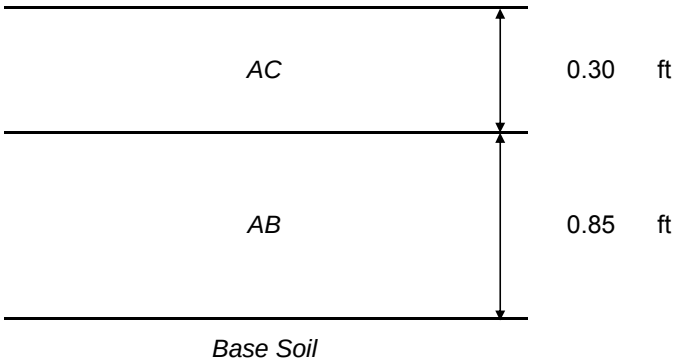
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=		***6***	
R_{BS}=		***15***	
R_{AB}=		78	
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		1.63	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.42	
=>	GE'_{AC} =	0.62	(add 0.2 ft safety factor)
	AC Thickness =	0.27	ft
=>	AC Thickness =	**0.30**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$ =	2.31	
	GE_{AC} =	0.69	
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		0.94	
	AB thickness=	0.85	ft
=>	AB Thickness=	**0.85**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	0.94	$G_{f,\,AB}$=1.1

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

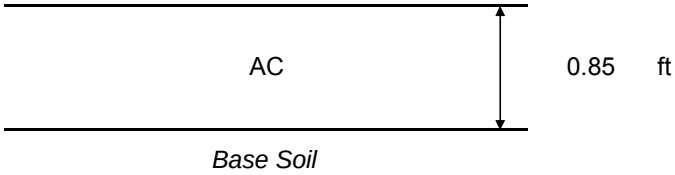
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***7***
R_{BS}= ***15***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		1.90	
=>	GE'_{AC}=	2.00	(add 0.1 ft safety factor)
=>	AC Thickness=	0.81	
=>	AC Thickness=	**0.85**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

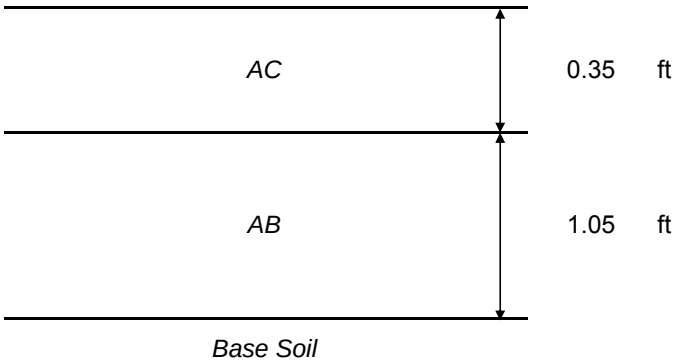
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=		***7***	
R_{BS}=		***15***	
R_{AB}=		78	
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		1.90	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.49	
=>	GE'_{AC} =	0.69	(add 0.2 ft safety factor)
	AC Thickness =	0.32	ft
=>	AC Thickness =	**0.35**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$ =	2.14	
	GE_{AC} =	0.75	
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		1.15	
	AB thickness=	1.05	ft
=>	AB Thickness=	**1.05**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.16	$G_{f,\,AB}$=1.1

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

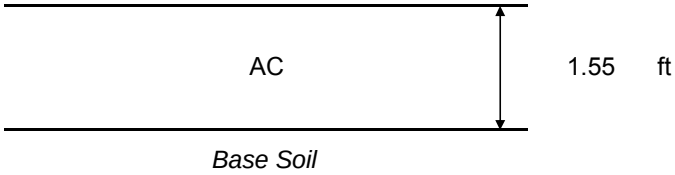
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***11.5***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		3.50	
=>	GE'_{AC}=	3.60	(add 0.1 ft safety factor)
=>	AC Thickness=	1.52	
=>	AC Thickness=	**1.55**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=	***11.5***	
R_{BS}=	***5***	
R_{AB}=	78	

$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$ 3.50

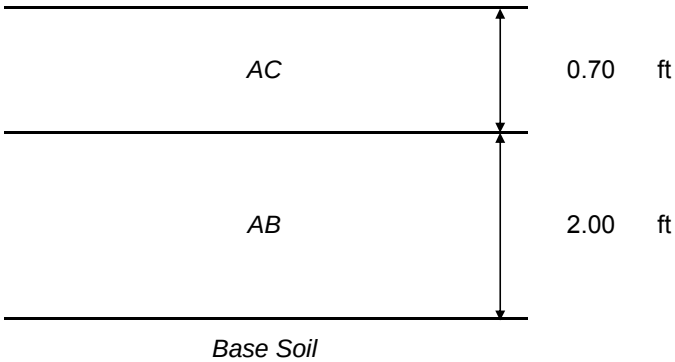
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$

=>	GE'_{AC} =		(add 0.2 ft safety factor)
	AC Thickness =		ft
=>	AC Thickness =	**0.70**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$ =	1.83	
	GE_{AC} =	1.28	

$GE_{AB} = GE_{AC+AB} - GE_{AC} =$ 2.21

	AB thickness=	2.01	ft
=>	AB Thickness=	**2.00**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	2.20	$G_{f,\,AB}$=1.1

Design Section:



PAVEMENT DESIGN

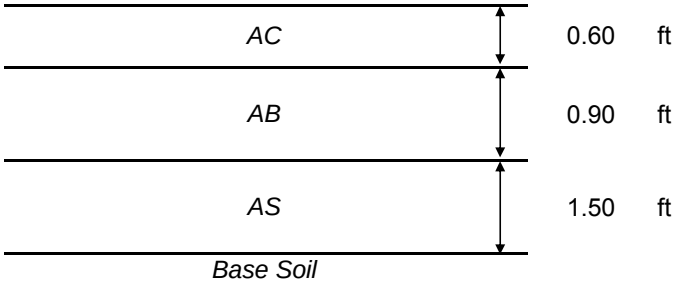
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB over AS

Design TI=		***11.5***	
R_{BS}=		***5***	
R_{AB}=		78	
R_{AS}=		50	
$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$		3.50	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.81	
=>	GE'_{AC} =	1.01	(add 0.2 ft safety factor)
	AC thickness =	0.58	ft
=>	AC Thickness=	**0.60**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ AC}$=	1.74	
	GE_{AC}=	1.04	
$GE_{AB+AC} = 0.0032*TI*(100-R_{AS}) =$		1.84	
=>	GE_{AC+AB}=	2.04	(add 0.2 ft safety factor)
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		1.00	
=>	AB thickness=	0.90	
=>	AB Thickness=	**0.90**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	0.99	$G_{f,\ AB}$=1.1
$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{AC} =$		1.46	
=>	AS Thickness=	**1.50**	ft (round up to the nearest 0.05 ft)

Design Section:



0.60 ft

0.90 ft

1.50 ft

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

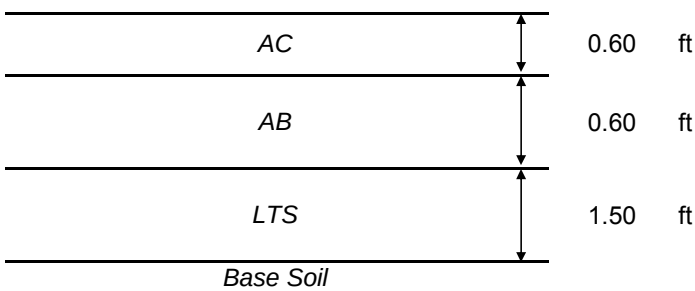
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB over LTS

Design TI=	***11.5***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	1.5	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$		3.50	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.81	
=>	GE'_{AC} =	1.01	(add 0.2 ft safety factor)
	AC thickness =	0.58	ft
=>	AC Thickness=	**0.60**	ft (round up to the nearest 0.05 ft)
	$G_{f, AC}$=	1.74	
	GE_{AC}=	1.04	
	$G_{f, LTS}$=	1.20	psi
$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$		1.80	
$GE_{AC+AB} = GE_{TOTAL}-GE_{LTS} =$		1.70	
$GE_{AB}=GE_{AC+AB}-GE_{AC} =$		0.65	
	AB thickness=	0.59	
=>	AB Thickness=	**0.60**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

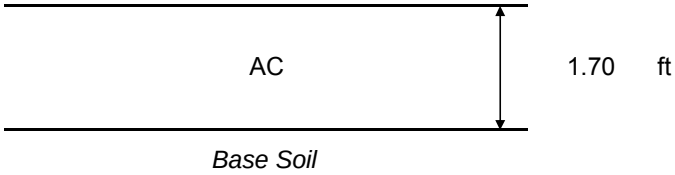
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***12.5***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		3.80	
=>	GE'_{AC}=	3.90	(add 0.1 ft safety factor)
=>	AC Thickness=	1.66	
=>	AC Thickness=	**1.70**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

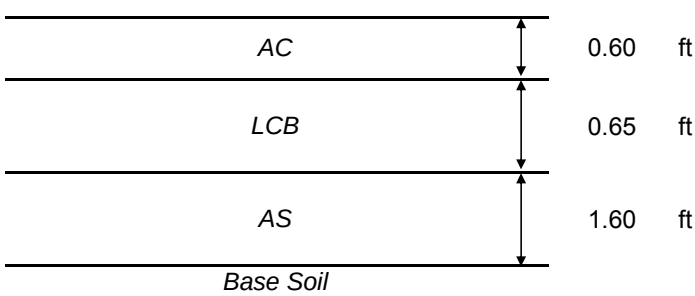
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over AS

Design TI=		***12.5***	
R_{BS}=		***5***	
R_{AB}=		78	
R_{AS}=		50	
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$		3.80	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS}) =$		2.00	
$GE_{AC} = 0.4*GE_{AC+LCB} =$		0.80	
=>	GE'_{AC} =	1.00	(add 0.2 ft safety factor)
	AC thickness =	0.60	ft
=>	AC Thickness=	**0.60**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$=	1.67	
	GE_{AC}=	1.00	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC} =$		1.00	
=>	GE_{AC+AB}=	1.20	(add 0.2 ft safety factor)
	$G_{f,\,LCB}$=	1.90	
	LCB thickness=	0.63	
=>	LCB Thickness=	**0.65**	ft (round up to the nearest 0.05 ft)
	GE_{AC}=	1.24	
$GE_{AS} = GE_{TOTAL}-GE_{LCB}-GE_{AC} =$		1.56	
=>	AS Thickness=	**1.60**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over LTS

Design TI=	***12.5***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	**1.5**	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$ 3.80

$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$ 1.80

$G_{f,\ LTS}$= 1.20

$GE_{AC+LCB} = GE_{TOTAL} - GE_{LTS} =$ 2.00

$GE_{AC} = 0.4*GE_{AC+LCB} =$ 0.80

=> GE'_{AC} = 1.00 (add 0.2 ft safety factor)

AC thickness = 0.60 ft

=> AC Thickness= **0.60** ft (round up to the nearest 0.05 ft)

$G_{f,\ AC}$= 1.67

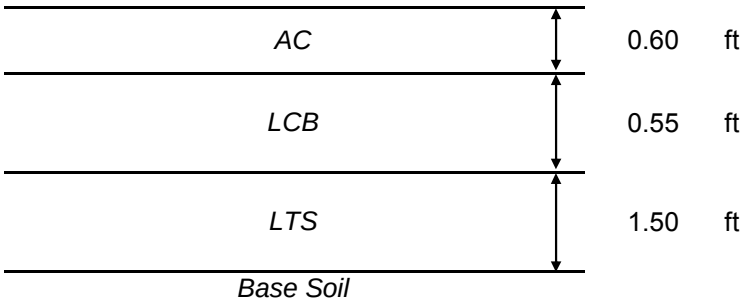
GE_{AC}= 1.00

$GE_{LCB} = GE_{TOTAL} - GE_{AC} - GE_{LTS} =$ 1.00

LCB thickness= 0.53

=> LCB Thickness= **0.55** ft (round up to the nearest 0.05 ft)

Design Section:



0.60 ft

0.55 ft

1.50 ft

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

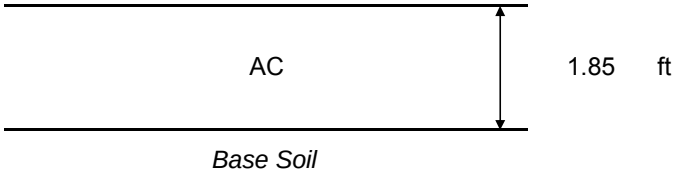
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***13.5***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		4.10	
=>	GE'_{AC}=	4.20	(add 0.1 ft safety factor)
=>	AC Thickness=	1.81	
=>	AC Thickness=	**1.85**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

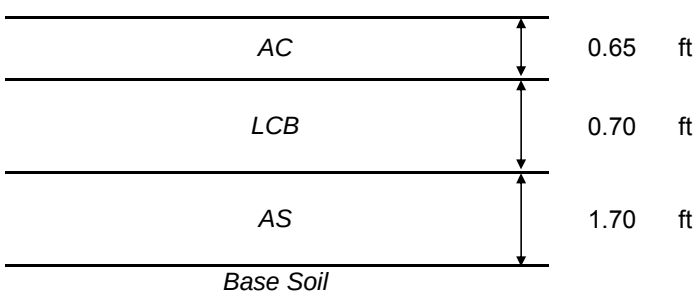
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over AS

Design TI=		***13.5***	
R_{BS}=		***5***	
R_{AB}=		78	
R_{AS}=		50	
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$		4.10	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS}) =$		2.16	
$GE_{AC} = 0.4*GE_{AC+LCB} =$		0.86	
=>	GE'_{AC} =	1.06	(add 0.2 ft safety factor)
	AC thickness =	0.65	ft
=>	AC Thickness=	**0.65**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ AC}$=	1.65	
	GE_{AC}=	1.07	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC} =$		1.09	
=>	GE_{AC+AB}=	1.29	(add 0.2 ft safety factor)
	$G_{f,\ LCB}$=	1.90	
	LCB thickness=	0.68	
=>	LCB Thickness=	**0.70**	ft (round up to the nearest 0.05 ft)
	GE_{AC}=	1.33	
$GE_{AS} = GE_{TOTAL}-GE_{LCB}-GE_{AC} =$		1.70	
=>	AS Thickness=	**1.70**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over LTS

Design TI=	***13.5***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	**1.5**	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$ 4.10

$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$ 1.80

$G_{f,\ LTS}$= 1.20

$GE_{AC+LCB} = GE_{TOTAL} - GE_{LTS} =$ 2.30

$GE_{AC} = 0.4*GE_{AC+LCB} =$ 0.92

=> GE'_{AC} = 1.12 (add 0.2 ft safety factor)

AC thickness = 0.67 ft

=> AC Thickness= **0.70** ft (round up to the nearest 0.05 ft)

$G_{f,\ AC}$= 1.69

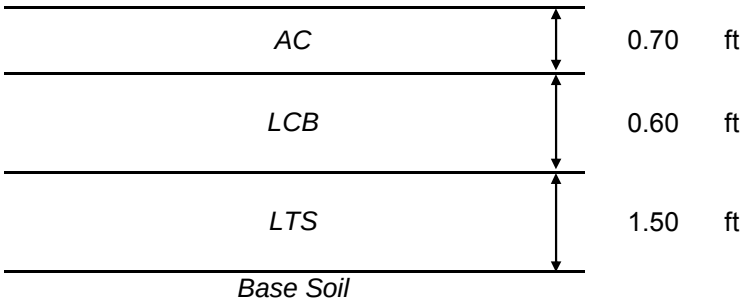
GE_{AC}= 1.18

$GE_{LCB} = GE_{TOTAL} - GE_{AC} - GE_{LTS} =$ 1.12

LCB thickness= 0.59

=> LCB Thickness= **0.60** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

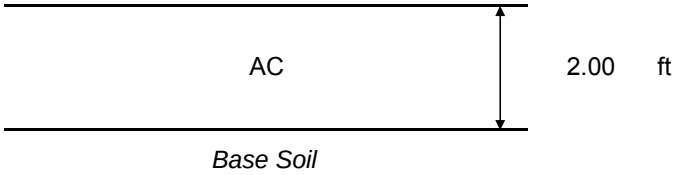
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***14.5***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		4.41	
=>	GE'_{AC}=	4.51	(add 0.1 ft safety factor)
=>	AC Thickness=	1.96	
=>	AC Thickness=	**2.00**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

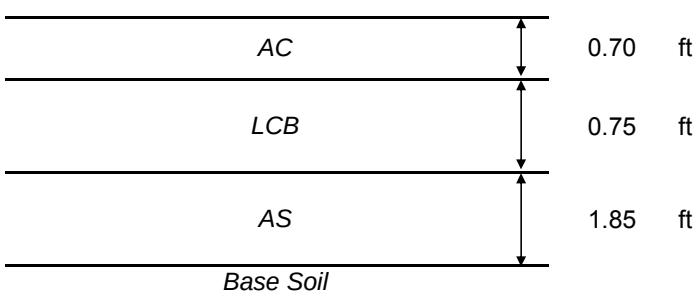
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.1*

Design Case: AC over LCB over AS

Design TI=		***14.5***	
R_{BS}=		***5***	
R_{AB}=		78	
R_{AS}=		50	
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$		4.41	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS}) =$		2.32	
$GE_{AC} = 0.4*GE_{AC+LCB} =$		0.93	
=>	GE'_{AC} =	1.13	(add 0.2 ft safety factor)
	AC thickness =	0.69	ft
=>	AC Thickness=	**0.70**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$=	1.63	
	GE_{AC}=	1.14	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC} =$		1.18	
=>	GE_{AC+AB}=	1.38	(add 0.2 ft safety factor)
	$G_{f,\,LCB}$=	1.90	
	LCB thickness=	0.72	
=>	LCB Thickness=	**0.75**	ft (round up to the nearest 0.05 ft)
	GE_{AC}=	1.43	
$GE_{AS} = GE_{TOTAL}-GE_{LCB}-GE_{AC} =$		1.84	
=>	AS Thickness=	**1.85**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over LTS

Design TI=	***14.5***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	**1.5**	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$ 4.41

$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$ 1.80

$G_{f,\ LTS}$= 1.20

$GE_{AC+LCB} = GE_{TOTAL} - GE_{LTS} =$ 2.61

$GE_{AC} = 0.4*GE_{AC+LCB} =$ 1.04

=> GE'_{AC} = 1.24 (add 0.2 ft safety factor)

AC thickness = 0.75 ft

=> AC Thickness= **0.75** ft (round up to the nearest 0.05 ft)

$G_{f,\ AC}$= 1.67

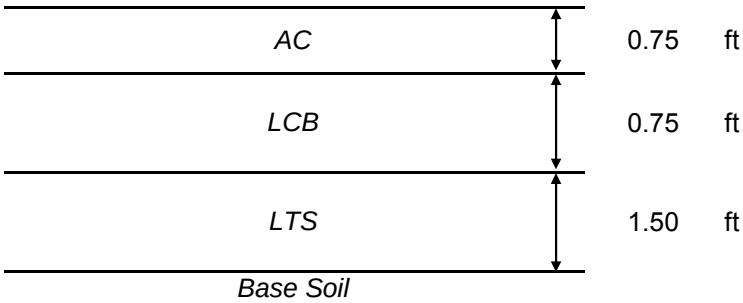
GE_{AC}= 1.25

$GE_{LCB} = GE_{TOTAL} - GE_{AC} - GE_{LTS} =$ 1.36

LCB thickness= 0.71

=> LCB Thickness= **0.75** ft (round up to the nearest 0.05 ft)

Design Section:



0.75 ft

0.75 ft

1.50 ft

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

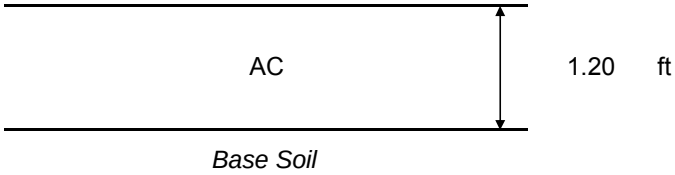
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***10***
R_{BS}= ***15***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		2.72	
=>	GE'_{AC}=	2.82	(add 0.1 ft safety factor)
=>	AC Thickness=	1.20	
=>	AC Thickness=	**1.20**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

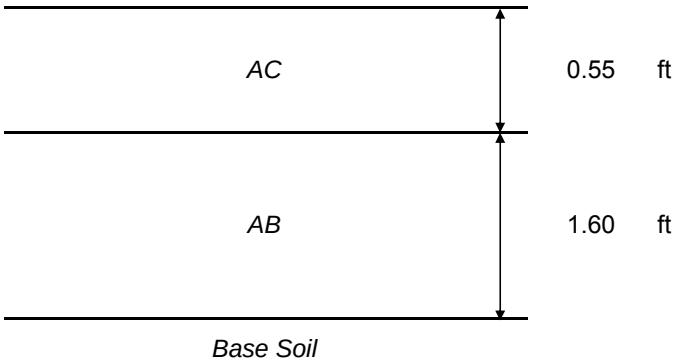
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=		***10***	
R_{BS}=		***15***	
R_{AB}=		78	
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		2.72	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.70	
=>	GE'_{AC} =	0.90	(add 0.2 ft safety factor)
	AC Thickness =	0.51	ft
=>	AC Thickness =	**0.55**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$ =	1.81	
	GE_{AC} =	1.00	
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		1.72	
	AB thickness=	1.57	ft
=>	AB Thickness=	**1.60**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.76	$G_{f,\,AB}$=1.1

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB over AS

Design TI=	***10***	
R_{BS}=	***15***	
R_{AB}=	78	
R_{AS}=	50	

$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$ 2.72

$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$ 0.70

=> GE'_{AC} = 0.90 (add 0.2 ft safety factor)

AC thickness = 0.51 ft

=> AC Thickness= **0.55** ft (round up to the nearest 0.05 ft)

$G_{f,\,AC}$= 1.81

GE_{AC}= 1.00

$GE_{AB+AC} = 0.0032*TI*(100-R_{AS}) =$ 1.60

=> GE_{AC+AB}= 1.80 (add 0.2 ft safety factor)

$GE_{AB} = GE_{AC+AB} - GE_{AC} =$ 0.80

=> AB thickness= 0.73

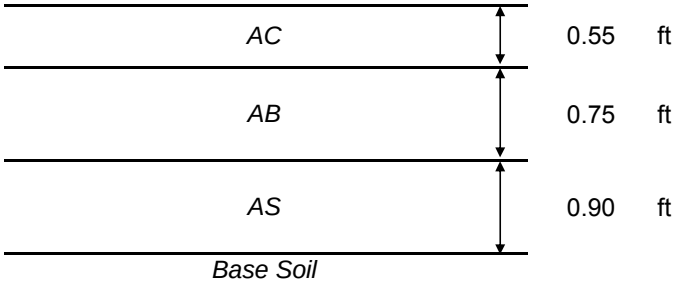
=> AB Thickness= **0.75** ft (round up to the nearest 0.05 ft)

GE_{AB}= 0.83 $G_{f,\,AB}$=1.1

$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{AC} =$ 0.90

=> AS Thickness= **0.90** ft (round up to the nearest 0.05 ft)

Design Section:



0.55 ft

0.75 ft

0.90 ft

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

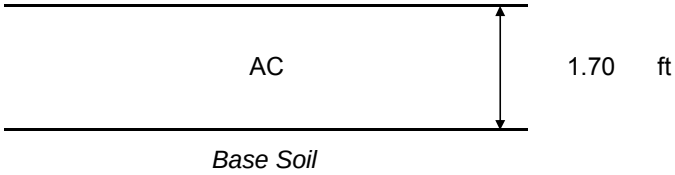
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***12.5***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		3.80	
=>	GE'_{AC}=	3.90	(add 0.1 ft safety factor)
=>	AC Thickness=	1.66	
=>	AC Thickness=	**1.70**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

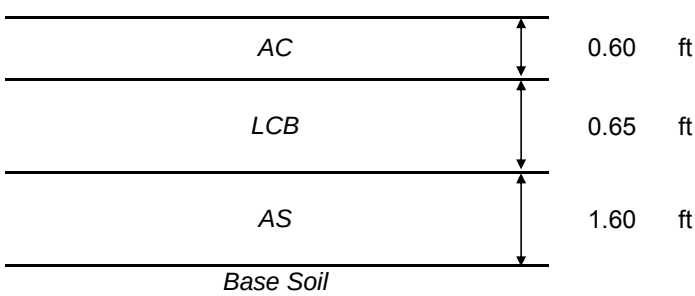
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over AS

Design TI=		***12.5***	
R_{BS}=		***5***	
R_{AB}=		78	
R_{AS}=		50	
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$		3.80	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS}) =$		2.00	
$GE_{AC} = 0.4*GE_{AC+LCB} =$		0.80	
=>	GE'_{AC} =	1.00	(add 0.2 ft safety factor)
	AC thickness =	0.60	ft
=>	AC Thickness=	**0.60**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$=	1.67	
	GE_{AC}=	1.00	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC} =$		1.00	
=>	GE_{AC+AB}=	1.20	(add 0.2 ft safety factor)
	$G_{f,\,LCB}$=	1.90	
	LCB thickness=	0.63	
=>	LCB Thickness=	**0.65**	ft (round up to the nearest 0.05 ft)
	GE_{AC}=	1.24	
$GE_{AS} = GE_{TOTAL}-GE_{LCB}-GE_{AC} =$		1.56	
=>	AS Thickness=	**1.60**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over LTS

Design TI=	***12.5***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	**1.5**	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$ 3.80

$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$ 1.80

$G_{f,\ LTS}$= 1.20

$GE_{AC+LCB} = GE_{TOTAL} - GE_{LTS} =$ 2.00

$GE_{AC} = 0.4*GE_{AC+LCB} =$ 0.80

=> GE'_{AC} = 1.00 (add 0.2 ft safety factor)

AC thickness = 0.60 ft

=> AC Thickness= **0.60** ft (round up to the nearest 0.05 ft)

$G_{f,\ AC}$= 1.67

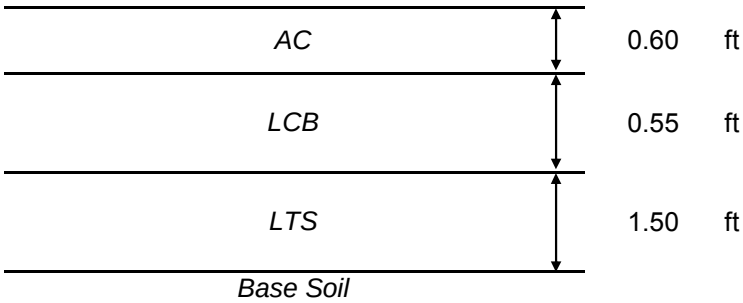
GE_{AC}= 1.00

$GE_{LCB} = GE_{TOTAL} - GE_{AC} - GE_{LTS} =$ 1.00

LCB thickness= 0.53

=> LCB Thickness= **0.55** ft (round up to the nearest 0.05 ft)

Design Section:



0.60 ft

0.55 ft

1.50 ft

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

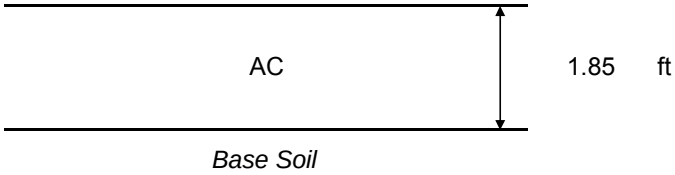
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***13.5***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		4.10	
=>	GE'_{AC}=	4.20	(add 0.1 ft safety factor)
=>	AC Thickness=	1.81	
=>	AC Thickness=	**1.85**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

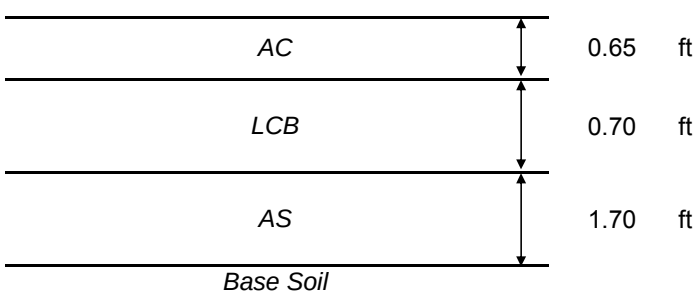
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.1*

Design Case: AC over LCB over AS

Design TI=	***13.5***	
R_{BS}=	***5***	
R_{AB}=	78	
R_{AS}=	50	
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$	4.10	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS}) =$	2.16	
$GE_{AC} = 0.4*GE_{AC+LCB} =$	0.86	
=> GE'_{AC} =	1.06	(add 0.2 ft safety factor)
AC thickness =	0.65	ft
=> AC Thickness=	**0.65**	ft (round up to the nearest 0.05 ft)
$G_{f,\ AC}$=	1.65	
GE_{AC}=	1.07	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC} =$	1.09	
=> GE_{AC+AB}=	1.29	(add 0.2 ft safety factor)
$G_{f,\ LCB}$=	1.90	
LCB thickness=	0.68	
=> LCB Thickness=	**0.70**	ft (round up to the nearest 0.05 ft)
GE_{AC}=	1.33	
$GE_{AS} = GE_{TOTAL} - GE_{LCB} - GE_{AC} =$	1.70	
=> AS Thickness=	**1.70**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over LTS

Design TI=	***13.5***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	**1.5**	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$ 4.10

$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$ 1.80

$G_{f,\ LTS}$= 1.20

$GE_{AC+LCB} = GE_{TOTAL} - GE_{LTS} =$ 2.30

$GE_{AC} = 0.4*GE_{AC+LCB} =$ 0.92

=> GE'_{AC} = 1.12 (add 0.2 ft safety factor)

AC thickness = 0.67 ft

=> AC Thickness= **0.70** ft (round up to the nearest 0.05 ft)

$G_{f,\ AC}$= 1.69

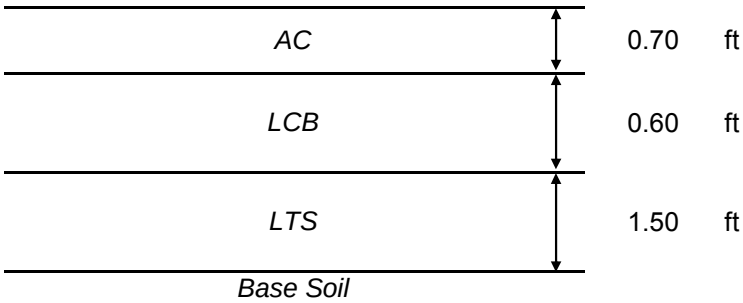
GE_{AC}= 1.18

$GE_{LCB} = GE_{TOTAL} - GE_{AC} - GE_{LTS} =$ 1.12

LCB thickness= 0.59

=> LCB Thickness= **0.60** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

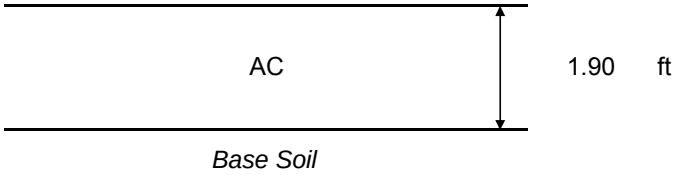
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***14***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		4.26	
=>	GE'_{AC}=	4.36	(add 0.1 ft safety factor)
=>	AC Thickness=	1.88	
=>	AC Thickness=	**1.90**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.1*

Design Case: AC over LCB over AS

Design TI=		***14***	
R_{BS}=		***5***	
R_{AB}=		78	
R_{AS}=		50	
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$		4.26	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS}) =$		2.24	
$GE_{AC} = 0.4*GE_{AC+LCB} =$		0.90	
=>	GE'_{AC} =	1.10	(add 0.2 ft safety factor)
	AC thickness =	0.67	ft
=>	AC Thickness=	**0.70**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ AC}$=	1.66	
	GE_{AC}=	1.16	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC} =$		1.08	
=>	GE_{AC+AB}=	1.28	(add 0.2 ft safety factor)
	$G_{f,\ LCB}$=	1.90	
	LCB thickness=	0.67	
=>	LCB Thickness=	**0.70**	ft (round up to the nearest 0.05 ft)
	GE_{AC}=	1.33	
$GE_{AS} = GE_{TOTAL}-GE_{LCB}-GE_{AC} =$		1.76	
=>	AS Thickness=	**1.80**	ft (round up to the nearest 0.05 ft)

Design Section:

AC	0.70	ft
LCB	0.70	ft
AS	1.80	ft

Base Soil

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over LTS

Design TI=	***14***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	**1.5**	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$ 4.26

$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$ 1.80

$G_{f,\ LTS}$= 1.20

$GE_{AC+LCB} = GE_{TOTAL} - GE_{LTS} =$ 2.46

$GE_{AC} = 0.4*GE_{AC+LCB} =$ 0.98

=> GE'_{AC} = 1.18 (add 0.2 ft safety factor)

AC thickness = 0.71 ft

=> AC Thickness= **0.75** ft (round up to the nearest 0.05 ft)

$G_{f,\ AC}$= 1.70

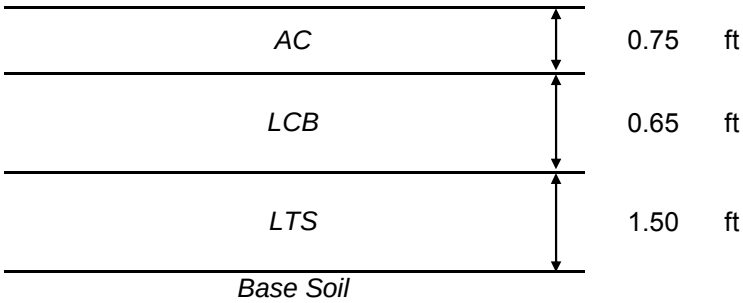
GE_{AC}= 1.27

$GE_{LCB} = GE_{TOTAL} - GE_{AC} - GE_{LTS} =$ 1.18

LCB thickness= 0.62

=> LCB Thickness= **0.65** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

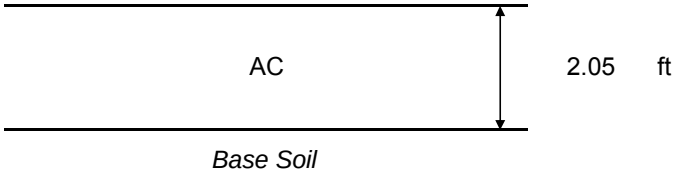
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***15***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		4.56	
=>	GE'_{AC}=	4.66	(add 0.1 ft safety factor)
=>	AC Thickness=	2.03	
=>	AC Thickness=	**2.05**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

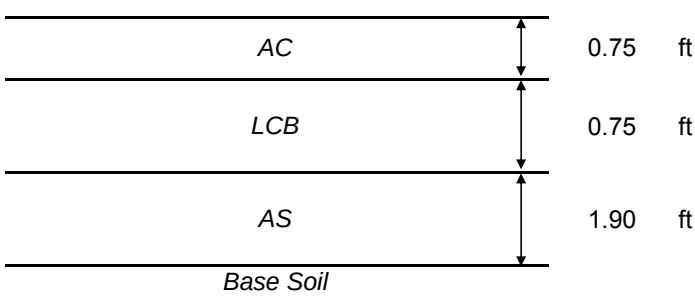
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.1*

Design Case: AC over LCB over AS

Design TI=		***15***	
R_{BS}=		***5***	
R_{AB}=		78	
R_{AS}=		50	
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$		4.56	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS}) =$		2.40	
$GE_{AC} = 0.4*GE_{AC+LCB} =$		0.96	
=>	GE'_{AC} =	1.16	(add 0.2 ft safety factor)
	AC thickness =	0.72	ft
=>	AC Thickness=	**0.75**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ AC}$=	1.64	
	GE_{AC}=	1.23	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC} =$		1.17	
=>	GE_{AC+AB}=	1.37	(add 0.2 ft safety factor)
	$G_{f,\ LCB}$=	1.90	
	LCB thickness=	0.72	
=>	LCB Thickness=	**0.75**	ft (round up to the nearest 0.05 ft)
	GE_{AC}=	1.43	
$GE_{AS} = GE_{TOTAL} - GE_{LCB} - GE_{AC} =$		1.90	
=>	AS Thickness=	**1.90**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over LTS

Design TI=	***15***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	**1.5**	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$ 4.56

$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$ 1.80

$G_{f,\ LTS}$= 1.20

$GE_{AC+LCB} = GE_{TOTAL} - GE_{LTS} =$ 2.76

$GE_{AC} = 0.4*GE_{AC+LCB} =$ 1.10

=> GE'_{AC} = 1.30 (add 0.2 ft safety factor)

AC thickness = 0.78 ft

=> AC Thickness= **0.80** ft (round up to the nearest 0.05 ft)

$G_{f,\ AC}$= 1.68

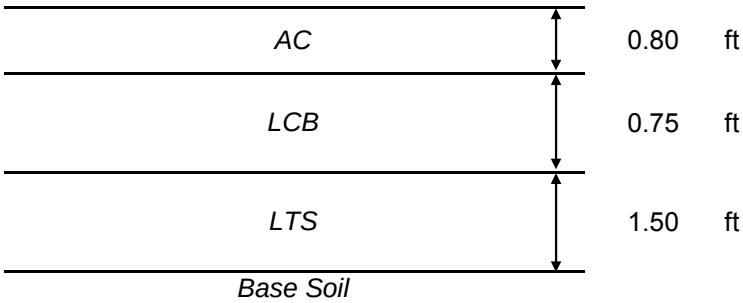
GE_{AC}= 1.34

$GE_{LCB} = GE_{TOTAL} - GE_{AC} - GE_{LTS} =$ 1.42

LCB thickness= 0.75

=> LCB Thickness= **0.75** ft (round up to the nearest 0.05 ft)

Design Section:



0.80 ft

0.75 ft

1.50 ft

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

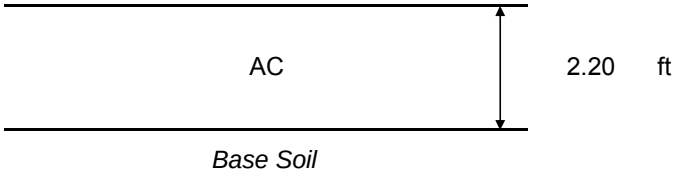
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***16***
R_{BS}= ***5***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		4.86	
=>	GE'_{AC}=	4.96	(add 0.1 ft safety factor)
=>	AC Thickness=	2.19	
=>	AC Thickness=	**2.20**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

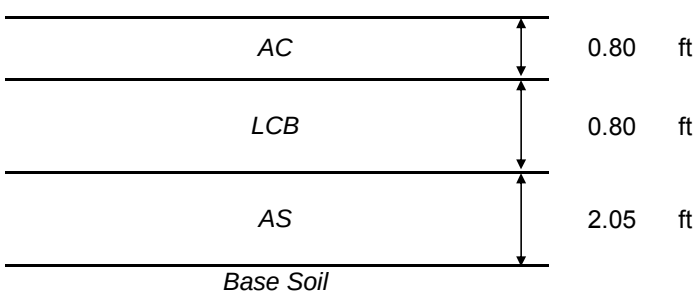
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over AS

Design TI=		***16***	
R_{BS}=		***5***	
R_{AB}=		78	
R_{AS}=		50	
$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$		4.86	
$GE_{AC+LCB} = 0.0032*TI*(100-R_{AS}) =$		2.56	
$GE_{AC} = 0.4*GE_{AC+LCB} =$		1.02	
=>	GE'_{AC} =	1.22	(add 0.2 ft safety factor)
	AC thickness =	0.76	ft
=>	AC Thickness=	**0.80**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ AC}$=	1.62	
	GE_{AC}=	1.30	
$GE_{LCB} = (GE_{AC+LCB})-GE_{AC} =$		1.26	
=>	GE_{AC+AB}=	1.46	(add 0.2 ft safety factor)
	$G_{f,\ LCB}$=	1.90	
	LCB thickness=	0.77	
=>	LCB Thickness=	**0.80**	ft (round up to the nearest 0.05 ft)
	GE_{AC}=	1.52	
$GE_{AS} = GE_{TOTAL}-GE_{LCB}-GE_{AC} =$		2.04	
=>	AS Thickness=	**2.05**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over LCB over LTS

Design TI=	***16***	
R_{BS}=	***5***	
R_{AB}=	78	
UCS	300	psi (Unconfined Strength)
$LTS_{thickness}$	**1.5**	ft

$GE_{TOTAL} = 0.0032*TI*(100-R_{BS}) =$ 4.86

$GE_{LTS} = (LTS_{thickness})*G_{f,LTS} =$ 1.80

$G_{f,\ LTS}$= 1.20

$GE_{AC+LCB} = GE_{TOTAL} - GE_{LTS} =$ 3.06

$GE_{AC} = 0.4*GE_{AC+LCB} =$ 1.23

=> GE'_{AC} = 1.43 (add 0.2 ft safety factor)

AC thickness = 0.86 ft

=> AC Thickness= **0.90** ft (round up to the nearest 0.05 ft)

$G_{f,\ AC}$= 1.69

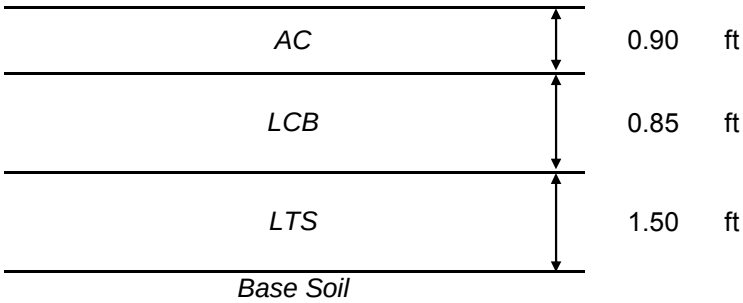
GE_{AC}= 1.52

$GE_{LCB} = GE_{TOTAL} - GE_{AC} - GE_{LTS} =$ 1.54

LCB thickness= 0.81

=> LCB Thickness= **0.85** ft (round up to the nearest 0.05 ft)

Design Section:



0.90 ft

0.85 ft

1.50 ft

PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

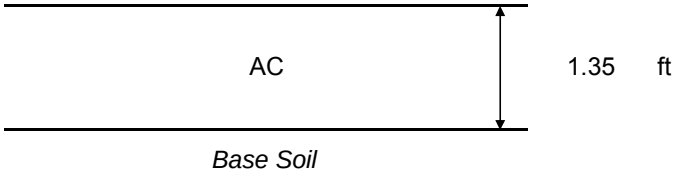
PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: Full depth AC

Design TI= ***11***
R_{BS}= ***15***

$GE_{AC} = 0.0032*TI*(100-R_{BS}) =$		2.99	
=>	GE'_{AC}=	3.09	(add 0.1 ft safety factor)
=>	AC Thickness=	1.33	
=>	AC Thickness=	**1.35**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN

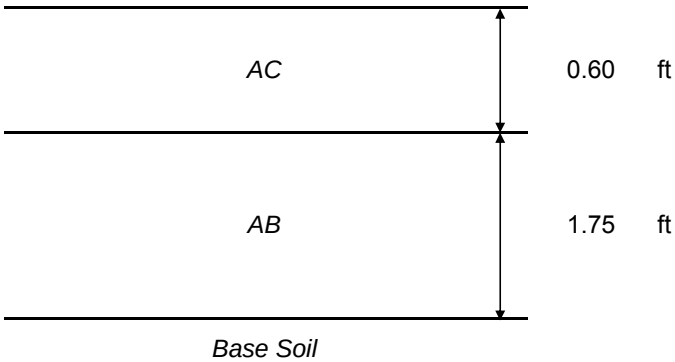
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB

Design TI=		***11***	
R_{BS}=		***15***	
R_{AB}=		78	
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		2.99	
$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$		0.77	
=>	GE'_{AC} =	0.97	(add 0.2 ft safety factor)
	AC Thickness =	0.56	ft
=>	AC Thickness =	**0.60**	ft (round up to the nearest 0.05 ft)
	$G_{f,\,AC}$ =	1.78	
	GE_{AC} =	1.07	
$GE_{AB} = GE_{AC+AB} - GE_{AC} =$		1.92	
	AB thickness=	1.75	ft
=>	AB Thickness=	**1.75**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.93	$G_{f,\,AB}$=1.1

Design Section:



PAVEMENT DESIGN

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: *I-80/I-680/SR12 IC PROJECT*
PROJECT NO.: *209130.10*

Design Case: AC over AB over AS

Design TI=	***11***
R_{BS}=	***15***
R_{AB}=	78
R_{AS}=	50

$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$ 2.99

$GE_{AC} = 0.0032*TI*(100-R_{AB}) =$ 0.77

=> GE'_{AC} = 0.97 (add 0.2 ft safety factor)

AC thickness = 0.56 ft

=> AC Thickness= **0.60** ft (round up to the nearest 0.05 ft)

$G_{f,\,AC}$= 1.78

GE_{AC}= 1.07

$GE_{AB+AC} = 0.0032*TI*(100-R_{AS}) =$ 1.76

=> GE_{AC+AB}= 1.96 (add 0.2 ft safety factor)

$GE_{AB} = GE_{AC+AB} - GE_{AC} =$ 0.89

=> AB thickness= 0.81

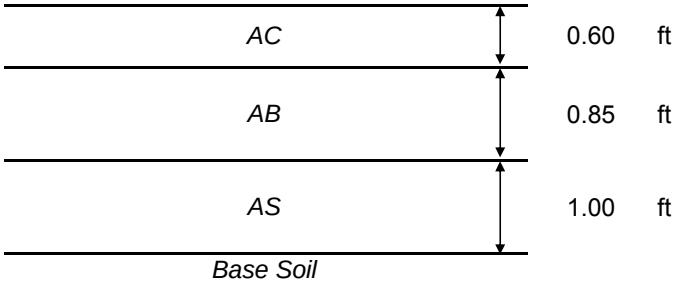
=> AB Thickness= **0.85** ft (round up to the nearest 0.05 ft)

GE_{AB}= 0.94 $G_{f,\,AB}$=1.1

$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{AC} =$ 0.99

=> AS Thickness= **1.00** ft (round up to the nearest 0.05 ft)

Design Section:



0.60 ft

0.85 ft

1.00 ft

APPENDIX D

Acacia CE
Consultants & Engineers

GROUND IMPROVEMENT CONSTRUCTION DOCUMENTS

65% DESIGN DEVELOPMENT
NOT FOR CONSTRUCTION

I-80/I-680/SR-12 ICP
Retaining Walls 8 & 9
Solano County, CA

Submitted to:

Y. David Wang, Ph.D., PE
Parikh Consultants, Inc.
2360 Qume Drive, Suite A
San Jose, CA 95131

Prepared by:
William M. Kenney, GE

Acacia CE

July 11, 2011
REVISED September 28, 2011

Project Number: AC 157

3025 Venture Road, Placerville, CA 95667 tel 530.748.1336 fax 530.621.4837 www.acaciace.com

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Mr. Y. David Wang
Parikh Consultants, Inc.
2360 Qume Drive, Suite A
San Jose, CA 95131

Subject: I-80/I-680/SR-12 ICP
"G" Line Retaining Walls 8 & 9
Solano County, CA

GROUND IMPROVEMENT CONSTRUCTION DOCUMENTS
65% DESIGN DEVELOPMENT

Dear Mr. Wang:

Acacia CE is pleased to present the following Ground Improvement Design Development and Construction Documents for subsurface improvements in the Retaining Wall 8 & 9 are of the "G" line for the I-8-/I-680/SR-12 ICP in Solano County California.

Generally, liquefaction mitigation and performance criteria vary according to the acceptable level of risk and required levels of performance for each structure type. The ground improvement described herein, once implemented, will provide liquefaction mitigation in the improved ground areas such that acceptable performance in the Wall 8 & 9 "soil raft" (i.e., stability and deformation levels) is achieved.

The calculations included in this submittal are for 24 inch diameter controlled low strength material (CLSM) ground improvement columns (GIC) using a 750 psi CLSM backfill material. Final design will include documentation for Deep Soil Mix (DSM) GIC providing substantially similar engineering properties using lower strength material (soil-cement ~200 psi) and a larger diameter column (higher area replacement ratio).

This Transmittal is based on 65% Design Development information and should be used for review of the ground improvement methods proposed. This submittal should not be considered as basis for the bidding or construction phase of this project.

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This 65% Design Development package includes the following Attachments:

ATTACHMENT A – Plan Sheets
ATTACHMENT B – Calculations
ATTACHMENT C – Load Test Requirements
ATTACHMENT D – Special Provisions CLSM GIC
ATTACHMENT E – Special Provisions DSM GIC

We are pleased to serve you on this project. If you have any questions regarding the contents of this Transmittal, please contact me at (530) 748-1336 ext. 15.

Sincerely,

9/28/11

Acacia CE Inc.

REGISTERED PROFESSIONAL ENGINEER
WILLIAM M. KENNEY
No. GE 2760
Exp. 3/31/13
GEOTECHNICAL
STATE OF CALIFORNIA

William M. Kenney, GE
Principal Engineer

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ATTACHMENT A
Plan Sheets

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Dist.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12.80	2.5/2.8 12.0/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2760 Exp. 12/31/12 CIVIL STATE OF CALIFORNIA

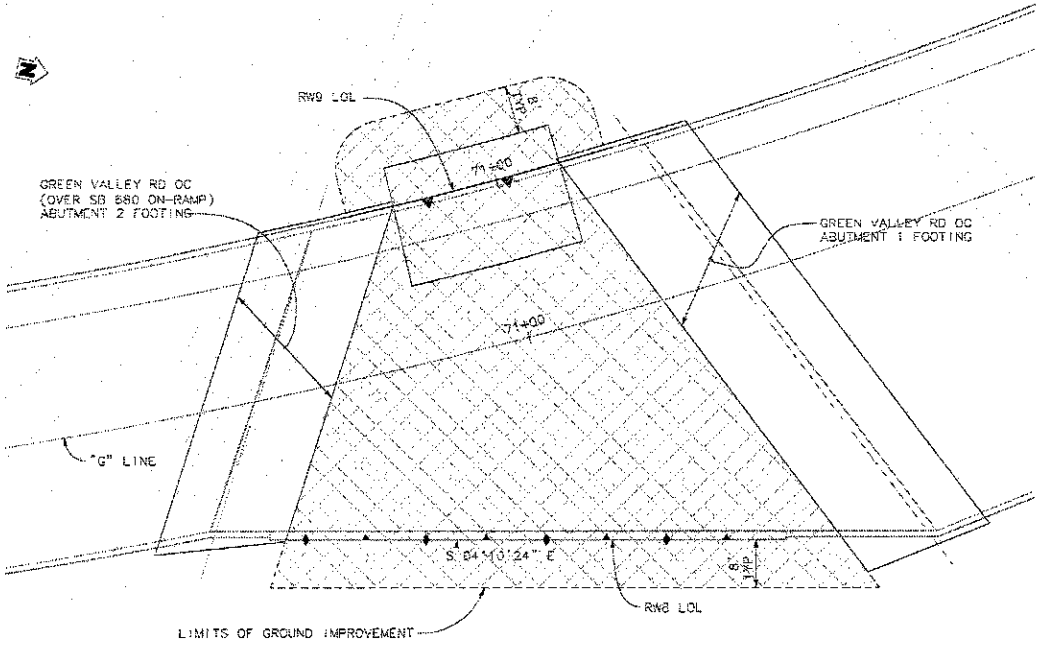
ACACIA CE
3025 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

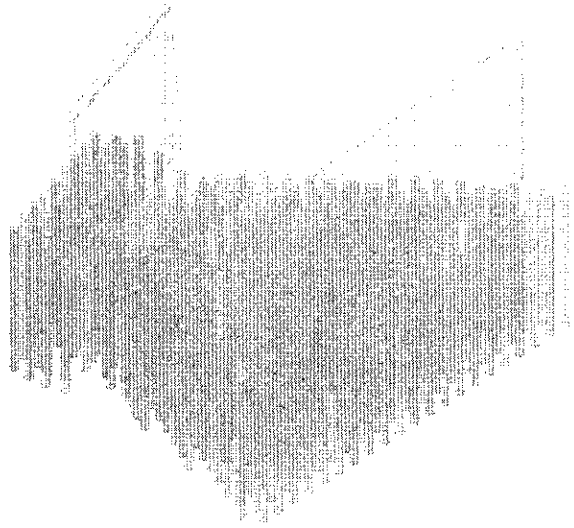
65% SUBMITTAL
07/11/11

LEGEND

GROUND IMPROVEMENT



PLAN
1" = 10'



CONCEPTUAL ISOMETRIC VIEW
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL

CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM M KENNEY

CALCULATED-DESIGNED BY: S. B. WARREN
CHECKED BY: W. M. KENNEY

REVISED BY
DATE REVISED

USERNAME => $USER | RELATIVE BORDER SCALE 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 0000000001

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	G-DET No.	TOTAL SHEETS
04	Sol	12,80	2.5/2.6 12.0/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2760 Exp. 3/31/13 CIVIL STATE OF CALIFORNIA

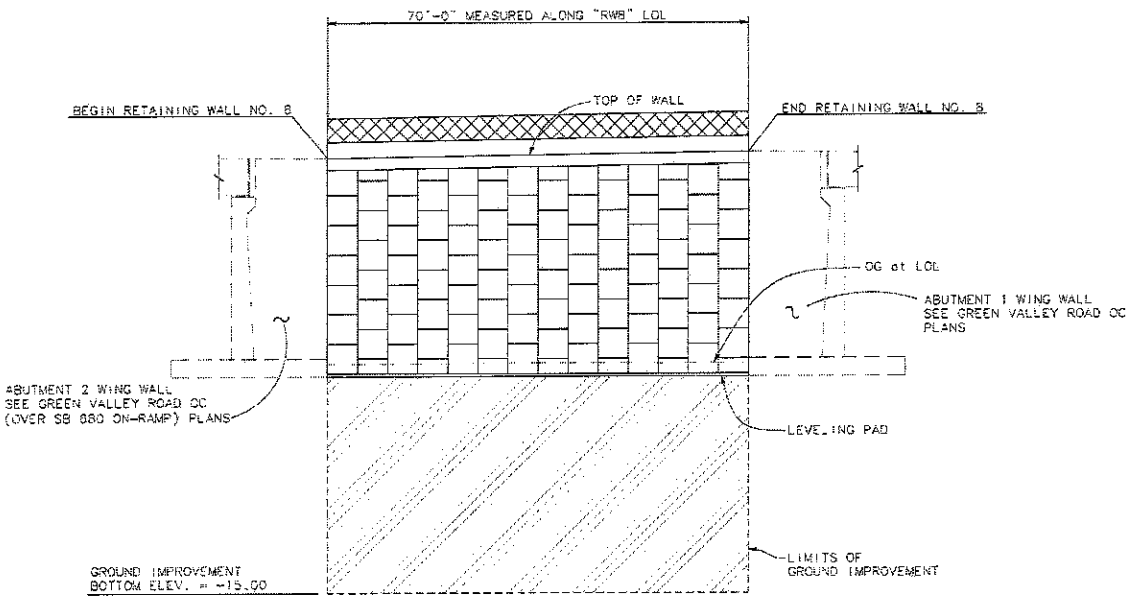
ACACIA CE
3525 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

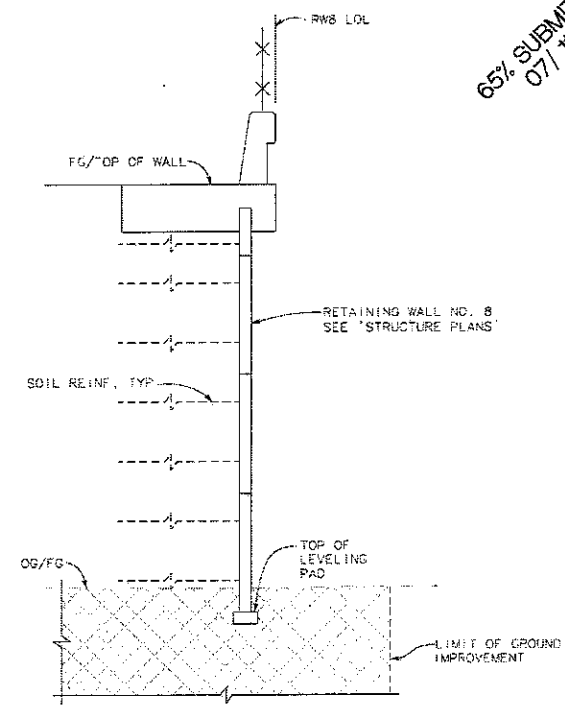
LEGEND

GROUND IMPROVEMENT

65% SUBMITTAL
07/11/11



ELEVATION
1" = 10'



TYPICAL SECTION - RETAINING WALL NO. 8
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL
CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM M. KENNEY
CALCULATED-DESIGNED BY: S. D. WARREN
CHECKED BY: W. M. KENNEY
REVISED BY
DATE REVISED

USERNAME =A$USER
RELATIVE BORDER SCALE 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0000000000
DATE PLOTTED = 11-JUL-2011

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.5/2.8 12.3/12.9		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER WILLIAM KENNEY No. 2780 Exp. 3/31/13 GEOTECHNICAL STATE OF CALIFORNIA

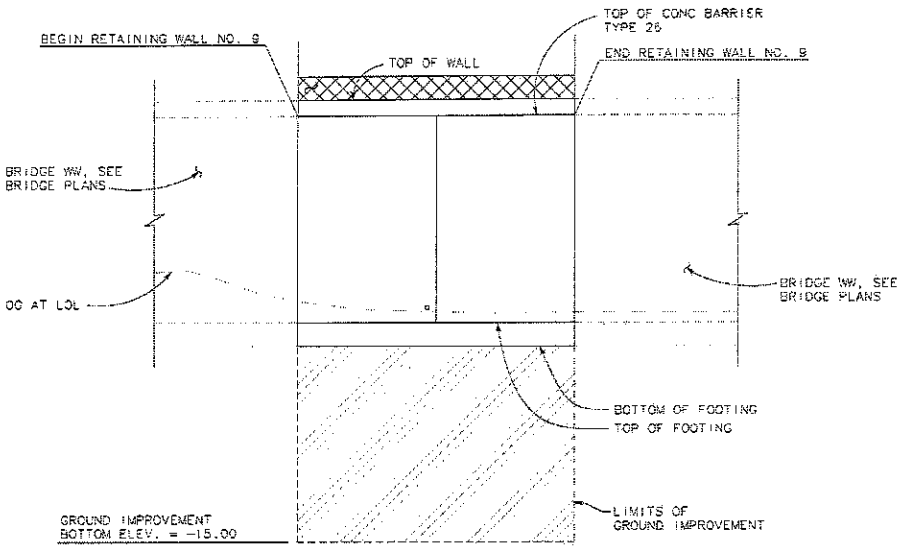
ACACIA CE
3025 VENTURE ROAD
PLACERVILLE, CA 95667

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

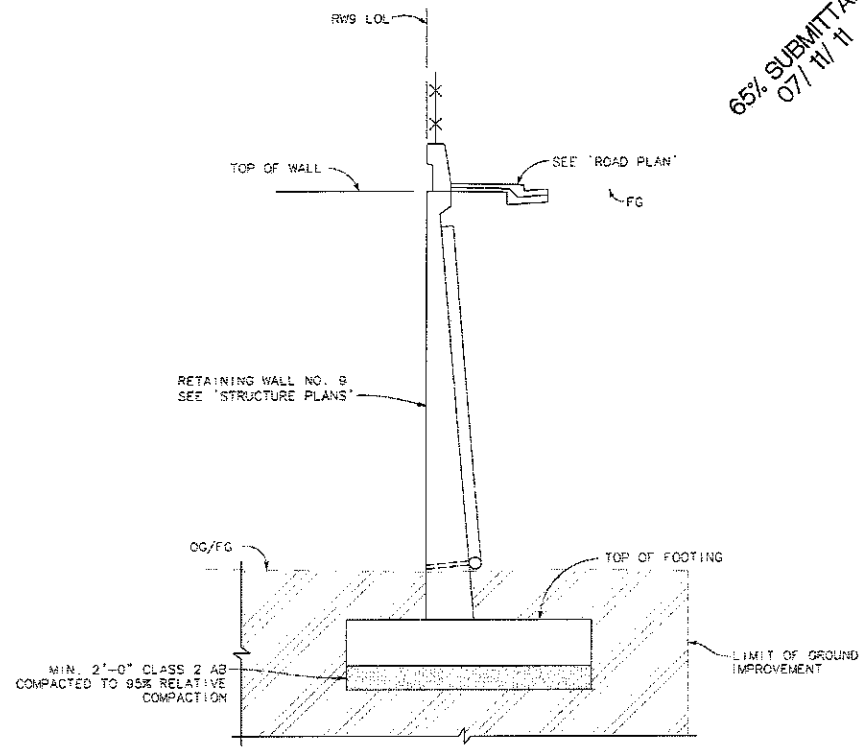
65% SUBMITTAL
07/11/11

LEGEND

GROUND IMPROVEMENT



ELEVATION
1" = 10'



TYPICAL SECTION - RETAINING WALL NO. 9
NO SCALE

CONSTRUCTION DETAILS
GROUND MODIFICATION
NO SCALE

C-XX

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL
CONSULTANT FUNCTIONAL SUPERVISOR: WILLIAM H. KENNEY
CALCULATED-DESIGNED BY: S. D. WARREN
CHECKED BY: W. M. KENNEY
REVISED BY
DATE REVISED

USERNAME => $USER
RELATIVE BORDER SCALE 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0000000000

ATTACHMENT B
Calculations

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Job Name: 80/680/12 Walls 8 + 9 By: WMK Sheet No. 1
Job No.: AC 157 Date:

CLSM GIC Composite Bearing Capacity (ULT.)

Two Zones : Zone 1 = Type 1 Wall
Zone 2 = MSE Wall / Field

$$q_{ac} = a_r \left(\frac{Q_{CLSM}}{q_{CLSM}}\right) + \beta (1 - a_r) q_s$$

Where: Q_{CLSM} = CLSM Cap (Ult.)
a_r = Area Replacement Ratio
β = Bearing Reduction Factor
0.5 - 1 for friction Col.
0.1 - 0.4 for end bearing
q_{CLSM} = Area CLSM GIC
q_s = Soil Bearing Cap (Ult.)

Determine Soil Bearing Cap. (q_s)

Generalized Soil Conditions
$\phi = 22°$ $c = 250$ psf $\gamma = 115$ pcf

Footing
$B = 20$ feet $D = \phi$ feet (Conservative)

$$q_s = c N_c + \gamma D_F N_q + \frac{\gamma B}{2} N_\gamma$$

For 22° $N_c = 16$ $N_q = 8$ $N_\gamma = 7$

$$q_s = (250)(16) + 0 + \frac{(115)(20)}{2}(7)$$

$q_s = 12{,}050$ psf

$$q_s = (750)(N_c) = (750)(5.5) = 4125 \Rightarrow 4{,}000 \text{ psf}$$

Area Replacement Ratio (a_r)

Zone 1, Rect. Spacing $= \frac{3.14}{(4.625)(3.75')} = 0.173$

Zone 2, Eq. Triang. $= \frac{3.14}{(.866)(4.83')^2} = 0.155$

Area CLSM GIC (q_{CLSM})

CLSM GIC diam = 24"

$\therefore$ $q_{CLSM} = 3.14$ ft²

CLSM GIC Bearing Capacity (Q_{CLSM})

$$Q_{CLSM} = (750 \text{ psi})\left(\frac{144 \text{ in}^2}{\text{ft}^2}\right) = 108{,}000 \text{ psf}$$

Composite Bearing Capacity - Zone 1 - Type 1 Wall Ftg.

$q_{ac} = (.17)(108{,}000) + (.75)(1-.17)(4{,}000)$

$q_{ac} = 20{,}850$ psf $\Rightarrow$ 20,500 psf

Composite Bearing Capacity - Zone 2 - MSE Wall / Field

$q_{ac} = (.155)(108{,}000) + (.75)(1-.155)(4{,}000)$

$q_{ac} = 19{,}275$ psf $\Rightarrow$ 19,500 psf

Bearing Capacity GIC Only (No Soil Contribution)

$q = (.17)(108{,}000) = 18{,}360$ psf $\Rightarrow$ 18,000 psf Zone 1

$q = (.155)(108{,}000) = 16{,}740$ psf $\Rightarrow$ 16,500 psf Zone 2

CLSM GIC Composite Shear Strength

$C = f_{CLSM}\, a_r + r\, C_o\, (1 - a_r)$

Where: f_{CLSM} = CLSM GIC Shear Strength = ½ Compressive Strength
a_r = Area Replacement Ratio
r = reduction factor for low strain in Soil
C_o = Soil Shear Strength

Zone 1 - Type 1 Wall
Zone 2 - MSE Wall / Field

Area Replacement Ratios

Zone 1 = 0.17
Zone 2 = 0.155

Use $r = 1$

C_o = Undrained Shear Strength
C_o = 750 psf

Composite Shear - Zone 1

$C = \left(\frac{108{,}000}{2}\right)(.17) + (1)(750)(1 - .17)$

$C = \underline{9803 \text{ psf}} \Rightarrow C = \underline{9800}$

Composite Shear - Zone 2

$C = \left(\frac{108{,}000}{2}\right)(.155) + (1)(750)(1 - .155)$

$C = 9004 \text{ psf} \Rightarrow \underline{C = 9000 \text{ psf}}$

Shear GIC ONLY (No Soil Contribution)

$C = \left(\frac{108{,}000}{2}\right)(.17) = \underline{9180}$ For Zone 1

$C = \left(\frac{108{,}000}{2}\right)(.155) = \underline{8370}$ For Zone 2

Acacia CE
Consultants & Engineers
www.acaciace.com

Job Name: 80/680/12 Walls 8+9 By: WMK Sheet No. 4
Job No.: AC 157 Date:

Soil Profile For Settlement Estimate

Use R-10-003A

BOF MSE = 22.0'

Bottom of Ground Imp = -15'

-20 LZ1 = 5'

-26 LZ2 = 6'

-33 LZ3 = 7'

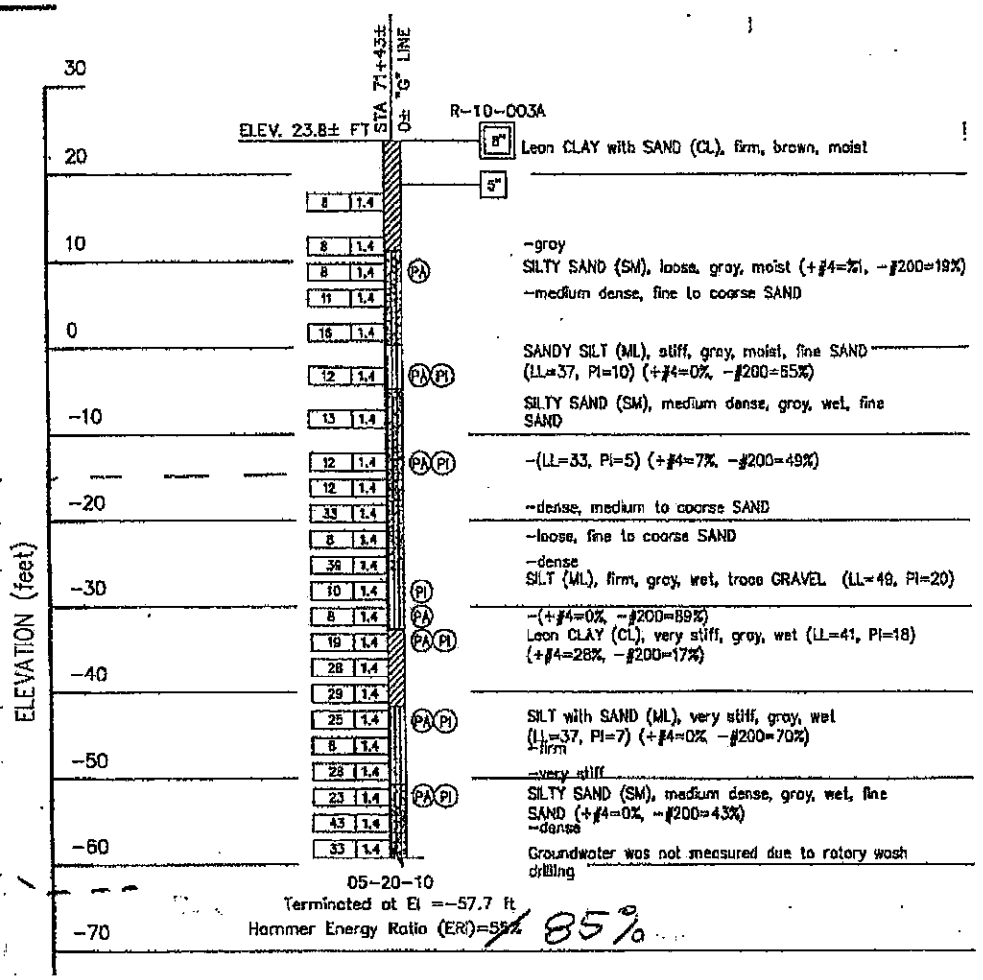
-41 LZ4 = 8'

-51 LZ5 = 10'

-67 LZ6 = 16'

LZ7 = 10'

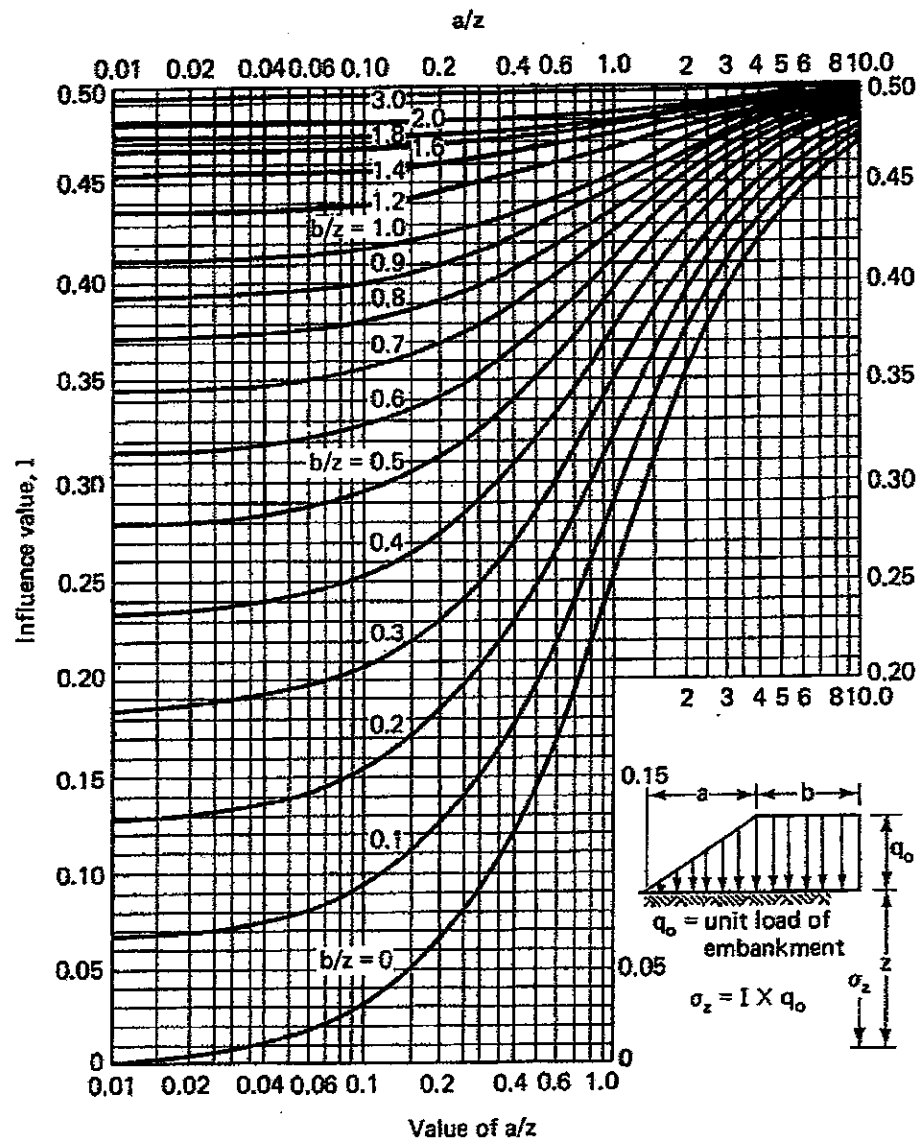
-77



		Mid Pt Depth
LZ1: Sand	E ~ 600 ksf	39.5
LZ2: Sand	E ~ 600 ksf	45.0
LZ3: Silt	E ~ 150 ksf	51.5
LZ4: Clay	E ~ 1000 ksf	59.0
LZ5: Silt	E ~ 250 ksf	68.0
LZ6: Sand	E ~ 600 ksf	81.0
* Below -63'	E ~ 600 ksf	94.0

Assume 10' Zone

* Based on CPT-10-003A



Influence factors for vertical stress under a very long embankment (after NAVFAC, 1971 as reported in Holtz and Kovacs, 1981)

Figure 9-2

Sheet No. 5

Job Name: 80/680/92
Job No.: AC 157
Engineer(s): WMK
Date: July 9, 2011

Acacia CE
Consultants & Engineers

Parameter	Symb	Val.
Column diameter (ft)	d	24
Depth to groundwater (ft)	dgw	18
Total unit weight of soil (pcf)	g	120
Soil frict. angle (degr)	f	22
Soil undr shear str (psf)	c	500
Max. hor. pressure (psf)	pmax	2500
Column cap. (kips)	Qcell	110
Bearing press. (ksf)	qall	5.5
Column stiffn. modulus (pci)	kcol	1000
Soil stiffness modulus (pci)	km	15

GIC ZONE SETTLEMENT CALCULATIONS

Parameter	Symb	Equation		
Load (kips)	P		111.38	
Cell width (ft)	B		4.5	
Cell length (ft)	L		4.5	
Cell bearing pressure	q	P/(B*L)	5.50	
No. Columns	N		1	
Area replacement ratio	Ra	N*Acol/(B*L)	0.16	
Stiffness ratio	Rs	kg/km	66.67	
Stress at top of Column (ksf)	qcol	q*Rs/(Rs*Ra-Ra+1)	32.77	
Load at top of Column (kips)	Qcol	qcol*Acol	102.96	
Improved zone settlement (in)	siz	qcol/kcol	0.23	

UZ = ↑

Notes:

For triangular spacing trib area = (.866)(a)(a)
Where a = on-center spacing
Equvalent sqaure are used in worksheet

INFLUENCE FACTORS FROM NAVFAC 1971

a = 1

Unform Load (q) = 5500

Determine Influence Factor Using "Long" Embankment

Mid Pt Depth	Width	Unit Load				(psf)	(ft)	(psf)	(ft)
(z)	(b)	(q)	(a/z)	b/z	I	I*q	H	E	s
39.5	27.4	5500	0.025316	0.693671	0.34	1870	5	600000	0.016
45	27.4	5500	0.022222	0.608889	0.32	1760	6	600000	0.018
51.5	27.4	5500	0.019417	0.532039	0.29	1595	7	150000	0.074
59	27.4	5500	0.016949	0.464407	0.26	1430	8	1000000	0.011
68	27.4	5500	0.014706	0.402941	0.235	1292.5	10	250000	0.052
81	27.4	5500	0.012346	0.338272	0.21	1155	16	600000	0.031
94	27.4	5500	0.010638	0.291489	0.17	935	10	600000	0.016

Lower Zone Settlement (ft) = 0.217
Lower Zone Settlement (in) = 2.6

LZ = ↑

Assume 3000 sf of embnkment load
Equivalent square = 54.77 feet E.W.
Therefore b= 1/2 side = 27.4 feet

NOTE: Due to the primarily granular (sandy) nature of zones 1, 2, 6, 7, and granular behavior of zone 5
About 1/2 to 1/3 of the total settlement should occur immediatley as the fill is placed

UZ + LZ = 2.8"

ATTACHMENT C
Load Test Requirements

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Acacia CE
Consultants & Engineers

Ground Improvement Column (GIC)
Modulus Test Schedule

Prepared: July 11, 2011

Job: I-80/I-680/SR-12 ICP "G" Line Walls 8 & 9
Job No.: AC 157

Test Criteria

GIC Col. Diameter = 24 inches

Test Load (100% ASD) = 110 kips

Jack Calibration Date: _____

Jack No.: _____
Pump No.: _____
Guage No.: _____

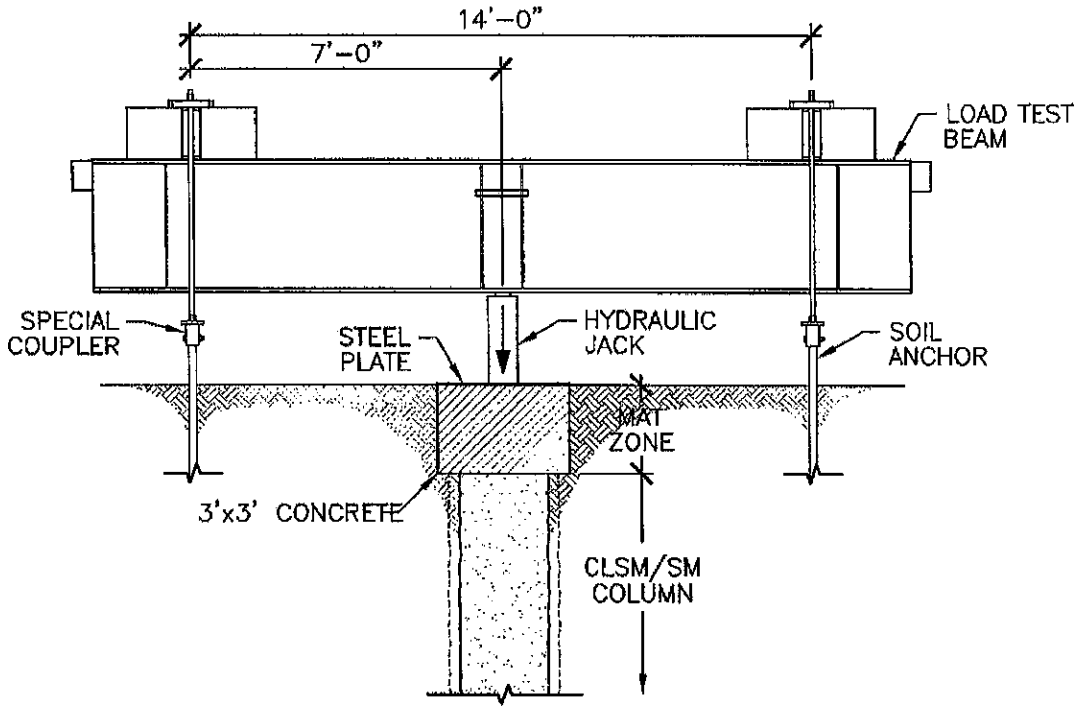
** - Gauge Factor to be based on latest Calibration for the Jack/Pump Gauge Setup used by the Testing Contractor

Gauge factor ** 31 in^2
Curve factor** 0 kips

Load No.	Percent of Design Load(%)	Gauge Pressure (psi)	Load (kips)	Load Duration (min.) MIN.	Load Duration (min.) MAX.
1	5%	177 / 200	5.5	0	0
2	17%	603 / 650	18.7	15	60
3	33%	1170 / 1200	36.3	15	60
4	50%	1774 / 1800	55.0	15	60
5	67%	2377 / 2400	73.7	15	60
6	83%	2945 / 2950	91.3	15	60
7	100%	3548 / 3550	110.0	15	60
8	115%	4080 / 4100	126.5	60	120
9	133%	4719 / 4750	146.3	15	60
10	150%	5322 / 5350	165.0	15	60
11	167%	5925 / 5950	183.7	15	60
12	183%	6493 / 6500	201.3	15	60
13	200%	7096 / 7100	220.0	15	60
14	167%	5925 / 5950	183.7	-	-
15	133%	4719 / 4750	146.3	-	-
16	100%	3548 / 3550	110.0	-	-
17	67%	2377 / 2400	73.7	-	-
18	33%	1170 / 1200	36.3	-	-
19	0%	-	0.0	-	-

Test Procedure

Apply seat load. Read dial gauges and apply first load increment. When Geopier average deflection is less than 0.01 inches per 1 hour or 0.0025 inches per 15 minutes go to next load increment or go to maximum load time of 1 hour if average deflection is greater. Hold load minimum of 60 minutes at 115% load increment.



CLSM/SM COLUMN SPECIFICATIONS	
APPRX. MAT ZONE	-- FT
MIN. CLSM/SMC SHAFT LENGTH (CSL)	-- FT
APPRX. CLSM/SMC DIA. (MAY VARY)	--- IN
TEST LOAD (100%)	-- KIPS
TEST LOAD (150%)	--- KIPS

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Base Documents

Sample Details

Load Test Setup

PROJECT NO.	AC 157		FIGURE NO.
DATE	JULY 11, 2011		1
REVISION	0		
DRAWN SW	CHECKED WK		

APPENDIX D
Special Provisions CLSM GIC

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10-1.XX DRILL DISPLACEMENT CLSM GROUND IMPROVEMENT COLUMN

This work shall consist of furnishing and installing Controlled Low Strength Material (CLSM) Ground Improvement Columns (GIC) by the drill displacement method at the locations shown on the plans.

CLSM GIC shall be performed by displacing soil with a specialized auger attachment and injecting CLSM in the displaced cavity under pressure as the displacement auger is removed from the ground to form a columnar inclusion of cemented material within the densified soil matrix. Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications regarding damage by CLSM GIC to existing utilities, improvements and facilities. The foundation information represents existing conditions at the specific boring locations at the time the borings were performed.

Installation of CLSM GIC shall create a soil/cemented column "raft" to improve strength properties of the foundation soils for the Type 1 wall and Mechanically Reinforced Earth (MSE) wall above. The Contractor shall confirm that the installed CLSM GIC achieves the required compressive strength and ensure that it is installed in the design configuration and within the specified limits.

The ground improvement shall extend to the designated depths shown on the plans. CLSM GIC installation equipment shall be capable of advancing through soil conditions as shown in the project boring logs.

CLSM GROUND IMPROVEMENT COLUMN

CLSM GIC shall improve strength properties of foundation soils within the area shown on the plans. CLSM GIC shall be placed according to the treatment pattern shown on the plans. The CLSM GIC displacement method shall displace at least 95 percent of the diameter of the displacement auger. The replacement of CLSM in the displaced cavity shall exceed 110 percent of the diameter of the displacement auger. The average 56-day unconfined compressive strength of CLSM shall be no less than 750 psi.

The Contractor may provide an alternative plan meeting the minimum performance requirement specified herein. The alternative plan shall be submitted as an attachment to the pre-construction submittal for approval by the Engineer.

The Contractor shall conduct a Pre-Production (PPC) Program within the limit of ground improvement areas shown on the plans prior to commencing CLSM GIC installation to establish production parameters procedures, and materials to be used during the production phase. The PPC Program shall produce CLSM mix design and procedures for production installation based upon the information provided from the PPC Program including: estimated 28-day and 56-day compressive strength of the CLSM, CLSM volume at the bottom of the GIC, injection pressure, injection volume per foot, and withdrawal rate of the auger, and complete description of all CLSM GIC operations.

SUBMITTALS

The submittals and other additional submittals shall conform to, the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions, and shall be stamped by a California Registered Professional Civil Engineer except for survey data which shall be stamped by a California Registered Professional Civil Engineer or a California Registered Land Surveyor.

The Contractor shall submit, for review by the Engineer, a statement of the previous work experience similar to that described in these special provisions. The statement shall include at least 3 successful CLSM GIC projects within past five years. This statement shall include a written description of each project, owner's contact name and current phone number, the dates and the extent of the work, the manner of its execution, and any other information that supports the Contractor's ability to carry out the work described in these special provisions.

Pre-construction Submittals

At least four weeks prior to commencement of mobilization of CLSM GIC equipment for production installation, the Contractor shall submit the following to the Engineer:

1. Names and qualifications of the ground improvement personnel including project experience, resumes and other documentation that demonstrate the experience qualifications of the project engineers, each field superintendent, and rig operator for the CLSM GIC installation.
2. A list of Contractors, responsible engineers, project descriptions and personnel responsibilities from CLSM GIC projects completed by the Project Engineers and Field Superintendents. Contractor's names, addresses and telephone numbers shall be included for these projects representing the individual's comparable experience. The projects listed shall demonstrate personnel qualifications using similar equipment and auger configuration(s) as proposed for the work of this Contract.
3. Submit data on equipment to be used for the CLSM GIC installation.
4. Sequence and time schedule of all operations including plan location and sequence of all CLSM GIC. The Contractor shall submit a CLSM GIC element Layout Plan based on the limits shown on the Plans to achieve the required plan area configurations and coverage. Plan locations of all proposed CLSM GIC shall be shown on Layout Plans. CLSM GIC elements on the Layout Plans shall be numbered and dimensioned and of suitable scale to clearly show the details of the layout.
5. CLSM mix design including: cement type and source, flyash type and source, water-cement ratio by weight and other pertinent details.
6. The results of the PPC Program including, but not limited-to: CLSM estimated 28-day and 56-day compressive strengths, injection pressure and rates, and complete description of all installation operations.

7. Description of Quality Control Plan for CLSM GIC installation including, but not limited to, the following:
   a. A detailed description of the Quality Control Plan to be undertaken each day during CLSM GIC installation to confirm that the installed columns conform to the required compressive strengths specified, the plan area coverage over the required depths and limits, and required horizontal and vertical alignments.
   b. Details of procedures used to obtain CLSM samples.
   c. Measures to be implemented each day during CLSM GIC to continuously monitor and control: CLSM injection pressures and quantities; withdrawal rates of the installation equipment; horizontal and vertical alignments of the CLSM GIC elements, and other related aspects of the installation process.
   d. Example formats of Daily Field Reports conforming to the requirements stated herein.
   e. Names, certifications and licenses of the Laboratory to be responsible for performing quality control tests.
   f. Proposed details and formats of all required data presentations to be submitted to the Engineer during the course of the Work.

Construction Submittals

Within two working days after the completion of each CLSM GIC element, submit the following:

1. Any deviation of the center coordinates from the layout plan to the nearest 3 inches at the top of the element.
2. The Daily Quality Control Report shall include as a minimum the results of the following QC parameter monitoring for each element:
   a. Rig Identification
   b. Type and size of installation tool
   c. Date and time (start and finish) of column construction
   d. Column number and reference drawing number
   e. Column diameter
   f. Column top and bottom elevations
   g. CLSM mix design designation
   h. CLSM slump measurements
   i. Description of obstructions, interruptions, or other difficulties during installation and how they were resolved.
3. Ready Mix plant production records (delivery tickets) including mix designation.

The Daily Quality control Reports shall also include the following parameters recorded automatically or manually for every 5th CLSM GIC at intervals no greater than and submitted in the form of either tables or figures (as agreed to by the Engineer):

a. Elevation in feet vs. depth

b. Displacement auger rotation speed in RPMs vs. depth

c. Vertical withdrawal rates in feet per minute vs. depth

d. Average volume of CLSM injection rates in cubic feet per foot vs. depth

Within one working day after the end of a work shift, submit Daily Production Reports for the work shift to the Engineer. Daily Production Reports shall be filled out, checked for correctness, and signed by the CLSM GIC Contractor's field superintendent and the Contractor's field superintendent at the end of every work shift. The reports shall contain, but not be limited to, the following information:

1. Day, month, year, time of work, shift, beginning and end; names of superintendent in charge of the Work for both the CLSM GIC Contractor and the Contractor; a list of all workers' names associated with each installation rig; and a summary of equipment used during the shift.

2. The location as shown on the Working Drawings of each completed CLSM GIC element installed during the work shift and all CLSM GIC elements completed to date, on a plan of suitable scale to clearly detail the locations of the elements.

3. Other pertinent observations including, but not limited to, spoil return, CLSM escapes, ground settlement and/or heave, collapse of the CLSM GIC, withdraw rates of the displacement auger, any unusual behavior of equipment during the installation process or any other noteworthy events. In the event of any Contractor claim, the Daily Production Reports shall be the primary documents to substantiate the reasons and basis for the claim.

4. Date, time, sample designation, and other details of CLSM sampling.

5. Summary of any downtime or unproductive time, including start and end time, duration, and reason.

4. Within five weeks after completion of the CLSM GIC, the Contractor shall submit survey data including:

   a. A final Layout Plan of suitable scales showing the locations of each CLSM GIC element at the top of the element.

   b. A tabular summary of layout center coordinates modified to reflect any measured- deviations of each CLSM GIC element at the top of the element, the elevation of the top and bottom of each element.

CLSM GIC QUALITY CONTROL

The Contractor shall verify that the installed CLSM GIC elements conform to these special provisions.

The Contractor shall obtain CLSM samples and provide them to the Laboratory for testing specified in these special provisions. The Laboratory shall cast preserve, cure, transport, and test the

samples and report the test results to the Engineer. The test results shall be signed and stamped by a California licensed Civil Engineer from the Laboratory. The Contractor shall coordinate sampling activities and CLSM GIC Quality Control with the Engineer and the Laboratory. The Contractor shall supply incidental items, access, inside storage space, curing boxes and electrical power to the curing boxes as necessary. The Laboratory shall supply molds for use in casting the samples.

CLSM GIC Samples

A minimum of two CLSM sampling rounds shall be performed daily during the PPC Program. The Contractor shall obtain Samples from the ready mix truck prior to introduction into the pump as selected by the Engineer. Each sample shall be of sufficient volume to produce a minimum of six full cylinders, 6 inches diameter by 12 inches deep.

Samples shall be formed, cured and preserved in accordance with ASTM D 4832 and protected from freezing and extreme weather conditions which could have deleterious effect, at all times.

Unless otherwise directed by the Engineer, the Laboratory shall test one each cylinder at 7 days, 14 days and 28 days for unconfined compressive strength in accordance with ASTM Designation D4832. The Laboratory shall submit the laboratory test results to the Engineer in accordance with these special provisions. Submit 3 cylinders from each sample round to the Engineer.

CLSM - CONTROLLED LOW STRENGTH MATERIAL - Materials

Controlled low strength material (CLSM) shall consist of a workable mixture of aggregate, cementitious materials, and water and shall conform to the provisions for slurry cement backfill in Section 19-3.062, "Slurry Cement Backfill," of the Standard Specifications and these special provisions. CLSM shall be a flowable, excavatable mixture of cement, pozzolan, coarse and fine aggregate and water which has been mixed in accordance with ASTM C 94.

Controlled low strength material in new construction shall not be permanently placed higher than the basement soil. When controlled low strength material is proposed for use, the Contractor shall submit a mix design and test data to the Engineer for approval prior to excavating the trench for which controlled low strength material is proposed for use. The test data and mix design shall provide for the following:

A. A 28-day compressive strength between 500 and 750 psi. Compressive strength shall be determined in conformance with the requirements in ASTM Designation D4832.

B. Cement shall be any type of Portland cement conforming to the requirements in ASTM Designation C150; or any type of blended hydraulic cement conforming to the requirements in ASTM Designation C595M or the physical requirements in ASTM Designation C1157M. Testing of cement will not be required.

C. Admixtures may be used in conformance with the provisions in Section 90-4, "Admixtures," the Standard Specifications. Chemical admixtures containing chlorides as CL in excess of one percent by mass of admixture, as determined in conformance with the requirements of California Test 415, shall not be used. If an air-entraining admixture is used, the maximum air content shall be limited to 20 percent. Mineral admixtures shall be used at the Contractor's option.

CLSM Properties:

1. Density shall be between 120 PCF minimum and 145 PCF maximum.
2. Slump shall be as approved by minimum 6 inches up to 10 inches.
3. Compressive strength at 28 days for CLSM shall at least 750 psi.
4. Cement: Cement shall be Type II in accordance with the requirements of ASTM C150.
5. Pozzolan: Pozzolan shall be Type F in accordance with the requirements of ASTM C618.
6. Aggregate: Aggregate shall consist of a well graded mixture of crushed rock, or sand with a maximum size aggregate of 3/8 inch. 100 percent shall pass the 3/8 inch sieve. Not more than 12 percent shall pass the No. 200 sieve. All material shall be free from organic matter and not contain more alkali, sulfates, or salts than the native materials at the site of the work.

Materials for CLSM shall be thoroughly machine-mixed in a pugmill, rotary drum or other approved mixer. Mixing shall continue until the cementitious material and water are thoroughly dispersed throughout the material. Controlled low strength material shall be placed in the work within 3 hours after introduction of the cement to the aggregates, unless retarders are added as approved by the Engineer.

HORIZONTAL AND VERTICAL ALIGNMENT TOLERANCES

The maximum horizontal deviation of the as-installed center of any CLSM GIC element at the ground surface shall not exceed 3 inches from the layout center coordinate, shown on the approved Contractor's submittal.

The measured vertical alignment of CLSM GIC elements shall not deviate in any direction more than two percent from vertical of the measured length.

At the direction of the Engineer, any CLSM GIC element which exceeds the allowable horizontal or vertical alignment tolerances shall be re-installed or supplemented with one or more adjacent or overlapping elements, at no additional cost.

OBSTRUCTIONS

Where obstructions are encountered during CLSM GIC installation, the Contractor shall remove the obstruction or install additional CLSM GIC, at the direction of the Engineer. If such conditions are encountered, the Contractor shall notify the Engineer in writing, and provide all pertinent information relating to the nature, depth, plan location coordinates, expected extent of the obstruction, and proposed procedures to overcome the obstruction. Such construction to overcome an unknown obstruction shall only be performed with the written authorization of the Engineer, and will be paid for as extra work as provided in Section 4-1.030 of the Standard Specifications.

If difficult drilling is encountered due to the presence of naturally occurring cobbles, boulders or dense well-cemented soils or other characteristics of the naturally occurring soils, the Contractor may elect to remove the hindrances, install CLSM GIC by an alternate pattern that avoids or encapsulates the hindrance but that achieves the required CLSM area ratio, subject to the approval of the Engineer.

CONTAINMENT, COLLECTION AND DISPOSAL OF SPOIL

The Contractor shall remove and dispose of all waste materials in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

The Contractor shall take all necessary precautions and implement measures to prevent any spoil material or stockpiled materials from entering storm drain structures, drainage courses and other utility lines or from leaving the site via surface runoff.

MEASUREMENT

CLSM GIC installation will be measured by volume using the cubic yard. The volume shall be determined by multiplying the treated area, by the required depth of the CLSM GIC elements in treatment areas shown on the plans.

PAYMENT

The contract price per cubic yard for CLSM GIC shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in installing CLSM GIC, complete-in-place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for CLSM GIC quality control shall be considered as included in the contract price paid per cubic meter for CLSM GIC volume treated and no separate payment will be allowed therefor.

APPENDIX E
Special Provisions DSM GIC

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10-1.XX DEEP SOIL CEMENT MIXING GROUND IMPROVEMENT COLUMNS

This work shall consist of furnishing and installing soil-cement by deep mixing at the locations shown on the plans.

Deep soil-cement mixing shall be performed by mixing in-situ soil with cement grout to form a uniform mixture, blended thoroughly and evenly by controlled methods. Foundation recommendations are included in the "Information Handout" available to the Contractor as provided for in Section 2-1.03, "Examination of Plans, Specifications, Contract, and Site of Work," of the Standard Specifications.

Attention is directed to "Order of Work 11 and "Obstructions" elsewhere in these special provisions. Attention is directed to Section 7-1.11, "Preservation of Property," of the Standard Specifications regarding damage by soil mixing operations to existing utilities, improvements and facilities.

The foundation information represents existing conditions at the specific boring locations at the time the borings were performed.

Installation of soil-cement by deep mixing auger;" methods shall create soil-cement foundations to improve strength properties of the foundation soils for the Type 1 Retaining Wall and Mechanically Reinforced Earth (MSE) wall above. The Contractor shall confirm that the installed soil- cement achieves the required compressive strength and ensure that it is installed in the design configuration and within the specified limits.

The ground improvement shall extend to the designated depths shown on the plans. Soil-cement mixing equipment shall be capable of advancing through previously installed and cured soil-cement.

DEEP-MIXING

Deep soil-cement mixing shall improve strength properties of foundation soils within the area shown on the plans. Soil-cement elements shall be placed according to the treatment pattern shown on the plans. The average 56-day unconfined compressive strength of soil-cement throughout the depth of each soil-cement element shall be no less than XXXX psi for a minimum XXX inch diameter element. •

The Contractor may provide an alternative plan meeting the minimum performance requirement specified herein. The alternative plan shall be submitted as an attachment to the pre-construction submittal for approval by• the Engineer.

The Contractor shall conduct a Pre-Production (PPC) Program within the limits of soil-cement areas shown on the plans prior to commencing soil-cement mixing to establish production parameters) procedures, and materials to be used during the production phase. The PPC Program shall produce soil-cement mix design and procedures for production mixing based upon the information provided from the PPC Program including: estimated in-situ 28-day and 56-day compressive strength of the soil- cement, cement-grout injection pre sure and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing tools, and mixing times at bottom of the soil-cement element when, there is no vertical movement of the mixing tool, and complete description of all mixing operations.

SUBMITTALS

The submittals and other additional submittals shall conform to, the requirements in Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications and these special provisions, and shall be stamped by a California Registered Professional Civil Engineer except for survey data which shall be stamped by a California Registered Professional Civil Engineer or a California Registered Land Surveyor.

The Contractor shall submit, for review by the Engineer, a statement of the previous work experience similar to that described in these special provisions. The statement shall include at least 5 successful soil cement mixing projects within past three years. This statement shall include a written description of each project, owner's contact name and current phone number, the dates and the extent of the work, the manner of its execution, and any other information that supports the Contractor's ability to carry out the work described in these special provisions.

Pre-construction Submittals

At least four weeks prior• to commencement of any mobilization of deep soil-cement mixing equipment for production mixing, the Contractor shall submit the following to the Engineer:

1. Names and qualifications of the soil-cement mixing personnel and surveyors, including project experience, resumes and other documentation that demonstrate the experience qualifications of the project engineers, each field superintendents, rig operators, and batch plant operators for the deep soil-cement mixing.
2. A list of Contractors, responsible engineers, project descriptions and personnel responsibilities from soil-cement mixing projects completed by the soil-cement mixing Project Engineers and Field Superintendents during the past three years. Contractor's names, addresses and telephone numbers shall be included for these projects representing the individual's comparable experience. The projects listed to demonstrate personnel qualifications shall have employed equipment using similar auger configuration(s) as proposed for the work of this Contract.
3. Data on equipment to be used for the deep soil-cement mixing, proportioning, pumping, injecting and mixing soil-cement as wells as all other ancillary equipment; including equipment capable of remixing non-conforming soil-cement.
4. Spoil containment (sheet piling or other) structures and methods to be used to prevent the migration or leakage of spoil return, disturbed in-situ soils or other spoil material beyond the immediate limits of soil-cement mixing operations. The Contractor shall demonstrate that the containment structure is stable under loads applied by soil-cement, water, in-situ soils, overlying fill materials, construction equipment, other surcharge load and loads applied by the subsequent deep mixing operations. Include also details and methods to be used to collect and dispose of the spoil return and other spoil materials.
5. Sequence and time schedule of all operations including plan location and sequence of all deep soil-cement mixing. The Contractor shall submit a soil-cement element Layout Plan based on the limits shown on the Plans to achieve the required plan area configurations and coverages, necessary overlaps, auger re-penetrations over the depths, and limits shown on the Plans. Plan locations of all proposed soil-cement mixing shall be shown on Layout Plans of suitable scale

to clearly show the details of the layout. Soil-cement elements on the Layout Plans shall be numbered and dimensioned.

6. Cement grout mix design including: cement type, cement source, cement compound composition, water-cement ratio by weight and other pertinent details. Limit water-cement ratio to (1:1 maximum), unless otherwise demonstrated in the Pre-Production (PPC) Program specified in these special provisions.

The results of the PPC Program including, but not limited to estimated in-situ 28-day and 56-day compressive strengths of the soil-cement, cement-grout injection pressure and rates, mixing rotational speeds, penetration and withdrawal rates of the mixing tools, and mixing times at bottom of the soil-cement element when there is no vertical movement of the mixing tools, and complete description of all mixing operations.

1. Description of Quality Control Plan for deep soil-cement mixing including, but not limited to the following:

   a. A detailed description of the Quality Control Plan to be undertaken each day during soil-cement mixing to confirm that the installed soil-cement conforms to the required compressive strengths and unit weights specified, the plan area coverage over the required depths and limits, and required horizontal and vertical alignments.

   b. Details of procedures to obtain soil-cement samples, catalog cuts of the soil-cement sampling device and curing boxes.

   c. Measures to be implemented each day during soil-cement mixing to continuously monitor, modify and control: water-cement ratios, cement-grout injection pressures and quantities, mixing rotational speeds, penetration and withdrawal rates of the mixing equipment, horizontal and vertical alignments of the soil-cement elements, and other related aspects of the soil-cement mixing process.

   d. Example formats of Daily Production Reports conforming to the requirements stated herein.

   e. Names, certifications and licenses of the Laboratory and companies to be responsible for performing quality control tests.

   f. Proposed details and formats of all required tabular and graphical data presentations to be submitted to the Engineer during the course of the Work.

Construction Submittals

Within two working days after the completion of each soil-cement element, submit the following:

2. Deviations of the center coordinates from the Layout Plan to the nearest 3 inches at the top of the element.

3. Vertical alignment profiles shall be submitted in accordance with the frequencies specified to the nearest ½ inch over the measurement length along axes parallel and perpendicular to the line of longitudinal progression; the elevation to the nearest 30 mm of the top and bottom of the element.

4. The Daily Quality Control Report shall" include as a minimum the results of the following QC parameter monitoring for each element:

    a. Rig number.
    b. Type of mixing tool.
    c. Date and time (start and finish) of column construction.
    d. Column number and reference drawing number.
    e. Column diameter.
    f. Column top and bottom elevations.
    g. Grout mix design designation.
    h. Slurry specific gravity measurements.
    i. Description of obstructions, interruptions, or other difficulties during installation and how they were resolved.

5. The Daily Quality Control Reports shall also include the following parameters recorded automatically or manually for each element at intervals no greater than 3 feet and submitted in the form of either tables or figures (as agreed to by the Engineer):

    a. Elevation in meter vs. depths.
    b. Shaft rotation speed in RPMs vs. depths.
    c. Penetration and withdrawal rates in feet per minute vs. depths.
    d. Grout injection rate in gpm vs. depths.
    e. The average quantity of grout in gallons per foot injected per vertical foot of column vs. depth.

6. Batch plant production records, water-cement ratios, cement type, brand, and cement grout injection pressures.

Within one working day after the end of a work shift, submit Daily Production Reports for the work shift to the Engineer. Daily Production Reports shall be filled out, checked for correctness, and signed by the Deep Soil Mixing Contractor's field superintendent and the Contractor's field superintendent at the end of every work shift. The reports shall contain, but not be limited to, the following information:

1. Day, month, year, time of work, shift, beginning and end; names of each superintendent in charge of the Work for both the soil-cement mixing firm and the Contractor; a list of all workers' names associated with each soil-cement mixing machine; and a summary of equipment used during the shift.

2. The location and "neat" limits as shown on the Working Drawings of each completed soil-cement element installed during the work shift and all soil-cement elements

completed to date, on a plan of suitable scale to clearly detail the locations of the elements.

3. Other pertinent observations including, but not limited to, spoil returns, cement grout escapes, ground settlement and/or heave, collapses of the soil-cement element advancement rates of the mixing equipment, and any unusual behavior of any equipment during the soil-cement mixing process and other noteworthy events. In the event of any Contractor claim, the Daily Production Reports shall be the primary documents to substantiate the reasons and basis for the claim.

4. Date, time, plan location, sample designation and elevation, and other details of soil-cement sampling.

5. Summary of any downtime or unproductive time, including start and end time, duration, and reason.

Within five weeks after completion of the deep soil-cement mixing, the Contractor shall submit survey data including:

1. A final Layout Plan of suitable scales showing the locations of each soil-cement element at the top of the element.

2. A tabular summary of layout center coordinates modified to reflect any measured-deviations of each soil-cement element at the top of the element, the elevation of the top and bottom of each element.

3. A compilation of all vertical alignment profiles.

SOIL-CEMENT QUALITY CONTROL

The Contractor shall verify that the installed soil-cement elements conform to these special provisions.

The Contractor shall obtain soil-cement samples, including fluid and core samples, and provide them to the Laboratory for testing specified in these special provisions. The Laboratory shall form, preserve, cure, transport, and test the samples and report the test results to the Engineer. The test results shall be signed and stamped by a California licensed Civil Engineer from the Laboratory. The Contractor shall coordinate sampling activities and Soil-Cement Quality Control with the Engineer and the Laboratory. The Contractor shall supply incidental items, access, inside storage space, curing boxes and electrical power to the curing boxes. The Contractor shall supply molds for use in forming the samples.

Wet Grab Soil-Cement Samples

A minimum of two in-situ sampling rounds shall be performed daily during the PPC Program at locations selected by the Engineer. The Contractor shall obtain sampling rounds at the same soil-cement element, which shall consist of moist-cured soil-cement samples from three depths selected by the Engineer. Separate soil-cement samples shall be retrieved within

60 minutes of the completion of the soil-cement column. The device used to retrieve the wet grab soil-cement samples shall be capable of obtaining a discrete fluid sample of soil-cement at a depth determined by the Engineer and shall be capable of accepting particles not thoroughly mixed that are up to 4 inches in dimension. The sampler shall be lowered empty, air only, to the required depth in the soil-cement element and then opened. Once filled with the soil-cement, the sampler shall be closed to exclude entry or loss of soil-cement and shall be expeditiously raised to ground surface.

Each retrieved soil-cement sample shall be of sufficient volume to produce a minimum of eight full cylinders, 3 inch diameter by 6 inches deep. The Contractor shall separate and retain all soil-cement retrieved from each depth. The Contractor shall then cut all retrieved particles of soil larger than 1 inch into smaller pieces that will pass a 1 inch sieve, and then immediately form the six cylinders with material passing through a 1 inch sieve, including particles of soil that were cut up.

Soil-cement samples shall be formed, cured and preserved in accordance with AASHTO T23 and protected from freezing and extreme weather conditions which could have deleterious effect, at all times.

The Contractor may obtain additional samples and perform additional testing for his or her own information, at the Contractor's expense.

If the Contractor cannot obtain all of the required wet grab samples of the soil-cement in the designated soil-cement element, the Contractor shall obtain a full round of wet grab samples from the next soil-cement element installed by that rig. Continue taking wet grab samples in subsequent soil-cement elements until a full round is obtained. From each sampling round, one cylinder from each sampling depth shall be used to determine the cement factor based on the cement content determined in accordance with AASHTO Specification T 144 (or ASTM D806). Unless otherwise directed by the Engineer, for each soil-cement element, the Laboratory shall test every one cylinder at 7 days, 14 days, 28 days, and 56 days for unconfined compressive strength in accordance with ASTM D2166. The Laboratory shall submit the laboratory test results to the Engineer in accordance with these special provisions. Submit 3 cylinders from each sampled depth for each soil-cement element to the Engineer.

Wet Grab Soil Cement Sampling and Testing Schedule

	Frequency	Quantity	Notes
Number of Sampling Rounds (soil-cement elements)	Per Day	2	At soil-cement determined by the engineer
Number of wet grab soil-cement samples	Per soil-cement element	2	At depths determined by the engineer
Number of Cylinders	Per wet grab soil-cement sample	8	3 inch diameter by 6 inch high cylinder
Total Cylinders	Per sampling round	16	
Number of cylinders for test of cement factor and cement content	Per sampling round	2	At each of the 2 sampling depths
Number of cylinders for unconfined compressive strength test	Per sampling round	8	Test at 7 days, 14 days, 28 days and 56 days for each depth
Number of cylinders shall be submitted to the Engineer	Per sampling round	6	3 at each of the 2 sampling depths

Core Samples

Core samples shall be taken by the Contractor for the purpose of obtaining and testing in-situ samples to evaluate compressive strength, unit weight, vertical alignment, and composition of the soil-cement. Coring of soil-cement shall be performed in accordance with AASTHO T225 and the requirements stated herein.

The Contractor shall take precautions such that vibration from the soil-cement work will not cause undue interference or damage to neighboring properties or buildings. If, in the opinion of the Engineer, ground vibrations, movements or noise from soil-cement mixing work adversely affect the project and neighboring properties and buildings, the Engineer may direct the Contractor to use alternative methods or procedures of soil- cement mixing construction. Alternate methods shall be subject to the prior approval of the Engineer but shall remain the responsibility of the Contractor.

CEMENT GROUT

Cement shall conform to AASHTO M85, Type II, and shall be as specified in the submitted cement grout mix design approved by the Engineer. Slag cement or fly ash shall not be allowed without the approval of the Engineer and submission of test data by the Contractor, which confirms no deleterious impact to the soil-cement.

Measure, handle, transport and store bulk cement in accordance with the manufacturer's recommendations. Cement packaged in cloth or paper bags shall be sealed within plastic or rubber vapor barriers.

Cement shall be stored to prevent damage by moisture. Material that has become caked due to moisture absorption shall not be used. Bags of cement shall be stacked no more than ten bags high to avoid compaction. Cement containing lumps or foreign matter of a nature and in amounts that may be deleterious to the grouting operations shall not be used. Tricalcium aluminate content shall not exceed 8 percent.

Water used in soil-cement and cement grout mixing and all other applications shall be potable, clean, of neutral pH and free from sewage, oil, acid, alkali, salts, organic materials and other contamination.

Cement grout shall be a stable homogeneous mixture of cement and water. The ratios of the components shall be included in the pre-construction submittal. Cement grout composition shall not change throughout the soil-cement mixing unless requested in writing by the Contractor and approved in writing by the Engineer.

SOIL-CEMENT

Soil-cement shall be a stable, uniform mixture of cement grout and the in-situ soils. The properties listed below shall be verified in conformance with the approved Soil-cement Quality submittal.

The ratios of various soil-cement components shall be proposed by the Contractor or as approved in the pre-construction submittal subject to review by .the Engineer. The Contractor shall adjust the mix design throughout the course of the Work in order to achieve the required compressive strengths and total unit weights. After final grouting of the soil-cement element, the Contractor shall obtain samples of in-situ soil-cement samples in accordance with the locations and frequencies in "Soil- Cement Quality Control" of these special provisions.

Water, debris or spoil material shall not be dumped or otherwise allowed to enter the soil-cement element.

Any soil cement element which exhibits partial or total instability, shall be backfilled with cement grout and be remixed full depth, at the Contractor's expense. Among other possibilities signs of instability which could be observed during construction could include excess flow of grout from the hole, settlement of ground, and squeezing in on the drill stem.

Horizontal and Vertical Alignment Tolerances

The maximum horizontal deviation of the as-installed center of any soil-cement element at the ground surface shall not exceed inches from the layout center coordinate, shown on the approved Contractor's submittal.

The measured vertical alignment of soil-cement elements shall not deviate in any direction more than two percent from vertical of the measured length, or be inclined more than two percent from vertical anywhere along the measured length.

At the direction of the Engineer any soil-cement elements which exceed the allowable horizontal or vertical alignment tolerances shall be re-mixed or supplemented with one or more adjacent or overlapping elements, at no additional cost to Caltrans.

Obstructions

Where obstructions are encountered during deep soil-cement mixing, the Contractor shall remove the obstruction or install additional soil-cement to encapsulate the obstruction, at the direction of the Engineer. If such conditions are encountered, the Contractor shall notify the Engineer in writing, and provide all pertinent information relating to the nature, depth, plan location coordinates, expected extent of the obstruction, and proposed procedures to overcome the obstruction. Such construction to overcome an unknown obstruction shall only be performed with the written authorization of the Engineer, and will be paid for as extra work as provided in Section 4-1.030 of the Standard Specifications.

If difficult drilling is encountered due to the presence of naturally occurring cobbles, boulders or dense well-cemented soils or other characteristics of the naturally occurring soils, the Contractor may elect to remove the hindrances, install soil cement by an alternate soil-cement mixing pattern that avoids or encapsulates the hindrance but that achieves the required soil-cement area ratio, subject to the approval of the Engineer.

Containment, Collection and Disposal of Spoil Return

At all times during and at completion of soil-cement mixing operations, the site shall be maintained cleared of all debris and water. Spoil return and other spoil material shall be piped or channeled to holding ponds, tanks, or other retention structures or facilities. The Contractor shall remove and dispose of all waste materials in accordance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications.

All soil-cement collection, containment and disposal methods shall be thoroughly explained and shown on Working Drawings in the Contractor's submittals to the Engineer prior to the start of deep soil-cement mixing. The Contractor shall incorporate and be responsible for all sedimentation and turbidity control measures required by applicable federal, state and local regulations.

The Contractor shall take all necessary precautions and implement measures to prevent any spoil return, other spoil material or stockpiled materials from entering storm drain •structures, drainage courses and other utility lines or from leaving the site via surface runoff. The Contractor shall prevent the migration of spoil return, spoil material or stockpiled materials into any surface water body, beyond the immediate limits of soil-cement mixing operations.

MEASUREMENT

Soil-cement will be measured by the cubic yard. The volume shall be determined by multiplying the treated area by the required depth of the soil-cement elements. The quantity of soil-cement to be paid for shall be the quantity of soil-cement furnished and installed within the

soil-cement treatment areas shown on the plans. Areas of overlapping and overdrilling will not be measured more than once.

PAYMENT

The contract price per cubic meter for soil-cement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all. the work involved in mixing soil-cement, complete-in-place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

Full compensation for soil-cement quality control shall be considered as included in the contract price paid per cubic yard for soil-cement and no separate payment will be allowed therefor.

Full compensation for containment and disposal of spoils shall be considered as included in the contract price paid per cubic yard for soil-cement and no separate payment will be allowed therefor.

APPENDIX E

NORCAL GEOPHYSICAL CONSULTANTS, INC.

November 14, 2012

Parikh Consultants
2360 Qume Drive
Suite A
San Jose, California 95131

Subject: Seismic Refraction Survey
I-80/I-680/SR-12 Interchange Project
Solano County, California
NORCAL Job # 12-426.20

Attention: Mr. Frank Wang

Dear Mr. Wang:

This report presents the findings of a seismic refraction (SR) survey performed by NORCAL Geophysical Consultants, Inc. for the planned freeway interchange improvement in Solano County, CA. The survey was performed on October 2nd, 2012 by NORCAL Professional Geophysicist David T. Hagin PGp 1033 and Senior Geophysical Technician Travis W Black. Logistical support was provided by Jim Baker of Parikh Consultants (Parikh).

1.0 SITE DESCRIPTION AND PURPOSE

This investigation is part of the Solano Transportation Authority I-80/I-680/SR-12 Interchange Project. The site is in the location of the planned westbound I-80 off-ramp to westbound SR-12 (Plate 1). The new alignment will take the off-ramp farther to the north than the present location, requiring the excavation of a portion of the hillside. The site can be characterized as sloping woodland terrain. Rock outcroppings of Sonoma Volcanics are visible in portions of the study area as well as at a nearby abandoned rock quarry.

The purpose of the SR survey was to obtain seismic refraction compressional P-wave velocity data within the upper 50 feet to aid in assessing subsurface geologic conditions. We understand that this information will be used to help evaluate both the excavatability (rippability) of the rock as well as the maximum safe slope for construction.

2.0 METHODOLOGY

The SR method is used to determine the compressional acoustic velocity of subsurface materials. The seismic velocity of fill, sediments, and rock are dependent on physical properties such as compaction, density, hardness, and induration. However, other factors such as bedding, fracturing, and saturation also affect seismic velocity. Typically, low velocities are indicative of loose, dry soils, poorly compacted fill material, poorly to semi-consolidated sediments, or alternatively, deeply weathered and/or highly fractured rock. Moderate velocities usually indicate dense and highly compacted or saturated sedimentary deposits or fill, and/or

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www.norcalgeophysical.com

moderately weathered and fractured rock. High velocities typically represent slightly weathered to unweathered (fresh) rock with little fracturing. A more detailed description of the SR methodology is provided in Appendix A.

3.0 FIELD SURVEY AND DATA PROCESSING

3.1 Data Acquisition

The geophysical survey entailed the acquisition of 2 SR lines, as shown on Plate 1. Each line consisted of a single geophone spread comprised of 24 geophones and 5 shot points distributed in a collinear array; geophones were coupled to the ground surface at 10 foot intervals. For each spread, the two end shot points were located one station beyond each end of the geophone spread and the remaining shot points were evenly spaced within the spread, yielding a total length of 250 feet for each line.

3.2 Instrumentation

The SR data were recorded using a Geometrics Geode, 24-bit digital seismic recording system and Oyo Geospace digital-grade geophones with a natural frequency of 10 Hz. We produced seismic energy at each shot point by striking an aluminum plate placed on the ground surface with a 16-pound sledge hammer or a 200-pound accelerated weight drop (AWD-200) where accessible. An accelerometer attached to the hammer transmitted a triggering pulse to the seismograph to begin recording each time the plate was struck. Several strikes were performed and stacked at each shot point to ensure an acceptable signal to noise ratio. The locations and elevations of the geophones and shot-points were determined using GPS referenced to the California State Plane and an established sea level datum.

3.3 Data Processing

The refraction data were processed in-house using SeisImager, specialized software developed by Geometrics, Inc. of San Jose, California. We then used the program Surfer 10 by Golden Software to graphically illustrate the subsurface distribution of seismic velocities. This consisted of generating a color-contoured seismic velocity cross-section (profile) for each seismic line.

4.0 RESULTS AND INTERPRETATION

The results of the seismic refraction survey are illustrated by the seismic velocity profiles shown on Plate 2 and Plate 3. On each profile the vertical axis represents elevation (above mean sea level (MSL)) and the horizontal axis represents survey stationing (distance along the line). The profiles show the ground surface and color contours representing the distribution of seismic velocity values according to the color scale shown at the bottom of the plate.

4.1 Seismic Velocities

SR Line 1 shows a near-surface moderate-velocity (4,500 feet per second (ft/s)) zone between station 90 and station 190 that correlates well to exposed outcrop in the dirt roadway in that location. The geologic map provided by Parikh shows that the low-velocity (<3,000 ft/s) zone apparent from station 0 to station 80 correlates well to a change in the geologic formations near station 80. A thin near-surface lower-velocity zone is also apparent between station 190 and station 250, likely representing a thin soil horizon where the topography flattens. At depths of approximately 30 feet seismic velocities increase to a maximum value near 5,500 ft/s. The maximum depth of exploration for Line 1 is approximately 50 feet. It is our interpretation that velocity values greater than about 4,000 ft /s probably represent weathered and fractured bedrock.

SR Line 2 shows a relatively thick layer of low-velocity material from ground surface to depths of 15 to 20 feet. The thicker low-velocity zone on Line 2 suggests a thicker layer of soil in this location. As the area is a topographic saddle where sediment tends to accumulate, these results are anticipated. Below this layer, velocities gradually increase with depth to a maximum value greater than 5,000 ft/s at depths of 25 to 30 feet. The maximum depth of exploration for this line is approximately 50 feet below ground surface. We interpret that velocity values greater than about 4,000 ft /s probably represent weathered and fractured bedrock.

4.2 Rippability

Seismic velocity charts relating seismic velocity to excavation characteristics have been developed from field tests by others. These charts list the seismic velocity of various types of rock and their relative ease of excavation using different types of rippers. Caterpillar Tractor Company publishes a performance manual that lists ripper performance charts for the D8R, D9R, D10T and D11T tractors. Larger equipment has greater ripping capabilities. The following information in Table A was obtained from a performance chart for a D8R ripper (Caterpillar Performance Handbook, Edition 36, April 2006).

Table A: CAT D8R Ripper Performance in Volcanic Rock

PERFORMANCE	VELOCITY RANGE (FT/S)
Rippable	Less than 6,300
Marginally Rippable	6,300 to 8,000
Non-Rippable	Greater than 8,000

We compared the measured seismic values to the various ranges listed in the Caterpillar Performance Handbook. Based on these comparisons all of the measured seismic velocities within the upper 50 feet are within the rippable range of values for moderate sized equipment.

5.0 LIMITATIONS

This information should only be used as a general guide to rippability as many other factors also contribute to the evaluation of rock rippability. These factors include rock jointing and fracture

patterns, the experience of the equipment operator, and the equipment and excavation methods selected. Also, the computed velocities measured along each line are an average; therefore, there may be localized zones where the velocities may be higher or lower than indicated. Since the accuracy of our findings is subject to these limitations, it should be noted that subsurface conditions may vary from those depicted in the final results. A more detailed discussion of the limitations with regard to the seismic refraction method is presented in Appendix A.

It should also be noted that the seismic refraction technique is based on the assumption that seismic velocity increases with depth. Any layers representing a decrease in velocity with depth, otherwise known as a velocity inversion, will not be defined and will result in the over-estimation of the depth of deeper, higher velocity layers. In addition, relatively thin layers might not be individually resolved and might, instead, be lumped together with other layers. Hard and soft zones within a given seismic layer will tend to be averaged into the velocity of that layer. Finally, there is not necessarily a one-to-one relationship between lithologic layers and seismic layers. It is entirely possible that two different types of material could have the same seismic velocity. Alternatively, a change in velocity can occur within a single lithologic unit.

6.0 STANDARD OF CARE

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the standard of care ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate having the opportunity to provide you with this information.

Respectfully,

NORCAL Geophysical Consultants, Inc.

David T. Hagin
Professional Geophysicist PGp 1033

DTH/KGB/tt
Enclosures: Plates 1 through 3
Appendix A - Seismic Refraction Survey

Appendix A

GEOPHYSICAL METHODOLOGY

Appendix A

SEISMIC REFRACTION

Methodology

The seismic refraction (SR) method provides information regarding the seismic velocity structure of the subsurface. An impulsive (mechanical or explosive) source is used to produce compressional (p) wave seismic energy. The p-waves propagate into the earth and are refracted along interfaces representing an increase in velocity. A portion of the p-wave energy is refracted back to the surface where it is detected by sensors (geophones) that are coupled to the ground surface in a collinear array (spread). The detected signals are recorded on a multi-channel seismograph and are analyzed to determine the shot point-to-geophone travel times. These data can be used along with the corresponding shot point-to-geophone distances to determine the depth, thickness, and velocity of subsurface seismic layers.

The seismic refraction technique is based on several assumptions. Paramount among these are that seismic velocity increases with depth. In cases where this assumption is invalid, the accuracy of the technique decreases. For example, if a low velocity layer occurs between two layers of higher velocity, the low velocity layer will not be detected and the depth to the underlying high velocity layer will be erroneously large.

Instrumentation

Data acquisition is initiated along each SR line by producing seismic energy using either an explosive or mechanical source. Explosive sources are typically buried from 2 to 4 feet beneath the ground surface and are detonated by electric blasting caps. The detonation is initiated by a blaster that is connected to a seismograph. Mechanical sources produce energy by impacting a metal strike plate on the ground surface with either a 12-16 pound sledge hammer or an elastic-band or hydraulically driven weight drop.

The resulting seismic wave forms are recorded using a Geometrics 24-channel digital, engineering seismograph and Mark Products geophones with a natural frequency of 8 or 10 Hz. The data may be recorded on hard copy records (seismograms) as well as on magnetic or optical media for future processing. The seismograms can be analyzed to determine the amount of time it takes for a p-wave to travel from a given shot point to each geophone in a spread.

Data Analysis

The seismic data are downloaded to a computer and processed using software by Optim. Picker is used to define the shot point to geophone travel times, and geophone geometry, including elevations as picked from topography maps, hand-level techniques and/or a global positioning system (GPS). Models are created from this information through inversion processing using a non-linear forward modeling optimization technique

called adaptive simulated annealing. This software employs an algorithm known as the Monte Carlo Computational Algorithm that relies on random sampling to achieve a stable model.

The final output consists of a color coded seismic velocity cross-section showing the surface topography, the elevation and configuration of the seismic velocity layers or zones and the corresponding velocity of each colored layer or zone.

Rippability

Rippability (excavatibility) is dependent on the physical condition of the rock masses to be excavated. In addition to the rock type and degree of weathering, structural features in the rock, such as bedding planes, cleavage planes, joints, fractures and shear zones also influence rippability. Rock masses tend to be more easily ripped if they have well defined, closely-spaced fractures, joints, or other planes of weakness. Massive rock bodies which lack discontinuities may exhibit marginal rippability, even where partially weathered, and may require blasting for efficient removal. The association between the rippability of various earth materials and their seismic velocity is most recently detailed in the Caterpillar Performance Handbook, Edition 36, October 2006.

The charts of ripper performance should be considered as being only one indicator of rippability. Ripper tooth penetration is usually the key to successful ripping, regardless of seismic velocity. This is particularly true in finer-grained, homogeneous materials and in tightly cemented formations. Ripping success may ultimately be determined by the operator finding the proper combination of factors, such as: number of shanks used, length and depth of shank, tooth angle and direction, and use of throttle. Although low seismic velocities in any rock type indicate probable rippability, if the fractures, bedding and/or joints do not allow tooth penetration, the material may not be ripped efficiently. In some cases, pre-blasting may be required to induce sufficient fracturing to allow tooth penetration for excavation.

Limitations

There are limitations unique to the SR method. The basic physics involved in refraction of acoustic waves dictates certain physical parameters for any survey. For example, if a layer has a lower velocity than that of the overlying layer, the low velocity layer will be invisible or improperly resolved. Furthermore, the computed depth of the next layer down will be erroneously large. Also, a velocity layer may simply be too thin to be detected. Due to these and other limitations inherent to the SR method, the results of the SR survey should be considered only as approximations of the subsurface conditions. The actual conditions may vary locally.

Additionally, there is inherent ambiguity involved with inversion processing. Models created through the inversion process are non-unique, and therefore must be evaluated carefully based upon site geology and data values.

VICINITY MAP

SCALE
0 30 60 120
(1 inch = 60 feet)

LEGEND	
	SEISMIC REFRACTION LINE

NOTE: TOPOGRAPHIC BASE MAP PROVIDED BY PARIKH CONSULTANTS

NORCAL

SITE LOCATION MAP
SEISMIC REFRACTION SURVEY
I-80/I-680/SR-12 INTERCHANGE PROJECT

LOCATION: SOLANO COUNTY, CALIFORNIA

CLIENT: PARIKH CONSULTANTS

NORCAL GEOPHYSICAL CONSULTANTS INC.

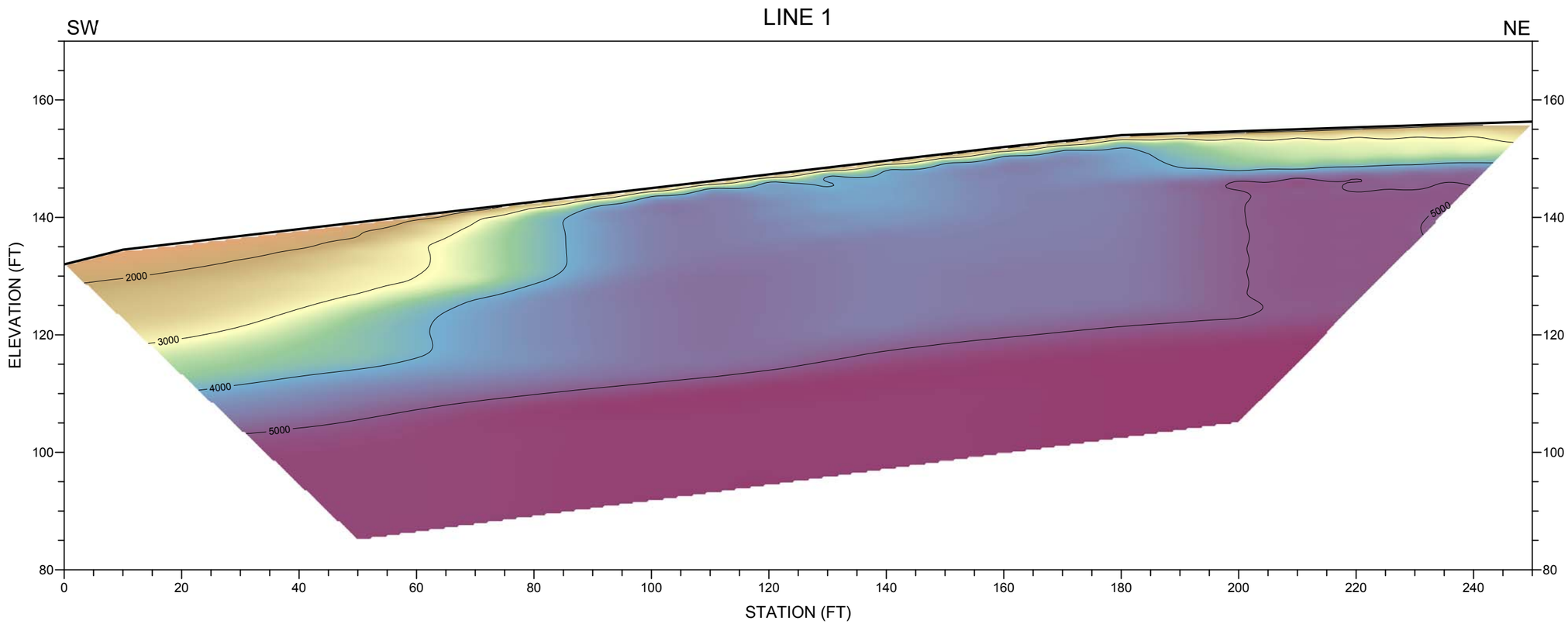
JOB #: 12-462.20

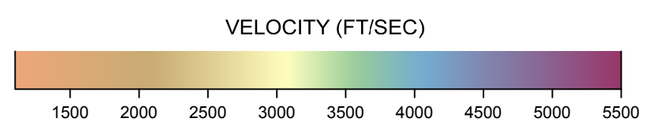
DATE: NOV. 2012

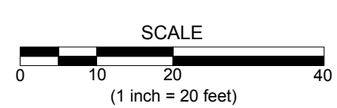
DRAWN BY: G.RANDALL

APPROVED BY: DTH

PLATE 1







NORCAL

SEISMIC REFRACTION PROFILE
LINE 1
I-80/I-680/SR-12 INTERCHANGE PROJECT

LOCATION: SOLANO COUNTY, CALIFORNIA

CLIENT: PARIKH CONSULTANTS

JOB #: 12-462.20

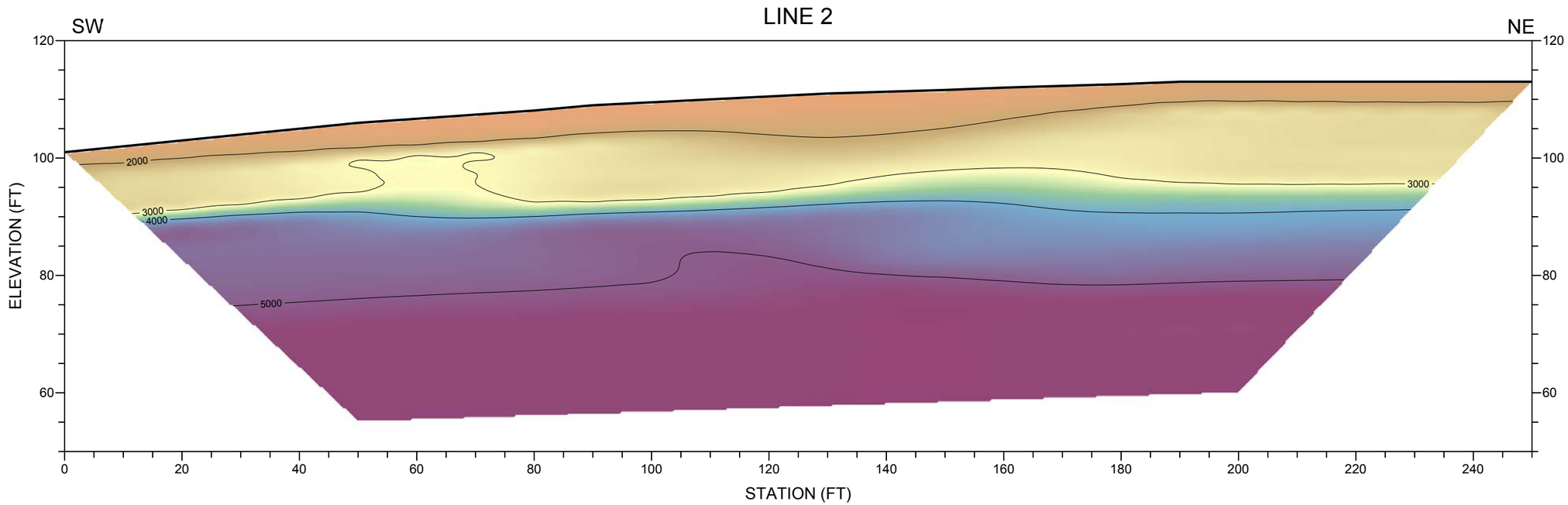
NORCAL GEOPHYSICAL CONSULTANTS INC.

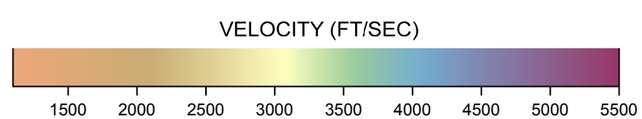
DATE: NOV. 2012

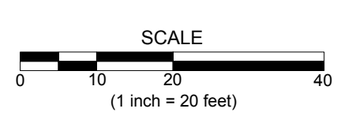
DRAWN BY: G.RANDALL

APPROVED BY: DTH

PLATE
2







NORCAL

SEISMIC REFRACTION PROFILE
LINE 2
I-80/I-680/SR-12 INTERCHANGE PROJECT

LOCATION: SOLANO COUNTY, CALIFORNIA

CLIENT: PARIKH CONSULTANTS

JOB #: 12-462.20

NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: NOV. 2012

DRAWN BY: G.RANDALL

APPROVED BY: DTH

PLATE
3

APPENDIX F

PARIKH
Practicing in the Geosciences

Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

Mark Thomas & Co., Inc.
7300 Folsom Blvd., Suite 203
Sacramento, CA 95826

December 28, 2012
Job No.: 2009-130-GDR

Attn.: Mr. James Pangburn

Sub: Response to Caltrans Review Comments
I-680/I-80/ SR 12 Interchange, 04-SOL/I-80, I-680
Solano County, California

Ref: Caltrans Review Comments (dated September 1, 2011)

Dear Mr. Pangburn:

We have received the review comments made by Mr. Leonardo Deleon of Caltrans on the above subject report. This letter documents our response to these comments, which have been incorporated in the GDMR.

Comment: Table 13A - Option 1, recalculate all the FDHMA for the R-Value = 5. It appears that the HMA sections are too thick.

Response: The thickness of FDHMA was calculated based on R-value of 5 for the subgrade. The additional 1-foot-thick ASB was added to provide extra over-burden, and the ASB was not considered when estimating the pavement section. The table will be revised to avoid confusion. The calculation is attached in Appendix C of the GDMR.

Comment: Table 13A - Option 2, with a TI=7 and an R-value = 5 the HMA section should be 0.4' and not 0.35' with the same AB and AS thickness.

Response: Option 2 consists of HMA over AB. The additional 0.5-foot-thick ASB was added to provide extra overburden and was not considered when estimating the pavement section. The table has been updated to avoid confusion. The calculation is attached in Appendix C of the GDMR.

Comment: Table 13A - Option 2, for R-value = 15, which column are for the subbase or base material be? Is this for AB or AS?

Response: Option 2 is HMA over AB. The table has been revised to avoid confusion.

Comment: Table 13B - Option 2, AB maximum thickness should be 2 feet. Revise the pavement section with 0.60' HMA and 2.25' of AB.

Response: Concur. The revised pavement section is 0.70' HMA over 2.00' AB.

Comment: Table 13B - Option 4, for TI= 12.5 and R-value = 5, the HMA thickness appears to be short. Our ·calculation indicates that it should be 0.70' instead of 0.60'. Recalculate the pavement section

Response: The section was calculated by assuming a gravel factor of 1.2 for LTS based on UCS=300 psi. Also, since there is no R-value for the LCB, 40% of the GE above LTS will be used for determining the thickness of HMA. This approach is consistent with the Flexible Pavement Design Examples - New Construction by Caltrans (dated September 28, 2006). The calculation is attached in Appendix C of the GDMR.

Comment: Table 13C - Green Valley Road Ramps· and Green Valley Road, provide a Rigid Pavement Section because the LCCA shows that these roads are supposed to be designed as PCCP.

Response: Recommendations for rigid pavement has been provided in the GDMR.

Comment: Add in the Table Notes that the FDHMA section are to be used for temporary pavement only and not for final pavement.

Response: The note has been added.

Very truly yours,
PARIKH CONSULTANTS, INC.

Frank Y. Wang, P.E, G.E. 2862
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

MATERIALS FILE

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: RONI F. BOUKHALIL
District 04 Branch Chief
Design North

Attention: Naga Adibhatla

Date: September 1, 2011

File: 04-SOL-12, 80 PM 2.5/11.3/12.9
EA 04-0A5340
IC Reconstruction & Modifications
GDMR

From: LEONARDO DELEON
Materials Design Engineer
Engineering Services I - Materials A

Concurred by: TINU MISHRA, P.E.
District Materials Engineer
District Branch Chief - Materials A

Subject: Oversight Review of Geotechnical Design and Materials Report (GDMR)

This is in response to your circulation routing form dated July 26, 2011 requesting our review comments on the GDMR submitted by Parikh Consultants, Inc. for the I-80/I-680/SR 12 Interchange Modification – WB I-80 Connector to WB SR 12W Project in the Cities of Fairfield and Suisun, Solano County.

Our review comments on the GDMR are below:

- Table 13A – Option 1, recalculate all the FDHMA for the R-Value = 5. It appears that the HMA sections are too thick.
- Table 13A – Option 2, with a TI=7 and an R-value = 5 the HMA section should be 0.4' and not 0.35' with the same AB and AS thickness.
- Table 13A – Option 2, for R-value = 15, which column are for the subbase or base material be? Is this for AB or AS?
- Table 13B – Option 2, AB maximum thickness should be 2 feet. Revise the pavement section with 0.60' HMA and 2.25' of AB.
- Table 13B – Option 4, for TI = 12.5 and R-value = 5, the HMA thickness appears to be short. Our calculation indicates that it should be 0.70' instead of 0.60'. Recalculate the pavement section.
- Table 13C – Green Valley Road Ramps and Green Valley Road, provide a Rigid Pavement Section because the LCCA shows that these roads are supposed to be designed as PCCP.
- Add in the Table Notes that the FDHMA section are to be used for temporary pavement only and not for final pavement.

If you have any questions, please call Leonardo Deleon at (510) 622-5444.

c: Daily File, Route File, Tinu Mishra
L. Deleon/ld/Sol 80/680/12 IC Project Report GDMR Review

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Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

Mark Thomas & Co., Inc.
7300 Folsom Blvd., Suite 203
Sacramento, CA 95826

December 3, 2012
Job No.: 2009-130-GDR

Attn.: Mr. James Pangburn

Sub: Response to Caltrans Review Comments
I-680/I-80/ SR 12 Interchange, 04-SOL/I-80, I-680
Solano County, California

Ref: Caltrans Review Comments (dated October 29, 2012)

Dear Mr. Pangburn:

We have received the review comments made by Caltrans on the above subject report. This letter documents our response to these comments, which have been incorporated in the GDMR.

Comment by Mr. Suja Ahmed (dated October 29, 2012)

Comment: Page 41, Design Assumptions and Strength Parameters of different MSE walls from GDMR should be included in the plan. Discuss this issue with the Designer.

Response: This was conveyed to the structural engineer. The plans have been revised and the strength parameters have been included.

Comment: Page 40, Table 9 (Pile Data Table) - The Nominal Resistance for Tension in GDMR does not match with Design Plan (RW 10P - Sheet 22 of 40 - Rev. 09/12/12) - Check with the Designer.

Response: The foundation design has been updated. This was also conveyed to the structural engineer, and the plans have been revised accordingly.

Comment by Mr. Rifaat Nashed (dated October 29, 2012)

Comment: The groundwater elevation at borehole No. A-09-005 is -2.1 ft not -9.9. Please correct.

Response: The text has been revised accordingly.

Comment: At Green Valley Road OC (RW05 thru RW09), the groundwater depth ranges between 12.0 ft and 26.0 ft and not 11.5 and 33.8 ft. Please correct.

Response: The text has been revised accordingly.

Comment: There was a conference call on October 17, 2012 regarding the pile types, pile thickness etc. drivability/constructability issues was the main topic of discussion. Designer (Mark Thomas & Co. & Parikh Consultant), Caltrans Structure

Construction, Structure Design, Geotechnical Design-West and District Design-Nmth were among the participants. No decision was made at that time. Designer may consider different pile types or larger thickness piles (Class 90 Alt. W) for RW-10. Please provide us a copy of new Plan and Foundation Report if such change occurs for our review and comments.

Response: For Retaining Wall No. 10, the foundation design has been updated during the final design phase, and the pile type was changed to Caltrans Standard Class 140 Alt. "W" with greater wall thickness.

Please be advised that we are performing a professional service and that our conclusions are professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

Very truly yours,
PARIKH CONSULTANTS, INC.

Frank Y. Wang, P.E, G.E. 2862
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. RONI BOUKHALIL
District Branch Chief
Design North Counties

Date: October 29, 2012

Attention: Naga Adibhatla

File: 04-SOL-80/680 PM 12.2/12.9
04- 0A5341
E-FIS: 0400021131
I-680/80/SR 12 Interchange

SA

From: SUJA AHMED
Transportation Engineer
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

H. Nikoui
HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

Subject : Review of GDMR for I-680/I-80/SR 12 Interchange

We have reviewed the above-mentioned GDMR prepared by Parikh Consultants, Inc dated on September 12, 2012. The following are our comments:

- Page 41- Design Assumptions and Strength Parameters of different MSE walls from GDMR should be included in the plan. Discuss this issue with the Designer.
- Page-40, Table 9 (Pile Data Table) - The Nominal Resistance for Tension in GDMR does not match with Design Plan (RW 10P- Sheet 22 of 40- Rev. 09/12/12) - Check with the Designer.

<u>Comments from Geologist (Rifaat Nashed)</u>

Please see attached sheet.

There was a conference call on October 17, 2012 regarding the pile types, pile thickness etc. drivability/constructability issues was the main topic of discussion. Designer (Mark Thomas & Co. & Parikh Consultant), Caltrans Structure Construction, Structure Design, Geotechnical Design-West and District Design-North were among the participants. No decision was made at that time. Designer may consider different pile types or larger thickness piles (Class 90 Alt. W) for RW-10. Please provide us a copy of new Plan and Foundation Report if such change occurs for our review and comments.

If you have any questions or need additional information, please call me at 510-286-4752, Rifaat Nashed at 510-622-1773, Sunny Yang at 510-286-4808 (Seismic) or Hooshmand Nikoui, Branch Chief at 510-286-4811.

Attachment:

c: TPokrywka, HNikoui, Rifaat Nashed, SAhmed, Daily File, Route File

SAhmed/mm

Agency:	Caltrans	**Responded By:**	
Review Unit:	Geotechnical Services	**Date Responded:**	
Comments By:	RIFAAT NASHED	**JRT Meeting Date:**	
Date Reviewed:	10 - 23- 2012		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments on Geotechnical Design & Materials Report**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	GDMR	*GDMR dated September, 2012*				
1	Page (6) **Table 2 EXLORATION PROGRAM**	Our comments dated June 4, 2012 have been adequately addressed.				
2	Page (14) Section **7.3.2 Groundwater & Table 3**	1- The groundwater elevation at borehole No. A-09-005 is -2.1ft not -9.9. Please correct. 2- At Green Valley Road OC (RW05 thru RW09), the groundwater depth ranges between 12.0 ft and 26.0 ft and not 11.5 and 33.8 ft. Please correct.				
3	**APPENDIX A**	Our comments dated June 4, 2012 have been adequately addressed.				

Agency:	Caltrans	**Responded By:**	
Review Unit:	Geotechnical Services	**Date Responded:**	
Comments By:	RIFAAT NASHED	**JRT Meeting Date:**	
Date Reviewed:	10 - 23- 2012		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments on Geotechnical Design & Materials Report**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.

I-80/I-680/SR12 Interchange: WB I-80 Connector to WB SR12W Project

Agency:	Caltrans	**Responded By:**	
Review Unit:	Geotechncial	**Date Responded:**	
Comments By:	Suja Ahmed		
Date Reviewed:	October 29, 2012		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 100% PS&E plans**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-STA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
1.		RW 10P – Sheet 22 of 40 (Rev. 09/12/12), Pile Data Table – Nominal Resistance for Tension should be match with latest GDMR (09/12/12).	The design of the Retaining Wall No. 10 has been updated based on the latest foundation design data, and the Pile Data Table has been revised.	
2.		Design Assumptions and Strength Parameters of different MSE walls (Page 41 of GDMR, dated 09/12/12) should be included in the plan.	This has been conveyed to the structural engineer.	
3.		RW-6 (Page 10 of 40), Typical Section of the Type-1 Wall – Geofabric layer is not shown (check the latest GDMR dated 09/12/12).	This has been conveyed to the structural engineer.	
4.		There was a conference call on October 17, 2012 regarding the pile types, pile thickness, etc. drivability/constructability issues was the main topic of discussion. Designer (Mark Thomas & Company and Parikh Consultants), Caltrans Structure Construction, Structure Design, Geotechnical Design-West and District Design-North were among the participants. No decision was made at that time. Designer may consider different pile types or larger thickness piles (Class 90 Alt. W) for RW-10. Please provide us a copy of new Plan and Foundation Report if such change occurs for our review and comments.	The design of the Retaining Wall No. 10 has been updated based on the latest foundation design data. The pile type has been revised to Caltrans Standard Class 140 Alt. “W”, which has greater wall thickness compared to the Class 90 piles.	

Agency:	Caltrans	**Responded By:**	Parikh Consulting
Review Unit:	Geotechnical	**Date Responded:**	9/21/2012
Comments By:	Suja Ahmed/Rifaat Nashed		
Date Reviewed:	June 13, 2012/June 4, 2012		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: Submittal: **Comments to 65% PS&E plans (GDMR Dated May 3, 2012)**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-STA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
1.	GDMR	Page 5, Section 5.1, 3rd Paragraph says 48 borings were drilled ----- then 5th paragraph mentioned about 35 borings. Re-check and fix this discrepancy.	The texts have been revised to 20 bulk samples and 37 borings.	
2.	GDMR	Page 6, Table 2 shows 4 CPT locations. Page 5 (6th Paragraph mentioned about 6 CPT). Update Table 2 of Page 6.	The two missing CPTs have been placed in Table 2.	
3.	GDMR	Page 11, 5th Paragraph (SEction 7.2) – At the planned locations of these walls -----. Is there any wall in this location (Sta. 61+00 and 75+00 "JW Line")?	A cantilever retaining wall was planned in the previous design phase and has been removed from the project scope. The text has been revised.	
4.	GDMR	Page 33, 1st Paragraph – The over-excavation recommendation of RW-1 is not shown properly (compacted AB or LCB with Geofabric underneath) in latest plan (Sheet 2 of 39, Rev. Dated April 1, 2012). Discuss this issue with the Designer).	This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.	
5.	GDMR	Page 35, 5th Paragraph of GDMR dated May 3, 2012 – The over-excavation recommendation of RW-5 is not shown properly (compacted AB or LCB with Geofabric underneath) in latest plan (sheet 9 of 39, Rev. Dated 04-01-2012).	This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.	
6.	GDMR	Page 36, 3rd Paragraph and Page 37, 1st Paragraph of GDMR dated May 3, 2012 – The over-excavation recommendation of RW-6 is not shown properly (compacted AB or LCB with Geofabric underneath) in latest plan (Sheet 10 of 39, Rev. Dated 05-04-2012). Discuss this issue with the Designer	This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.	
7.	GDMR	Page 40 – Design Assumptions and Strength Parameters of different MSE walls should be included in the plan. Discuss this issue with the Designer.	This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.	
8.	GDMR	Page 41, 2nd Paragraph – The length of the RW-2 is not correct.	The length of Retaining Wall No. 2 has been revised.	
9.	GDMR	Page 28, "Waiting Period" – Due to settlement is recommended for Abutments 1 and 2 backfilling (Green Valley Road OC), are RW-7, RW-8 and RW-9 falls under this "Waiting period" recommendation? If yes, then mention this "Waiting period" later on where RW-7, 8 and 9 (Page 37, 44 & 45) are discussed in details. Otherwise, remove RW-7, RW-8 and RW-9 from Page 28.	Retaining Walls No. 7, 8 & 9 will be constructed first and serve as surcharge, and the waiting period is recommended after the completion of the walls, primarily for the construction of the foundation and pavement. The texts have been revised.	

Agency:	Caltrans	**Responded By:**	Parikh Consulting
Review Unit:	Geotechnical	**Date Responded:**	9/21/2012
Comments By:	Suja Ahmed/Rifaat Nashed		
Date Reviewed:	June 13, 2012/June 4, 2012		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: Submittal: **Comments to 65% PS&E plans (GDMR Dated May 3, 2012)**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-STA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
10.	GDMR	Page 45, Last Paragraph (RW-8) – "Shear Strength" parameter from Page 40 (Table 10) is missing.	The shear strength parameters have been included.	
11.	GDMR	"Key Map" of LOTBs (right after "Soil Legend" sheet) shows two sheets of Log of Test Boring No. 1". Later on "Log of Test Boring No. 1" is missing.	We have renumbered the set of drawings to clear up any confusion. The format is in the following order: Soil Legend, Key Map, Log of Test Borings.	
12.	GDMR	Log of Test Borings No. 2 to Log of Test Boring NO. 5 shows 35 Borings and 6 CPT locations. Second line of Page 5, Section 5.1 of this report (dated May 3, 2012) shows 48 Borings were drilled. Do these 48 Borings include those five Borings (A-09-135 to A-09-140) which were removed from the scope of work? If it is removed from the scope of work, then why are Boring No. A-09-13 to A-09-139 shown on "Log of Test Boring No. 3" sheet? Please go through the boring numbers and plotted locations again and make sure it matches with **Page 5, Section 5.1.**	We have revised Section 5.1 to show 20 bulk samples, 37 borings and 6 CPTs. We have included the A-09-135 to A-09-140 since those are used to assist with the PG&E pipe relocation.	
13.	GDMR	"Log of Test Boring No. 6" is missing.	The sheet has been included.	
14.	GDMR	RW 10P – Sheet 21 of 39 (Rev. May 1, 2012) – Design Tip Elevation and Specified Tip Elevation should be included in Pile Data Table from the latest GDMR.	This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.	
15.	GDMR	Design Assumptions and Strength Parameters of different MSE walls (Page 40 of GDMR, Dated May 03, 2012) should be put in the plan.	This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.	
16.	GDMR	Page 6 Table 2, Exploration Program 1. In "Purpose" column, define the number of the retaining wall where the specific borehole will be used. 2. Borehole No. CPT-10-129A for Retaining Walls No. 5 and 6 is missing.	The table has been revised accordingly.	
17.	GDMR	Page 14, Section 7.3.2 Groundwater and Table 3 In general groundwater depth ranges between 8.5 feet (elevation 25.3 feet) at borehole NO. A-9-111 and 26 feet (different elevations: -1.0, -2.1, and 77.8 feet) at boreholes No's A-09-005, A-09-130 and A-09-130 in order. Please correct.	The text and table have been revised.	

Agency:	Caltrans	**Responded By:**	Parikh Consulting
Review Unit:	Geotechnical	**Date Responded:**	9/21/2012
Comments By:	Suja Ahmed/Rifaat Nashed		
Date Reviewed:	June 13, 2012/June 4, 2012		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: Submittal: **Comments to 65% PS&E plans (GDMR Dated May 3, 2012)**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-STA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
18.	GDMR	Appendix 1. The serial numbers of "LOG OF TEST BORINGS" from sheet No. 3 to sheet No. 6 should be corrected. 2. In sheet "LOG OF TEST BORINGS NO. 17," borehole No. **A**-10-003A, should be correct to be No. **R**-10-003A.	The sheets have been revised accordingly.	

Agency:	Caltrans	**Responded By:**	Parikh/MTCo/NV5
Review Unit:	Materials	**Date Responded:**	9/21/2012
Comments By:	Leonardo DeLeon		
Date Reviewed:	June 12, 2012 (#1-3)/June 18, 2012		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: Submittal: **Comments to 65% PS&E plans**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-STA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
1.	GDMR	Page 49, Table 13 – Summary of R-Value Test Results – Only Boring Nos. A-09-112 and A-09-119 are in the log of test borings. Where were Boring nos. A-09-110, A-10-132, A-10-141, A-10-143, A-09-147 to 150 taken? All these boring locations and soil data should be included in the log of test boring plans.	We have included the listed borings in the Log of Test Borings.	
2.	GDMR	Page 51, Table 14A – Structural Pavement for Bike Lanes – Place the working table 1.0 and 0.5' AS (4) for Option 1 and 2 respectively (where the R-Value = 5) in the table instead of just making a note.	The table has been revised.	
3.	GDMR	Page 53, Table 14C – Add in the Notes that the FDHMA section are to be used for temporary pavement only and not for final pavement.	We have included "FDHMA section are to be used for temporary pavement only and not for final pavement" in Note 5.	

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Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

Mark Thomas & Co., Inc.
7300 Folsom Blvd., Suite 203
Sacramento, CA 95826

August 27, 2012
Job No.: 2009-130-GDR

Attn.: Mr. James Pangburn

Sub: Response to Caltrans (dated June 13, 2012)
I-680/I-80/ SR 12 Interchange
Solano County, California
04-SOL/I-80, I-680

Ref: Caltrans Review Comments

Dear Mr. Pangburn:

We have received the review comments made by Caltrans on the above subject report. This letter documents our response to these comments, which have been incorporated in the GDMR.

<u>Comment by Mr. Suja Ahmed (dated June 11, 2012)</u>

Comment: Page 5, Section 5.1, 3rd Paragraph says 48 borings were drilled -----then 5th Paragraph mentioned about 35 borings. Re-check and fix this discrepancy.

Response: The texts have been revised to 20 bulk samples and 35 borings.

Comment: Page 6, Table 2 shows 4 CPT locations. Page 5 (6th Paragraph mentioned about 6 CPT). Update Table 2 of Page 6.

Response: We have included the two missing CPTs in Table 2.

Comment: Page 11, 5th Paragraph (Section 7.2) - At the planned locations of these walls ------. Is there any wall in this location (Sta. 61+00 and 75+00 "JW Line")?

Response: A cantilever retaining wall was planned in the previous design phase and has been removed from the project scope. The text has been revised.

Comment: Page 33, 1st Paragraph - The over-excavation recommendation of RW-1 is not shown properly (compacted AB or LCB with Geofabric underneath) in latest plan (Sheet 2 of 39, Rev. Dated April1, 2012). Discuss this issue with the Designer.

Response: This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.

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Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

Mark Thomas & Co., Inc.
7300 Folsom Blvd., Suite 203
Sacramento, CA 95826

November 15, 2012
Job No.: 2009-130-GDR

Attn.: Mr. James Pangburn

Sub: Response to Caltrans Review Comments
I-680/I-80/ SR 12 Interchange, 04-SOL/I-80, I-680
Solano County, California

Ref: Caltrans Review Comments (dated October 29, 2012)

Dear Mr. Pangburn:

We have received the review comments made by Caltrans on the above subject report. This letter documents our response to these comments, which have been incorporated in the GDMR.

Comment by Mr. Suja Ahmed (dated October 29, 2012)

Comment: Page 41, Design Assumptions and Strength Parameters of different MSE walls from GDMR should be included in the plan. Discuss this issue with the Designer.

Response: This was conveyed to the structural engineer. The plans have been revised and the strength parameters have been included.

Comment: Page 40, Table 9 (Pile Data Table) - The Nominal Resistance for Tension in GDMR does not match with Design Plan (RW 10P - Sheet 22 of 40 - Rev. 09/12/12) - Check with the Designer.

Response: The pile data table has been revised. This was also conveyed to the structural engineer, and the plans have been revised accordingly.

Comment by Mr. Rifaat Nashed (dated October 29, 2012)

Comment: The groundwater elevation at borehole No. A-09-005 is -2.1 ft not -9.9. Please correct.

Response: The text has been revised accordingly.

Comment: At Green Valley Road OC (RW05 thru RW09), the groundwater depth ranges between 12.0 ft and 26.0 ft and not 11.5 and 33.8 ft. Please correct.

Response: The text has been revised accordingly.

Please be advised that we are performing a professional service and that our conclusions are professional opinions only. All work done and all recommendations made are in accordance

with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

Very truly yours,
PARIKH CONSULTANTS, INC.

Frank Y. Wang, P.E, G.E. 2862
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

{Response to Comments}

Comment: Page 35, 5th Paragraph- The over-excavation recommendation of RW-5 is not shown properly compacted AB or LCB with Geofabric undemeath) in latest plan (Sheet 9 of 39, Rev. Dated April 1, 2012). Discuss this issue with the Designer.

Response: This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.

Comment: Page 36, 3rd Paragraph & Page 37, 1st Paragraph - The over-excavation recommendation of RW-6 is not shown properly (compacted AB or LCB with Geofabric underneath) in latest plan (Sheet 10 of 39, Rev. Dated May 4, 2012). Discuss this issue with the Designer.

Response: This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.

Comment: Page 40 - Design Assumptions and Strength Parameters of different MSE walls should be included in the plan. Discuss this issue with the Designer.

Response: This was conveyed to the structural engineer and the plans have been revised to reflect the recommendation.

Comment: Page 41, 2nd Paragraph -The length of the RW-2 is not correct.

Response: We have revised the length of Retaining Wall No. 2 in the report.

Comment: Page 28, "Waiting period" - Due to settlement is recommended for Abutments 1 and 2 backfilling (Green Valley Road OC), are RW-7, RW-8 and RW-9 falls under this "Waiting period" recommendation? If yes, then mention this "Waiting period" later on where RW-7, 8 and 9 (Page 37, 44 & 45) are discussed in details. Otherwise, remove RW-7, RW-8 and RW-9 from Page 28.

Response: Retaining Walls No. 7, 8 & 9 will be constructed first and serve as surcharge, and the waiting period is recommended after the completion of the walls, primarily for the construction of the foundation and pavement. The texts have been revised.

Comment: Page-45, Last Paragraph (RW-8) - "Shear Strength" parameter from Page 40 (Table-10) is missing.

Response: We have included the shear strength parameters.

Comment: "Key Map" of LOTBs (right after "Soil Legend" sheet) shows two sheets of "Log of Test Boring No.1". Later on "Log of Test Boring No.1" is missing.

Response: We have renumbered the set of drawings to clear up any confusion. The format is in the following order: Soil Legend, Key Map, Log of Test Borings.

Comment: Log of Test Boring No.2 to Log of Test Boring No. 5 shows 35 Borings and 6 CPT locations. Second line of Page 5, Section 5.1 of this report (dated May 03, 2012) shows 48 Borings were drilled. Please clarify this confusion. Are these 48 Borings includes those five Borings (A-09-135 to A-09-140) which were removed from the scope of work? If it is removed from the scope of work, then why Boring No. A-09-136 to A-09-139 is shown on "Log of Test Boring No. 3" sheet? Please go through the boring numbers and plotted locations again and make sure it match with Page 5, Section 5.1.

Response: We have revised Section 5.1 to show 20 bulk samples, 35 borings and 6 CPTs. We have included the A-09-135 to A-09-140 since those are used to assist with the PG&E pipe relocation.

Comment: "Log of Test Boring No.6" is missing.

Response: We have included LOTB No. 6.

<u>Comment by Mr. Rifaat Nashed (dated June 4, 2012)</u>

Comment: Page (6), Table 2 EXPLORATION PROGRAM:

1. In "Purpose" Column, define the number of the retaining wall where the specific borehole will be used.
2. Borehoel No. CPT-10-129A for Retaining Walls No. 5 and 6 is missing.

Response: The table has been revised accordingly.

Comment: Page (14), Section 7.3.2 Groundwater & Table 3: In general groundwater depth ranges between 8.5 ft (elevation 25.3 ft) at borehole No. A-9-111 and 26 ft (different elevations: -1.0, -2.1 & 77.8 ft) at boreholes NO's A-09-005, A-09-130 & A-09-130 in order. Please correct.

Response: The text and table have been revised.

Comment: APPENDIX A:

1. The serial numbers of "LOG OF TEST BORINGS" from sheet No. 3 to sheet No. 6 should be corrected.
2. In sheet "LOG OF TEST BORINGS NO. 17, borehole No. A-10-003A should be corrected to be No. R-10-003A.

Response: The sheets have been revised accordingly.

Please be advised that we are performing a professional service and that our conclusions are professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

Very truly yours,
PARIKH CONSULTANTS, INC.

Frank Y. Wang, P.E, G.E. 2862
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

{Response to Comments}

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MR. RONI BOUKHALIL
District Branch Chief
Design North Counties

Date: June 13, 2011

Attention: Naga Adibhatla

File: 04-SOL/I-80, I-680
04- 0A5341
E-FIS: 0400021131

S.A

From: SUJA AHMED
Transportation Engineer
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

H. Nikoui

HOOSHMAND NIKOUI
Chief, Branch A
Office of Geotechnical Design – West
Geotechnical Services
Division of Engineering Services

Subject : Review of GDMR for I-680/I-80/SR 12 Interchange - PM 12.2/12.9

We have reviewed the above-mentioned GDMR prepared by Parikh Consultants, Inc dated on May 03, 2012. The following are our comments:

- Page 5, Section 5.1, 3rd Paragraph says 48 borings were drilled -----then 5th Paragraph mentioned about 35 borings. Re-check and fix this discrepancy.

- Page 6, Table 2 shows 4 CPT locations. Page 5 (6th Paragraph mentioned about 6 CPT). Update Table 2 of Page 6.

- Page 11, 5th Paragraph (Section 7.2) - At the planned locations of these walls ------ . Is there any wall in this location (Sta. 61+00 and 75+00 "JW Line")?

- Page 33, 1st Paragraph - The over-excavation recommendation of RW-1 is not shown properly (compacted AB or LCB with Geofabric underneath) in latest plan (Sheet 2 of 39, Rev. Dated April 1, 2012). Discuss this issue with the Designer.

- Page 35, 5th Paragraph - The over-excavation recommendation of RW-5 is not shown properly (compacted AB or LCB with Geofabric underneath) in latest plan (Sheet 9 of 39, Rev. Dated April 1, 2012). Discuss this issue with the Designer.

- Page 36, 3rd Paragraph & Page 37, 1st. Paragraph – The over-excavation recommendation of RW-6 is not shown properly (compacted AB or LCB with Geofabric underneath) in latest plan (Sheet 10 of 39, Rev. Dated May 4, 2012). Discuss this issue with the Designer.

- Page 40- Design Assumptions and Strength Parameters of different MSE walls should be included in the plan. Discuss this issue with the Designer.

- Page 41, 2nd Paragraph - The length of the RW-2 is not correct.

- Page 28, "Waiting period" - Due to settlement is recommended for Abutments 1 and 2 backfilling (Green Valley Road OC), are RW-7, RW-8 and RW-9 falls under this "Waiting period" recommendation? If yes, then mention this "Waiting period" later on where RW-7, 8 and 9 (Page 37, 44 & 45) are discussed in details. Otherwise, remove RW-7, RW-8 and RW-9 from Page 28.

- Page-45, Last Paragraph (RW-8) - "Shear Strength" parameter from Page 40 (Table-10) is missing.

- "Key Map" of LOTBs (right after "Soil Legend" sheet) shows two sheets of "Log of Test Boring No.1". Later on "Log of Test Boring No.1" is missing.

- Log of Test Boring No.2 to Log of Test Boring No.5 shows 35 Borings and 6 CPT locations. Second line of Page 5, Section 5.1 of this report (dated May 03, 2012) shows 48 Borings were drilled. Please clarify this confusion. Are these 48 Borings includes those five Borings (A-09-135 to A-09-140) which were removed from the scope of work? If it is removed from the scope of work, then why Boring No. A-09-136 to A-09-139 is shown on "Log of Test Boring No.3" sheet? Please go through the boring numbers and plotted locations again and make sure it match with **Page 5, Section 5.1**

- "Log of Test Boring No.6" is missing.

Comments from Geologist (Rifaat Nashed)

See attached sheet.

If you have any questions or need additional information, please call me at 510-286-4752, Rifaat Nashed at 510-622-1773 or Hooshmand Nikoui, Branch Chief at 510-286-4811.

Attachment:

c: TPokrywka, HNikoui, Rifaat Nashed, SAhmed, Daily File, Route File

SAhmed/mm

Agency:	Caltrans	**Responded By:**	
Review Unit:	Geotechnical Services	**Date Responded:**	
Comments By:	RIFAAT NASHED	**JRT Meeting Date:**	
Date Reviewed:	06 - 04- 2012		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments on Geotechnical Design & Materials Report**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	GDMR	***GDMR dated May 3, 2012***				
1	Page (6) **Table 2** **EXLORATION PROGRAM**	1- In "Purpose" column", define the number of the retaining wall where the specific borehole will be used. 2- Borehole No. CPT-10-129A for Retaining Walls No.5 and 6 is missing.				
2	Page (14) Section **7.3.2** **Groundwater & Table 3**	In general groundwater depth ranges between 8.5 ft (elevation 25.3 ft) at borehole No. A-9-111 and 26. Ft (different elevations: -1.0, -2.1 & 77.8 ft) at boreholes NO's A-09-005, A—09-130 & A-09-130 in order. Please correct				
3	**APPENDIX A**	1- The serial numbers of "LOG OF TEST BORINGS"from sheet No. 3 to sheet No. 6 should be corrected. 2- In sheet "LOG OF TEST BORINGS NO. 17, borehole No. **A**-10-003A , should be corrected to be NO. **R**-10-003A.				
4						
5						

Agency:	Caltrans	**Responded By:**	MTCo/ Nolte
Review Unit:	Engineering Services I - Materials A	**Date Responded:**	
Comments By:	Leonardo DeLeon		
Date Reviewed:	December 16, 2010		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: Submittal: **Comments to GDMR**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-STA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
1		**Corrosion Investigation:** The consultant have selected a very conservative pH values of 7.5 and 8.5 respectively and a lower resistivity of 200 ohm-cm, a sulfate concentration of 600 ppm, and chloride concentration of 2000 ppm for AltPipe design for all the pipes that will be used for the entire project. We suggest that the AltPipe design analysis be done on multiple locations i.e., each location may have to be divided and analyzed differently in order to come up with different pipe material for culvert and storm drain application.	Concur. We have further reviewed the test results and revised the analyses.	A
2		**Structural Pavement (Table 10):** There are no recommended structural pavement sections nor any test bore on I-680 corridor. Does this mean that there is a separate GDMR for the I-680?	It is our understanding that the study for I-680 corridor is beyond the current project scope.	A
3		**Structural Pavement (Table 10):** (Table 10C) Delete the Flexible Pavement Sections, i.e Options 1, 2, 3 and 4. Neither our District nor the Highway Design Manual has guidelines for a 40 year flexible design method. You may however, call them the "20+ year flexible pavement section".	Concur. For Life-Cycle Cost Analysis (LCCA), we will keep the Flexible Pavement Sections but rename it to “20+ Year Flexible Pavement Section”.	A
4		**Log of Test Boring (LOTB) - Layout Sheets:** There should be a Key Map and/or an Index Sheet for the layout sheets of LOTB. Also, the layout sheets should identify the existing roadways so we can clearly identify the locations of each borings.	Will comply.	A

Agency:	Caltrans	**Responded By:**	MTCo/ Nolte
Review Unit:	Engineering Services – Geotechnical Design	**Date Responded:**	
Comments By:	Suja Ahmed		
Date Reviewed:	January 10, 2011		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: Submittal: **Comments to GDMR, 65% PS&E**

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-STA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
1	GDR (Pg 12)	5th paragraph-"----Retaining Wall No.10,which is recently added to the project". Project Plan doesn't show any Retaining Wall10.	The text will be revised. The numbers of retaining walls and their configurations have been revised. A total of nine retaining walls are planned.	A
2	GDR (Pg 13)	1st paragraph – Boring A-09-009 is not shown in the boring locations plan.	Boring location plans will be revised.	A
3	GDR (Pg 13)	5th Paragraph – Boring R-10-003A is shown as # R-10-003 in boring location plan.	Boring location plans will be revised.	A
4	GDR (Pg 27)	4th Paragraph-Mention the height of the embankment fills @ Green Valley Road OC, Green Valley Road Temporary OC/RW 07 through RW 09.	Will comply.	A
5	GDR (Pg 29)	Section 8.4 mentioned ten proposed retaining walls in this project. RW plans and Table7-Summary of Retaining Walls (GDR) shows up to RW09.	The text will be revised. The numbers of retaining walls and their configurations have been revised. A total of nine retaining walls are planned.	A
6	GDR (Pg 29)	Section8.4.1-Length of RW is not correct.	The text will be revised per current design.	A
7	Pg 16	**Seismic Comments (Reviewed by Sunny Yang):** Table-4 should include fault distance to site.	Will comply. The fault distance to the main structures (Green Valley Road OC, Green Valley Road OC (Over SB 680 On-Ramp) and WB 80 to WB 12 Separation Structure) will be provided.	A
8		Include ARS curve in Appendix.	Will comply.	A
9		Should include ARS curve and notes (seismicdata) in plans for bridge.	The designer will address this comment.	
10		Include pile data table in plans.	The designer will address this comment.	

Agency:	Caltrans	**Responded By:**	MTCo/ Nolte
Review Unit:	Engineering Services – Geotechnical Design	**Date Responded:**	
Comments By:	Suja Ahmed		
Date Reviewed:	January 10, 2011		

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Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
11		**Regional Geology** The first three paragraphs should be replaced by the following statement: "The project area is located on the boundary between the central Coast Range and the Great Valley Geomorphic Provinces. The San Francisco Bay Area block lies between the mountains of the Coast Range. The Project site is located within the northern portion of the Diablo Range northeast of San Francisco Bay. The Mesozoic sediments (Great Valley Sediments) mainly grewacke and shales accumulated along the south western margin of Sacramento Valley, where they are now tilted up and exposed by uplift of the Coast Range. The Mesozoic rocks include the Coast Range Ophiolite, Franciscan Complex, and the Great Valley Sequence. In Pliocene time on the western side of the Sacramento Valley, alluvial deposits eroded from Coast Range were deposited as Thema Formation; it contains distinctive widespread ash layers. Today rivers and streams flowing from the surrounding mountains and hills continue to carry sediments to the valley. The two chief types of surface sediments in the Central Valley are flood plain deposits, mud that settle out of floor waters, and stream deposits, which form alluvial fans at base of the range on either sides of the valley.	Will comply. The text will be revised accordingly.	A

Agency:	Caltrans	**Responded By:**	MTCo/ Nolte
Review Unit:	Engineering Services – Geotechnical Design	**Date Responded:**	
Comments By:	Suja Ahmed		
Date Reviewed:	January 10, 2011		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: Submittal: **Comments to GDMR, 65% PS&E**

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Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
12		**Site Geology** The following statement should be added: "The James Canyon area and to the north is largely underlain by broadly folded Eocene Markley Formation and flat or gently tilted Pliocene Sonoma Volcanics. The Sonoma Volcanics are mostly andesitic tuff and breccias, but there is also some basalt and rhyolite. The area east of the Green Valley Fault, is largely underlain by late Pleistocene to Holocene alluvial fan deposits. The Green Valley Fault, which intersects the project area, separates the Sonoma Volcanics from the Cretaceous. Great Valley Sequence on the east. (CGS 2002, Bezore,S.P., Wagner, D.L, and Sowers, J.M., Geologic Map of Cordelia 7.5' Quadrangle, Solano and Napa Counties, California).	Will comply. The text will be revised accordingly.	A
13		**Erosion** The Statement "The subject was considered…not applicable for the project" should be replaced by the following statement: "Erosion within the project limits is minimal. Localized erosion and raveling may occur within some poorly cemented rock layers exposed by excavation in the cut slopes. While soils within the flatter regions of the project area are classified as no hazard to slight hazard of erosion. This project should not adversely affect erosion within or outside the project limits.	Will comply. The text will be revised accordingly.	A
14		**Groundwater** The boring number where the minimum elevation, maximum elevation, minimum depth and maximum depth under the ground surface should be mentioned under this item.	Will comply.	A

Agency:	Caltrans	**Responded By:**	MTCo/ Nolte
Review Unit:	Engineering Services – Geotechnical Design	**Date Responded:**	
Comments By:	Suja Ahmed		
Date Reviewed:	January 10, 2011		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title: Submittal: **Comments to GDMR, 65% PS&E**

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Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action
15		**Stability** Please explain the following contradictory statement: "In our opinion, the overall stability at the proposed cuts should not be a design issue. However, the presence of local shears observed in the road cut suggests that localized wedge failure may occur".	In order to clarify, the text will be revised to the following: “In our opinion, the global stability of the proposed cut slopes should not pose a significant constraint on the design of cuts with slopes less than 2H:1V. However, the blocky nature of the Sonoma Volcanics and the presence of localized shears within fault zones may lead to wedge-type failures, which is expected to be localized and relatively insignificant. It may be necessary to over-excavate and re-compact areas where shears or joints are exposed in the cuts.”	A
16	APPENDIX A	In Retaining Wall No.6, Borehole No. A-09-128 is repeated in sheet No.17 and Sheet No.18.	The LOTB sheets have been re-arranged based on the latest retaining wall design.	A

APPENDIX A

California Environmental Protection Agency
Department of Toxic Substances Control

VARIANCE

Applicant Names:

State of California
Department of Transportation
(Caltrans)
1120 N Street
Sacramento, California 95814

Variance No. V09HQSCD006

Effective Date: July 1, 2009

Expiration Date: July 1, 2014

Modification History:

Pursuant to California Health and Safety Code, Section 25143, the Department of Toxic Substances Control hereby issues the attached Variance consisting of 9 pages to the Department of Transportation.

Beverly Rikala
Team Leader, Operating Facilities Team
Department of Toxic Substances Control

Date: 6/30/09

1. INTRODUCTION.

a) Pursuant to Health and Safety Code, section 25143, the California Department of Toxic Substances Control (DTSC) grants this variance to the applicant below for waste considered to be hazardous solely because of its lead concentrations and as further specified herein.

b) DTSC hereby grants this variance only from the requirements specified herein and only in accordance with all terms and conditions specified herein.

2. IDENTIFYING INFORMATION.

APPLICANT/OWNER/OPERATOR

State of California
Department of Transportation, (Caltrans)
All Districts

3. TYPE OF VARIANCE.

Generation, Manifest, Transportation, Storage and Disposal.

4. ISSUANCE AND EXPIRATION DATES.

DATE ISSUED: July 1, 2009 EXPIRATION DATE: July 1, 2014

5. APPLICABLE STATUTES AND REGULATIONS. The hazardous waste that is the subject of this variance is fully regulated under Health and Safety Code, section 25100, et seq. and California Code of Regulations, title 22, division 4.5 except as specifically identified in Section 8 of this variance.

6. DEFINITION. For purposes of this variance, "lead-contaminated soil(s)" shall mean soil that meets the criteria for hazardous waste but contains less than 3397 mg/kg total lead and is hazardous primarily because of aerially-deposited lead contamination associated with exhaust emissions from the operation of motor vehicles.

7. FINDINGS/DETERMINATIONS. DTSC has determined that the variance applicant meets the requirements set forth in Health and Safety Code, section 25143 for a variance from specific regulatory requirements as outlined in Section 8 of this variance. The specific determinations and findings made by DTSC are as follows:

a) Caltrans intends to excavate, stockpile, transport, bury and cover large volumes of soil associated with highway construction projects. In the more urbanized highway corridors around the State this soil is contaminated with lead, primarily due to historic emissions from automobile exhausts. In situ sampling and laboratory testing has shown that some of the soil contains concentrations of lead in excess of State regulatory thresholds, and thus any generated waste from disturbance of the soil

would be regulated as hazardous waste. Such soil contains a Total Threshold Limit Concentration (TTLC) of 1000 milligrams per kilogram (mg/kg) or more lead and/or it meets or exceeds the Soluble Threshold Limit Concentration (STLC) for lead of 5 milligrams per liter (mg/l). A Human Health Risk Assessment prepared for this variance concludes that soil contaminated with elevated concentrations of lead can be managed in a way that presents no significant risk to human health.

b) The lead-contaminated soil will be placed only in Caltrans' right-of-way. Depending on concentration levels, the wastes will be covered with a minimum thickness of one (1) foot of non-hazardous soil or asphalt/concrete cover and will always be at least five (5) feet above the highest groundwater elevation. Caltrans will assure that proper health and safety procedures will be followed for workers, including any persons engaged in maintenance work in areas where the waste has been buried and covered.

c) DTSC finds and requires that the lead-contaminated soil excavated, stockpiled, transported, buried and covered pursuant to this variance is a non-RCRA hazardous waste, and that the waste management activity is insignificant as a potential hazard to human health and safety and the environment, when managed in accordance with the conditions, limitations and other requirements specified in this variance.

8. PROVISIONS WAIVED.

Provided Caltrans meets the terms and conditions of this variance, DTSC waives the hazardous waste management requirements of Health and Safety Code, Chapter 6.5 and California Code of Regulations, title 22 for the lead-contaminated soil that Caltrans reuses in projects that would require Caltrans to obtain a permit for a disposal facility and any other generator requirements that concern the transportation, manifesting, storage and land disposal of hazardous waste.

9. SPECIFIC CONDITIONS, LIMITATIONS AND OTHER REQUIREMENTS.

In order for the provisions discussed in section 8 to be waived, lead-contaminated soil must not exceed the contaminant concentrations discussed below and Caltrans management practices must meet all the following conditions:

a) Caltrans implementation of this variance shall comply with all applicable state laws and regulations for water quality control, water quality control plans, waste discharge requirements (including storm water permits), and others issued by the State Water Resources Control Board (SWRCB) and/or a California Regional Water Quality Control Board (RWQCB). Caltrans shall provide written notification to the appropriate RWQCB at least 30 days prior to advertisement for bids of projects that involve invocation of this variance, or as otherwise negotiated with the SWRCB or appropriate RWQCB.

b) The waivers in this variance shall only be applied to lead-contaminated soil that is not a RCRA hazardous waste and is hazardous primarily because of aerially-

deposited lead contamination associated with exhaust emissions from the operation of motor vehicles. The variance is not applicable to any other hazardous waste.

c) Soil containing 1.5 mg/l extractable lead or less (based on a modified waste extraction test using deionized water as the extractant) and 1411 mg/kg or less total lead may be used as fill provided that the lead-contaminated soil is placed a minimum of five (5) feet above the maximum historic water table elevation and covered with at least one (1) foot of nonhazardous soil that will be maintained by Caltrans to prevent future erosion.

d) Soil containing 150 mg/L extractable lead or less (based on a modified waste extraction test using deionized water as the extractant) and 3397 mg/kg or less total lead may be used as fill provided that the lead-contaminated soils are placed a minimum of five (5) feet above the maximum historic water table elevation and protected from infiltration by a pavement structure which will be maintained by Caltrans.

e) Lead-contaminated soil with a pH less than 5.5 but greater than 5.0 shall only be used as fill material under the paved portion of the roadway. Lead-contaminated soil with a pH at or less than 5.0 shall be managed as a hazardous waste.

f) For each project that has the potential to generate waste by disturbing lead-contaminated soil (as defined in 6), Caltrans shall conduct sampling and analysis to adequately characterize the soils containing aerially deposited lead in the areas of planned excavation along the project route. Such sampling and analysis shall include the Toxicity Characteristic Leaching Procedure (TCLP) as prescribed by the United States Environmental Protection Agency to determine whether concentrations of contaminants in soil exceed federal criteria for classification as a hazardous waste.

g) Lead-contaminated soil managed pursuant to this variance shall not be moved outside the designated corridor boundaries (see paragraph t) below. All lead-contaminated soil not buried and covered within the same Caltrans corridor where it originated is not eligible for management under this variance and shall be managed as a hazardous waste.

h) Lead-contaminated soil managed pursuant to this variance shall not be placed in areas where it would become in contact with groundwater or surface water (such as streams and rivers).

i) Lead-contaminated soil managed pursuant to this variance shall be buried and covered only in locations that are protected from erosion that may result from storm water run-on and run-off.

j) The lead-contaminated soil shall be buried and covered in a manner that will prevent accidental or deliberate breach of the asphalt, concrete, and/or cover soil.

k) The presence of lead-contaminated soil shall be incorporated into the projects' as-built drawings. The as-built drawings shall be annotated with the location, representative analytical data, and volume of lead-contaminated soil. The as-built drawings shall also state the depth of the cover. These as-built drawings shall be retained by Caltrans.

l) Caltrans shall ensure that no other hazardous wastes, other than the lead-contaminated hazardous waste soil, are placed in the burial areas.

m) Lead-contaminated soil shall not be buried within ten (10) feet of culverts or locations subject to frequent worker exposure.

n) Excavated lead-contaminated soil not placed into the designated area (fill area, roadbed area) by the end of the working day shall be stockpiled and covered with sheets of polyethylene or at least one foot of non-hazardous soil. The lead-contaminated soil, while stockpiled or under transport, shall be protected from contacting surface water and from being dislodged or transported by wind or storm water. The stockpile covers shall be inspected at least once a week and within 24 hours after rainstorms. If the lead-contaminated soil is stockpiled for more than 4 days from the time of excavation, Caltrans shall restrict public access to the stockpile by using barriers that meet the safety requirements of the construction zone. The lead-contaminated soil shall be stockpiled for no more than 90 days from the time the soil is first excavated. If the contaminated soil is stockpiled beyond the 90 day limit Caltrans shall:

1. notify DTSC in writing of the 90 day exceedance and expected date of removal;
2. perform weekly inspections of the stockpiled material to ensure that there is adequate protection from run-on, runoff, public access, and wind dispersion; and
3. notify DTSC on weekly basis of the stockpile status until the stockpile is removed.

The lead-contaminated soil shall be stockpiled for no more than 180 days from the time the soil is first excavated.

o) Caltrans shall ensure that all stockpiling of lead-contaminated soil remains within the project area of the specified corridor. Stockpiling of lead-contaminated soil within the specified corridor, but outside the project area, is prohibited.

p) Caltrans shall conduct confirmatory sampling of any stockpile area in areas not known or expected to contain lead-contaminated soil after removal of the lead-contaminated soil to ensure that contamination has not been left behind or has not migrated from the stockpiled material to the surrounding soils.

q) Caltrans shall stockpile lead-contaminated soil only on high ground (i.e. no sump areas or low points) so that stockpiled soil will not come in contact with surface

water run-on or run-off.

r) Caltrans shall not stockpile lead-contaminated soil in environmentally and ecologically sensitive areas.

s) Caltrans shall ensure that storm/rain run-off that has come into contact with stockpiled lead-contaminated soil will not flow to storm drains, inlets, or waters of the State.

t) Caltrans may dispose of the lead-contaminated soil only within the operating right-of-way of an existing highway, as defined in Streets and Highways Code, section 23. Caltrans may move lead-contaminated soil from one Caltrans project to another Caltrans project only if the lead-contaminated soil remains within the same designated corridor.

Caltrans shall record any movement of lead-contaminated soil by using a bill of lading. The bill of lading must contain: 1) the US DOT description including shipping name, hazard class and ID number; 2) handling codes; 3) quantity of material; 4) volume of material; 5) date of shipment; 6) origin and destination of shipment; and 7) any specific handling instructions. The bill of lading shall be referenced in and kept on file with the project's as-built drawings. The lead-contaminated soil must be kept covered during transportation.

u) For each specific corridor where this variance is to be implemented, all of the following information shall be submitted in writing to DTSC at least five (5) days before construction of any project begins:

1. plan drawing designating the boundaries of the corridor where lead-contaminated soils will be excavated, stockpiled, buried and covered;

2. a list of the Caltrans projects that the corridor encompasses;

3. a list of Caltrans contractors that will be conducting any phase of work on any project affected by this variance;

4. duration of corridor construction;

5. location where sampling and analytical data used to make lead concentration level determinations are kept (e.g. a particular Caltrans project file);

6. name and phone number (including area code) of project resident engineer and project manager;

7. location where Caltrans and contractor health and safety plan and records are kept;

8. location of project special provisions (including page or section number) for soil excavation, transportation, stockpile, burial and placement of cover material;

9. location of project drawings (including drawing page number) for soil excavation, burial and placement of cover in plan and cross section (for example, "The project plans are located at the resident engineer's office located at 5th and Main Streets, City of Fresno, See pages xxxxx of contract xxxx");

10. updated information if a Caltrans project within the corridor is added, changed or deleted; and

11. type of environmental document prepared for each project, date of adoption, document title, Clearing House number and where the document is available for review. A copy of the Caltrans Categorical Exemption, Categorical Exclusion Form, or if filed, the Notice of Exemption for any project shall be submitted to the DTSC Headquarters Project Manager.

v) Changes in location of lead-contaminated soil placement, quantities or protection measures (field changes) shall be noted in the resident engineer's project log within five (5) days of the field change.

w) Caltrans shall ensure that field changes are in compliance with the requirements of this variance.

x) Operational procedures described in the California Environmental Quality Act (CEQA) Special Initial Study shall be followed by Caltrans for activities conducted under this variance.

y) Caltrans shall implement appropriate health and safety procedures to protect its employees and the public, and to prevent or minimize exposure to potentially hazardous wastes. A project-specific health and safety plan must be prepared and implemented. The monitoring and exposure standards shall be based on construction standards for exposure to lead in California Code of Regulations, title 8, section 1532.1.

z) Caltrans shall provide a district Coordinator for this variance. This Coordinator will be the primary point of contact for information flowing to, or received from, DTSC regarding any matter or submission under this variance. Caltrans shall promptly notify DTSC of the name of Coordinator and any change in the Coordinator.

aa) Caltrans shall conduct regular inspections, consistent with Caltrans' Maintenance Division's current Pavement Inspection and Slope Inspection programs, of the locations where lead-contaminated soil has been buried and/or covered pursuant to this variance. If site inspection reveals deterioration of cover so that conditions in the variance are not met, Caltrans shall repair or replace the cover.

bb) Caltrans shall develop and implement a record keeping mechanisms to record and retain permanent records of all locations where lead-contaminated soil has been buried per this variance. The records shall be made available to DTSC.

cc) If areas subject to the terms of this variance are sold, relinquished or abandoned (including roadways), all future property owners shall be notified in writing in advance by Caltrans of the requirements of this variance, and Caltrans shall provide the owner with a copy of the variance. A copy of such a notice shall be sent to DTSC and contain the corridor location and project. Caltrans shall also disclose to DTSC and the new owner the location of areas where lead-contaminated soil has been buried. Future property owners shall be subject to the same requirements as Caltrans.

dd) For the purposes of informing the public about instances where the variance is implemented, Caltrans shall:

1. maintain current fact sheets at all Caltrans resident engineer offices and the Caltrans District office. Caltrans shall make the fact sheets available to anyone expressing an interest in variance-related work.

2. maintain a binder(s) containing copies of all reports submitted to DTSC at the District office. Caltrans shall ensure that the binders are readily accessible to the public.

3. carry out the following actions when it identifies additional projects:

(A) notify the public via a display advertisement in a newspaper of general circulation in that area.

(B) update and distribute the fact sheet to the mailing list and repository locations.

ee) Lead-contaminated soil may be buried only in areas where access is limited or where lead-contaminated soil is covered and contained by a pavement structure.

ff) Dust containing lead-contaminated soil must be controlled. Water or dust palliative may be applied to control dust. If visible dust migration occurs, all excavation, stockpiling and truck loading and burying must be stopped. The granting of this variance confers no relief on Caltrans from compliance with the laws, regulations and requirements enforced by any local air district or the California Air Resources Board.

gg) Sampling and analysis is required to show the lead-contaminated soil meets the variance criteria. All sampling and analysis must be conducted in accordance with the appropriate methods specified in U.S. EPA SW-846.

hh) DTSC retains the right to require Caltrans or any future owner to remove, and properly dispose of, lead-contaminated soil in the event DTSC determines it is necessary for protection of public health, safety or the environment.

ii) DTSC finds that some projects involving lead-contaminated soil are joint projects between Caltrans and other government entities. In these joint projects, Caltrans may not be the lead agency implementing the project although Caltrans is still involved if the project occurs on its right-of-way.

Caltrans may invoke this variance for joint projects where Caltrans and local government entity are involved provided that 1) the project is within the Caltrans Right-of-Way; 2) Caltrans reviews/ oversees all phases of the project including design, contracting, environmental assessment, construction, operation, and maintenance; and 3) Caltrans oversees the project to verify all variance conditions are complied with. Caltrans will be fully responsible for the variance notification and implementation in these joint projects.

jj) All correspondence shall be directed to the following office:

Hazardous Waste Permitting
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826

Attn: Caltrans Lead Variance Notification Unit

10. DISCLAIMER.

a) The issuance of this variance does not relieve Caltrans of the responsibility for compliance with Health and Safety Code, chapter 6.5, or the regulations adopted thereunder, and any other laws and regulations other than those specifically identified in Section 8 of this variance. Caltrans is subject to all terms and conditions herein. The granting of this variance confers no relief from compliance with any federal, State or local requirements other than those specifically provided herein.

b) The issuance of this variance does not release Caltrans from any liability associated with the handling of hazardous waste, except as specifically provided herein and subject to all terms and conditions of this variance.

11. VARIANCE MODIFICATION OR REVOCATION. This variance is subject to review at the discretion of DTSC and may be modified or revoked by DTSC upon change of ownership and at any other time pursuant to Health and Safety Code, section 25143.

12. CEQA DETERMINATION. DTSC adopted a Negative Declaration on June 30, 2009.

Approved:

6/30/09
Date

Beverly Rikala
Operating Facilities Team
Department of Toxic Substances Control

APPENDIX B

APPENDIX B

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: sanleandrolab@emsl.com

Attn: **Chris Giuntoli**
Geocon Consultants, Inc.
6671 Brisa Street

Livermore, CA 94550

Fax: (925) 371-5915 Phone: (925) 371-5900
Project: **E8128-06-07**

Customer ID: GECN21
Customer PO: E8128-06-07
Received: 09/26/11 9:00 AM
EMSL Order: 091110890

EMSL Proj:
Analysis Date: 10/10/2011

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

Sample	Description	Appearance	Non-Asbestos % Fibrous	Non-Asbestos % Non-Fibrous	Asbestos % Type
B19-2.0 *091110890-0001*		Gray Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B22-2.0 *091110890-0002*		Gray Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B25-2.0 *091110890-0003*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B39-1.25 *091110890-0004*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B40-1.5 *091110890-0005*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B41-1.5 *091110890-0006*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B42-1.5 *091110890-0007*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B58-1.5 *091110890-0008*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Initial report from 10/10/2011 10:58:35

Analyst(s)
Baojia Ke (2)
Rui Cindy Geng (6)

Baojia Ke, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

THIS IS THE LAST PAGE OF THE REPORT.

EMSL ANALYTICAL, INC.

Asbestos Lab Services Chain of Custody

EMSL Order Number (Lab Use Only): 091110890

San Leandro, CA
Suite 230
2235 Polvorosa Ave
San Leandro, CA 94577
PHONE: (510) 895-3675
FAX: (510) 895-3680

Company: Geocon Consultants, Inc.
Street: 6671 Brisa Street
City/State/Zip: Livermore, CA 94550
Report To (Name): Chris Giuntoli
Telephone: 925-371-5900
Project Name/Number: E8128-06-07
Please Provide Results: Email **Purchase Order:**

EMSL-Bill to: ☑ Same ☐ Different
If Bill to is Different note instructions in Comments**
Third Party Billing requires written authorization from third party

Fax:
Email Address: giuntoli@geoconinc.com
State Samples Taken: CA

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☒ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air ☐ Check if samples are from NY
☐ NIOSH 7400
☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
☐ PLM EPA 600/R-93/116 (<1%)
☐ PLM EPA NOB (<1%)
Point Count
☐ 400 (<0.25%) ☐ 1000 (<0.1%)
Point Count w/Gravimetric
☐ 400 (<0.25%) ☐ 1000 (<0.1%)
☐ NYS 198.1 (friable in NY)
☐ NYS 198.6 NOB (non-friable-NY)
☐ NIOSH 9002 (<1%)

TEM – Air ☐ 4-4.5hr TAT (AHERA only)
☐ AHERA 40 CFR, Part 763
☐ NIOSH 7402
☐ EPA Level II
☐ ISO 10312

TEM - Bulk
☐ TEM EPA NOB
☐ NYS NOB 198.4 (non-friable-NY)
☐ Chatfield SOP
☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
Fibers >10µm ☐ Waste ☐ Drinking
All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
☐ Microvac - ASTM D 5755
☐ Wipe - ASTM D6480
☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
☒ PLM CARB 435 - A (0.25% sensitivity)
☐ PLM CARB 435 - B (0.1% sensitivity)
☐ TEM CARB 435 - B (0.1% sensitivity)
☐ TEM CARB 435 - C (0.01% sensitivity)
☐ EPA Protocol (Semi-Quantitative)
☐ EPA Protocol (Quantitative)

Other:
☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**
Filter Pore Size (Air Samples): ☐ 0.8µm ☐ 0.45µm

Samplers Name: GEMMA REBLANDO
Samplers Signature: Gemma Reblando

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
B19-2.0			9/21/11 1239
B22-2.0			9/21/11 1200
B25-2.0			9/21/11 1111
B39-1.25			9/21/11 0955
B40-1.5			9/21/11 0928
B41-1.5			9/21/11 0942
B42-1.5			9/21/11 1010
B58-1.5			9/21/11 1036

Client Sample # (s):
Total # of Samples: 8
Relinquished (Client): Gemma Reblando / Geocon **Date:** 9/22/11 **Time:** 0900
Received (Lab): [illegible] **Date:** 9/26/11 **Time:** 0900 PK

Comments/Special Instructions:

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: sanleandrolab@emsl.com

Attn: **Chris Giuntoli**
Geocon Consultants, Inc.
6671 Brisa Street

Livermore, CA 94550

Fax: (925) 371-5915 Phone: (925) 371-5900
Project: **E8128-06-07**

Customer ID: GECN21
Customer PO: E8128-06-07
Received: 09/29/11 9:00 AM
EMSL Order: 091111030

EMSL Proj:
Analysis Date: 10/12/2011

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B43-1.5 *091111030-0001*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B44-1.5 *091111030-0002*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B45-1.5 *091111030-0003*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B46-1.5 *091111030-0004*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B47-1.5 *091111030-0005*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B48-1.5 *091111030-0006*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B49-1.5 *091111030-0007*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B50-1.5 *091111030-0008*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B51-1.5 *091111030-0009*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Initial report from 10/12/2011 17:25:37

Analyst(s)
Adam C. Fink (11)

Baojia Ke, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: sanleandrolab@emsl.com

Attn: **Chris Giuntoli**
Geocon Consultants, Inc.
6671 Brisa Street

Livermore, CA 94550

Fax: (925) 371-5915 Phone: (925) 371-5900
Project: **E8128-06-07**

Customer ID: GECN21
Customer PO: E8128-06-07
Received: 09/29/11 9:00 AM
EMSL Order: 091111030

EMSL Proj:
Analysis Date: 10/12/2011

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B52-1.5 *091111030-0010*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B53-1.5 *091111030-0011*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Initial report from 10/12/2011 17:25:37

Analyst(s)
Adam C. Fink (11)

Baojia Ke, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

THIS IS THE LAST PAGE OF THE REPORT.

EMSL ANALYTICAL, INC.

San Leandro, CA
Suite 230
2235 Polvorosa Ave
San Leandro, CA 94577
PHONE: (510) 895-3675
FAX: (510) 895-3680

Asbestos Lab Services Chain of Custody

EMSL Order Number (Lab Use Only): 091111030

Company: Geocon Consultants, Inc.
Street: 6671 Brisa Street
City/State/Zip: Livermorw, CA 94550
Report To (Name): Chris Giuntoli
Telephone: 925-371-5900
Project Name/Number: E8128-06-07
Please Provide Results: Email **Purchase Order:**

EMSL-Bill to: ☑ Same ☐ Different
If Bill to is Different note instructions in Comments**
Third Party Billing requires written authorization from third party

Fax:
Email Address: giuntoli@geoconinc.com
State Samples Taken: CA

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☒ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air ☐ Check if samples are from NY
☐ NIOSH 7400
☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
☐ PLM EPA 600/R-93/116 (<1%)
☐ PLM EPA NOB (<1%)
Point Count
☐ 400 (<0.25%) ☐ 1000 (<0.1%)
Point Count w/Gravimetric
☐ 400 (<0.25%) ☐ 1000 (<0.1%)
☐ NYS 198.1 (friable in NY)
☐ NYS 198.6 NOB (non-friable-NY)
☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT** (AHERA only)
☐ AHERA 40 CFR, Part 763
☐ NIOSH 7402
☐ EPA Level II
☐ ISO 10312

TEM - Bulk
☐ TEM EPA NOB
☐ NYS NOB 198.4 (non-friable-NY)
☐ Chatfield SOP
☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
Fibers >10µm ☐ Waste ☐ Drinking
All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
☐ Microvac - ASTM D 5755
☐ Wipe - ASTM D6480
☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
☒ PLM CARB 435 - A (0.25% sensitivity)
☐ PLM CARB 435 - B (0.1% sensitivity)
☐ TEM CARB 435 - B (0.1% sensitivity)
☐ TEM CARB 435 - C (0.01% sensitivity)
☐ EPA Protocol (Semi-Quantitative)
☐ EPA Protocol (Quantitative)

Other:
☐

☐ **Check For Positive Stop – Clearly Identify Homogenous Group**

Filter Pore Size (Air Samples): ☐ 0.8µm ☐ 0.45µm

Samplers Name:
Samplers Signature:

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
B43-1.5			9/27/11 / 945
B44-1.5			1007
B45-1.5			1021
B46-1.5			1125
B47-1.5			1215
B48-1.5			1040
B49-1.5			1059
B50-1.5			1140

Client Sample # (s): **Total # of Samples:**
Relinquished (Client): **Date:** 9/28/11 **Time:** 1500
Received (Lab): **Date:** 9/29/11 **Time:** 9:00 AM

Comments/Special Instructions:

925
525. 775. 585. 6116.

EMSL ANALYTICAL, INC.

Asbestos Lab Services Chain of Custody

EMSL Order Number*(Lab Use Only)*: 091111030

San Leandro, CA
Suite 230
2235 Polvorosa Ave
San Leandro, CA 94577
PHONE: (510) 895-3675
FAX: (510) 895-3680

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
B51-1.5			9/27/11 / 1158
~~B4~~ B52-1.5			↓ 1229
B53-1.5			↓ 1241

Comments/Special Instructions:

9/29/11 9:00 AM

Controlled Document – Asbestos Lab Services COC – A1.0 – 11/23/2009

Page ___ of ___ Pages

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: sanleandrolab@emsl.com

Attn: **Chris Giuntoli**
Geocon Consultants, Inc.
4010 Technology Way Ste D
Carson City, NV 89706

Fax: (775) 888-9904 Phone: (775) 888-9900
Project: **E8128-06-07 / 80/680/12 Interchange**

Customer ID: GCNV25
Customer PO: E8128-06-07
Received: 10/18/11 9:00 AM
EMSL Order: 091111873

EMSL Proj:
Analysis Date: 10/31/2011

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B70-2NOA *091111873-0001*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B71-2NOA *091111873-0002*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B72-2NOA *091111873-0003*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B73-2NOA *091111873-0004*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B74-2NOA *091111873-0005*		Yellow Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B75-2NOA *091111873-0006*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B65-2NOA *091111873-0007*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B55-4NOA *091111873-0008*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B54-4NOA *091111873-0009*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Initial report from

Analyst(s)

Baojia Ke (5)
Rui Cindy Geng (15)

Baojia Ke, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: sanleandrolab@emsl.com

Attn: **Chris Giuntoli**
Geocon Consultants, Inc.
4010 Technology Way Ste D
Carson City, NV 89706

Fax: (775) 888-9904 Phone: (775) 888-9900
Project: **E8128-06-07 / 80/680/12 Interchange**

Customer ID: GCNV25
Customer PO: E8128-06-07
Received: 10/18/11 9:00 AM
EMSL Order: 091111873

EMSL Proj:
Analysis Date: 10/31/2011

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B63-2NOA *091111873-0010*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B64-2NOA *091111873-0011*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B53-4NOA *091111873-0012*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B51-4NOA *091111873-0013*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B38-2NOA *091111873-0014*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B37-2NOA *091111873-0015*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B6-2NOA *091111873-0016*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B1-2NOA *091111873-0017*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
BS2-4NOA *091111873-0018*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Initial report from

Analyst(s)

Baojia Ke (5)
Rui Cindy Geng (15)

Baojia Ke, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: sanleandrolab@emsl.com

Attn: **Chris Giuntoli**
Geocon Consultants, Inc.
4010 Technology Way Ste D
Carson City, NV 89706

Fax: (775) 888-9904 Phone: (775) 888-9900
Project: **E8128-06-07 / 80/680/12 Interchange**

Customer ID: GCNV25
Customer PO: E8128-06-07
Received: 10/18/11 9:00 AM
EMSL Order: 091111873

EMSL Proj:
Analysis Date: 10/31/2011

Test Report: PLM Analysis of Bulk Samples for Asbestos via EPA 600/R-93/116 Method with CARB 435 Prep (Milling) Level A for 0.25% Target Analytical Sensitivity

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
B36-2NOA *091111873-0019*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**
B66-2NOA *091111873-0020*		Brown Non-Fibrous Homogeneous		100.00% Non-fibrous (other)	**None Detected**

Initial report from

Analyst(s)

Baojia Ke (5)
Rui Cindy Geng (15)

Baojia Ke, Laboratory Manager
or other approved signatory

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Samples analyzed by EMSL Analytical, Inc San Leandro, CA

THIS IS THE LAST PAGE OF THE REPORT.

091111873

EMSL ANALYTICAL, INC.
LABORATORY·PRODUCTS·TRAINING

Chain of Custody

EMSL Order Number *(Lab Use Only)*: 091111873

EMSL ANALYTICAL, INC.
200 ROUTE 130 NORTH
CINNAMINSON, NJ 08077
PHONE: (800) 220-3675
FAX: (856) 786-5974

Company: GEOCON	EMSL-Bill to: ☒ Same ☐ Different If Bill to is Different note instructions in Comments** Third Party Billing requires written authorization from third party
Street: 6671 BRISA ST.	
City: LIVERMORE State/Province: CA	Zip/Postal Code: 94550 Country: USA
Report To (Name): CHRIS GIUNTOLI	Fax #: 925-371-5915
Telephone #: 925-371-5900	Email Address: GIUNTOLI@GEOCONINC.COM
Project Name/Number: 80/680 INTERCHANGE - ES128-06-07	
Please Provide Results: ☐ Fax ☒ Email	Purchase Order: U.S. State Samples Taken:

Turnaround Time (TAT) Options* - Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ☐ 1 Week ☒ 2 Week

**For RUSH TAT's Please Call Ahead to Confirm Lab Hours and Availability. Not all TAT options are valid for every test. Materials Science and IAQ TATs are in Business Days rather than Hours (i.e. 24 Hour = End of Next Business Day)*

Asbestos

PCM - Air
☐ NIOSH 7400
☐ w/ 8hr TWA

TEM– Air ☐ 4-4.5hr TAT (AHERA ONLY)
☐ AHERA 40 CFR, Part 763
☐ NIOSH 7402
☐ EPA Level II
☐ ISO 10312

TEM - Water
Fibers ≥10µm ☐ Waste ☐ Drinking
All Fiber Sizes ☐ Waste ☐ Drinking

PLM - Bulk
☐ PLM EPA 600/R-93/116
☐ PLM EPA NOB (<1%)
☐ NYS 198.1 (friable-NY)
☐ NYS 198.6 (non-friable-NY)
Point Count ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
Point Count w/ Gravimetric
☐ 400 (<0.25%) ☐ 1000 (<0.1%)

TEM - Dust
☐ Microvac – ASTM D 5755
☐ Wipe-ASTM D6480

TEM - Bulk
☐ TEM EPA NOB
☐ NYS NOB 198.4 (non-friable-NY)
☐ Chatfield SOP

Soil/Rock/Vermiculite
☒ PLM CARB 435 – A (0.25% sensitivity)
☐ PLM CARB 435 – B (0.1% sensitivity)
☐ TEM CARB 435 – B (0.1% sensitivity)
☐ EPA Reg. 1 Screening Protocol (Qualitative)

Other:

Lead (Pb)

Flame Atomic Absorption
☐ Chips SW846-7000B or AOAC 974.02
☐ Soil SW846-7000B/7420
☐ Air NIOSH 7082
☐ Wastewater SM3111B or SW846-7000B/7420
☐ ASTM Wipe SW846-7000B/7420
☐ non ASTM Wipe SW846-7000B/7420
☐ TCLP SW846-1311/7420/SM 3111B

ICP
☐ Air NIOSH 7300 Modified
☐ non ASTM Wipe SW846-6010B or C
☐ ASTM Wipe SW846-6010B or C
☐ Soil SW846-6010 B or C
☐ Waste Water SW846-6010B or C
☐ TCLP SW846-6010B or C

Graphite Furnace Atomic Absorption
☐ Soil SW846-7421 ☐ Wastewater EPA 200.9
☐ Air NIOSH 7105 ☐ Drinking Water EPA 200.9

Other: ☐

Materials Science

☐ Common Particle ID (large particles)
☐ Full Particle ID (environmental dust)
☐ Basic Material ID (solids)
☐ Advanced Material ID
☐ Physical Testing (Tensile, Compression)
☐ Combustion-by-products (soot, char, etc.)
☐ X-Ray Fluorescence (elem. analysis)
☐ X-Ray Diffraction (Crystalline Part.)
☐ MMVF's (Fibrous glass, RCF's)
☐ Particle Size (sieve/microscopy/laser)
☐ Combustible Dust
☐ Petrographic Examination
Other: ☐

Microbiology

Wipe and Bulk Samples
☐ Mold & Fungi – Direct Examination
☐ Mold & Fungi Culture (Genus Only)
☐ Mold & Fungi Culture (Genus & Species)
☐ Bacterial Count & ID (Up to Three Types)
☐ Bacterial Count & ID (Up to Five Types)
☐ MRSA
☐ *Pseudomonas aeruginosa*

Water Samples
☐ Total Coliform & E.coli (P/A)
☐ Fecal Coliform (SM 9222D)
☐ Sewage Screen
☐ Heterotrophic Plate Count (SM 9215)

Air Samples
☐ Mold & Fungi (Spore Trap)
☐ Mold & Fungi Culture (Genus Only)
☐ Mold & Fungi (Genus & Species)
☐ Bacterial Culture & ID (Up to Three Types)
☐ Bacterial Culture & ID (Up to Five Types)
☐ Endotoxin Testing

Real Time Q-PCR (See Analytical Guide for Code)
Code:

Legionella
☐ Level 1 ☐ Level 2 ☐ Level 3 ☐ Level 4

Other: ☐

IAQ

Nuisance Dust NIOSH ☐ 0500 ☐ 0600
Airborne Dust ☐ PM10 ☐ TSP
Silica Analysis: ☐ All Species
Silica Analysis – Single Species
☐ Alpha Quartz ☐ Cristobalite ☐ Tridymite
☐ HVAC Efficiency
☐ Carbon Black
☐ Airborne Oil Mist
Radon Testing: Call for Kit and COC
Other: ☐

****Comments/Special Instructions:**

Client Sample #'s	Various	Total # of Samples:	20
Relinquished (Client):	[signature]	Date: 10/7/11	Time: 1500
Received (Lab):	[signature]	Date: 10/10/11	Time: 0900

Analysis Completed in Accordance with EMSL's Terms and Conditions located in the Analytical Price Guide

EMSL ANALYTICAL, INC.

Asbestos Lab Services Chain of Custody

EMSL Order Number *(Lab Use Only)*: 091111873

San Leandro, C
Suite 23
2235 Polvorosa Av
San Leandro, CA 9457
PHONE: (510) 895-367
FAX: (510) 895-368

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
B70-2NOA	SOIL		10/13/11 0858
B71-2NOA	COMPOSITE		0927
B72-2NOA			0953
B73-2NOA			0956
B74-2NOA	COMPOSITE		0940
B75-2NOA			0948
JVC ~~B76~~ B65-2NOA			0909
B55-4NOA			1006
B54-4NOA			1048
B63-2NOA			1150
B64-2NOA			1200
B53-4NOA			1240
B51-4NOA			1618
B36-2NOA			1539
B37-2NOA			1532
B6-2NOA			1506

Comments/Special Instructions:

RECEIVED OCT 18 2011 0900

Controlled Document – Asbestos Lab Services COC – A1.0 – 11/23/2009

Page 1 of 2 Pages

EMSL ANALYTICAL, INC.

Asbestos Lab Services Chain of Custody

EMSL Order Number *(Lab Use Only):* 091111873

San Leandro, CA
Suite 230
2235 Polvorosa Ave
San Leandro, CA 94577
PHONE: (510) 895-3675
FAX: (510) 895-3680

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
B1-2NOA			10/3/11 1444
BS2-4NOA			1713
B36-2NOA			1421
B66-2NOA			1747

Comments/Special Instructions:

Controlled Document – Asbestos Lab Services COC – A1.0 – 11/23/2009

September 30, 2011

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Chris Giuntoli
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550

TEL: (925) 371-5900
FAX: (925) 371-5915

Workorder No.: 119956

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on September 22, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

for Eddie F. Rodriguez
Laboratory Director

The cover letter and the case narrative are an integral part of this analytical report and cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

CLIENT: Geocon Consultants, Inc.
Project: 80/680/12 Interchange, E8128-06-07
Lab Order: 119956

CASE NARRATIVE

Analytical Comments for Method 6010

Matrix Spike (MS) and /or Matrix Spike Duplicate (MSD) are/is outside recovery criteria for samples 119957-005AMS and 119957-005AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8015 (DRO/ORO)

Dilution was necessary for samples 119956-001A, 119956-003A and 119956-006A, due to sample matrix.

Surrogate recovery was diluted out for samples 119956-001A, 119956-003A, 119956-006A, 119956-009A, 119956-012A, 119956-015A and 119956-024A.

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for samples 119987-001AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8021

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for samples 119956-010AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Advanced Technology Laboratories
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Advanced Technology Laboratories

Date: 9/30/2011

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	119956
Project:	80/680/12 Interchange, E8128-06-07	**Date Received**	9/22/2011 8:27:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	IL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
119956-001A	B4-0.0	13	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-003A	B18-0.0	29	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-004A	B18-1.0	12	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-005A	B18-2.0	6.3	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-007A	B19-1.0	24	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-008A	B19-2.0	9.0	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-009A	B20-0.0	90	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-010A	B20-1.0	38	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-011A	B20-2.0	19	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-012A	B21-0.0	81	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-013A	B21-1.0	71	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-014A	B21-2.0	9.2	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-016A	B22-1.0	110	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-017A	B22-2.0	31	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-018A	B23-0.0	180	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-019A	B23-1.0	50	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-020A	B23-2.0	ND	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-021A	B24-0.0	71	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 9/30/2011

ANALYTICAL RESULTS

LEAD BY ICP
EPA 6010B

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	119956
Project:	80/680/12 Interchange, E8128-06-07	**Date Received**	9/22/2011 8:27:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	IL

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
119956-022A	B24-1.0	22	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-023A	B24-2.0	5.1	mg/Kg	75957	5.0	1	9/21/2011	9/29/2011
119956-024A	B25-0.0	14	mg/Kg	75958	5.0	1	9/21/2011	9/29/2011
119956-025A	B25-1.0	ND	mg/Kg	75958	5.0	1	9/21/2011	9/29/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

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Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B4-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 1:17:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-001A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	940	100		mg/Kg	10	9/27/2011 01:04 PM
ORO	4700	100		mg/Kg	10	9/27/2011 01:04 PM
Surr: p-Terphenyl	0	30-128	SDO	%REC	10	9/27/2011 01:04 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B4-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 1:25:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-002A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_110928H	QC Batch: 75927			PrepDate: 9/28/2011		Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:14 PM
Arsenic	ND	1.0		mg/Kg	1	9/28/2011 08:14 PM
Barium	29	1.0		mg/Kg	1	9/28/2011 08:14 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:14 PM
Cadmium	1.1	1.0		mg/Kg	1	9/28/2011 08:14 PM
Chromium	16	1.0		mg/Kg	1	9/28/2011 08:14 PM
Cobalt	14	1.0		mg/Kg	1	9/28/2011 08:14 PM
Copper	31	2.0		mg/Kg	1	9/28/2011 08:14 PM
Lead	9.8	1.0		mg/Kg	1	9/28/2011 08:14 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:14 PM
Nickel	23	1.0		mg/Kg	1	9/28/2011 08:14 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:14 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:14 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:14 PM
Vanadium	81	1.0		mg/Kg	1	9/28/2011 08:14 PM
Zinc	54	1.0		mg/Kg	1	9/28/2011 08:14 PM
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B(M)			
RunID: GC2_110927A	QC Batch: E11VS334			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/27/2011 01:04 PM
Surr: Bromofluorobenzene (FID)	105	69-158		%REC	1	9/27/2011 01:04 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
			EPA 8021B			
RunID: GC2_110927A	QC Batch: E11VS334			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/27/2011 01:04 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/27/2011 01:04 PM
m,p-Xylene	ND	10		µg/Kg	1	9/27/2011 01:04 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/27/2011 01:04 PM
o-Xylene	ND	5.0		µg/Kg	1	9/27/2011 01:04 PM
Toluene	ND	5.0		µg/Kg	1	9/27/2011 01:04 PM
Surr: Bromofluorobenzene (PID)	104	65-140		%REC	1	9/27/2011 01:04 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B4-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 1:25:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-002A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	0.38	0.10		mg/Kg	1	9/28/2011 05:17 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

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Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B18-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 12:49:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-003A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	27	10		mg/Kg	10	9/27/2011 01:27 PM
ORO	160	10		mg/Kg	10	9/27/2011 01:27 PM
Surr: p-Terphenyl	0	30-128	SDO	%REC	10	9/27/2011 01:27 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B18-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 12:53:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-004A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/27/2011 01:19 PM
Surr: Bromofluorobenzene (FID)	104	69-158		%REC	1	9/27/2011 01:19 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/27/2011 01:19 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/27/2011 01:19 PM
m,p-Xylene	ND	10		µg/Kg	1	9/27/2011 01:19 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/27/2011 01:19 PM
o-Xylene	ND	5.0		µg/Kg	1	9/27/2011 01:19 PM
Toluene	ND	5.0		µg/Kg	1	9/27/2011 01:19 PM
Surr: Bromofluorobenzene (PID)	104	65-140		%REC	1	9/27/2011 01:19 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B19-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 12:34:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-006A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_110928H	QC Batch: 75927			PrepDate:	9/28/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:17 PM
Arsenic	7.2	1.0		mg/Kg	1	9/28/2011 08:17 PM
Barium	59	1.0		mg/Kg	1	9/28/2011 08:17 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:17 PM
Cadmium	ND	1.0		mg/Kg	1	9/28/2011 08:17 PM
Chromium	19	1.0		mg/Kg	1	9/28/2011 08:17 PM
Cobalt	6.3	1.0		mg/Kg	1	9/28/2011 08:17 PM
Copper	21	2.0		mg/Kg	1	9/28/2011 08:17 PM
Lead	81	1.0		mg/Kg	1	9/28/2011 08:17 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:17 PM
Nickel	20	1.0		mg/Kg	1	9/28/2011 08:17 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:17 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:17 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:17 PM
Vanadium	32	1.0		mg/Kg	1	9/28/2011 08:17 PM
Zinc	120	1.0		mg/Kg	1	9/28/2011 08:17 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	81	20		mg/Kg	10	9/27/2011 12:01 PM
ORO	590	20		mg/Kg	10	9/27/2011 12:01 PM
Surr: p-Terphenyl	0	30-128	SDO	%REC	10	9/27/2011 12:01 PM
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	9/28/2011 05:19 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B19-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 12:37:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-007A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/27/2011 01:35 PM
Surr: Bromofluorobenzene (FID)	105	69-158		%REC	1	9/27/2011 01:35 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/27/2011 01:35 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/27/2011 01:35 PM
m,p-Xylene	ND	10		µg/Kg	1	9/27/2011 01:35 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/27/2011 01:35 PM
o-Xylene	ND	5.0		µg/Kg	1	9/27/2011 01:35 PM
Toluene	ND	5.0		µg/Kg	1	9/27/2011 01:35 PM
Surr: Bromofluorobenzene (PID)	104	65-140		%REC	1	9/27/2011 01:35 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B20-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 12:14:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-009A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	420	10		mg/Kg	1	9/27/2011 12:22 PM
ORO	1600	10		mg/Kg	1	9/27/2011 12:22 PM
Surr: p-Terphenyl	0	30-128	SDO	%REC	1	9/27/2011 12:22 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B20-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 12:16:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-010A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110928A	QC Batch:	E11VS335		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/28/2011 12:35 PM
Surr: Bromofluorobenzene (FID)	99.0	69-158		%REC	1	9/28/2011 12:35 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110928A	QC Batch:	E11VS335		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/28/2011 12:35 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/28/2011 12:35 PM
m,p-Xylene	ND	10		µg/Kg	1	9/28/2011 12:35 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/28/2011 12:35 PM
o-Xylene	ND	5.0		µg/Kg	1	9/28/2011 12:35 PM
Toluene	ND	5.0		µg/Kg	1	9/28/2011 12:35 PM
Surr: Bromofluorobenzene (PID)	98.8	65-140		%REC	1	9/28/2011 12:35 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B21-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 12:05:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-012A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	400	100		mg/Kg	10	9/27/2011 01:48 PM
ORO	1900	100		mg/Kg	10	9/27/2011 01:48 PM
Surr: p-Terphenyl	0	30-128	SDO	%REC	10	9/27/2011 01:48 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B21-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 12:06:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-013A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/27/2011 02:06 PM
Surr: Bromofluorobenzene (FID)	93.6	69-158		%REC	1	9/27/2011 02:06 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/27/2011 02:06 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/27/2011 02:06 PM
m,p-Xylene	ND	10		µg/Kg	1	9/27/2011 02:06 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/27/2011 02:06 PM
o-Xylene	ND	5.0		µg/Kg	1	9/27/2011 02:06 PM
Toluene	ND	5.0		µg/Kg	1	9/27/2011 02:06 PM
Surr: Bromofluorobenzene (PID)	93.8	65-140		%REC	1	9/27/2011 02:06 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B22-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:52:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-015A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_110928H	QC Batch: 75927			PrepDate:	9/28/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:21 PM
Arsenic	2.8	1.0		mg/Kg	1	9/28/2011 08:21 PM
Barium	91	1.0		mg/Kg	1	9/28/2011 08:21 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:21 PM
Cadmium	ND	1.0		mg/Kg	1	9/28/2011 08:21 PM
Chromium	7.6	1.0		mg/Kg	1	9/28/2011 08:21 PM
Cobalt	3.9	1.0		mg/Kg	1	9/28/2011 08:21 PM
Copper	10	2.0		mg/Kg	1	9/28/2011 08:21 PM
Lead	47	1.0		mg/Kg	1	9/28/2011 08:21 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:21 PM
Nickel	6.7	1.0		mg/Kg	1	9/28/2011 08:21 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:21 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:21 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:21 PM
Vanadium	17	1.0		mg/Kg	1	9/28/2011 08:21 PM
Zinc	52	1.0		mg/Kg	1	9/28/2011 08:21 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	34	6.0		mg/Kg	1	9/27/2011 12:12 PM
ORO	210	6.0		mg/Kg	1	9/27/2011 12:12 PM
Surr: p-Terphenyl	0	30-128	SDO	%REC	1	9/27/2011 12:12 PM
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	9/28/2011 05:21 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B22-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:54:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-016A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B(M)			
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/27/2011 02:22 PM
Surr: Bromofluorobenzene (FID)	106	69-158		%REC	1	9/27/2011 02:22 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
			EPA 8021B			
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/27/2011 02:22 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/27/2011 02:22 PM
m,p-Xylene	ND	10		µg/Kg	1	9/27/2011 02:22 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/27/2011 02:22 PM
o-Xylene	ND	5.0		µg/Kg	1	9/27/2011 02:22 PM
Toluene	ND	5.0		µg/Kg	1	9/27/2011 02:22 PM
Surr: Bromofluorobenzene (PID)	106	65-140		%REC	1	9/27/2011 02:22 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B23-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:39:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-018A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	210	6.0		mg/Kg	1	9/27/2011 12:33 PM
ORO	810	6.0		mg/Kg	1	9/27/2011 12:33 PM
Surr: p-Terphenyl	100	30-128		%REC	1	9/27/2011 12:33 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B23-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:40:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-019A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B(M)			
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/27/2011 05:39 PM
Surr: Bromofluorobenzene (FID)	96.3	69-158		%REC	1	9/27/2011 05:39 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
			EPA 8021B			
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/27/2011 05:39 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/27/2011 05:39 PM
m,p-Xylene	ND	10		µg/Kg	1	9/27/2011 05:39 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/27/2011 05:39 PM
o-Xylene	ND	5.0		µg/Kg	1	9/27/2011 05:39 PM
Toluene	ND	5.0		µg/Kg	1	9/27/2011 05:39 PM
Surr: Bromofluorobenzene (PID)	95.2	65-140		%REC	1	9/27/2011 05:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B24-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:15:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-021A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	13	1.0		mg/Kg	1	9/27/2011 10:50 AM
ORO	54	1.0		mg/Kg	1	9/27/2011 10:50 AM
Surr: p-Terphenyl	53.5	30-128		%REC	1	9/27/2011 10:50 AM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B24-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:18:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-022A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/27/2011 02:51 PM
Surr: Bromofluorobenzene (FID)	100	69-158		%REC	1	9/27/2011 02:51 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/27/2011 02:51 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/27/2011 02:51 PM
m,p-Xylene	ND	10		µg/Kg	1	9/27/2011 02:51 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/27/2011 02:51 PM
o-Xylene	ND	5.0		µg/Kg	1	9/27/2011 02:51 PM
Toluene	ND	5.0		µg/Kg	1	9/27/2011 02:51 PM
Surr: Bromofluorobenzene (PID)	100	65-140		%REC	1	9/27/2011 02:51 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B25-0.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:07:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-024A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_110927A	QC Batch: 75876			PrepDate:	9/27/2011	Analyst: **CBR**
DRO	300	60		mg/Kg	10	9/27/2011 01:38 PM
ORO	1300	60		mg/Kg	10	9/27/2011 01:38 PM
Surr: p-Terphenyl	0	30-128	SDO	%REC	10	9/27/2011 01:38 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B25-1.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:09:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-025A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	9/27/2011 03:07 PM
Surr: Bromofluorobenzene (FID)	111	69-158		%REC	1	9/27/2011 03:07 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_110927A	QC Batch:	E11VS334		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	9/27/2011 03:07 PM
Ethylbenzene	ND	5.0		µg/Kg	1	9/27/2011 03:07 PM
m,p-Xylene	ND	10		µg/Kg	1	9/27/2011 03:07 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	9/27/2011 03:07 PM
o-Xylene	ND	5.0		µg/Kg	1	9/27/2011 03:07 PM
Toluene	ND	5.0		µg/Kg	1	9/27/2011 03:07 PM
Surr: Bromofluorobenzene (PID)	111	65-140		%REC	1	9/27/2011 03:07 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B25-2.0
Lab Order:	119956	**Collection Date:**	9/21/2011 11:11:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119956-026A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_110928H	QC Batch: 75927			PrepDate:	9/28/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:24 PM
Arsenic	2.4	1.0		mg/Kg	1	9/28/2011 08:24 PM
Barium	65	1.0		mg/Kg	1	9/28/2011 08:24 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:24 PM
Cadmium	ND	1.0		mg/Kg	1	9/28/2011 08:24 PM
Chromium	9.6	1.0		mg/Kg	1	9/28/2011 08:24 PM
Cobalt	3.9	1.0		mg/Kg	1	9/28/2011 08:24 PM
Copper	9.9	2.0		mg/Kg	1	9/28/2011 08:24 PM
Lead	22	1.0		mg/Kg	1	9/28/2011 08:24 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:24 PM
Nickel	13	1.0		mg/Kg	1	9/28/2011 08:24 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:24 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:24 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:24 PM
Vanadium	13	1.0		mg/Kg	1	9/28/2011 08:24 PM
Zinc	42	1.0		mg/Kg	1	9/28/2011 08:24 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	9/28/2011 05:23 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-75927** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **PBS** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250429**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.083	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	0.043	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-75927** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **LCSS** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250430**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	48.558	2.0	50.00	0.08290	97.0	80	120				
Arsenic	46.010	1.0	50.00	0	92.0	80	120				
Barium	50.213	1.0	50.00	0	100	80	120				
Beryllium	49.454	1.0	50.00	0	98.9	80	120				
Cadmium	47.993	1.0	50.00	0	96.0	80	120				
Chromium	47.217	1.0	50.00	0.04342	94.3	80	120				
Cobalt	49.964	1.0	50.00	0	99.9	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-75927** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **LCSS** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250430**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	49.178	2.0	50.00	0	98.4	80	120				
Lead	48.465	1.0	50.00	0	96.9	80	120				
Molybdenum	49.868	1.0	50.00	0	99.7	80	120				
Nickel	49.352	1.0	50.00	0	98.7	80	120				
Selenium	44.926	1.0	50.00	0	89.9	80	120				
Silver	47.967	1.0	50.00	0	95.9	80	120				
Thallium	46.610	1.0	50.00	0	93.2	80	120				
Vanadium	50.106	1.0	50.00	0	100	80	120				
Zinc	48.198	1.0	50.00	0	96.4	80	120				

Sample ID: **119957-005A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **ZZZZZZ** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250446**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	91.406	2.0	125.0	0.4333	72.8	44	105				
Arsenic	102.876	1.0	125.0	3.686	79.4	57	103				
Barium	303.907	1.0	125.0	257.5	37.1	36	134				
Beryllium	104.848	1.0	125.0	0.2175	83.7	64	106				
Cadmium	98.158	1.0	125.0	1.198	77.6	58	102				
Chromium	105.300	1.0	125.0	7.687	78.1	55	105				
Cobalt	110.789	1.0	125.0	15.17	76.5	59	105				
Copper	133.154	2.0	125.0	17.84	92.3	64	117				
Lead	128.700	1.0	125.0	34.06	75.7	46	116				
Molybdenum	101.531	1.0	125.0	0	81.2	59	108				
Nickel	111.386	1.0	125.0	12.17	79.4	52	109				
Selenium	100.806	1.0	125.0	0	80.6	56	100				
Silver	104.935	1.0	125.0	0	83.9	65	107				
Thallium	94.501	1.0	125.0	0	75.6	47	100				
Vanadium	125.545	1.0	125.0	22.68	82.3	64	110				
Zinc	227.280	1.0	125.0	223.0	3.40	37	123				S

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **119957-005A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **ZZZZZZ** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250447**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	84.616	2.0	125.0	0.4333	67.3	44	105	91.41	7.72	20	
Arsenic	97.438	1.0	125.0	3.686	75.0	57	103	102.9	5.43	20	
Barium	334.585	1.0	125.0	257.5	61.7	36	134	303.9	9.61	20	
Beryllium	101.094	1.0	125.0	0.2175	80.7	64	106	104.8	3.65	20	
Cadmium	93.617	1.0	125.0	1.198	73.9	58	102	98.16	4.74	20	
Chromium	100.977	1.0	125.0	7.687	74.6	55	105	105.3	4.19	20	
Cobalt	110.396	1.0	125.0	15.17	76.2	59	105	110.8	0.355	20	
Copper	127.527	2.0	125.0	17.84	87.8	64	117	133.2	4.32	20	
Lead	120.871	1.0	125.0	34.06	69.5	46	116	128.7	6.27	20	
Molybdenum	97.349	1.0	125.0	0	77.9	59	108	101.5	4.20	20	
Nickel	107.284	1.0	125.0	12.17	76.1	52	109	111.4	3.75	20	
Selenium	95.104	1.0	125.0	0	76.1	56	100	100.8	5.82	20	
Silver	96.447	1.0	125.0	0	77.2	65	107	104.9	8.43	20	
Thallium	89.788	1.0	125.0	0	71.8	47	100	94.50	5.12	20	
Vanadium	121.023	1.0	125.0	22.68	78.7	64	110	125.5	3.67	20	
Zinc	211.520	1.0	125.0	223.0	-9.21	37	123	227.3	7.18	20	S

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-75957** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **9/29/2011** RunNo: **137129**
Client ID: **PBS** Batch ID: **75957** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **9/29/2011** SeqNo: **2250861**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.634	5.0									

Sample ID: **LCS-75957** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **9/29/2011** RunNo: **137129**
Client ID: **LCSS** Batch ID: **75957** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **9/29/2011** SeqNo: **2250862**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	280.505	5.0	250.0	0.6338	112	80	120				

Sample ID: **119956-023A-MS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **9/29/2011** RunNo: **137129**
Client ID: **B24-2.0** Batch ID: **75957** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **9/29/2011** SeqNo: **2250883**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	207.847	5.0	250.0	5.133	81.1	46	116				

Sample ID: **119956-023A-MSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **9/29/2011** RunNo: **137129**
Client ID: **B24-2.0** Batch ID: **75957** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **9/29/2011** SeqNo: **2250884**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	229.955	5.0	250.0	5.133	89.9	46	116	207.8	10.1	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_SPB

Sample ID: **MB-75958A** SampType: **MBLK** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **9/29/2011** RunNo: **137130**
Client ID: **PBS** Batch ID: **75958** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **9/29/2011** SeqNo: **2250885**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.132	5.0									

Sample ID: **LCS-75958** SampType: **LCS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **9/29/2011** RunNo: **137130**
Client ID: **LCSS** Batch ID: **75958** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **9/29/2011** SeqNo: **2250886**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	284.173	5.0	250.0	0.1323	114	80	120				

Sample ID: **119956-025A-MS** SampType: **MS** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **9/29/2011** RunNo: **137130**
Client ID: **B25-1.0** Batch ID: **75958** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **9/29/2011** SeqNo: **2250889**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	220.753	5.0	250.0	3.342	87.0	46	116				

Sample ID: **119956-025A-MSD** SampType: **MSD** TestCode: **6010_SPB** Units: **mg/Kg** Prep Date: **9/29/2011** RunNo: **137130**
Client ID: **B25-1.0** Batch ID: **75958** TestNo: **EPA 6010B** **EPA 3050M** Analysis Date: **9/29/2011** SeqNo: **2250890**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	220.555	5.0	250.0	3.342	86.9	46	116	220.8	0.0895	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-75920** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137119**
Client ID: **PBS** Batch ID: **75920** TestNo: **EPA 7471A** Analysis Date: **9/28/2011** SeqNo: **2250654**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.003	0.10									

Sample ID: **LCS-75920** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137119**
Client ID: **LCSS** Batch ID: **75920** TestNo: **EPA 7471A** Analysis Date: **9/28/2011** SeqNo: **2250655**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.766	0.10	0.8300	0.003171	91.9	80	120				

Sample ID: **119956-002A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137119**
Client ID: **B4-1.0** Batch ID: **75920** TestNo: **EPA 7471A** Analysis Date: **9/28/2011** SeqNo: **2250657**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.006	0.10	0.8300	0.3781	75.7	70	130				

Sample ID: **119956-002A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137119**
Client ID: **B4-1.0** Batch ID: **75920** TestNo: **EPA 7471A** Analysis Date: **9/28/2011** SeqNo: **2250658**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.961	0.10	0.8300	0.3781	70.3	70	130	1.006	4.54	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-75876** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **9/27/2011** RunNo: **137040**
Client ID: **PBS** Batch ID: **75876** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **9/27/2011** SeqNo: **2248906**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	1.510		2.670		56.6	30	128				

Sample ID: **LCS-75876** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **9/27/2011** RunNo: **137040**
Client ID: **LCSS** Batch ID: **75876** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **9/27/2011** SeqNo: **2248907**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	19.210	1.0	33.00	0	58.2	35	118				
Surr: p-Terphenyl	1.724		2.670		64.6	30	128				

Sample ID: **119987-001AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **9/27/2011** RunNo: **137040**
Client ID: **ZZZZZZ** Batch ID: **75876** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **9/27/2011** SeqNo: **2248908**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	21.393	1.0	33.00	0	64.8	25	129				
Surr: p-Terphenyl	1.675		2.670		62.7	30	128				

Sample ID: **119987-001AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **9/27/2011** RunNo: **137040**
Client ID: **ZZZZZZ** Batch ID: **75876** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **9/27/2011** SeqNo: **2248909**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	13.328	1.0	33.00	0	40.4	25	129	21.39	46.5	20	R
Surr: p-Terphenyl	1.133		2.670		42.4	30	128		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
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Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E110927LC1** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137070**
Client ID: **LCSS** Batch ID: **E11VS334** TestNo: **EPA 8015B(M** Analysis Date: **9/27/2011** SeqNo: **2249559**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	5.120	1.0	5.000	0	102	70	130				
Surr: Bromofluorobenzene (FID)	109.345		100.0		109	69	158				

Sample ID: **E110927MB1MS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137070**
Client ID: **ZZZZZZ** Batch ID: **E11VS334** TestNo: **EPA 8015B(M** Analysis Date: **9/27/2011** SeqNo: **2249560**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.682	1.0	5.000	0	93.6	46	135				
Surr: Bromofluorobenzene (FID)	107.359		100.0		107	69	158				

Sample ID: **E110927MB1MSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137070**
Client ID: **ZZZZZZ** Batch ID: **E11VS334** TestNo: **EPA 8015B(M** Analysis Date: **9/27/2011** SeqNo: **2249561**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.628	1.0	5.000	0	92.6	46	135	4.682	1.16	20	
Surr: Bromofluorobenzene (FID)	119.459		100.0		119	69	158		0	0	

Sample ID: **E110927MB1** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137070**
Client ID: **PBS** Batch ID: **E11VS334** TestNo: **EPA 8015B(M** Analysis Date: **9/27/2011** SeqNo: **2249562**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	93.256		100.0		93.3	69	158				

Sample ID: **119956-025AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137070**
Client ID: **B25-1.0** Batch ID: **E11VS334** TestNo: **EPA 8015B(M** Analysis Date: **9/27/2011** SeqNo: **2249571**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.933	1.0	5.000	0	98.7	46	135				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **119956-025AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137070**
Client ID: **B25-1.0** Batch ID: **E11VS334** TestNo: **EPA 8015B(M** Analysis Date: **9/27/2011** SeqNo: **2249571**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	115.717		100.0		116	69	158				

Sample ID: **119956-025AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137070**
Client ID: **B25-1.0** Batch ID: **E11VS334** TestNo: **EPA 8015B(M** Analysis Date: **9/27/2011** SeqNo: **2249572**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.321	1.0	5.000	0	86.4	46	135	4.933	13.2	20	
Surr: Bromofluorobenzene (FID)	122.455		100.0		122	69	158		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E110928LC1** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137091**
Client ID: **LCSS** Batch ID: **E11VS335** TestNo: **EPA 8015B(M** Analysis Date: **9/28/2011** SeqNo: **2250024**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	5.353	1.0	5.000	0	107	70	130				
Surr: Bromofluorobenzene (FID)	127.580		100.0		128	69	158				

Sample ID: **E110928MB1MS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137091**
Client ID: **ZZZZZZ** Batch ID: **E11VS335** TestNo: **EPA 8015B(M** Analysis Date: **9/28/2011** SeqNo: **2250025**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.424	1.0	5.000	0	88.5	46	135				
Surr: Bromofluorobenzene (FID)	116.494		100.0		116	69	158				

Sample ID: **E110928MB1MSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137091**
Client ID: **ZZZZZZ** Batch ID: **E11VS335** TestNo: **EPA 8015B(M** Analysis Date: **9/28/2011** SeqNo: **2250026**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	5.007	1.0	5.000	0	100	46	135	4.424	12.4	20	
Surr: Bromofluorobenzene (FID)	125.400		100.0		125	69	158		0	0	

Sample ID: **E110928MB1** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137091**
Client ID: **PBS** Batch ID: **E11VS335** TestNo: **EPA 8015B(M** Analysis Date: **9/28/2011** SeqNo: **2250027**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	86.205		100.0		86.2	69	158				

Sample ID: **119956-010AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137091**
Client ID: **B20-1.0** Batch ID: **E11VS335** TestNo: **EPA 8015B(M** Analysis Date: **9/28/2011** SeqNo: **2250030**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.353	1.0	5.000	0	87.1	46	135				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **119956-010AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137091**
Client ID: **B20-1.0** Batch ID: **E11VS335** TestNo: **EPA 8015B(M** Analysis Date: **9/28/2011** SeqNo: **2250030**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	104.488		100.0		104	69	158				

Sample ID: **119956-010AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137091**
Client ID: **B20-1.0** Batch ID: **E11VS335** TestNo: **EPA 8015B(M** Analysis Date: **9/28/2011** SeqNo: **2250031**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.891	1.0	5.000	0	97.8	46	135	4.353	11.6	20	
Surr: Bromofluorobenzene (FID)	128.186		100.0		128	69	158		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E110927LC2** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137070**
Client ID: **LCSS** Batch ID: **E11VS334** TestNo: **EPA 8021B** Analysis Date: **9/27/2011** SeqNo: **2249574**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	100.419	5.0	100.0	0	100	70	130				
Ethylbenzene	106.604	5.0	100.0	0	107	70	130				
m,p-Xylene	217.762	10	200.0	0	109	70	130				
Methyl tert-butyl ether	97.971	5.0	100.0	0	98.0	70	130				
o-Xylene	110.853	5.0	100.0	0	111	70	130				
Toluene	106.143	5.0	100.0	0	106	70	130				
Surr: Bromofluorobenzene (PID)	103.327		100.0		103	65	140				

Sample ID: **E110927LC2** SampType: **LCSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137070**
Client ID: **LCSS02** Batch ID: **E11VS334** TestNo: **EPA 8021B** Analysis Date: **9/27/2011** SeqNo: **2249575**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	95.012	5.0	100.0	0	95.0	70	130	100.4	5.53	20	
Ethylbenzene	103.441	5.0	100.0	0	103	70	130	106.6	3.01	20	
m,p-Xylene	211.306	10	200.0	0	106	70	130	217.8	3.01	20	
Methyl tert-butyl ether	95.754	5.0	100.0	0	95.8	70	130	97.97	2.29	20	
o-Xylene	106.851	5.0	100.0	0	107	70	130	110.9	3.68	20	
Toluene	102.130	5.0	100.0	0	102	70	130	106.1	3.85	20	
Surr: Bromofluorobenzene (PID)	98.597		100.0		98.6	65	140		0	0	

Sample ID: **E110927MB1MS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137070**
Client ID: **ZZZZZZ** Batch ID: **E11VS334** TestNo: **EPA 8021B** Analysis Date: **9/27/2011** SeqNo: **2249576**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	33.828	5.0	22.15	0	153	69	264				
Ethylbenzene	53.336	5.0	42.30	0	126	37	161				
m,p-Xylene	183.373	10	180.2	0	102	30	149				
Methyl tert-butyl ether	361.409	5.0	578.9	0	62.4	39	121				
o-Xylene	68.618	5.0	64.80	0	106	31	166				
Toluene	169.670	5.0	172.6	0	98.3	44	150				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E110927MB1MS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137070**
Client ID: **ZZZZZZ** Batch ID: **E11VS334** TestNo: **EPA 8021B** Analysis Date: **9/27/2011** SeqNo: **2249576**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	90.984		100.0		91.0	65	140				

Sample ID: **E110927MB1MSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137070**
Client ID: **ZZZZZZ** Batch ID: **E11VS334** TestNo: **EPA 8021B** Analysis Date: **9/27/2011** SeqNo: **2249577**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	33.070	5.0	22.15	0	149	69	264	33.83	2.27	20	
Ethylbenzene	52.321	5.0	42.30	0	124	37	161	53.34	1.92	20	
m,p-Xylene	179.574	10	180.2	0	99.7	30	149	183.4	2.09	20	
Methyl tert-butyl ether	368.037	5.0	578.9	0	63.6	39	121	361.4	1.82	20	
o-Xylene	67.116	5.0	64.80	0	104	31	166	68.62	2.21	20	
Toluene	165.952	5.0	172.6	0	96.1	44	150	169.7	2.22	20	
Surr: Bromofluorobenzene (PID)	98.717		100.0		98.7	65	140		0	20	

Sample ID: **E110927MB1** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137070**
Client ID: **PBS** Batch ID: **E11VS334** TestNo: **EPA 8021B** Analysis Date: **9/27/2011** SeqNo: **2249578**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	93.494		100.0		93.5	65	140				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **119956-025AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137070**
Client ID: **B25-1.0** Batch ID: **E11VS334** TestNo: **EPA 8021B** Analysis Date: **9/27/2011** SeqNo: **2249586**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	35.592	5.0	22.15	0	161	69	264				
Ethylbenzene	55.753	5.0	42.30	0	132	37	161				
m,p-Xylene	190.683	10	180.2	0	106	30	149				
Methyl tert-butyl ether	349.460	5.0	578.9	0	60.4	39	121				
o-Xylene	71.700	5.0	64.80	0	111	31	166				
Toluene	177.431	5.0	172.6	0	103	44	150				
Xylenes, Total	262.383	15	245.0	0	107	30	149				
Surr: Bromofluorobenzene (PID)	115.938		100.0		116	65	140				

Sample ID: **119956-025AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137070**
Client ID: **B25-1.0** Batch ID: **E11VS334** TestNo: **EPA 8021B** Analysis Date: **9/27/2011** SeqNo: **2249587**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	31.157	5.0	22.15	0	141	69	264	35.59	13.3	20	
Ethylbenzene	48.503	5.0	42.30	0	115	37	161	55.75	13.9	20	
m,p-Xylene	166.887	10	180.2	0	92.6	30	149	190.7	13.3	20	
Methyl tert-butyl ether	308.874	5.0	578.9	0	53.4	39	121	349.5	12.3	20	
o-Xylene	62.659	5.0	64.80	0	96.7	31	166	71.70	13.5	20	
Toluene	155.330	5.0	172.6	0	90.0	44	150	177.4	13.3	20	
Xylenes, Total	229.546	15	245.0	0	93.7	30	149	262.4	13.4	20	
Surr: Bromofluorobenzene (PID)	111.634		100.0		112	65	140		0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E110928LC2** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137091**
Client ID: **LCSS** Batch ID: **E11VS335** TestNo: **EPA 8021B** Analysis Date: **9/28/2011** SeqNo: **2250032**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	98.478	5.0	100.0	0	98.5	70	130				
Ethylbenzene	105.506	5.0	100.0	0	106	70	130				
m,p-Xylene	214.722	10	200.0	0	107	70	130				
Methyl tert-butyl ether	89.754	5.0	100.0	0	89.8	70	130				
o-Xylene	107.751	5.0	100.0	0	108	70	130				
Toluene	104.345	5.0	100.0	0	104	70	130				
Surr: Bromofluorobenzene (PID)	94.756		100.0		94.8	65	140				

Sample ID: **E110928LC2** SampType: **LCSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137091**
Client ID: **LCSS02** Batch ID: **E11VS335** TestNo: **EPA 8021B** Analysis Date: **9/28/2011** SeqNo: **2250033**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	91.686	5.0	100.0	0	91.7	70	130	98.48	7.14	20	
Ethylbenzene	98.410	5.0	100.0	0	98.4	70	130	105.5	6.96	20	
m,p-Xylene	200.318	10	200.0	0	100	70	130	214.7	6.94	20	
Methyl tert-butyl ether	82.795	5.0	100.0	0	82.8	70	130	89.75	8.07	20	
o-Xylene	100.124	5.0	100.0	0	100	70	130	107.8	7.34	20	
Toluene	96.693	5.0	100.0	0	96.7	70	130	104.3	7.61	20	
Surr: Bromofluorobenzene (PID)	87.651		100.0		87.7	65	140		0	0	

Sample ID: **E110928MB1MS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137091**
Client ID: **ZZZZZZ** Batch ID: **E11VS335** TestNo: **EPA 8021B** Analysis Date: **9/28/2011** SeqNo: **2250034**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	31.852	5.0	22.15	0	144	69	264				
Ethylbenzene	51.363	5.0	42.30	0	121	37	161				
m,p-Xylene	176.880	10	180.2	0	98.2	30	149				
Methyl tert-butyl ether	338.043	5.0	578.9	0	58.4	39	121				
o-Xylene	66.053	5.0	64.80	0	102	31	166				
Toluene	162.319	5.0	172.6	0	94.0	44	150				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E110928MB1MS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137091**
Client ID: **ZZZZZZ** Batch ID: **E11VS335** TestNo: **EPA 8021B** Analysis Date: **9/28/2011** SeqNo: **2250034**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	95.434		100.0		95.4	65	140				

Sample ID: **E110928MB1MSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137091**
Client ID: **ZZZZZZ** Batch ID: **E11VS335** TestNo: **EPA 8021B** Analysis Date: **9/28/2011** SeqNo: **2250035**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	36.824	5.0	22.15	0	166	69	264	31.85	14.5	20	
Ethylbenzene	58.591	5.0	42.30	0	139	37	161	51.36	13.1	20	
m,p-Xylene	202.116	10	180.2	0	112	30	149	176.9	13.3	20	
Methyl tert-butyl ether	386.591	5.0	578.9	0	66.8	39	121	338.0	13.4	20	
o-Xylene	76.072	5.0	64.80	0	117	31	166	66.05	14.1	20	
Toluene	185.530	5.0	172.6	0	107	44	150	162.3	13.3	20	
Surr: Bromofluorobenzene (PID)	104.151		100.0		104	65	140		0	20	

Sample ID: **E110928MB1** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137091**
Client ID: **PBS** Batch ID: **E11VS335** TestNo: **EPA 8021B** Analysis Date: **9/28/2011** SeqNo: **2250036**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	87.313		100.0		87.3	65	140				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **119956-010AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137091**
Client ID: **B20-1.0** Batch ID: **E11VS335** TestNo: **EPA 8021B** Analysis Date: **9/28/2011** SeqNo: **2250039**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	33.531	5.0	22.15	0	151	69	264				
Ethylbenzene	48.902	5.0	42.30	0	116	37	161				
m,p-Xylene	167.715	10	180.2	0	93.1	30	149				
Methyl tert-butyl ether	348.016	5.0	578.9	0	60.1	39	121				
o-Xylene	62.731	5.0	64.80	0	96.8	31	166				
Toluene	162.053	5.0	172.6	0	93.9	44	150				
Xylenes, Total	230.446	15	245.0	0	94.1	30	149				
Surr: Bromofluorobenzene (PID)	94.389		100.0		94.4	65	140				

Sample ID: **119956-010AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137091**
Client ID: **B20-1.0** Batch ID: **E11VS335** TestNo: **EPA 8021B** Analysis Date: **9/28/2011** SeqNo: **2250040**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	39.025	5.0	22.15	0	176	69	264	33.53	15.1	20	
Ethylbenzene	57.877	5.0	42.30	0	137	37	161	48.90	16.8	20	
m,p-Xylene	199.739	10	180.2	0	111	30	149	167.7	17.4	20	
Methyl tert-butyl ether	438.941	5.0	578.9	0	75.8	39	121	348.0	23.1	20	R
o-Xylene	75.673	5.0	64.80	0	117	31	166	62.73	18.7	20	
Toluene	191.014	5.0	172.6	0	111	44	150	162.1	16.4	20	
Xylenes, Total	275.412	15	245.0	0	112	30	149	230.4	17.8	20	
Surr: Bromofluorobenzene (PID)	116.315		100.0		116	65	140		0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☑ FedEx ☐ Other: _____

Sample Condition Upon Receipt: 1. CHILLED 4.8 Y ☐ N ☐ 2. HEADSPACE (VOA) Y ☐ N ☐ 3. CONTAINER INTACT Y ☐ N ☐ 4. SEALED Y ☐ N ☐ 5. # OF SPLS MATCH COC Y ☐ N ☐ 6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Gemma Reblando (Signature) [signature]

Relinquished by: (Signature and Printed Name) Gemma Reblando [signature] Date: 9/21/11 Time: 1600
Received by: (Signature and Printed Name) [signature] Date: 9/22/11 Time: 827
Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:
Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: GEMMA REBLANDO 9/21/11
Print Name Date
[signature]
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	GRPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)			SOIL	WATER	GROUND WATER	WASTEWATER	CARBON			TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	119956-1	~~B17-1.0~~ B4-0.0 GR	9/21/2011	1317									X	~~X~~ GR	X				X							E	1	T M	C	
	2	~~B17-2.0~~ B4-1.0 GR	9/21/2011	1325								X		X	~~X~~ GR				X							E	1	~~Bag P~~ T M	C	
	3	B18-0.0	9/21/2011	1249									X		X				X							E	1	T M	C	
	4	B18-1.0	9/21/2011	1253										X	X				X							E	1	T M	C	
	5	B18-2.0	9/21/2011	1256											X				X							E	1	Bag P	C	
	6	B19-0.0	9/21/2011	1234								X	X						X							E	1	T M	C	
	7	B19-1.0	9/21/2011	1237										X	X				X							E	1	T M	C	
	8	B19-2.0	9/21/2011	1239											X				X							E	1	Bag P	C	
	9	B20-0.0	9/21/2011	1214									X		X				X							E	1	T M	C	
	10	B20-1.0	9/21/2011	1216										X	X				X							E	1	T M	C	

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐
4. SEALED Y ☐ N ☐
5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Gemma Reblando (Signature) [signature]

Relinquished by: (Signature and Printed Name) Gemma Reblando [signature] Date: 9/21/11 Time: 1600
Received by: (Signature and Printed Name) [signature] Date: 9/22/11 Time: 877

Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:

Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: GEMMA REBLANDO 9/21/11
Print Name Date
[signature]
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	11997 - 11	B20-2.0	9/21/2011	1218												X		X					E	1	Bag	P	C
	12	B21-0.0	9/21/2011	1205										X		X		X					E	1	T	M	C
	13	B21-1.0	9/21/2011	1206											X	X		X					E	1	T	M	C
	14	B21-2.0	9/21/2011	1208												X		X					E	1	Bag	P	C
	15	B22-0.0	9/21/2011	1152									X	X				X					E	1	T	M	C
	16	B22-1.0	9/21/2011	1154											X	X		X					E	1	T	M	C
	17	B22-2.0	9/21/2011	1200												X		X					E	1	Bag	P	C
	18	B23-0.0	9/21/2011	1139										X		X		X					E	1	T	M	C
	19	B23-1.0	9/21/2011	1140											X	X		X					E	1	T	M	C
	20	B23-2.0	9/21/2011	1142												X		X					E	1	Bag	P	C

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐
4. SEALED Y ☐ N ☐
5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Gemma Reblando (Signature) [signature]

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Gemma Reblando [signature]	9/21/11	1600	Marg [signature]	9/22/11	827

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: GEMMA REBLANDO 9/21/11
Print Name Date
[signature]
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Type	PRESERVATION	REMARKS
	119956-21	B24-0.0	9/21/2011	1115									X		X			X					E	1	T M	C	
	22	B24-1.0	9/21/2011	1118										X	X			X					E	1	T M	C	
	23	B24-2.0	9/21/2011	1120											X			X					E	1	Bag P	C	
	24	B25-0.0	9/21/2011	1107									X		X			X					E	1	T M	C	
	25	B25-1.0	9/21/2011	1109										X	X			X					E	1	T M	C	
	26	B25-2.0	9/21/2011	1111								X						X					E	1	Bag P	C	

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

October 10, 2011

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Workorder No.: 119956

Chris Giuntoli
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550

TEL: (925) 371-5900
FAX: (925) 371-5915

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on September 22, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

Advanced Technology Laboratories

Date: *10-Oct-11*

CLIENT: Geocon Consultants, Inc.
Project: 80/680/12 Interchange, E8128-06-07
Lab Order: 119956

CASE NARRATIVE

Analytical Comments for Method 7420

Dilution was necessary for samples 119956-016A and 119956-018A, due to sample matrix.

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 10/10/2011

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION (STLC)
WET/ EPA 7420

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	119956
Project:	80/680/12 Interchange, E8128-06-07	**Date Received**	9/22/2011 8:27:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	VV

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
119956-006A	B19-0.0	3.7	mg/L	76036	0.50	1	9/21/2011	10/7/2011
119956-009A	B20-0.0	4.5	mg/L	76036	0.50	1	9/21/2011	10/7/2011
119956-012A	B21-0.0	4.6	mg/L	76036	0.50	1	9/21/2011	10/7/2011
119956-013A	B21-1.0	5.7	mg/L	76036	0.50	1	9/21/2011	10/7/2011
119956-016A	B22-1.0	9.0	mg/L	76036	1.0	2	9/21/2011	10/7/2011
119956-018A	B23-0.0	21	mg/L	76036	2.5	5	9/21/2011	10/7/2011
119956-019A	B23-1.0	2.9	mg/L	76036	0.50	1	9/21/2011	10/7/2011
119956-021A	B24-0.0	3.8	mg/L	76036	0.50	1	9/21/2011	10/7/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 10/10/2011

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION (TCLP)
EPA 1311/ 7420

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	119956
Project:	80/680/12 Interchange, E8128-06-07	**Date Received**	9/22/2011 8:27:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	VV

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
119956-016A	B22-1.0	ND	mg/L	76065	0.50	1	9/21/2011	10/7/2011
119956-018A	B23-0.0	ND	mg/L	76065	0.50	1	9/21/2011	10/7/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_ST

Sample ID: **MB-76036A** SampType: **MBLK** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/4/2011** RunNo: **137316**
Client ID: **PBS** Batch ID: **76036** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/7/2011** SeqNo: **2254838**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Sample ID: **LCS-76036** SampType: **LCS** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/4/2011** RunNo: **137316**
Client ID: **LCSS** Batch ID: **76036** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/7/2011** SeqNo: **2254839**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.123	0.50	5.000	0	102	80	120				

Sample ID: **119956-021A-MS** SampType: **MS** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/4/2011** RunNo: **137316**
Client ID: **B24-0.0** Batch ID: **76036** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/7/2011** SeqNo: **2254848**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	9.021	0.50	5.000	3.790	105	80	120				

Sample ID: **119956-021A-MSD** SampType: **MSD** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/4/2011** RunNo: **137316**
Client ID: **B24-0.0** Batch ID: **76036** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/7/2011** SeqNo: **2254849**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	9.101	0.50	5.000	3.790	106	80	120	9.021	0.876	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_TC

Sample ID: **MB-76065A** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/6/2011** RunNo: **137336**
Client ID: **PBS** Batch ID: **76065** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/7/2011** SeqNo: **2255124**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Sample ID: **MB-76056A TCLP** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/6/2011** RunNo: **137336**
Client ID: **PBS** Batch ID: **76065** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/7/2011** SeqNo: **2255125**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Sample ID: **LCS-76065** SampType: **LCS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/6/2011** RunNo: **137336**
Client ID: **LCSS** Batch ID: **76065** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/7/2011** SeqNo: **2255127**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	1.009	0.25	1.000	0	101	80	120				

Sample ID: **119956-018A-MSD** SampType: **MSD** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/6/2011** RunNo: **137336**
Client ID: **B23-0.0** Batch ID: **76065** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/7/2011** SeqNo: **2255131**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.470	0.50	2.500	0	98.8	70	130	2.364	4.38	20	

Sample ID: **119956-018A-MS** SampType: **MS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/6/2011** RunNo: **137336**
Client ID: **B23-0.0** Batch ID: **76065** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/7/2011** SeqNo: **2255132**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.364	0.50	2.500	0	94.6	70	130				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Diane Galvan

From: Chris Giuntoli [giuntoli@geoconinc.com]
Sent: Monday, October 03, 2011 2:04 PM
To: Diane Galvan
Cc: Luann Beadle
Subject: RE: Results/EDD - 80/680/12 Interchange (119956)

Hi Diane,

For work order 119956, please run the following samples for WET lead:

B19-0.0,
B20-0.0,
B21-0.0,
B21-1.0,
B22-1.0,
B23-0.0,
B23-1.0, and
B24-0.0.

Please run the following samples for TCLP lead:

B22-1.0 and B23-0.0.

All on standard TAT.
Thanks,
Chris

October 21, 2011

Chris Giuntoli
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550
TEL: (925) 371-5900
FAX: (925) 371-5915

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Workorder No.: 119956

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on September 22, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

Advanced Technology Laboratories

Date: 10/21/2011

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION
WET DI/ EPA 7420

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	119956
Project:	80/680/12 Interchange, E8128-06-07	**Date Received:**	9/22/2011 8:27:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	VV

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
119956-013A	B21-1.0	ND	mg/L	76272	0.50	1	9/21/2011	10/19/2011
119956-016A	B22-1.0	ND	mg/L	76272	0.50	1	9/21/2011	10/19/2011
119956-018A	B23-0.0	ND	mg/L	76272	0.50	1	9/21/2011	10/19/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 10/21/2011

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION (TCLP)
EPA 1311/ 7420

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	119956
Project:	80/680/12 Interchange, E8128-06-07	**Date Received:**	9/22/2011 8:27:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	VV

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
119956-013A	B21-1.0	ND	mg/L	76393	0.50	1	9/21/2011	10/21/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

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Advanced Technology Laboratories

Date: 10/21/2011

ANALYTICAL RESULTS

pH
EPA 9045C

CLIENT:	Geocon Consultants, Inc.	**Lab Order:**	119956
Project:	80/680/12 Interchange, E8128-06-07	**Date Received:**	9/22/2011 8:27:00 AM
Project No:		**Matrix:**	Soil
Analyte:	pH	**Analyst:**	PT

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
119956-001A	B4-0.0	8.0	pH Units	R137540	0.10	1	9/21/2011	10/17/2011
119956-007A	B19-1.0	7.8	pH Units	R137540	0.10	1	9/21/2011	10/17/2011
119956-015A	B22-0.0	7.8	pH Units	R137540	0.10	1	9/21/2011	10/17/2011
119956-025A	B25-1.0	8.7	pH Units	R137540	0.10	1	9/21/2011	10/17/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

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CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_DI_GEOCON

Sample ID: **MB-76272A** SampType: **MBLK** TestCode: **7420_DI_GEO** Units: **mg/L** Prep Date: **10/17/2011** RunNo: **137637**
Client ID: **PBS** Batch ID: **76272** TestNo: **WET DI/ EPA WET** Analysis Date: **10/19/2011** SeqNo: **2260836**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.134	0.50									

Sample ID: **LCS-76272** SampType: **LCS** TestCode: **7420_DI_GEO** Units: **mg/L** Prep Date: **10/17/2011** RunNo: **137637**
Client ID: **LCSS** Batch ID: **76272** TestNo: **WET DI/ EPA WET** Analysis Date: **10/19/2011** SeqNo: **2260837**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.351	0.50	5.000	0.1337	104	80	120				

Sample ID: **119956-018A-MS** SampType: **MS** TestCode: **7420_DI_GEO** Units: **mg/L** Prep Date: **10/17/2011** RunNo: **137637**
Client ID: **B23-0.0** Batch ID: **76272** TestNo: **WET DI/ EPA WET** Analysis Date: **10/19/2011** SeqNo: **2260841**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.246	0.50	5.000	0	105	70	130				

Sample ID: **119956-018A-MSD** SampType: **MSD** TestCode: **7420_DI_GEO** Units: **mg/L** Prep Date: **10/17/2011** RunNo: **137637**
Client ID: **B23-0.0** Batch ID: **76272** TestNo: **WET DI/ EPA WET** Analysis Date: **10/19/2011** SeqNo: **2260842**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.213	0.50	5.000	0	104	70	130	5.246	0.628	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_TC

Sample ID: **MB-76393A** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/21/2011** RunNo: **137726**
Client ID: **PBS** Batch ID: **76393** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/21/2011** SeqNo: **2262524**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.475	0.50									

Sample ID: **MB-76375A TCLP** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/21/2011** RunNo: **137726**
Client ID: **PBS** Batch ID: **76393** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/21/2011** SeqNo: **2262525**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.377	0.50									

Sample ID: **LCS-76393** SampType: **LCS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/21/2011** RunNo: **137726**
Client ID: **LCSS** Batch ID: **76393** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/21/2011** SeqNo: **2262526**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	1.311	0.50	1.000	0.4746	83.7	80	120				

Sample ID: **119956-013A-MS** SampType: **MS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/21/2011** RunNo: **137726**
Client ID: **B21-1.0** Batch ID: **76393** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/21/2011** SeqNo: **2262528**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.936	0.50	2.500	0.4609	99.0	70	130				

Sample ID: **119956-013A-MSD** SampType: **MSD** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/21/2011** RunNo: **137726**
Client ID: **B21-1.0** Batch ID: **76393** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/21/2011** SeqNo: **2262529**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.960	0.50	2.500	0.4609	100	70	130	2.936	0.795	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CLIENT: Geocon Consultants, Inc.
Work Order: 119956
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 9045_S

Sample ID: **120262-001ADUP** SampType: **DUP** TestCode: **9045_S** Units: **pH Units** Prep Date: RunNo: **137540**
Client ID: **ZZZZZZ** Batch ID: **R137540** TestNo: **EPA 9045C** Analysis Date: **10/17/2011** SeqNo: **2259138**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	7.620	0.10						7.740	1.56	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Diane Galvan

From: Chris Giuntoli [giuntoli@geoconinc.com]
Sent: Thursday, October 13, 2011 9:55 AM
To: Diane Galvan
Subject: FW: Results/EDD - 80/680/12 Interchange (119956)

Hi Diane,

For workorder 119956, please run sample B21-1.0 for TCLP lead and DI-WET lead, and Samples B22-1.0 and B23-0.0 for DI-WET lead all on standard TAT.

Also, please analyze then following samples for pH on standard TAT:

B4-0.0,
B19-1.0,
B22-0.0, and
B25-1.0.

Thanks,
Chris

September 30, 2011

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Chris Giuntoli
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550

TEL: (925) 371-5900
FAX: (925) 371-5915

Workorder No.: 119957

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on September 22, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter and the case narrative are an integral part of this analytical report and cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

CLIENT: Geocon Consultants, Inc.
Project: 80/680/12 Interchange, E8128-06-07
Lab Order: 119957

CASE NARRATIVE

Analytical Comments for Method 6010

Matrix Spike (MS) and /or Matrix Spike Duplicate (MSD) are/is outside recovery criteria for samples 119957-005AMS and 119957-005AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8081

Surrogate recovery biased high and low for sample 119957-005A, possibly due to matrix interferences.

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B39-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 9:53:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-001A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_110928H	QC Batch: 75927			PrepDate:	9/28/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:28 PM
Arsenic	11	1.0		mg/Kg	1	9/28/2011 08:28 PM
Barium	160	1.0		mg/Kg	1	9/28/2011 08:28 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:28 PM
Cadmium	1.1	1.0		mg/Kg	1	9/28/2011 08:28 PM
Chromium	4.8	1.0		mg/Kg	1	9/28/2011 08:28 PM
Cobalt	4.3	1.0		mg/Kg	1	9/28/2011 08:28 PM
Copper	16	2.0		mg/Kg	1	9/28/2011 08:28 PM
Lead	49	1.0		mg/Kg	1	9/28/2011 08:28 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:28 PM
Nickel	7.6	1.0		mg/Kg	1	9/28/2011 08:28 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:28 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:28 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:28 PM
Vanadium	40	1.0		mg/Kg	1	9/28/2011 08:28 PM
Zinc	68	1.0		mg/Kg	1	9/28/2011 08:28 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	9/28/2011 08:15 PM
4,4´-DDE	2.1	2.0		µg/Kg	1	9/28/2011 08:15 PM
4,4´-DDT	2.9	2.0		µg/Kg	1	9/28/2011 08:15 PM
Aldrin	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
alpha-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
beta-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
Chlordane	ND	8.5		µg/Kg	1	9/28/2011 08:15 PM
delta-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
Dieldrin	ND	2.0		µg/Kg	1	9/28/2011 08:15 PM
Endosulfan I	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
Endosulfan II	ND	2.0		µg/Kg	1	9/28/2011 08:15 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	9/28/2011 08:15 PM
Endrin	ND	2.0		µg/Kg	1	9/28/2011 08:15 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	9/28/2011 08:15 PM
Endrin ketone	ND	2.0		µg/Kg	1	9/28/2011 08:15 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B39-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 9:53:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-001A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
Heptachlor	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	9/28/2011 08:15 PM
Methoxychlor	ND	5.0		µg/Kg	1	9/28/2011 08:15 PM
Toxaphene	ND	50		µg/Kg	1	9/28/2011 08:15 PM
Surr: Decachlorobiphenyl	66.4	39-104		%REC	1	9/28/2011 08:15 PM
Surr: Tetrachloro-m-xylene	50.2	43-100		%REC	1	9/28/2011 08:15 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	0.12	0.10		mg/Kg	1	9/28/2011 05:27 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B40-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 9:25:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-002A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_110928H	QC Batch: 75927			PrepDate:	9/28/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:31 PM
Arsenic	4.5	1.0		mg/Kg	1	9/28/2011 08:31 PM
Barium	110	1.0		mg/Kg	1	9/28/2011 08:31 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:31 PM
Cadmium	ND	1.0		mg/Kg	1	9/28/2011 08:31 PM
Chromium	12	1.0		mg/Kg	1	9/28/2011 08:31 PM
Cobalt	11	1.0		mg/Kg	1	9/28/2011 08:31 PM
Copper	9.1	2.0		mg/Kg	1	9/28/2011 08:31 PM
Lead	15	1.0		mg/Kg	1	9/28/2011 08:31 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:31 PM
Nickel	10	1.0		mg/Kg	1	9/28/2011 08:31 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:31 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:31 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:31 PM
Vanadium	32	1.0		mg/Kg	1	9/28/2011 08:31 PM
Zinc	21	1.0		mg/Kg	1	9/28/2011 08:31 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM
4,4´-DDE	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM
4,4´-DDT	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM
Aldrin	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
alpha-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
beta-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
Chlordane	ND	8.5		µg/Kg	1	9/28/2011 08:29 PM
delta-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
Dieldrin	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM
Endosulfan I	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
Endosulfan II	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM
Endrin	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM
Endrin ketone	ND	2.0		µg/Kg	1	9/28/2011 08:29 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B40-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 9:25:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-002A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
Heptachlor	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	9/28/2011 08:29 PM
Methoxychlor	ND	5.0		µg/Kg	1	9/28/2011 08:29 PM
Toxaphene	ND	50		µg/Kg	1	9/28/2011 08:29 PM
Surr: Decachlorobiphenyl	89.8	39-104		%REC	1	9/28/2011 08:29 PM
Surr: Tetrachloro-m-xylene	76.8	43-100		%REC	1	9/28/2011 08:29 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	9/28/2011 05:29 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B41-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 9:40:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-003A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_110928H	QC Batch: 75927			PrepDate:	9/28/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:42 PM
Arsenic	1.7	1.0		mg/Kg	1	9/28/2011 08:42 PM
Barium	120	1.0		mg/Kg	1	9/28/2011 08:42 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:42 PM
Cadmium	ND	1.0		mg/Kg	1	9/28/2011 08:42 PM
Chromium	25	1.0		mg/Kg	1	9/28/2011 08:42 PM
Cobalt	7.6	1.0		mg/Kg	1	9/28/2011 08:42 PM
Copper	14	2.0		mg/Kg	1	9/28/2011 08:42 PM
Lead	21	1.0		mg/Kg	1	9/28/2011 08:42 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:42 PM
Nickel	17	1.0		mg/Kg	1	9/28/2011 08:42 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:42 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:42 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:42 PM
Vanadium	25	1.0		mg/Kg	1	9/28/2011 08:42 PM
Zinc	28	1.0		mg/Kg	1	9/28/2011 08:42 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM
4,4´-DDE	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM
4,4´-DDT	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM
Aldrin	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
alpha-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
beta-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
Chlordane	ND	8.5		µg/Kg	1	9/28/2011 08:42 PM
delta-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
Dieldrin	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM
Endosulfan I	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
Endosulfan II	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM
Endrin	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM
Endrin ketone	ND	2.0		µg/Kg	1	9/28/2011 08:42 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B41-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 9:40:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-003A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
Heptachlor	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	9/28/2011 08:42 PM
Methoxychlor	ND	5.0		µg/Kg	1	9/28/2011 08:42 PM
Toxaphene	ND	50		µg/Kg	1	9/28/2011 08:42 PM
Surr: Decachlorobiphenyl	56.2	39-104		%REC	1	9/28/2011 08:42 PM
Surr: Tetrachloro-m-xylene	46.3	43-100		%REC	1	9/28/2011 08:42 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	0.18	0.10		mg/Kg	1	9/28/2011 05:35 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B42-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 10:08:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-004A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_110928H	QC Batch: 75927			PrepDate:	9/28/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:46 PM
Arsenic	4.2	1.0		mg/Kg	1	9/28/2011 08:46 PM
Barium	200	1.0		mg/Kg	1	9/28/2011 08:46 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:46 PM
Cadmium	ND	1.0		mg/Kg	1	9/28/2011 08:46 PM
Chromium	13	1.0		mg/Kg	1	9/28/2011 08:46 PM
Cobalt	6.9	1.0		mg/Kg	1	9/28/2011 08:46 PM
Copper	16	2.0		mg/Kg	1	9/28/2011 08:46 PM
Lead	19	1.0		mg/Kg	1	9/28/2011 08:46 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:46 PM
Nickel	15	1.0		mg/Kg	1	9/28/2011 08:46 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:46 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:46 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:46 PM
Vanadium	33	1.0		mg/Kg	1	9/28/2011 08:46 PM
Zinc	47	1.0		mg/Kg	1	9/28/2011 08:46 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM
4,4´-DDE	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM
4,4´-DDT	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM
Aldrin	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
alpha-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
beta-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
Chlordane	ND	8.5		µg/Kg	1	9/28/2011 08:56 PM
delta-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
Dieldrin	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM
Endosulfan I	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
Endosulfan II	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM
Endrin	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM
Endrin ketone	ND	2.0		µg/Kg	1	9/28/2011 08:56 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B42-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 10:08:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-004A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
Heptachlor	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	9/28/2011 08:56 PM
Methoxychlor	ND	5.0		µg/Kg	1	9/28/2011 08:56 PM
Toxaphene	ND	50		µg/Kg	1	9/28/2011 08:56 PM
Surr: Decachlorobiphenyl	70.2	39-104		%REC	1	9/28/2011 08:56 PM
Surr: Tetrachloro-m-xylene	59.5	43-100		%REC	1	9/28/2011 08:56 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	9/28/2011 05:37 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B58-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 10:34:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-005A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_110928H	QC Batch: 75927			PrepDate:	9/28/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	9/28/2011 08:50 PM
Arsenic	3.7	1.0		mg/Kg	1	9/28/2011 08:50 PM
Barium	260	1.0		mg/Kg	1	9/28/2011 08:50 PM
Beryllium	ND	1.0		mg/Kg	1	9/28/2011 08:50 PM
Cadmium	1.2	1.0		mg/Kg	1	9/28/2011 08:50 PM
Chromium	7.7	1.0		mg/Kg	1	9/28/2011 08:50 PM
Cobalt	15	1.0		mg/Kg	1	9/28/2011 08:50 PM
Copper	18	2.0		mg/Kg	1	9/28/2011 08:50 PM
Lead	34	1.0		mg/Kg	1	9/28/2011 08:50 PM
Molybdenum	ND	1.0		mg/Kg	1	9/28/2011 08:50 PM
Nickel	12	1.0		mg/Kg	1	9/28/2011 08:50 PM
Selenium	ND	1.0		mg/Kg	1	9/28/2011 08:50 PM
Silver	ND	1.0		mg/Kg	1	9/28/2011 08:50 PM
Thallium	ND	1.0		mg/Kg	1	9/28/2011 08:50 PM
Vanadium	23	1.0		mg/Kg	1	9/28/2011 08:50 PM
Zinc	220	1.0		mg/Kg	1	9/28/2011 08:50 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM
4,4´-DDE	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM
4,4´-DDT	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM
Aldrin	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
alpha-BHC	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
beta-BHC	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
Chlordane	ND	8.5		µg/Kg	1	9/28/2011 09:10 PM
delta-BHC	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
Dieldrin	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM
Endosulfan I	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
Endosulfan II	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM
Endrin	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM
Endrin ketone	ND	2.0		µg/Kg	1	9/28/2011 09:10 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *30-Sep-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B58-0.0
Lab Order:	119957	**Collection Date:**	9/21/2011 10:34:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	119957-005A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_110928A	QC Batch: 75917			PrepDate:	9/28/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
Heptachlor	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	9/28/2011 09:10 PM
Methoxychlor	ND	5.0		µg/Kg	1	9/28/2011 09:10 PM
Toxaphene	ND	50		µg/Kg	1	9/28/2011 09:10 PM
Surr: Decachlorobiphenyl	415	39-104	S	%REC	1	9/28/2011 09:10 PM
Surr: Tetrachloro-m-xylene	35.4	43-100	S	%REC	1	9/28/2011 09:10 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_110928B	QC Batch: 75920			PrepDate:	9/28/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	9/28/2011 05:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants, Inc.
Work Order: 119957
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-75927** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **PBS** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250429**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.083	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	0.043	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-75927** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **LCSS** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250430**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	48.558	2.0	50.00	0.08290	97.0	80	120				
Arsenic	46.010	1.0	50.00	0	92.0	80	120				
Barium	50.213	1.0	50.00	0	100	80	120				
Beryllium	49.454	1.0	50.00	0	98.9	80	120				
Cadmium	47.993	1.0	50.00	0	96.0	80	120				
Chromium	47.217	1.0	50.00	0.04342	94.3	80	120				
Cobalt	49.964	1.0	50.00	0	99.9	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119957
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-75927** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **LCSS** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250430**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	49.178	2.0	50.00	0	98.4	80	120				
Lead	48.465	1.0	50.00	0	96.9	80	120				
Molybdenum	49.868	1.0	50.00	0	99.7	80	120				
Nickel	49.352	1.0	50.00	0	98.7	80	120				
Selenium	44.926	1.0	50.00	0	89.9	80	120				
Silver	47.967	1.0	50.00	0	95.9	80	120				
Thallium	46.610	1.0	50.00	0	93.2	80	120				
Vanadium	50.106	1.0	50.00	0	100	80	120				
Zinc	48.198	1.0	50.00	0	96.4	80	120				

Sample ID: **119957-005A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **B58-0.0** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250446**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	91.406	2.0	125.0	0.4333	72.8	44	105				
Arsenic	102.876	1.0	125.0	3.686	79.4	57	103				
Barium	303.907	1.0	125.0	257.5	37.1	36	134				
Beryllium	104.848	1.0	125.0	0.2175	83.7	64	106				
Cadmium	98.158	1.0	125.0	1.198	77.6	58	102				
Chromium	105.300	1.0	125.0	7.687	78.1	55	105				
Cobalt	110.789	1.0	125.0	15.17	76.5	59	105				
Copper	133.154	2.0	125.0	17.84	92.3	64	117				
Lead	128.700	1.0	125.0	34.06	75.7	46	116				
Molybdenum	101.531	1.0	125.0	0	81.2	59	108				
Nickel	111.386	1.0	125.0	12.17	79.4	52	109				
Selenium	100.806	1.0	125.0	0	80.6	56	100				
Silver	104.935	1.0	125.0	0	83.9	65	107				
Thallium	94.501	1.0	125.0	0	75.6	47	100				
Vanadium	125.545	1.0	125.0	22.68	82.3	64	110				
Zinc	227.280	1.0	125.0	223.0	3.40	37	123				S

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CLIENT: Geocon Consultants, Inc.
Work Order: 119957
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **119957-005A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137109**
Client ID: **B58-0.0** Batch ID: **75927** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **9/28/2011** SeqNo: **2250447**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	84.616	2.0	125.0	0.4333	67.3	44	105	91.41	7.72	20	
Arsenic	97.438	1.0	125.0	3.686	75.0	57	103	102.9	5.43	20	
Barium	334.585	1.0	125.0	257.5	61.7	36	134	303.9	9.61	20	
Beryllium	101.094	1.0	125.0	0.2175	80.7	64	106	104.8	3.65	20	
Cadmium	93.617	1.0	125.0	1.198	73.9	58	102	98.16	4.74	20	
Chromium	100.977	1.0	125.0	7.687	74.6	55	105	105.3	4.19	20	
Cobalt	110.396	1.0	125.0	15.17	76.2	59	105	110.8	0.355	20	
Copper	127.527	2.0	125.0	17.84	87.8	64	117	133.2	4.32	20	
Lead	120.871	1.0	125.0	34.06	69.5	46	116	128.7	6.27	20	
Molybdenum	97.349	1.0	125.0	0	77.9	59	108	101.5	4.20	20	
Nickel	107.284	1.0	125.0	12.17	76.1	52	109	111.4	3.75	20	
Selenium	95.104	1.0	125.0	0	76.1	56	100	100.8	5.82	20	
Silver	96.447	1.0	125.0	0	77.2	65	107	104.9	8.43	20	
Thallium	89.788	1.0	125.0	0	71.8	47	100	94.50	5.12	20	
Vanadium	121.023	1.0	125.0	22.68	78.7	64	110	125.5	3.67	20	
Zinc	211.520	1.0	125.0	223.0	-9.21	37	123	227.3	7.18	20	S

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119957
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-75920** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137119**
Client ID: **PBS** Batch ID: **75920** TestNo: **EPA 7471A** Analysis Date: **9/28/2011** SeqNo: **2250654**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.003	0.10									

Sample ID: **LCS-75920** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137119**
Client ID: **LCSS** Batch ID: **75920** TestNo: **EPA 7471A** Analysis Date: **9/28/2011** SeqNo: **2250655**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.766	0.10	0.8300	0.003171	91.9	80	120				

Sample ID: **119956-002A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137119**
Client ID: **ZZZZZZ** Batch ID: **75920** TestNo: **EPA 7471A** Analysis Date: **9/28/2011** SeqNo: **2250657**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.006	0.10	0.8300	0.3781	75.7	70	130				

Sample ID: **119956-002A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **9/28/2011** RunNo: **137119**
Client ID: **ZZZZZZ** Batch ID: **75920** TestNo: **EPA 7471A** Analysis Date: **9/28/2011** SeqNo: **2250658**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.961	0.10	0.8300	0.3781	70.3	70	130	1.006	4.54	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 119957
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-75917** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **9/28/2011** RunNo: **137093**
Client ID: **PBS** Batch ID: **75917** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **9/28/2011** SeqNo: **2250059**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	11.381		16.67		68.3	43	100				
Surr: Decachlorobiphenyl	12.337		16.67		74.0	39	104				

Sample ID: **LCS-75917** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **9/28/2011** RunNo: **137093**
Client ID: **LCSS** Batch ID: **75917** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **9/28/2011** SeqNo: **2250060**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	11.510	1.0	16.67	0	69.0	56	108				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 *Tel: 562. 989.4045* *Fax: 562.989.4040*

CLIENT: Geocon Consultants, Inc.
Work Order: 119957
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-75917** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **9/28/2011** RunNo: **137093**
Client ID: **LCSS** Batch ID: **75917** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **9/28/2011** SeqNo: **2250060**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	11.942	2.0	16.67	0	71.6	53	115				
Endrin	11.981	2.0	16.67	0	71.9	55	125				
gamma-BHC	11.379	1.0	16.67	0	68.3	59	110				
Heptachlor	12.106	1.0	16.67	0	72.6	53	114				
Surr: Tetrachloro-m-xylene	11.288		16.67		67.7	43	100				
Surr: Decachlorobiphenyl	11.968		16.67		71.8	39	104				

Sample ID: **120037-005AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **9/28/2011** RunNo: **137093**
Client ID: **ZZZZZZ** Batch ID: **75917** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **9/28/2011** SeqNo: **2250061**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	12.375	2.0	16.67	0	74.2	17	165				
Aldrin	11.582	1.0	16.67	0	69.5	34	130				
Dieldrin	12.504	2.0	16.67	0	75.0	33	143				
Endrin	13.608	2.0	16.67	0	81.6	39	152				
gamma-BHC	12.223	1.0	16.67	0	73.3	37	131				
Heptachlor	12.034	1.0	16.67	0	72.2	31	140				
Surr: Tetrachloro-m-xylene	10.879		16.67		65.3	43	100				
Surr: Decachlorobiphenyl	11.374		16.67		68.2	39	104				

Sample ID: **120037-005AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **9/28/2011** RunNo: **137093**
Client ID: **ZZZZZZ** Batch ID: **75917** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **9/28/2011** SeqNo: **2250062**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	11.740	2.0	16.67	0	70.4	17	165	12.38	5.27	20	
Aldrin	11.594	1.0	16.67	0	69.5	34	130	11.58	0.0978	20	
Dieldrin	11.790	2.0	16.67	0	70.7	33	143	12.50	5.87	20	
Endrin	13.018	2.0	16.67	0	78.1	39	152	13.61	4.43	20	
gamma-BHC	12.204	1.0	16.67	0	73.2	37	131	12.22	0.157	20	
Heptachlor	12.529	1.0	16.67	0	75.2	31	140	12.03	4.04	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CLIENT: Geocon Consultants, Inc.
Work Order: 119957
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **120037-005AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **9/28/2011** RunNo: **137093**
Client ID: **ZZZZZZ** Batch ID: **75917** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **9/28/2011** SeqNo: **2250062**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	10.906		16.67		65.4	43	100		0	0	
Surr: Decachlorobiphenyl	11.098		16.67		66.6	39	104		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 *Tel: 562. 989.4045* *Fax: 562.989.4040*

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☑ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☑ N ☐ (4 °C)
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☑ N ☐
4. SEALED Y ☐ N ☑
5. # OF SPLS MATCH COC Y ☑ N ☐
6. PRESERVED Y ☐ N ☑

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Gemma Reblando (Signature) [signature]

Relinquished by: (Signature and Printed Name) Gemma Reblando [signature] Date: 9/21/11 Time: 1600
Received by: (Signature and Printed Name) [signature] Date: 9/21/11 Time: 1600

Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:

Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: GEMMA REBLANDO 9/21/11
Print Name Date
[signature]
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Batch #: / Lab No.	Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	11995 7 -1	B39-0.0	9/21/2011	0953	X							X					X					E	1	T M	C	
	2	B40-0.0	9/21/2011	0925	X							X					X					E	1	T M	C	
	3	B41-0.0	9/21/2011	0940	X							X					X					E	1	T M	C	
	4	B42-0.0	9/21/2011	1008	X							X					X					E	1	T M	C	
	5	B58-0.0	9/21/2011	1034	X							X					X					E	1	T M	C	

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

October 06, 2011

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Chris Giuntoli
Geocon Consultants, Inc.
6671 Brisa Street
Livermore, CA 94550

TEL: (925) 371-5900
FAX: (925) 371-5915

Workorder No.: 120065

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on September 29, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B43-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011 9:45:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-001A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
Aldrin	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
beta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
Chlordane	ND	8.5		µg/Kg	1	10/4/2011 11:16 PM
delta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
Dieldrin	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
Endrin	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/4/2011 11:16 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
Heptachlor	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/4/2011 11:16 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/4/2011 11:16 PM
Toxaphene	ND	50		µg/Kg	1	10/4/2011 11:16 PM
Surr: Decachlorobiphenyl	73.4	39-104		%REC	1	10/4/2011 11:16 PM
Surr: Tetrachloro-m-xylene	72.5	43-100		%REC	1	10/4/2011 11:16 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B43-1.5
Lab Order:	120065	**Collection Date:**	9/27/2011 9:47:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-002A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111004D	QC Batch: 76014			PrepDate:	10/3/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	10/4/2011 01:21 PM
Arsenic	4.1	1.0		mg/Kg	1	10/4/2011 01:21 PM
Barium	61	1.0		mg/Kg	1	10/4/2011 01:21 PM
Beryllium	ND	1.0		mg/Kg	1	10/4/2011 01:21 PM
Cadmium	ND	1.0		mg/Kg	1	10/4/2011 01:21 PM
Chromium	12	1.0		mg/Kg	1	10/4/2011 01:21 PM
Cobalt	6.7	1.0		mg/Kg	1	10/4/2011 01:21 PM
Copper	15	2.0		mg/Kg	1	10/4/2011 01:21 PM
Lead	5.5	1.0		mg/Kg	1	10/4/2011 01:21 PM
Molybdenum	ND	1.0		mg/Kg	1	10/4/2011 01:21 PM
Nickel	9.1	1.0		mg/Kg	1	10/4/2011 01:21 PM
Selenium	ND	1.0		mg/Kg	1	10/4/2011 01:21 PM
Silver	ND	1.0		mg/Kg	1	10/4/2011 01:21 PM
Thallium	ND	1.0		mg/Kg	1	10/4/2011 01:21 PM
Vanadium	29	1.0		mg/Kg	1	10/4/2011 01:21 PM
Zinc	31	1.0		mg/Kg	1	10/4/2011 01:21 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111004A	QC Batch: 76012			PrepDate:	10/3/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/4/2011 01:17 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B48-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011 10:35:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-007A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
Aldrin	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
beta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
Chlordane	ND	8.5		µg/Kg	1	10/4/2011 11:30 PM
delta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
Dieldrin	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
Endrin	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/4/2011 11:30 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
Heptachlor	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/4/2011 11:30 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/4/2011 11:30 PM
Toxaphene	ND	50		µg/Kg	1	10/4/2011 11:30 PM
Surr: Decachlorobiphenyl	68.0	39-104		%REC	1	10/4/2011 11:30 PM
Surr: Tetrachloro-m-xylene	63.5	43-100		%REC	1	10/4/2011 11:30 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B48-1.5
Lab Order:	120065	**Collection Date:**	9/27/2011 10:40:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-008A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111004D	QC Batch: 76014			PrepDate:	10/3/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	10/4/2011 01:24 PM
Arsenic	3.5	1.0		mg/Kg	1	10/4/2011 01:24 PM
Barium	150	1.0		mg/Kg	1	10/4/2011 01:24 PM
Beryllium	ND	1.0		mg/Kg	1	10/4/2011 01:24 PM
Cadmium	ND	1.0		mg/Kg	1	10/4/2011 01:24 PM
Chromium	12	1.0		mg/Kg	1	10/4/2011 01:24 PM
Cobalt	6.7	1.0		mg/Kg	1	10/4/2011 01:24 PM
Copper	17	2.0		mg/Kg	1	10/4/2011 01:24 PM
Lead	5.1	1.0		mg/Kg	1	10/4/2011 01:24 PM
Molybdenum	ND	1.0		mg/Kg	1	10/4/2011 01:24 PM
Nickel	12	1.0		mg/Kg	1	10/4/2011 01:24 PM
Selenium	ND	1.0		mg/Kg	1	10/4/2011 01:24 PM
Silver	ND	1.0		mg/Kg	1	10/4/2011 01:24 PM
Thallium	ND	1.0		mg/Kg	1	10/4/2011 01:24 PM
Vanadium	28	1.0		mg/Kg	1	10/4/2011 01:24 PM
Zinc	28	1.0		mg/Kg	1	10/4/2011 01:24 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111004A	QC Batch: 76012			PrepDate:	10/3/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/4/2011 01:19 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *06-Oct-11*

CLIENT: Geocon Consultants, Inc.
Lab Order: 120065
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120065-009A

Client Sample ID: B49-0.0
Collection Date: 9/27/2011 10:55:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111004D	QC Batch: 76014			PrepDate:	10/3/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	10/4/2011 01:27 PM
Arsenic	3.6	1.0		mg/Kg	1	10/4/2011 01:27 PM
Barium	140	1.0		mg/Kg	1	10/4/2011 01:27 PM
Beryllium	ND	1.0		mg/Kg	1	10/4/2011 01:27 PM
Cadmium	ND	1.0		mg/Kg	1	10/4/2011 01:27 PM
Chromium	22	1.0		mg/Kg	1	10/4/2011 01:27 PM
Cobalt	7.1	1.0		mg/Kg	1	10/4/2011 01:27 PM
Copper	15	2.0		mg/Kg	1	10/4/2011 01:27 PM
Lead	6.4	1.0		mg/Kg	1	10/4/2011 01:27 PM
Molybdenum	ND	1.0		mg/Kg	1	10/4/2011 01:27 PM
Nickel	20	1.0		mg/Kg	1	10/4/2011 01:27 PM
Selenium	ND	1.0		mg/Kg	1	10/4/2011 01:27 PM
Silver	ND	1.0		mg/Kg	1	10/4/2011 01:27 PM
Thallium	ND	1.0		mg/Kg	1	10/4/2011 01:27 PM
Vanadium	29	1.0		mg/Kg	1	10/4/2011 01:27 PM
Zinc	30	1.0		mg/Kg	1	10/4/2011 01:27 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM
Aldrin	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
beta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
Chlordane	ND	8.5		µg/Kg	1	10/4/2011 11:43 PM
delta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
Dieldrin	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM
Endrin	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/4/2011 11:43 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B49-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011 10:55:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-009A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
Heptachlor	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/4/2011 11:43 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/4/2011 11:43 PM
Toxaphene	ND	50		µg/Kg	1	10/4/2011 11:43 PM
Surr: Decachlorobiphenyl	84.0	39-104		%REC	1	10/4/2011 11:43 PM
Surr: Tetrachloro-m-xylene	74.7	43-100		%REC	1	10/4/2011 11:43 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111004A	QC Batch: 76012			PrepDate:	10/3/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/4/2011 01:20 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B50-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011 10:30:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-010A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
Aldrin	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
beta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
Chlordane	ND	8.5		µg/Kg	1	10/4/2011 11:57 PM
delta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
Dieldrin	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
Endrin	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/4/2011 11:57 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
Heptachlor	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/4/2011 11:57 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/4/2011 11:57 PM
Toxaphene	ND	50		µg/Kg	1	10/4/2011 11:57 PM
Surr: Decachlorobiphenyl	61.9	39-104		%REC	1	10/4/2011 11:57 PM
Surr: Tetrachloro-m-xylene	53.4	43-100		%REC	1	10/4/2011 11:57 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B50-1.5
Lab Order:	120065	**Collection Date:**	9/27/2011 11:40:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-011A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111004D	QC Batch: 76014			PrepDate:	10/3/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	10/4/2011 01:31 PM
Arsenic	3.4	1.0		mg/Kg	1	10/4/2011 01:31 PM
Barium	200	1.0		mg/Kg	1	10/4/2011 01:31 PM
Beryllium	ND	1.0		mg/Kg	1	10/4/2011 01:31 PM
Cadmium	ND	1.0		mg/Kg	1	10/4/2011 01:31 PM
Chromium	13	1.0		mg/Kg	1	10/4/2011 01:31 PM
Cobalt	7.3	1.0		mg/Kg	1	10/4/2011 01:31 PM
Copper	17	2.0		mg/Kg	1	10/4/2011 01:31 PM
Lead	6.6	1.0		mg/Kg	1	10/4/2011 01:31 PM
Molybdenum	ND	1.0		mg/Kg	1	10/4/2011 01:31 PM
Nickel	12	1.0		mg/Kg	1	10/4/2011 01:31 PM
Selenium	ND	1.0		mg/Kg	1	10/4/2011 01:31 PM
Silver	ND	1.0		mg/Kg	1	10/4/2011 01:31 PM
Thallium	ND	1.0		mg/Kg	1	10/4/2011 01:31 PM
Vanadium	32	1.0		mg/Kg	1	10/4/2011 01:31 PM
Zinc	31	1.0		mg/Kg	1	10/4/2011 01:31 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111004A	QC Batch: 76012			PrepDate:	10/3/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/4/2011 01:22 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *06-Oct-11*

CLIENT: Geocon Consultants, Inc.
Lab Order: 120065
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120065-012A

Client Sample ID: B51-0.0
Collection Date: 9/27/2011 11:50:00 AM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111004D	QC Batch: 76014			PrepDate:	10/3/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	10/4/2011 01:34 PM
Arsenic	4.0	1.0		mg/Kg	1	10/4/2011 01:34 PM
Barium	170	1.0		mg/Kg	1	10/4/2011 01:34 PM
Beryllium	ND	1.0		mg/Kg	1	10/4/2011 01:34 PM
Cadmium	ND	1.0		mg/Kg	1	10/4/2011 01:34 PM
Chromium	12	1.0		mg/Kg	1	10/4/2011 01:34 PM
Cobalt	9.8	1.0		mg/Kg	1	10/4/2011 01:34 PM
Copper	16	2.0		mg/Kg	1	10/4/2011 01:34 PM
Lead	9.2	1.0		mg/Kg	1	10/4/2011 01:34 PM
Molybdenum	ND	1.0		mg/Kg	1	10/4/2011 01:34 PM
Nickel	12	1.0		mg/Kg	1	10/4/2011 01:34 PM
Selenium	ND	1.0		mg/Kg	1	10/4/2011 01:34 PM
Silver	ND	1.0		mg/Kg	1	10/4/2011 01:34 PM
Thallium	ND	1.0		mg/Kg	1	10/4/2011 01:34 PM
Vanadium	32	1.0		mg/Kg	1	10/4/2011 01:34 PM
Zinc	31	1.0		mg/Kg	1	10/4/2011 01:34 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM
Aldrin	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
beta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
Chlordane	ND	8.5		µg/Kg	1	10/4/2011 11:02 PM
delta-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
Dieldrin	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM
Endrin	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/4/2011 11:02 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B51-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011 11:50:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-012A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
Heptachlor	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/4/2011 11:02 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/4/2011 11:02 PM
Toxaphene	ND	50		µg/Kg	1	10/4/2011 11:02 PM
Surr: Decachlorobiphenyl	80.9	39-104		%REC	1	10/4/2011 11:02 PM
Surr: Tetrachloro-m-xylene	75.5	43-100		%REC	1	10/4/2011 11:02 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111004A	QC Batch: 76012			PrepDate:	10/3/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/4/2011 01:24 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

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ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B52-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011 12:25:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-013A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
4,4´-DDE	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
4,4´-DDT	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
Aldrin	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
alpha-BHC	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
beta-BHC	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
Chlordane	ND	8.5		µg/Kg	1	10/5/2011 12:11 AM
delta-BHC	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
Dieldrin	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
Endosulfan I	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
Endosulfan II	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
Endrin	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
Endrin ketone	ND	2.0		µg/Kg	1	10/5/2011 12:11 AM
gamma-BHC	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
Heptachlor	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/5/2011 12:11 AM
Methoxychlor	ND	5.0		µg/Kg	1	10/5/2011 12:11 AM
Toxaphene	ND	50		µg/Kg	1	10/5/2011 12:11 AM
Surr: Decachlorobiphenyl	62.4	39-104		%REC	1	10/5/2011 12:11 AM
Surr: Tetrachloro-m-xylene	59.8	43-100		%REC	1	10/5/2011 12:11 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B52-1.5
Lab Order:	120065	**Collection Date:**	9/27/2011 12:29:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-014A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111004D	QC Batch: 76014			PrepDate:	10/3/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	10/4/2011 01:37 PM
Arsenic	2.8	1.0		mg/Kg	1	10/4/2011 01:37 PM
Barium	110	1.0		mg/Kg	1	10/4/2011 01:37 PM
Beryllium	ND	1.0		mg/Kg	1	10/4/2011 01:37 PM
Cadmium	ND	1.0		mg/Kg	1	10/4/2011 01:37 PM
Chromium	11	1.0		mg/Kg	1	10/4/2011 01:37 PM
Cobalt	5.5	1.0		mg/Kg	1	10/4/2011 01:37 PM
Copper	17	2.0		mg/Kg	1	10/4/2011 01:37 PM
Lead	6.8	1.0		mg/Kg	1	10/4/2011 01:37 PM
Molybdenum	ND	1.0		mg/Kg	1	10/4/2011 01:37 PM
Nickel	10	1.0		mg/Kg	1	10/4/2011 01:37 PM
Selenium	ND	1.0		mg/Kg	1	10/4/2011 01:37 PM
Silver	ND	1.0		mg/Kg	1	10/4/2011 01:37 PM
Thallium	ND	1.0		mg/Kg	1	10/4/2011 01:37 PM
Vanadium	24	1.0		mg/Kg	1	10/4/2011 01:37 PM
Zinc	26	1.0		mg/Kg	1	10/4/2011 01:37 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111004A	QC Batch: 76012			PrepDate:	10/3/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/4/2011 01:26 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B53-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011 12:38:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-015A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111004D	QC Batch: 76014			PrepDate:	10/3/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	10/4/2011 01:41 PM
Arsenic	2.9	1.0		mg/Kg	1	10/4/2011 01:41 PM
Barium	140	1.0		mg/Kg	1	10/4/2011 01:41 PM
Beryllium	ND	1.0		mg/Kg	1	10/4/2011 01:41 PM
Cadmium	ND	1.0		mg/Kg	1	10/4/2011 01:41 PM
Chromium	12	1.0		mg/Kg	1	10/4/2011 01:41 PM
Cobalt	5.9	1.0		mg/Kg	1	10/4/2011 01:41 PM
Copper	17	2.0		mg/Kg	1	10/4/2011 01:41 PM
Lead	11	1.0		mg/Kg	1	10/4/2011 01:41 PM
Molybdenum	ND	1.0		mg/Kg	1	10/4/2011 01:41 PM
Nickel	10	1.0		mg/Kg	1	10/4/2011 01:41 PM
Selenium	ND	1.0		mg/Kg	1	10/4/2011 01:41 PM
Silver	ND	1.0		mg/Kg	1	10/4/2011 01:41 PM
Thallium	ND	1.0		mg/Kg	1	10/4/2011 01:41 PM
Vanadium	26	1.0		mg/Kg	1	10/4/2011 01:41 PM
Zinc	58	1.0		mg/Kg	1	10/4/2011 01:41 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM
4,4´-DDE	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM
4,4´-DDT	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM
Aldrin	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
alpha-BHC	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
beta-BHC	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
Chlordane	ND	8.5		µg/Kg	1	10/5/2011 12:25 AM
delta-BHC	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
Dieldrin	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM
Endosulfan I	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
Endosulfan II	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM
Endrin	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM
Endrin ketone	ND	2.0		µg/Kg	1	10/5/2011 12:25 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	B53-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011 12:38:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-015A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
Heptachlor	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/5/2011 12:25 AM
Methoxychlor	ND	5.0		µg/Kg	1	10/5/2011 12:25 AM
Toxaphene	ND	50		µg/Kg	1	10/5/2011 12:25 AM
Surr: Decachlorobiphenyl	86.3	39-104		%REC	1	10/5/2011 12:25 AM
Surr: Tetrachloro-m-xylene	54.3	43-100		%REC	1	10/5/2011 12:25 AM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111004A	QC Batch: 76012			PrepDate:	10/3/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/4/2011 01:29 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *06-Oct-11*

CLIENT: Geocon Consultants, Inc.
Lab Order: 120065
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120065-016A

Client Sample ID: Composite B44-0.0 / B47-0.0
Collection Date: 9/27/2011
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111004D	QC Batch: 76014			PrepDate:	10/3/2011	Analyst: **IL**
Antimony	ND	2.0		mg/Kg	1	10/4/2011 01:52 PM
Arsenic	4.9	1.0		mg/Kg	1	10/4/2011 01:52 PM
Barium	190	1.0		mg/Kg	1	10/4/2011 01:52 PM
Beryllium	ND	1.0		mg/Kg	1	10/4/2011 01:52 PM
Cadmium	ND	1.0		mg/Kg	1	10/4/2011 01:52 PM
Chromium	15	1.0		mg/Kg	1	10/4/2011 01:52 PM
Cobalt	8.5	1.0		mg/Kg	1	10/4/2011 01:52 PM
Copper	19	2.0		mg/Kg	1	10/4/2011 01:52 PM
Lead	15	1.0		mg/Kg	1	10/4/2011 01:52 PM
Molybdenum	ND	1.0		mg/Kg	1	10/4/2011 01:52 PM
Nickel	12	1.0		mg/Kg	1	10/4/2011 01:52 PM
Selenium	ND	1.0		mg/Kg	1	10/4/2011 01:52 PM
Silver	ND	1.0		mg/Kg	1	10/4/2011 01:52 PM
Thallium	ND	1.0		mg/Kg	1	10/4/2011 01:52 PM
Vanadium	35	1.0		mg/Kg	1	10/4/2011 01:52 PM
Zinc	42	1.0		mg/Kg	1	10/4/2011 01:52 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM
Aldrin	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
beta-BHC	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
Chlordane	ND	8.5		µg/Kg	1	10/5/2011 02:25 PM
delta-BHC	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
Dieldrin	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM
Endrin	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/5/2011 02:25 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *06-Oct-11*

CLIENT:	Geocon Consultants, Inc.	**Client Sample ID:**	Composite B44-0.0 / B47-0.0
Lab Order:	120065	**Collection Date:**	9/27/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120065-016A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111004B	QC Batch: 76041			PrepDate:	10/4/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
Heptachlor	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/5/2011 02:25 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/5/2011 02:25 PM
Toxaphene	ND	50		µg/Kg	1	10/5/2011 02:25 PM
Surr: Decachlorobiphenyl	88.2	39-104		%REC	1	10/5/2011 02:25 PM
Surr: Tetrachloro-m-xylene	71.0	43-100		%REC	1	10/5/2011 02:25 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111004A	QC Batch: 76012			PrepDate:	10/3/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/4/2011 12:55 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants, Inc.
Work Order: 120065
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-76014** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137237**
Client ID: **PBS** Batch ID: **76014** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/4/2011** SeqNo: **2253242**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.485	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	0.049	1.0									
Cobalt	ND	1.0									
Copper	0.344	2.0									
Lead	ND	1.0									
Molybdenum	0.046	1.0									
Nickel	0.041	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	0.080	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-76014** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137237**
Client ID: **LCSS** Batch ID: **76014** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/4/2011** SeqNo: **2253243**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	49.048	2.0	50.00	0.4853	97.1	80	120				
Arsenic	45.699	1.0	50.00	0	91.4	80	120				
Barium	49.908	1.0	50.00	0	99.8	80	120				
Beryllium	49.583	1.0	50.00	0	99.2	80	120				
Cadmium	47.610	1.0	50.00	0	95.2	80	120				
Chromium	46.987	1.0	50.00	0.04873	93.9	80	120				
Cobalt	49.555	1.0	50.00	0	99.1	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 120065
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-76014** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137237**
Client ID: **LCSS** Batch ID: **76014** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/4/2011** SeqNo: **2253243**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	49.481	2.0	50.00	0.3438	98.3	80	120				
Lead	48.968	1.0	50.00	0	97.9	80	120				
Molybdenum	50.560	1.0	50.00	0.04639	101	80	120				
Nickel	48.772	1.0	50.00	0.04142	97.5	80	120				
Selenium	45.299	1.0	50.00	0	90.6	80	120				
Silver	45.844	1.0	50.00	0	91.7	80	120				
Thallium	47.379	1.0	50.00	0.07977	94.6	80	120				
Vanadium	50.723	1.0	50.00	0	101	80	120				
Zinc	48.509	1.0	50.00	0	97.0	80	120				

Sample ID: **120065-016A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137237**
Client ID: **Composite B44-0.0 /** Batch ID: **76014** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/4/2011** SeqNo: **2253262**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	85.509	2.0	125.0	0.2771	68.2	44	105				
Arsenic	94.824	1.0	125.0	4.863	72.0	57	103				
Barium	281.507	1.0	125.0	189.7	73.4	36	134				
Beryllium	96.135	1.0	125.0	0.5248	76.5	64	106				
Cadmium	90.611	1.0	125.0	0.5247	72.1	58	102				
Chromium	107.035	1.0	125.0	14.60	73.9	55	105				
Cobalt	102.895	1.0	125.0	8.453	75.6	59	105				
Copper	125.781	2.0	125.0	19.00	85.4	64	117				
Lead	107.361	1.0	125.0	14.91	74.0	46	116				
Molybdenum	93.510	1.0	125.0	0	74.8	59	108				
Nickel	103.992	1.0	125.0	11.59	73.9	52	109				
Selenium	87.147	1.0	125.0	0	69.7	56	100				
Silver	98.878	1.0	125.0	0	79.1	65	107				
Thallium	89.581	1.0	125.0	0	71.7	47	100				
Vanadium	140.124	1.0	125.0	34.84	84.2	64	110				
Zinc	133.089	1.0	125.0	41.96	72.9	37	123				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 120065
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **120065-016A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137237**
Client ID: **Composite B44-0.0 /** Batch ID: **76014** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/4/2011** SeqNo: **2253263**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	87.497	2.0	125.0	0.2771	69.8	44	105	85.51	2.30	20	
Arsenic	96.604	1.0	125.0	4.863	73.4	57	103	94.82	1.86	20	
Barium	268.852	1.0	125.0	189.7	63.3	36	134	281.5	4.60	20	
Beryllium	97.186	1.0	125.0	0.5248	77.3	64	106	96.14	1.09	20	
Cadmium	92.016	1.0	125.0	0.5247	73.2	58	102	90.61	1.54	20	
Chromium	107.565	1.0	125.0	14.60	74.4	55	105	107.0	0.494	20	
Cobalt	104.310	1.0	125.0	8.453	76.7	59	105	102.9	1.37	20	
Copper	127.074	2.0	125.0	19.00	86.5	64	117	125.8	1.02	20	
Lead	107.875	1.0	125.0	14.91	74.4	46	116	107.4	0.478	20	
Molybdenum	94.062	1.0	125.0	0	75.2	59	108	93.51	0.589	20	
Nickel	105.005	1.0	125.0	11.59	74.7	52	109	104.0	0.970	20	
Selenium	89.274	1.0	125.0	0	71.4	56	100	87.15	2.41	20	
Silver	100.313	1.0	125.0	0	80.3	65	107	98.88	1.44	20	
Thallium	91.921	1.0	125.0	0	73.5	47	100	89.58	2.58	20	
Vanadium	140.769	1.0	125.0	34.84	84.7	64	110	140.1	0.459	20	
Zinc	134.437	1.0	125.0	41.96	74.0	37	123	133.1	1.01	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CLIENT: Geocon Consultants, Inc.
Work Order: 120065
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-76012** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137235**
Client ID: **PBS** Batch ID: **76012** TestNo: **EPA 7471A** Analysis Date: **10/4/2011** SeqNo: **2253191**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.003	0.10									

Sample ID: **LCS-76012** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137235**
Client ID: **LCSS** Batch ID: **76012** TestNo: **EPA 7471A** Analysis Date: **10/4/2011** SeqNo: **2253192**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.984	0.10	0.8300	0.002993	118	80	120				

Sample ID: **120065-016A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137235**
Client ID: **Composite B44-0.0 /** Batch ID: **76012** TestNo: **EPA 7471A** Analysis Date: **10/4/2011** SeqNo: **2253193**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.986	0.10	0.8300	0.04926	113	70	130				

Sample ID: **120065-016A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/3/2011** RunNo: **137235**
Client ID: **Composite B44-0.0 /** Batch ID: **76012** TestNo: **EPA 7471A** Analysis Date: **10/4/2011** SeqNo: **2253194**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.967	0.10	0.8300	0.04926	111	70	130	0.9861	1.94	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 120065
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-76041** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/4/2011** RunNo: **137264**
Client ID: **PBS** Batch ID: **76041** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/4/2011** SeqNo: **2253705**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	11.975		16.67		71.8	43	100				
Surr: Decachlorobiphenyl	11.999		16.67		72.0	39	104				

Sample ID: **LCS-76041** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/4/2011** RunNo: **137264**
Client ID: **LCSS** Batch ID: **76041** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/4/2011** SeqNo: **2253706**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	11.800	1.0	16.67	0	70.8	56	108				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 *Tel: 562. 989.4045* *Fax: 562.989.4040*

CLIENT: Geocon Consultants, Inc.
Work Order: 120065
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-76041** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/4/2011** RunNo: **137264**
Client ID: **LCSS** Batch ID: **76041** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/4/2011** SeqNo: **2253706**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	11.962	2.0	16.67	0	71.8	53	115				
Endrin	12.805	2.0	16.67	0	76.8	55	125				
gamma-BHC	11.849	1.0	16.67	0	71.1	59	110				
Heptachlor	12.499	1.0	16.67	0	75.0	53	114				
Surr: Tetrachloro-m-xylene	11.833		16.67		71.0	43	100				
Surr: Decachlorobiphenyl	11.724		16.67		70.3	39	104				

Sample ID: **120065-012AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/4/2011** RunNo: **137264**
Client ID: **B51-0.0** Batch ID: **76041** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/4/2011** SeqNo: **2253707**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	15.738	2.0	16.67	0	94.4	17	165				
Aldrin	15.338	1.0	16.67	0	92.0	34	130				
Dieldrin	15.958	2.0	16.67	0	95.7	33	143				
Endrin	17.347	2.0	16.67	0	104	39	152				
gamma-BHC	15.188	1.0	16.67	0	91.1	37	131				
Heptachlor	16.901	1.0	16.67	0	101	31	140				
Surr: Tetrachloro-m-xylene	13.217		16.67		79.3	43	100				
Surr: Decachlorobiphenyl	13.537		16.67		81.2	39	104				

Sample ID: **120065-012AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/4/2011** RunNo: **137264**
Client ID: **B51-0.0** Batch ID: **76041** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/4/2011** SeqNo: **2253708**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	16.188	2.0	16.67	0	97.1	17	165	15.74	2.82	20	
Aldrin	15.694	1.0	16.67	0	94.1	34	130	15.34	2.30	20	
Dieldrin	16.309	2.0	16.67	0	97.8	33	143	15.96	2.17	20	
Endrin	17.807	2.0	16.67	0	107	39	152	17.35	2.61	20	
gamma-BHC	15.564	1.0	16.67	0	93.4	37	131	15.19	2.45	20	
Heptachlor	17.457	1.0	16.67	0	105	31	140	16.90	3.24	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants, Inc.
Work Order: 120065
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **120065-012AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/4/2011** RunNo: **137264**
Client ID: **B51-0.0** Batch ID: **76041** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/4/2011** SeqNo: **2253708**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	13.461		16.67		80.7	43	100		0	0	
Surr: Decachlorobiphenyl	13.900		16.67		83.4	39	104		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 *Tel: 562. 989.4045* *Fax: 562.989.4040*

CHAIN OF CUSTODY RECORD

1/2

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: 9/28/11

Method of Transport: Client ☐ ATL ☐ CA OverN ☑ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED 3.0 Y ☑ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☑ N ☐
4. SEALED Y ☐ N ☑
5. # OF SPLS MATCH COC Y ☑ N ☐
6. PRESERVED Y ☐ N ☑

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien	9/27/11	1630	Geocon Cold Storage	9/27/11	1630
Geocon Cold Storage	9/28/11	1630	ATRAC	9/28/11	1630
				9/29/11	9:48

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	120065- 1	B43 - 0.0	9/27/11	945	X												X					E	1	SS T	C	
	2	B43 - 1.5		947									X													
	3	B44 - 0.0		1005	X								X													
	4	B45 - 0.0		1020	X								X													
	5	B46 - 0.0		1120	X								X													Composite
	6	B47 - 0.0		1210	X								X													
	7	B48 - 0.0		1035	X																					
	8	B48 - 1.5		1040									X													
	9	B49 - 0.0		1055	X								X													
	10	B50 - 0.0		1030	X																					

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

CHAIN OF CUSTODY RECORD

2/2

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐ 4. SEALED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐ 5. # OF SPLS MATCH COC Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐ 6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien	9/27/11	1630	Geocon Cold Storage	9/27/11	1630
Geocon Cold Storage / RSL	9/28/11	1630	On Trac	9/28/11	1630
			Margo	9/29/11	9:48

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	R10165 - 11	B50-1.5	9/27/11	1140									X				X					E	1	55 T	C	
	12	B51-0.0	↓	1150	X								X				↓					↓	↓	↓	↓	
	13	B52-0.0	↓	1225	X												↓					↓	↓	↓	↓	
	14	B52-1.5	↓	1229									X				↓					↓	↓	↓	↓	
	15	B53-0.0	↓	1238	X								X				↓					↓	↓	↓	↓	

■ TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

October 20, 2011

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Workorder No.: 120226

Chris Giuntoli
Geocon Consultants
4010 Technology Way, Suite D
Carson City, NV 89706

TEL: (775) 888-9900
FAX: (775) 888-9904

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on October 08, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

for Eddie F. Rodriguez
Laboratory Director

The cover letter and the case narrative are an integral part of this analytical report and cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

CLIENT: Geocon Consultants
Project: 80/680/12 Interchange, E8128-06-07
Lab Order: 120226

CASE NARRATIVE

Analytical Comments for Method 7471

Matrix Spike (MS) and /or Matrix Spike Duplicate (MSD) are/is outside recovery criteria for samples 120226-017AMS and 120226-017AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8015 (DRO/ORO)

Dilution was necessary for samples 120226-007A, 120226-011A, 120226-016A, 120226-019A and 120226-022A, due to sample matrix.

Surrogate recovery was diluted out for samples 120226-007A, 120226-011A, 120226-016A, 120226-019A and 120226-022A.

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B54-0
Lab Order:	120226	**Collection Date:**	10/6/2011 8:38:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-001A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
Aldrin	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
beta-BHC	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
Chlordane	ND	8.5		µg/Kg	1	10/12/2011 04:57 PM
delta-BHC	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
Dieldrin	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
Endrin	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/12/2011 04:57 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
Heptachlor	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/12/2011 04:57 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/12/2011 04:57 PM
Toxaphene	ND	50		µg/Kg	1	10/12/2011 04:57 PM
Surr: Decachlorobiphenyl	68.2	39-104		%REC	1	10/12/2011 04:57 PM
Surr: Tetrachloro-m-xylene	65.8	43-100		%REC	1	10/12/2011 04:57 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B54-1.5
Lab Order:	120226	**Collection Date:**	10/6/2011 8:40:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-002A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015A	QC Batch: 76210			PrepDate:	10/14/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/15/2011 03:44 PM
Arsenic	5.0	1.0		mg/Kg	1	10/15/2011 03:44 PM
Barium	520	1.0		mg/Kg	1	10/15/2011 03:44 PM
Beryllium	ND	1.0		mg/Kg	1	10/15/2011 03:44 PM
Cadmium	ND	1.0		mg/Kg	1	10/15/2011 03:44 PM
Chromium	16	1.0		mg/Kg	1	10/15/2011 03:44 PM
Cobalt	10	1.0		mg/Kg	1	10/15/2011 03:44 PM
Copper	14	2.0		mg/Kg	1	10/15/2011 03:44 PM
Lead	6.8	1.0		mg/Kg	1	10/15/2011 03:44 PM
Molybdenum	ND	1.0		mg/Kg	1	10/15/2011 03:44 PM
Nickel	11	1.0		mg/Kg	1	10/15/2011 03:44 PM
Selenium	ND	1.0		mg/Kg	1	10/15/2011 03:44 PM
Silver	ND	1.0		mg/Kg	1	10/15/2011 03:44 PM
Thallium	ND	1.0		mg/Kg	1	10/15/2011 03:44 PM
Vanadium	36	1.0		mg/Kg	1	10/15/2011 03:44 PM
Zinc	27	1.0		mg/Kg	1	10/15/2011 03:44 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111014B	QC Batch: 76207			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/14/2011 02:56 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B55-0
Lab Order:	120226	**Collection Date:**	10/6/2011 8:44:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-003A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015A	QC Batch: 76210			PrepDate:	10/14/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/15/2011 03:47 PM
Arsenic	4.0	1.0		mg/Kg	1	10/15/2011 03:47 PM
Barium	150	1.0		mg/Kg	1	10/15/2011 03:47 PM
Beryllium	ND	1.0		mg/Kg	1	10/15/2011 03:47 PM
Cadmium	ND	1.0		mg/Kg	1	10/15/2011 03:47 PM
Chromium	16	1.0		mg/Kg	1	10/15/2011 03:47 PM
Cobalt	6.7	1.0		mg/Kg	1	10/15/2011 03:47 PM
Copper	15	2.0		mg/Kg	1	10/15/2011 03:47 PM
Lead	12	1.0		mg/Kg	1	10/15/2011 03:47 PM
Molybdenum	ND	1.0		mg/Kg	1	10/15/2011 03:47 PM
Nickel	12	1.0		mg/Kg	1	10/15/2011 03:47 PM
Selenium	ND	1.0		mg/Kg	1	10/15/2011 03:47 PM
Silver	ND	1.0		mg/Kg	1	10/15/2011 03:47 PM
Thallium	ND	1.0		mg/Kg	1	10/15/2011 03:47 PM
Vanadium	31	1.0		mg/Kg	1	10/15/2011 03:47 PM
Zinc	36	1.0		mg/Kg	1	10/15/2011 03:47 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM
Aldrin	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
beta-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
Chlordane	ND	8.5		µg/Kg	1	10/12/2011 05:11 PM
delta-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
Dieldrin	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM
Endrin	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/12/2011 05:11 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B55-0
Lab Order:	120226	**Collection Date:**	10/6/2011 8:44:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-003A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
Heptachlor	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/12/2011 05:11 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/12/2011 05:11 PM
Toxaphene	ND	50		µg/Kg	1	10/12/2011 05:11 PM
Surr: Decachlorobiphenyl	65.4	39-104		%REC	1	10/12/2011 05:11 PM
Surr: Tetrachloro-m-xylene	63.0	43-100		%REC	1	10/12/2011 05:11 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111014B	QC Batch: 76207			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/14/2011 02:58 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B56-0
Lab Order:	120226	**Collection Date:**	10/6/2011 9:20:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-004A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
Aldrin	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
beta-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
Chlordane	ND	8.5		µg/Kg	1	10/12/2011 05:25 PM
delta-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
Dieldrin	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
Endrin	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/12/2011 05:25 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
Heptachlor	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/12/2011 05:25 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/12/2011 05:25 PM
Toxaphene	ND	50		µg/Kg	1	10/12/2011 05:25 PM
Surr: Decachlorobiphenyl	70.6	39-104		%REC	1	10/12/2011 05:25 PM
Surr: Tetrachloro-m-xylene	70.0	43-100		%REC	1	10/12/2011 05:25 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B56-1.5
Lab Order:	120226	**Collection Date:**	10/6/2011 9:25:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-005A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015A	QC Batch: 76210			PrepDate:	10/14/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/15/2011 03:50 PM
Arsenic	1.6	1.0		mg/Kg	1	10/15/2011 03:50 PM
Barium	120	1.0		mg/Kg	1	10/15/2011 03:50 PM
Beryllium	ND	1.0		mg/Kg	1	10/15/2011 03:50 PM
Cadmium	ND	1.0		mg/Kg	1	10/15/2011 03:50 PM
Chromium	14	1.0		mg/Kg	1	10/15/2011 03:50 PM
Cobalt	8.7	1.0		mg/Kg	1	10/15/2011 03:50 PM
Copper	16	2.0		mg/Kg	1	10/15/2011 03:50 PM
Lead	8.3	1.0		mg/Kg	1	10/15/2011 03:50 PM
Molybdenum	ND	1.0		mg/Kg	1	10/15/2011 03:50 PM
Nickel	14	1.0		mg/Kg	1	10/15/2011 03:50 PM
Selenium	ND	1.0		mg/Kg	1	10/15/2011 03:50 PM
Silver	ND	1.0		mg/Kg	1	10/15/2011 03:50 PM
Thallium	ND	1.0		mg/Kg	1	10/15/2011 03:50 PM
Vanadium	43	1.0		mg/Kg	1	10/15/2011 03:50 PM
Zinc	34	1.0		mg/Kg	1	10/15/2011 03:50 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111014B	QC Batch: 76207			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/14/2011 03:00 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B57-0
Lab Order:	120226	**Collection Date:**	10/6/2011 9:30:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-006A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015A	QC Batch: 76210			PrepDate:	10/14/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/15/2011 03:54 PM
Arsenic	3.8	1.0		mg/Kg	1	10/15/2011 03:54 PM
Barium	120	1.0		mg/Kg	1	10/15/2011 03:54 PM
Beryllium	ND	1.0		mg/Kg	1	10/15/2011 03:54 PM
Cadmium	ND	1.0		mg/Kg	1	10/15/2011 03:54 PM
Chromium	13	1.0		mg/Kg	1	10/15/2011 03:54 PM
Cobalt	5.5	1.0		mg/Kg	1	10/15/2011 03:54 PM
Copper	15	2.0		mg/Kg	1	10/15/2011 03:54 PM
Lead	6.0	1.0		mg/Kg	1	10/15/2011 03:54 PM
Molybdenum	ND	1.0		mg/Kg	1	10/15/2011 03:54 PM
Nickel	11	1.0		mg/Kg	1	10/15/2011 03:54 PM
Selenium	ND	1.0		mg/Kg	1	10/15/2011 03:54 PM
Silver	ND	1.0		mg/Kg	1	10/15/2011 03:54 PM
Thallium	ND	1.0		mg/Kg	1	10/15/2011 03:54 PM
Vanadium	28	1.0		mg/Kg	1	10/15/2011 03:54 PM
Zinc	35	1.0		mg/Kg	1	10/15/2011 03:54 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM
Aldrin	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
beta-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
Chlordane	ND	8.5		µg/Kg	1	10/12/2011 05:39 PM
delta-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
Dieldrin	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM
Endrin	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/12/2011 05:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B57-0
Lab Order:	120226	**Collection Date:**	10/6/2011 9:30:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-006A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
Heptachlor	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/12/2011 05:39 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/12/2011 05:39 PM
Toxaphene	ND	50		µg/Kg	1	10/12/2011 05:39 PM
Surr: Decachlorobiphenyl	61.6	39-104		%REC	1	10/12/2011 05:39 PM
Surr: Tetrachloro-m-xylene	58.7	43-100		%REC	1	10/12/2011 05:39 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111014B	QC Batch: 76207			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/14/2011 03:02 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B17-0
Lab Order:	120226	**Collection Date:**	10/6/2011 10:45:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-007A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015A	QC Batch: 76210			PrepDate:	10/14/2011	Analyst: **CBB**
Lead	1.4	1.0		mg/Kg	1	10/15/2011 03:57 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111013C	QC Batch: 76187			PrepDate:	10/12/2011	Analyst: **CBR**
DRO	2200	200		mg/Kg	20	10/13/2011 07:39 PM
ORO	12000	200		mg/Kg	20	10/13/2011 07:39 PM
Surr: p-Terphenyl	0	39-123	SDO	%REC	20	10/13/2011 07:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B17-1
Lab Order:	120226	**Collection Date:**	10/6/2011 10:46:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-008A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015A QC Batch: 76210				PrepDate: 10/14/2011		Analyst: **CBB**
Lead	8.2	1.0		mg/Kg	1	10/15/2011 04:00 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/13/2011 11:56 PM
Surr: Bromofluorobenzene (FID)	104	69-158		%REC	1	10/13/2011 11:56 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/13/2011 11:56 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/13/2011 11:56 PM
m,p-Xylene	ND	10		µg/Kg	1	10/13/2011 11:56 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/13/2011 11:56 PM
o-Xylene	ND	5.0		µg/Kg	1	10/13/2011 11:56 PM
Toluene	ND	5.0		µg/Kg	1	10/13/2011 11:56 PM
Surr: Bromofluorobenzene (PID)	103	65-140		%REC	1	10/13/2011 11:56 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B16-0
Lab Order:	120226	**Collection Date:**	10/6/2011 11:00:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-009A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B	QC Batch: 76211			PrepDate:	10/14/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/15/2011 04:26 PM
Arsenic	ND	1.0		mg/Kg	1	10/15/2011 04:26 PM
Barium	39	1.0		mg/Kg	1	10/15/2011 04:26 PM
Beryllium	ND	1.0		mg/Kg	1	10/15/2011 04:26 PM
Cadmium	ND	1.0		mg/Kg	1	10/15/2011 04:26 PM
Chromium	20	1.0		mg/Kg	1	10/15/2011 04:26 PM
Cobalt	14	1.0		mg/Kg	1	10/15/2011 04:26 PM
Copper	20	2.0		mg/Kg	1	10/15/2011 04:26 PM
Lead	3.1	1.0		mg/Kg	1	10/15/2011 04:26 PM
Molybdenum	ND	1.0		mg/Kg	1	10/15/2011 04:26 PM
Nickel	30	1.0		mg/Kg	1	10/15/2011 04:26 PM
Selenium	ND	1.0		mg/Kg	1	10/15/2011 04:26 PM
Silver	ND	1.0		mg/Kg	1	10/15/2011 04:26 PM
Thallium	ND	1.0		mg/Kg	1	10/15/2011 04:26 PM
Vanadium	35	1.0		mg/Kg	1	10/15/2011 04:26 PM
Zinc	31	1.0		mg/Kg	1	10/15/2011 04:26 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111013C	QC Batch: 76187			PrepDate:	10/12/2011	Analyst: **CBR**
DRO	13	2.0		mg/Kg	1	10/13/2011 03:25 PM
ORO	74	2.0		mg/Kg	1	10/13/2011 03:25 PM
Surr: p-Terphenyl	78.3	39-123		%REC	1	10/13/2011 03:25 PM
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA1_111014B	QC Batch: 76207			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/14/2011 03:04 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B16-1
Lab Order:	120226	**Collection Date:**	10/6/2011 11:01:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-010A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate: 10/14/2011		Analyst: **CBB**
Lead	33	1.0		mg/Kg	1	10/15/2011 04:29 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/14/2011 12:12 AM
Surr: Bromofluorobenzene (FID)	104	69-158		%REC	1	10/14/2011 12:12 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/14/2011 12:12 AM
Ethylbenzene	ND	5.0		µg/Kg	1	10/14/2011 12:12 AM
m,p-Xylene	ND	10		µg/Kg	1	10/14/2011 12:12 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/14/2011 12:12 AM
o-Xylene	ND	5.0		µg/Kg	1	10/14/2011 12:12 AM
Toluene	ND	5.0		µg/Kg	1	10/14/2011 12:12 AM
Surr: Bromofluorobenzene (PID)	102	65-140		%REC	1	10/14/2011 12:12 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B15-0
Lab Order:	120226	**Collection Date:**	10/6/2011 11:13:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-011A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**	
Lead	46	1.0		mg/Kg	1	10/15/2011 04:33 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111013C QC Batch: 76187				PrepDate: 10/12/2011	Analyst: **CBR**	
DRO	140	40		mg/Kg	10	10/13/2011 06:57 PM
ORO	740	40		mg/Kg	10	10/13/2011 06:57 PM
Surr: p-Terphenyl	0	39-123	SDO	%REC	10	10/13/2011 06:57 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B15-1
Lab Order:	120226	**Collection Date:**	10/6/2011 11:14:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-012A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate: 10/14/2011		Analyst: **CBB**
Lead	110	1.0		mg/Kg	1	10/15/2011 04:36 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/14/2011 12:27 AM
Surr: Bromofluorobenzene (FID)	108	69-158		%REC	1	10/14/2011 12:27 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/14/2011 12:27 AM
Ethylbenzene	ND	5.0		µg/Kg	1	10/14/2011 12:27 AM
m,p-Xylene	ND	10		µg/Kg	1	10/14/2011 12:27 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/14/2011 12:27 AM
o-Xylene	ND	5.0		µg/Kg	1	10/14/2011 12:27 AM
Toluene	ND	5.0		µg/Kg	1	10/14/2011 12:27 AM
Surr: Bromofluorobenzene (PID)	105	65-140		%REC	1	10/14/2011 12:27 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B14-0
Lab Order:	120226	**Collection Date:**	10/6/2011 11:20:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-013A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate:	10/14/2011	Analyst: **CBB**
Lead	4.7	1.0		mg/Kg	1	10/15/2011 04:40 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111013C QC Batch: 76187				PrepDate:	10/12/2011	Analyst: **CBR**
DRO	15	2.0		mg/Kg	1	10/13/2011 03:36 PM
ORO	69	2.0		mg/Kg	1	10/13/2011 03:36 PM
Surr: p-Terphenyl	75.9	39-123		%REC	1	10/13/2011 03:36 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B14-1
Lab Order:	120226	**Collection Date:**	10/6/2011 11:21:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-014A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate: 10/14/2011		Analyst: **CBB**
Lead	3.0	1.0		mg/Kg	1	10/15/2011 04:43 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/14/2011 12:42 AM
Surr: Bromofluorobenzene (FID)	104	69-158		%REC	1	10/14/2011 12:42 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/14/2011 12:42 AM
Ethylbenzene	ND	5.0		µg/Kg	1	10/14/2011 12:42 AM
m,p-Xylene	ND	10		µg/Kg	1	10/14/2011 12:42 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/14/2011 12:42 AM
o-Xylene	ND	5.0		µg/Kg	1	10/14/2011 12:42 AM
Toluene	ND	5.0		µg/Kg	1	10/14/2011 12:42 AM
Surr: Bromofluorobenzene (PID)	102	65-140		%REC	1	10/14/2011 12:42 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B14-2
Lab Order:	120226	**Collection Date:**	10/6/2011 11:22:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-015A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015B	QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**
Lead	3.2	1.0		mg/Kg	1	10/15/2011 04:47 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B13-0
Lab Order:	120226	**Collection Date:**	10/6/2011 11:40:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-016A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**	
Lead	1.8	1.0		mg/Kg	1	10/15/2011 04:50 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111013C QC Batch: 76187				PrepDate: 10/12/2011	Analyst: **CBR**	
DRO	690	100		mg/Kg	10	10/13/2011 07:08 PM
ORO	4300	100		mg/Kg	10	10/13/2011 07:08 PM
Surr: p-Terphenyl	0	39-123	SDO	%REC	10	10/13/2011 07:08 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B13-1
Lab Order:	120226	**Collection Date:**	10/6/2011 11:41:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-017A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B	QC Batch: 76211			PrepDate: 10/14/2011		Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/15/2011 04:54 PM
Arsenic	ND	1.0		mg/Kg	1	10/15/2011 04:54 PM
Barium	11	1.0		mg/Kg	1	10/15/2011 04:54 PM
Beryllium	ND	1.0		mg/Kg	1	10/15/2011 04:54 PM
Cadmium	ND	1.0		mg/Kg	1	10/15/2011 04:54 PM
Chromium	9.3	1.0		mg/Kg	1	10/15/2011 04:54 PM
Cobalt	15	1.0		mg/Kg	1	10/15/2011 04:54 PM
Copper	21	2.0		mg/Kg	1	10/15/2011 04:54 PM
Lead	7.8	1.0		mg/Kg	1	10/15/2011 04:54 PM
Molybdenum	ND	1.0		mg/Kg	1	10/15/2011 04:54 PM
Nickel	19	1.0		mg/Kg	1	10/15/2011 04:54 PM
Selenium	ND	1.0		mg/Kg	1	10/15/2011 04:54 PM
Silver	ND	1.0		mg/Kg	1	10/15/2011 04:54 PM
Thallium	ND	1.0		mg/Kg	1	10/15/2011 04:54 PM
Vanadium	81	1.0		mg/Kg	1	10/15/2011 04:54 PM
Zinc	140	1.0		mg/Kg	1	10/15/2011 04:54 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111013B	QC Batch: E11VS354			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/14/2011 12:58 AM
Surr: Bromofluorobenzene (FID)	98.0	69-158		%REC	1	10/14/2011 12:58 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111013B	QC Batch: E11VS354			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/14/2011 12:58 AM
Ethylbenzene	ND	5.0		µg/Kg	1	10/14/2011 12:58 AM
m,p-Xylene	ND	10		µg/Kg	1	10/14/2011 12:58 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/14/2011 12:58 AM
o-Xylene	ND	5.0		µg/Kg	1	10/14/2011 12:58 AM
Toluene	ND	5.0		µg/Kg	1	10/14/2011 12:58 AM
Surr: Bromofluorobenzene (PID)	95.6	65-140		%REC	1	10/14/2011 12:58 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B13-1
Lab Order:	120226	**Collection Date:**	10/6/2011 11:41:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-017A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA1_111014B	QC Batch: 76207			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	0.46	0.10		mg/Kg	1	10/14/2011 02:17 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B13-2
Lab Order:	120226	**Collection Date:**	10/6/2011 11:42:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-018A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015B	QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**
Lead	3.4	1.0		mg/Kg	1	10/15/2011 05:05 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B12-0
Lab Order:	120226	**Collection Date:**	10/6/2011 11:50:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-019A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B	QC Batch: 76211			PrepDate:	10/14/2011	Analyst: **CBB**
Lead	1.7	1.0		mg/Kg	1	10/15/2011 05:09 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111013C	QC Batch: 76187			PrepDate:	10/12/2011	Analyst: **CBR**
DRO	2400	200		mg/Kg	20	10/13/2011 07:29 PM
ORO	14000	200		mg/Kg	20	10/13/2011 07:29 PM
Surr: p-Terphenyl	0	39-123	SDO	%REC	20	10/13/2011 07:29 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B12-1
Lab Order:	120226	**Collection Date:**	10/6/2011 11:51:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-020A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate: 10/14/2011		Analyst: **CBB**
Lead	3.6	1.0		mg/Kg	1	10/15/2011 05:13 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/14/2011 01:13 AM
Surr: Bromofluorobenzene (FID)	104	69-158		%REC	1	10/14/2011 01:13 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/14/2011 01:13 AM
Ethylbenzene	ND	5.0		µg/Kg	1	10/14/2011 01:13 AM
m,p-Xylene	ND	10		µg/Kg	1	10/14/2011 01:13 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/14/2011 01:13 AM
o-Xylene	ND	5.0		µg/Kg	1	10/14/2011 01:13 AM
Toluene	ND	5.0		µg/Kg	1	10/14/2011 01:13 AM
Surr: Bromofluorobenzene (PID)	103	65-140		%REC	1	10/14/2011 01:13 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B12-2
Lab Order:	120226	**Collection Date:**	10/6/2011 11:52:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-021A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015B	QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**
Lead	3.1	1.0		mg/Kg	1	10/15/2011 05:16 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B11-0
Lab Order:	120226	**Collection Date:**	10/6/2011 12:05:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-022A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**	
Lead	630	1.0		mg/Kg	1	10/15/2011 05:20 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111013C QC Batch: 76187				PrepDate: 10/12/2011	Analyst: **CBR**	
DRO	130	40		mg/Kg	10	10/13/2011 06:47 PM
ORO	760	40		mg/Kg	10	10/13/2011 06:47 PM
Surr: p-Terphenyl	0	39-123	SDO	%REC	10	10/13/2011 06:47 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B11-1
Lab Order:	120226	**Collection Date:**	10/6/2011 12:06:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-023A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B QC Batch: 76211				PrepDate: 10/14/2011		Analyst: **CBB**
Lead	5.9	1.0		mg/Kg	1	10/15/2011 05:23 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/14/2011 01:29 AM
Surr: Bromofluorobenzene (FID)	105	69-158		%REC	1	10/14/2011 01:29 AM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111013B QC Batch: E11VS354				PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/14/2011 01:29 AM
Ethylbenzene	ND	5.0		µg/Kg	1	10/14/2011 01:29 AM
m,p-Xylene	ND	10		µg/Kg	1	10/14/2011 01:29 AM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/14/2011 01:29 AM
o-Xylene	ND	5.0		µg/Kg	1	10/14/2011 01:29 AM
Toluene	ND	5.0		µg/Kg	1	10/14/2011 01:29 AM
Surr: Bromofluorobenzene (PID)	104	65-140		%REC	1	10/14/2011 01:29 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B11-2
Lab Order:	120226	**Collection Date:**	10/6/2011 12:07:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-024A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015B	QC Batch: 76211			PrepDate:	10/14/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/15/2011 05:27 PM
Arsenic	6.2	1.0		mg/Kg	1	10/15/2011 05:27 PM
Barium	40	1.0		mg/Kg	1	10/15/2011 05:27 PM
Beryllium	ND	1.0		mg/Kg	1	10/15/2011 05:27 PM
Cadmium	ND	1.0		mg/Kg	1	10/15/2011 05:27 PM
Chromium	12	1.0		mg/Kg	1	10/15/2011 05:27 PM
Cobalt	1.5	1.0		mg/Kg	1	10/15/2011 05:27 PM
Copper	4.0	2.0		mg/Kg	1	10/15/2011 05:27 PM
Lead	5.7	1.0		mg/Kg	1	10/15/2011 05:27 PM
Molybdenum	ND	1.0		mg/Kg	1	10/15/2011 05:27 PM
Nickel	9.1	1.0		mg/Kg	1	10/15/2011 05:27 PM
Selenium	ND	1.0		mg/Kg	1	10/15/2011 05:27 PM
Silver	ND	1.0		mg/Kg	1	10/15/2011 05:27 PM
Thallium	ND	1.0		mg/Kg	1	10/15/2011 05:27 PM
Vanadium	13	1.0		mg/Kg	1	10/15/2011 05:27 PM
Zinc	10	1.0		mg/Kg	1	10/15/2011 05:27 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111014A	QC Batch: 76208			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/14/2011 01:18 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B69-0
Lab Order:	120226	**Collection Date:**	10/6/2011 12:25:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-025A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111015B	QC Batch: 76211			PrepDate:	10/14/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/15/2011 05:30 PM
Arsenic	2.3	1.0		mg/Kg	1	10/15/2011 05:30 PM
Barium	91	1.0		mg/Kg	1	10/15/2011 05:30 PM
Beryllium	ND	1.0		mg/Kg	1	10/15/2011 05:30 PM
Cadmium	ND	1.0		mg/Kg	1	10/15/2011 05:30 PM
Chromium	16	1.0		mg/Kg	1	10/15/2011 05:30 PM
Cobalt	7.9	1.0		mg/Kg	1	10/15/2011 05:30 PM
Copper	21	2.0		mg/Kg	1	10/15/2011 05:30 PM
Lead	94	1.0		mg/Kg	1	10/15/2011 05:30 PM
Molybdenum	ND	1.0		mg/Kg	1	10/15/2011 05:30 PM
Nickel	12	1.0		mg/Kg	1	10/15/2011 05:30 PM
Selenium	ND	1.0		mg/Kg	1	10/15/2011 05:30 PM
Silver	ND	1.0		mg/Kg	1	10/15/2011 05:30 PM
Thallium	ND	1.0		mg/Kg	1	10/15/2011 05:30 PM
Vanadium	45	1.0		mg/Kg	1	10/15/2011 05:30 PM
Zinc	87	1.0		mg/Kg	1	10/15/2011 05:30 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM
Aldrin	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
beta-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
Chlordane	ND	8.5		µg/Kg	1	10/12/2011 05:53 PM
delta-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
Dieldrin	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM
Endrin	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/12/2011 05:53 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B69-0
Lab Order:	120226	**Collection Date:**	10/6/2011 12:25:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-025A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
Heptachlor	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/12/2011 05:53 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/12/2011 05:53 PM
Toxaphene	ND	50		µg/Kg	1	10/12/2011 05:53 PM
Surr: Decachlorobiphenyl	63.4	39-104		%REC	1	10/12/2011 05:53 PM
Surr: Tetrachloro-m-xylene	61.8	43-100		%REC	1	10/12/2011 05:53 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111014A	QC Batch: 76208			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	0.31	0.10		mg/Kg	1	10/14/2011 01:25 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B17-2
Lab Order:	120226	**Collection Date:**	10/6/2011 10:47:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-026A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015B	QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**
Lead	6.7	1.0		mg/Kg	1	10/15/2011 05:34 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B16-2
Lab Order:	120226	**Collection Date:**	10/6/2011 11:02:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-027A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015B	QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**
Lead	5.9	1.0		mg/Kg	1	10/15/2011 05:37 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B15-2
Lab Order:	120226	**Collection Date:**	10/6/2011 11:15:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-028A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111015B	QC Batch: 76211				PrepDate: 10/14/2011	Analyst: **CBB**
Lead	3.0	1.0		mg/Kg	1	10/15/2011 05:48 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B62-0, B61-0
Lab Order:	120226	**Collection Date:**	10/6/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-031A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111014A	QC Batch: 76212			PrepDate: 10/14/2011		Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/14/2011 12:57 PM
Arsenic	2.6	1.0		mg/Kg	1	10/14/2011 12:57 PM
Barium	80	1.0		mg/Kg	1	10/14/2011 12:57 PM
Beryllium	ND	1.0		mg/Kg	1	10/14/2011 12:57 PM
Cadmium	ND	1.0		mg/Kg	1	10/14/2011 12:57 PM
Chromium	7.3	1.0		mg/Kg	1	10/14/2011 12:57 PM
Cobalt	3.9	1.0		mg/Kg	1	10/14/2011 12:57 PM
Copper	9.3	2.0		mg/Kg	1	10/14/2011 12:57 PM
Lead	5.6	1.0		mg/Kg	1	10/14/2011 12:57 PM
Molybdenum	ND	1.0		mg/Kg	1	10/14/2011 12:57 PM
Nickel	9.1	1.0		mg/Kg	1	10/14/2011 12:57 PM
Selenium	ND	1.0		mg/Kg	1	10/14/2011 12:57 PM
Silver	ND	1.0		mg/Kg	1	10/14/2011 12:57 PM
Thallium	ND	1.0		mg/Kg	1	10/14/2011 12:57 PM
Vanadium	17	1.0		mg/Kg	1	10/14/2011 12:57 PM
Zinc	35	1.0		mg/Kg	1	10/14/2011 12:57 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC10_111012B	QC Batch: 76172			PrepDate: 10/12/2011		Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM
Aldrin	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
beta-BHC	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
Chlordane	ND	8.5		µg/Kg	1	10/12/2011 06:06 PM
delta-BHC	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
Dieldrin	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM
Endrin	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/12/2011 06:06 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *20-Oct-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B62-0, B61-0
Lab Order:	120226	**Collection Date:**	10/6/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-031A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111012B	QC Batch: 76172			PrepDate:	10/12/2011	Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
Heptachlor	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/12/2011 06:06 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/12/2011 06:06 PM
Toxaphene	ND	50		µg/Kg	1	10/12/2011 06:06 PM
Surr: Decachlorobiphenyl	60.8	39-104		%REC	1	10/12/2011 06:06 PM
Surr: Tetrachloro-m-xylene	51.1	43-100		%REC	1	10/12/2011 06:06 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111014A	QC Batch: 76208			PrepDate:	10/14/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/14/2011 01:27 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-76210** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137553**
Client ID: **PBS** Batch ID: **76210** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/15/2011** SeqNo: **2259304**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.222	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	0.178	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-76210** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137553**
Client ID: **LCSS** Batch ID: **76210** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/15/2011** SeqNo: **2259305**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	46.943	2.0	50.00	0.2222	93.4	80	120				
Arsenic	44.487	1.0	50.00	0	89.0	80	120				
Barium	47.408	1.0	50.00	0	94.8	80	120				
Beryllium	47.154	1.0	50.00	0	94.3	80	120				
Cadmium	45.170	1.0	50.00	0	90.3	80	120				
Chromium	44.869	1.0	50.00	0	89.7	80	120				
Cobalt	47.254	1.0	50.00	0	94.5	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-76210** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137553**
Client ID: **LCSS** Batch ID: **76210** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/15/2011** SeqNo: **2259305**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	46.676	2.0	50.00	0.1778	93.0	80	120				
Lead	47.726	1.0	50.00	0	95.5	80	120				
Molybdenum	47.847	1.0	50.00	0	95.7	80	120				
Nickel	46.514	1.0	50.00	0	93.0	80	120				
Selenium	43.166	1.0	50.00	0	86.3	80	120				
Silver	46.004	1.0	50.00	0	92.0	80	120				
Thallium	45.630	1.0	50.00	0	91.3	80	120				
Vanadium	47.940	1.0	50.00	0	95.9	80	120				
Zinc	45.730	1.0	50.00	0	91.5	80	120				

Sample ID: **120226-008A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137553**
Client ID: **B17-1** Batch ID: **76210** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/15/2011** SeqNo: **2259326**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	89.477	2.0	125.0	0.2976	71.3	44	105				
Arsenic	93.810	1.0	125.0	3.872	72.0	57	103				
Barium	268.533	1.0	125.0	169.9	78.9	36	134				
Beryllium	96.548	1.0	125.0	0.2159	77.1	64	106				
Cadmium	91.498	1.0	125.0	0.5231	72.8	58	102				
Chromium	106.052	1.0	125.0	14.31	73.4	55	105				
Cobalt	101.450	1.0	125.0	6.473	76.0	59	105				
Copper	120.153	2.0	125.0	16.07	83.3	64	117				
Lead	102.605	1.0	125.0	8.241	75.5	46	116				
Molybdenum	95.786	1.0	125.0	0	76.6	59	108				
Nickel	104.503	1.0	125.0	12.55	73.6	52	109				
Selenium	88.195	1.0	125.0	0	70.6	56	100				
Silver	98.545	1.0	125.0	0	78.8	65	107				
Thallium	90.192	1.0	125.0	0	72.2	47	100				
Vanadium	134.060	1.0	125.0	32.21	81.5	64	110				
Zinc	133.041	1.0	125.0	42.32	72.6	37	123				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **120226-008A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137553**
Client ID: **B17-1** Batch ID: **76210** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/15/2011** SeqNo: **2259327**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	96.500	2.0	125.0	0.2976	77.0	44	105	89.48	7.55	20	
Arsenic	98.281	1.0	125.0	3.872	75.5	57	103	93.81	4.65	20	
Barium	258.946	1.0	125.0	169.9	71.2	36	134	268.5	3.63	20	
Beryllium	102.313	1.0	125.0	0.2159	81.7	64	106	96.55	5.80	20	
Cadmium	96.282	1.0	125.0	0.5231	76.6	58	102	91.50	5.10	20	
Chromium	110.370	1.0	125.0	14.31	76.8	55	105	106.1	3.99	20	
Cobalt	107.173	1.0	125.0	6.473	80.6	59	105	101.5	5.49	20	
Copper	126.543	2.0	125.0	16.07	88.4	64	117	120.2	5.18	20	
Lead	107.791	1.0	125.0	8.241	79.6	46	116	102.6	4.93	20	
Molybdenum	100.858	1.0	125.0	0	80.7	59	108	95.79	5.16	20	
Nickel	110.652	1.0	125.0	12.55	78.5	52	109	104.5	5.72	20	
Selenium	92.399	1.0	125.0	0	73.9	56	100	88.19	4.66	20	
Silver	104.107	1.0	125.0	0	83.3	65	107	98.54	5.49	20	
Thallium	94.708	1.0	125.0	0	75.8	47	100	90.19	4.88	20	
Vanadium	138.599	1.0	125.0	32.21	85.1	64	110	134.1	3.33	20	
Zinc	138.636	1.0	125.0	42.32	77.1	37	123	133.0	4.12	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-76211** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137555**
Client ID: **PBS** Batch ID: **76211** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/15/2011** SeqNo: **2259443**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.512	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	0.025	1.0									
Cobalt	ND	1.0									
Copper	0.623	2.0									
Lead	0.163	1.0									
Molybdenum	ND	1.0									
Nickel	ND	1.0									
Selenium	ND	1.0									
Silver	0.072	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-76211** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137555**
Client ID: **LCSS** Batch ID: **76211** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/15/2011** SeqNo: **2259444**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	46.484	2.0	50.00	0.5124	91.9	80	120				
Arsenic	43.320	1.0	50.00	0	86.6	80	120				
Barium	47.697	1.0	50.00	0	95.4	80	120				
Beryllium	47.263	1.0	50.00	0	94.5	80	120				
Cadmium	45.118	1.0	50.00	0	90.2	80	120				
Chromium	44.117	1.0	50.00	0.02484	88.2	80	120				
Cobalt	46.900	1.0	50.00	0	93.8	80	120				
Copper	46.090	2.0	50.00	0.6229	90.9	80	120				
Lead	46.400	1.0	50.00	0.1627	92.5	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-76211**	SampType: **LCS**	TestCode: **6010_S**	Units: **mg/Kg**	Prep Date: **10/14/2011**	RunNo: **137555**
Client ID: **LCSS**	Batch ID: **76211**	TestNo: **EPA 6010B**	**EPA 3050B**	Analysis Date: **10/15/2011**	SeqNo: **2259444**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	47.334	1.0	50.00	0	94.7	80	120				
Nickel	45.707	1.0	50.00	0	91.4	80	120				
Selenium	42.347	1.0	50.00	0	84.7	80	120				
Silver	45.155	1.0	50.00	0.07161	90.2	80	120				
Thallium	44.830	1.0	50.00	0	89.7	80	120				
Vanadium	47.163	1.0	50.00	0	94.3	80	120				
Zinc	45.779	1.0	50.00	0	91.6	80	120				

Sample ID: **120226-028A-MS**	SampType: **MS**	TestCode: **6010_S**	Units: **mg/Kg**	Prep Date: **10/14/2011**	RunNo: **137555**
Client ID: **B15-2**	Batch ID: **76211**	TestNo: **EPA 6010B**	**EPA 3050B**	Analysis Date: **10/15/2011**	SeqNo: **2259465**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	108.058	2.0	125.0	0.7079	85.9	44	105				
Arsenic	114.582	1.0	125.0	7.364	85.8	57	103				
Barium	161.605	1.0	125.0	46.03	92.5	36	134				
Beryllium	111.735	1.0	125.0	0.1784	89.2	64	106				
Cadmium	107.321	1.0	125.0	0.4875	85.5	58	102				
Chromium	137.465	1.0	125.0	30.57	85.5	55	105				
Cobalt	118.095	1.0	125.0	5.715	89.9	59	105				
Copper	123.364	2.0	125.0	4.499	95.1	64	117				
Lead	113.017	1.0	125.0	3.005	88.0	46	116				
Molybdenum	111.043	1.0	125.0	0.06263	88.8	59	108				
Nickel	160.282	1.0	125.0	47.87	89.9	52	109				
Selenium	103.713	1.0	125.0	0	83.0	56	100				
Silver	114.564	1.0	125.0	0	91.7	65	107				
Thallium	108.979	1.0	125.0	0	87.2	47	100				
Vanadium	134.559	1.0	125.0	19.19	92.3	64	110				
Zinc	120.169	1.0	125.0	12.76	85.9	37	123				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **120226-028A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137555**
Client ID: **B15-2** Batch ID: **76211** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/15/2011** SeqNo: **2259466**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	106.207	2.0	125.0	0.7079	84.4	44	105	108.1	1.73	20	
Arsenic	111.850	1.0	125.0	7.364	83.6	57	103	114.6	2.41	20	
Barium	170.505	1.0	125.0	46.03	99.6	36	134	161.6	5.36	20	
Beryllium	111.629	1.0	125.0	0.1784	89.2	64	106	111.7	0.0949	20	
Cadmium	106.193	1.0	125.0	0.4875	84.6	58	102	107.3	1.06	20	
Chromium	145.884	1.0	125.0	30.57	92.2	55	105	137.5	5.94	20	
Cobalt	116.174	1.0	125.0	5.715	88.4	59	105	118.1	1.64	20	
Copper	124.576	2.0	125.0	4.499	96.1	64	117	123.4	0.977	20	
Lead	112.648	1.0	125.0	3.005	87.7	46	116	113.0	0.327	20	
Molybdenum	110.193	1.0	125.0	0.06263	88.1	59	108	111.0	0.768	20	
Nickel	165.731	1.0	125.0	47.87	94.3	52	109	160.3	3.34	20	
Selenium	102.404	1.0	125.0	0	81.9	56	100	103.7	1.27	20	
Silver	115.166	1.0	125.0	0	92.1	65	107	114.6	0.524	20	
Thallium	107.540	1.0	125.0	0	86.0	47	100	109.0	1.33	20	
Vanadium	134.636	1.0	125.0	19.19	92.4	64	110	134.6	0.0571	20	
Zinc	117.947	1.0	125.0	12.76	84.1	37	123	120.2	1.87	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-76212** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137513**
Client ID: **PBS** Batch ID: **76212** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/14/2011** SeqNo: **2258746**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.190	2.0									
Arsenic	0.052	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	ND	1.0									
Cobalt	ND	1.0									
Copper	ND	2.0									
Lead	ND	1.0									
Molybdenum	ND	1.0									
Nickel	0.046	1.0									
Selenium	ND	1.0									
Silver	ND	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-76212** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137513**
Client ID: **LCSS** Batch ID: **76212** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/14/2011** SeqNo: **2258747**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	46.783	2.0	50.00	0.1896	93.2	80	120				
Arsenic	44.574	1.0	50.00	0.05186	89.0	80	120				
Barium	48.983	1.0	50.00	0	98.0	80	120				
Beryllium	47.757	1.0	50.00	0	95.5	80	120				
Cadmium	46.410	1.0	50.00	0	92.8	80	120				
Chromium	45.753	1.0	50.00	0	91.5	80	120				
Cobalt	48.491	1.0	50.00	0	97.0	80	120				
Copper	47.782	2.0	50.00	0	95.6	80	120				
Lead	47.567	1.0	50.00	0	95.1	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-76212** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137513**
Client ID: **LCSS** Batch ID: **76212** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/14/2011** SeqNo: **2258747**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	49.444	1.0	50.00	0	98.9	80	120				
Nickel	47.935	1.0	50.00	0.04614	95.8	80	120				
Selenium	43.491	1.0	50.00	0	87.0	80	120				
Silver	46.508	1.0	50.00	0	93.0	80	120				
Thallium	47.148	1.0	50.00	0	94.3	80	120				
Vanadium	49.273	1.0	50.00	0	98.5	80	120				
Zinc	47.033	1.0	50.00	0	94.1	80	120				

Sample ID: **120268-012A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137513**
Client ID: **ZZZZZZ** Batch ID: **76212** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/14/2011** SeqNo: **2258760**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	86.192	2.0	125.0	0	69.0	44	105				
Arsenic	94.449	1.0	125.0	0	75.6	57	103				
Barium	172.138	1.0	125.0	69.39	82.2	36	134				
Beryllium	101.910	1.0	125.0	0	81.5	64	106				
Cadmium	95.484	1.0	125.0	0.5403	76.0	58	102				
Chromium	109.212	1.0	125.0	13.28	76.7	55	105				
Cobalt	106.713	1.0	125.0	7.248	79.6	59	105				
Copper	125.867	2.0	125.0	11.97	91.1	64	117				
Lead	102.364	1.0	125.0	5.741	77.3	46	116				
Molybdenum	102.121	1.0	125.0	0	81.7	59	108				
Nickel	108.442	1.0	125.0	10.04	78.7	52	109				
Selenium	93.681	1.0	125.0	0	74.9	56	100				
Silver	106.451	1.0	125.0	0	85.2	65	107				
Thallium	85.585	1.0	125.0	0	68.5	47	100				
Vanadium	137.338	1.0	125.0	28.90	86.8	64	110				
Zinc	142.725	1.0	125.0	47.84	75.9	37	123				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **120268-012A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137513**
Client ID: **ZZZZZZ** Batch ID: **76212** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/14/2011** SeqNo: **2258761**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	88.746	2.0	125.0	0	71.0	44	105	86.19	2.92	20	
Arsenic	96.764	1.0	125.0	0	77.4	57	103	94.45	2.42	20	
Barium	176.279	1.0	125.0	69.39	85.5	36	134	172.1	2.38	20	
Beryllium	103.756	1.0	125.0	0	83.0	64	106	101.9	1.80	20	
Cadmium	97.430	1.0	125.0	0.5403	77.5	58	102	95.48	2.02	20	
Chromium	111.995	1.0	125.0	13.28	79.0	55	105	109.2	2.52	20	
Cobalt	108.794	1.0	125.0	7.248	81.2	59	105	106.7	1.93	20	
Copper	128.506	2.0	125.0	11.97	93.2	64	117	125.9	2.07	20	
Lead	104.443	1.0	125.0	5.741	79.0	46	116	102.4	2.01	20	
Molybdenum	104.107	1.0	125.0	0	83.3	59	108	102.1	1.93	20	
Nickel	111.321	1.0	125.0	10.04	81.0	52	109	108.4	2.62	20	
Selenium	95.706	1.0	125.0	0	76.6	56	100	93.68	2.14	20	
Silver	108.602	1.0	125.0	0	86.9	65	107	106.5	2.00	20	
Thallium	87.150	1.0	125.0	0	69.7	47	100	85.59	1.81	20	
Vanadium	140.528	1.0	125.0	28.90	89.3	64	110	137.3	2.30	20	
Zinc	144.084	1.0	125.0	47.84	77.0	37	123	142.7	0.948	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-76207**	SampType: **MBLK**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **10/14/2011**	RunNo: **137516**
Client ID: **PBS**	Batch ID: **76207**	TestNo: **EPA 7471A**		Analysis Date: **10/14/2011**	SeqNo: **2258829**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-76207**	SampType: **LCS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **10/14/2011**	RunNo: **137516**
Client ID: **LCSS**	Batch ID: **76207**	TestNo: **EPA 7471A**		Analysis Date: **10/14/2011**	SeqNo: **2258830**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.943	0.10	0.8300	0	114	80	120				

Sample ID: **120226-017A-MS**	SampType: **MS**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **10/14/2011**	RunNo: **137516**
Client ID: **B13-1**	Batch ID: **76207**	TestNo: **EPA 7471A**		Analysis Date: **10/14/2011**	SeqNo: **2258831**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.919	0.10	0.8300	0.4576	55.6	70	130				S

Sample ID: **120226-017A-MSD**	SampType: **MSD**	TestCode: **7471_S**	Units: **mg/Kg**	Prep Date: **10/14/2011**	RunNo: **137516**
Client ID: **B13-1**	Batch ID: **76207**	TestNo: **EPA 7471A**		Analysis Date: **10/14/2011**	SeqNo: **2258832**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.847	0.10	0.8300	0.4576	46.9	70	130	0.9193	8.16	20	S

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-76208** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137506**
Client ID: **PBS** Batch ID: **76208** TestNo: **EPA 7471A** Analysis Date: **10/14/2011** SeqNo: **2258619**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **120268-012A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137506**
Client ID: **ZZZZZZ** Batch ID: **76208** TestNo: **EPA 7471A** Analysis Date: **10/14/2011** SeqNo: **2258620**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.884	0.10	0.8300	0.01047	105	70	130				

Sample ID: **120268-012A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137506**
Client ID: **ZZZZZZ** Batch ID: **76208** TestNo: **EPA 7471A** Analysis Date: **10/14/2011** SeqNo: **2258621**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.900	0.10	0.8300	0.01047	107	70	130	0.8842	1.74	20	

Sample ID: **LCS-76208** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/14/2011** RunNo: **137506**
Client ID: **LCSS** Batch ID: **76208** TestNo: **EPA 7471A** Analysis Date: **10/14/2011** SeqNo: **2258624**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.895	0.10	0.8300	0	108	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-76187** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **10/12/2011** RunNo: **137496**
Client ID: **PBS** Batch ID: **76187** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **10/13/2011** SeqNo: **2258367**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	2.097		2.670		78.5	39	123				

Sample ID: **LCS-76187** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **10/12/2011** RunNo: **137496**
Client ID: **LCSS** Batch ID: **76187** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **10/13/2011** SeqNo: **2258368**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	20.264	1.0	33.00	0	61.4	37	109				
Surr: p-Terphenyl	2.132		2.670		79.9	39	123				

Sample ID: **120200-003AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **10/12/2011** RunNo: **137496**
Client ID: **ZZZZZZ** Batch ID: **76187** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **10/13/2011** SeqNo: **2258369**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	17.279	1.0	33.00	0	52.4	29	107				
Surr: p-Terphenyl	1.760		2.670		65.9	39	123				

Sample ID: **120200-003AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **10/12/2011** RunNo: **137496**
Client ID: **ZZZZZZ** Batch ID: **76187** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **10/13/2011** SeqNo: **2258370**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	18.304	1.0	33.00	0	55.5	29	107	17.28	5.76	20	
Surr: p-Terphenyl	1.903		2.670		71.3	39	123		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E111013LC3** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137493**
Client ID: **LCSS** Batch ID: **E11VS354** TestNo: **EPA 8015B(M** Analysis Date: **10/13/2011** SeqNo: **2258228**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.940	1.0	5.000	0	98.8	70	130				
Surr: Bromofluorobenzene (FID)	119.796		100.0		120	69	158				

Sample ID: **E111013MB2MS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137493**
Client ID: **ZZZZZZ** Batch ID: **E11VS354** TestNo: **EPA 8015B(M** Analysis Date: **10/13/2011** SeqNo: **2258229**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.810	1.0	5.000	0	96.2	46	135				
Surr: Bromofluorobenzene (FID)	122.398		100.0		122	69	158				

Sample ID: **E111013MB2MSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137493**
Client ID: **ZZZZZZ** Batch ID: **E11VS354** TestNo: **EPA 8015B(M** Analysis Date: **10/13/2011** SeqNo: **2258230**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.939	1.0	5.000	0	98.8	46	135	4.810	2.65	20	
Surr: Bromofluorobenzene (FID)	119.230		100.0		119	69	158		0	0	

Sample ID: **E111013MB2** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137493**
Client ID: **PBS** Batch ID: **E11VS354** TestNo: **EPA 8015B(M** Analysis Date: **10/13/2011** SeqNo: **2258231**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	86.260		100.0		86.3	69	158				

Sample ID: **120226-023AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137493**
Client ID: **B11-1** Batch ID: **E11VS354** TestNo: **EPA 8015B(M** Analysis Date: **10/14/2011** SeqNo: **2258243**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.182	1.0	5.000	0	83.6	46	135				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **120226-023AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137493**
Client ID: **B11-1** Batch ID: **E11VS354** TestNo: **EPA 8015B(M** Analysis Date: **10/14/2011** SeqNo: **2258243**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	128.666		100.0		129	69	158				

Sample ID: **120226-023AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137493**
Client ID: **B11-1** Batch ID: **E11VS354** TestNo: **EPA 8015B(M** Analysis Date: **10/14/2011** SeqNo: **2258244**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.127	1.0	5.000	0	82.5	46	135	4.182	1.32	20	
Surr: Bromofluorobenzene (FID)	124.084		100.0		124	69	158		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
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ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E111013LC4** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137493**
Client ID: **LCSS** Batch ID: **E11VS354** TestNo: **EPA 8021B** Analysis Date: **10/13/2011** SeqNo: **2258258**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	99.539	5.0	100.0	0	99.5	70	130				
Ethylbenzene	101.682	5.0	100.0	0	102	70	130				
m,p-Xylene	206.395	10	200.0	0	103	70	130				
Methyl tert-butyl ether	96.500	5.0	100.0	0	96.5	70	130				
o-Xylene	104.551	5.0	100.0	0	105	70	130				
Toluene	101.761	5.0	100.0	0	102	70	130				
Surr: Bromofluorobenzene (PID)	93.624		100.0		93.6	65	140				

Sample ID: **E111013MB2MS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137493**
Client ID: **ZZZZZZ** Batch ID: **E11VS354** TestNo: **EPA 8021B** Analysis Date: **10/13/2011** SeqNo: **2258260**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	34.065	5.0	22.15	0	154	69	264				
Ethylbenzene	54.209	5.0	42.30	0	128	37	161				
m,p-Xylene	186.980	10	180.2	0	104	30	149				
Methyl tert-butyl ether	397.843	5.0	578.9	0	68.7	39	121				
o-Xylene	70.906	5.0	64.80	0	109	31	166				
Toluene	171.838	5.0	172.6	0	99.5	44	150				
Surr: Bromofluorobenzene (PID)	96.291		100.0		96.3	65	140				

Sample ID: **E111013MB2MSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137493**
Client ID: **ZZZZZZ** Batch ID: **E11VS354** TestNo: **EPA 8021B** Analysis Date: **10/13/2011** SeqNo: **2258261**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	34.062	5.0	22.15	0	154	69	264	34.06	0.00881	20	
Ethylbenzene	55.007	5.0	42.30	0	130	37	161	54.21	1.46	20	
m,p-Xylene	188.589	10	180.2	0	105	30	149	187.0	0.857	20	
Methyl tert-butyl ether	369.241	5.0	578.9	0	63.8	39	121	397.8	7.46	20	
o-Xylene	70.449	5.0	64.80	0	109	31	166	70.91	0.647	20	
Toluene	172.414	5.0	172.6	0	99.9	44	150	171.8	0.335	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E111013MB2MSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137493**
Client ID: **ZZZZZZ** Batch ID: **E11VS354** TestNo: **EPA 8021B** Analysis Date: **10/13/2011** SeqNo: **2258261**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	92.455		100.0		92.5	65	140		0	20	

Sample ID: **E111013MB2** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137493**
Client ID: **PBS** Batch ID: **E11VS354** TestNo: **EPA 8021B** Analysis Date: **10/13/2011** SeqNo: **2258262**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	84.736		100.0		84.7	65	140				

Sample ID: **120226-023AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137493**
Client ID: **B11-1** Batch ID: **E11VS354** TestNo: **EPA 8021B** Analysis Date: **10/14/2011** SeqNo: **2258270**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	22.354	5.0	22.15	0	101	69	264				
Ethylbenzene	34.983	5.0	42.30	0	82.7	37	161				
m,p-Xylene	117.976	10	180.2	0	65.5	30	149				
Methyl tert-butyl ether	398.198	5.0	578.9	0	68.8	39	121				
o-Xylene	65.921	5.0	64.80	0	102	31	166				
Toluene	112.058	5.0	172.6	0	64.9	44	150				
Xylenes, Total	183.897	15	245.0	0	75.1	30	149				
Surr: Bromofluorobenzene (PID)	111.466		100.0		111	65	140				

Qualifiers:

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DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **120226-023AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137493**
Client ID: **B11-1** Batch ID: **E11VS354** TestNo: **EPA 8021B** Analysis Date: **10/14/2011** SeqNo: **2258271**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	21.879	5.0	22.15	0	98.8	69	264	22.35	2.15	20	
Ethylbenzene	37.872	5.0	42.30	0	89.5	37	161	34.98	7.93	20	
m,p-Xylene	118.054	10	180.2	0	65.5	30	149	118.0	0.0661	20	
Methyl tert-butyl ether	376.412	5.0	578.9	0	65.0	39	121	398.2	5.63	20	
o-Xylene	65.633	5.0	64.80	0	101	31	166	65.92	0.438	20	
Toluene	112.186	5.0	172.6	0	65.0	44	150	112.1	0.114	20	
Xylenes, Total	183.687	15	245.0	0	75.0	30	149	183.9	0.114	20	
Surr: Bromofluorobenzene (PID)	110.982		100.0		111	65	140		0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
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ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-76172**	SampType: **MBLK**	TestCode: **8081_S**	Units: **µg/Kg**	Prep Date: **10/12/2011**	RunNo: **137454**
Client ID: **PBS**	Batch ID: **76172**	TestNo: **EPA 8081A**	**EPA 3550B**	Analysis Date: **10/12/2011**	SeqNo: **2257446**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	12.181		16.67		73.1	43	100				
Surr: Decachlorobiphenyl	11.731		16.67		70.4	39	104				

Sample ID: **LCS-76172**	SampType: **LCS**	TestCode: **8081_S**	Units: **µg/Kg**	Prep Date: **10/12/2011**	RunNo: **137454**
Client ID: **LCSS**	Batch ID: **76172**	TestNo: **EPA 8081A**	**EPA 3550B**	Analysis Date: **10/12/2011**	SeqNo: **2257447**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	11.828	1.0	16.67	0	71.0	56	108				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
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Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-76172** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/12/2011** RunNo: **137454**
Client ID: **LCSS** Batch ID: **76172** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/12/2011** SeqNo: **2257447**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	11.717	2.0	16.67	0	70.3	53	115				
Endrin	12.579	2.0	16.67	0	75.5	55	125				
gamma-BHC	11.998	1.0	16.67	0	72.0	59	110				
Heptachlor	12.968	1.0	16.67	0	77.8	53	114				
Surr: Tetrachloro-m-xylene	11.998		16.67		72.0	43	100				
Surr: Decachlorobiphenyl	11.554		16.67		69.3	39	104				

Sample ID: **120196-001AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/12/2011** RunNo: **137454**
Client ID: **ZZZZZZ** Batch ID: **76172** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/12/2011** SeqNo: **2257448**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	25.669	2.0	16.67	10.34	92.0	17	165				
Aldrin	14.560	1.0	16.67	0	87.3	34	130				
Dieldrin	16.926	2.0	16.67	0	102	33	143				
Endrin	16.373	2.0	16.67	0	98.2	39	152				
gamma-BHC	14.648	1.0	16.67	0	87.9	37	131				
Heptachlor	16.504	1.0	16.67	0	99.0	31	140				
Surr: Tetrachloro-m-xylene	13.510		16.67		81.0	43	100				
Surr: Decachlorobiphenyl	13.423		16.67		80.5	39	104				

Sample ID: **120196-001AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/12/2011** RunNo: **137454**
Client ID: **ZZZZZZ** Batch ID: **76172** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/12/2011** SeqNo: **2257449**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	26.021	2.0	16.67	10.34	94.1	17	165	25.67	1.36	20	
Aldrin	14.500	1.0	16.67	0	87.0	34	130	14.56	0.411	20	
Dieldrin	16.551	2.0	16.67	0	99.3	33	143	16.93	2.24	20	
Endrin	16.349	2.0	16.67	0	98.1	39	152	16.37	0.147	20	
gamma-BHC	14.871	1.0	16.67	0	89.2	37	131	14.65	1.52	20	
Heptachlor	16.567	1.0	16.67	0	99.4	31	140	16.50	0.381	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **120196-001AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/12/2011** RunNo: **137454**
Client ID: **ZZZZZZ** Batch ID: **76172** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/12/2011** SeqNo: **2257449**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	13.529		16.67		81.2	43	100		0	0	
Surr: Decachlorobiphenyl	14.220		16.67		85.3	39	104		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
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DO	Surrogate Diluted Out		Calculations are based on raw values		

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3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CHAIN OF CUSTODY RECORD

1/4

Advanced Technology Laboratories

3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☑ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED 5.4 Y ☑ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☑ N ☐
4. SEALED Y ☐ N ☑
5. # OF SPLS MATCH COC Y ☑ N ☐
6. PRESERVED Y ☐ N ☑

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien	10/7/11	1600	On Trac	10/7/11	1600
			FPO Iwa	10/8/11	1039

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	1202226-1	B54-0	10/6/11	838	X							X					X					E	1	T	SS	
	2	↓ -1.5		840								X													SS	
	3	B55-0		844	X							X													SS	
	4	B56-0		920	X																				SS	
	5	↓ -1.5		925								X													SS	
	6	B57-0		930	X							X													SS	
	7	B17-0		1045									X		X										P	
	8	↓ -1		1046										X	X										P	
	9	B16-0		1100								X	X												P	
	10	↓ -1		1101										X	X										P	

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives:
H=HCl N=HNO_3 S=H_2SO_4 C=4°C
Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

CHAIN OF CUSTODY RECORD

2/4

Advanced Technology Laboratories

3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____

Logged By: _____ Date: _____

Method of Transport: Client ☑ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☑ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐
4. SEALED Y ☐ N ☐
5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien	10/7/11	1600	On Trac	10/7/11	1600
			FPDiwa	10/8/11	1039

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

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Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	1202226-11	B15-0	10/6/11	1113									X		X		X					E	1	T	P	
	12	-1		1114										X	X										P	
	13	B14-0		1120									X		X										P	
	14	-1		1121										X	X										P	
	15	-2		1122											X										P	
	16	B13-0		1140									X		X										P	
	17	-1		1141								X		X											P	
	18	-2		1142											X										P	
	19	B12-0		1150									X		X										P	
	20	-1		1151										X	X										P	

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Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

3/4

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐ 4. SEALED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐ 5. # OF SPLS MATCH COC Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐ 6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien	10/7/11	1600	On Trac	10/7/11	1600
			FPDiwa	10/8/11	1039

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
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- Records: $1 /ATL workorder /mo (after 1 year)

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SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	120726 – 21	B12-2	10/6/11	1152											X		X					E	1	T	P	
	22	B11-0		1205										X	X										P	
	23	-1		1206										X	X										P	
	24	-2		1207									X												P	
	25	B69-0		1225	X								X												P	
		-2		1226																					P	
		B67-0		1300																						
		-2		1301																						
	26	B17-2		1047											X										P	
	27	B16-2		1102											X										P	

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TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

4/4

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories

3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____

Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐
4. SEALED Y ☐ N ☐
5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien	10/7/11	1600	OnTrac	10/7/11	1600
			Fedex	10/8/11	1039

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter:
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:
composite
B61-0 & B62-0

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	120226	B15-2	10/6/11	1115											X		X					E	1	T P		
	27	B62-0 > composite		1510	X							X											1	P		composite
	28	B61-0		1525	X							X											1	SS		

JS 10/7/11

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

October 28, 2011

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Workorder No.: 120226

Chris Giuntoli
Geocon Consultants
4010 Technology Way, Suite D
Carson City, NV 89706

TEL: (775) 888-9900
FAX: (775) 888-9904

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on October 08, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

CLIENT: Geocon Consultants
Project: 80/680/12 Interchange, E8128-06-07
Lab Order: 120226

CASE NARRATIVE

Analytical Comments for Method 7420

Dilution was necessary for samples 120226-012A and 120226-022A, due to sample matrix.

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 10/28/2011

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION (STLC)
WET/ EPA 7420

CLIENT:	Geocon Consultants	**Lab Order:**	120226
Project:	80/680/12 Interchange, E8128-06-07	**Date Received**	10/8/2011 10:39:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	VV

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
120226-012A	B15-1	14	mg/L	76470	1.0	2	10/6/2011	10/28/2011
120226-022A	B11-0	44	mg/L	76470	2.5	5	10/6/2011	10/28/2011
120226-025A	B69-0	4.8	mg/L	76470	0.50	1	10/6/2011	10/28/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

Date: 10/28/2011

ANALYTICAL RESULTS

LEAD BY ATOMIC ABSORPTION (TCLP)
EPA 1311/ 7420

CLIENT:	Geocon Consultants	**Lab Order:**	120226
Project:	80/680/12 Interchange, E8128-06-07	**Date Received**	10/8/2011 10:39:00 AM
Project No:		**Matrix:**	Soil
Analyte:	Lead	**Analyst:**	VV

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
120226-012A	B15-1	ND	mg/L	76543	0.50	1	10/6/2011	10/28/2011
120226-022A	B11-0	0.89	mg/L	76543	0.50	1	10/6/2011	10/28/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

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Advanced Technology Laboratories

Date: 10/28/2011

ANALYTICAL RESULTS

pH
EPA 9045C

CLIENT:	Geocon Consultants	**Lab Order:**	120226
Project:	80/680/12 Interchange, E8128-06-07	**Date Received**	10/8/2011 10:39:00 AM
Project No:		**Matrix:**	Soil
Analyte:	pH	**Analyst:**	PT

Laboratory ID	Client Sample ID	Results	Units	QC Batch	PQL	DF	Date Collected	Date Analyzed
120226-009A	B16-0	8.2	pH Units	R137815	0.10	1	10/6/2011	10/26/2011
120226-020A	B12-1	8.4	pH Units	R137815	0.10	1	10/6/2011	10/26/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_ST

Sample ID: **MB-76470A** SampType: **MBLK** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137937**
Client ID: **PBS** Batch ID: **76470** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/28/2011** SeqNo: **2266180**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Sample ID: **LCS-76470** SampType: **LCS** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137937**
Client ID: **LCSS** Batch ID: **76470** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/28/2011** SeqNo: **2266181**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	4.953	0.50	5.000	0	99.1	80	120				

Sample ID: **120420-005A-DUP** SampType: **DUP** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137937**
Client ID: **ZZZZZZ** Batch ID: **76470** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/28/2011** SeqNo: **2266192**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.468	0.50						2.474	0.218	20	

Sample ID: **120420-005A-MS** SampType: **MS** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137937**
Client ID: **ZZZZZZ** Batch ID: **76470** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/28/2011** SeqNo: **2266193**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	7.766	0.50	5.000	2.474	106	80	120				

Sample ID: **MB-76470B** SampType: **MBLK** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137937**
Client ID: **PBS** Batch ID: **76470** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/28/2011** SeqNo: **2266194**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_ST

Sample ID: **120420-008A-DUP** SampType: **DUP** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137937**
Client ID: **ZZZZZZ** Batch ID: **76470** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/28/2011** SeqNo: **2266198**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.644	0.50						0.5590	14.1	20	

Sample ID: **120420-008A-MS** SampType: **MS** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137937**
Client ID: **ZZZZZZ** Batch ID: **76470** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/28/2011** SeqNo: **2266199**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.739	0.50	5.000	0.5590	104	80	120				

Sample ID: **120420-008A-MSD** SampType: **MSD** TestCode: **7420_ST** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137937**
Client ID: **ZZZZZZ** Batch ID: **76470** TestNo: **WET/ EPA 74 WET** Analysis Date: **10/28/2011** SeqNo: **2266200**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.512	0.50	5.000	0.5590	99.1	80	120	5.739	4.03	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_TC

Sample ID: **MB-76543** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/27/2011** RunNo: **137935**
Client ID: **PBS** Batch ID: **76543** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/28/2011** SeqNo: **2266112**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Sample ID: **MB-76529A TCLP** SampType: **MBLK** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/27/2011** RunNo: **137935**
Client ID: **PBS** Batch ID: **76543** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/28/2011** SeqNo: **2266113**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Sample ID: **LCS-76543** SampType: **LCS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/27/2011** RunNo: **137935**
Client ID: **LCSS** Batch ID: **76543** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/28/2011** SeqNo: **2266114**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	1.101	0.50	1.000	0	110	80	120				

Sample ID: **120299-006A-DUP** SampType: **DUP** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/27/2011** RunNo: **137935**
Client ID: **ZZZZZZ** Batch ID: **76543** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/28/2011** SeqNo: **2266118**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50						0	0	20	

Sample ID: **120299-006A-MS** SampType: **MS** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/27/2011** RunNo: **137935**
Client ID: **ZZZZZZ** Batch ID: **76543** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/28/2011** SeqNo: **2266119**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.939	0.50	2.500	0	118	70	130				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_TC

Sample ID: **120299-006A-MSD** SampType: **MSD** TestCode: **7420_TC** Units: **mg/L** Prep Date: **10/27/2011** RunNo: **137935**
Client ID: **ZZZZZZ** Batch ID: **76543** TestNo: **EPA 1311/ 74 EPA3010A** Analysis Date: **10/28/2011** SeqNo: **2266120**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	2.958	0.50	2.500	0	118	70	130	2.939	0.660	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 9045_S

Sample ID: **120381-068ADUP** SampType: **DUP** TestCode: **9045_S** Units: **pH Units** Prep Date: RunNo: **137815**
Client ID: **ZZZZZZ** Batch ID: **R137815** TestNo: **EPA 9045C** Analysis Date: **10/26/2011** SeqNo: **2264053**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
pH	7.560	0.10						7.820	3.38	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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Diane Galvan

From: Chris Giuntoli [giuntoli@geoconinc.com]
Sent: Friday, October 21, 2011 2:01 PM
To: Diane Galvan
Cc: Luann Beadle
Subject: RE: Results/EDD - 80/680/12 Interchange (120226)

Hi Diane,

For Workorder 120226, please run WET lead for samples B11-0, B15-1, and B69-0.

Please run TCLP lead for samples B11-0 and B15-1.

Please also run pH for samples B12-1 and B16-0.

Run these on standard TAT. Thanks.

November 03, 2011

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Chris Giuntoli
Geocon Consultants
4010 Technology Way, Suite D
Carson City, NV 89706

TEL: (775) 888-9900
FAX: (775) 888-9904

Workorder No.: 120226

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on October 08, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

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Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *03-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B15-1
Lab Order:	120226	**Collection Date:**	10/6/2011 11:14:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-012A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
LEAD BY ATOMIC ABSORPTION						
WET			**WET DI/ EPA 7420**			
RunID: AA2_111102A	QC Batch: 76618				PrepDate: 10/30/2011	Analyst: **VV**
Lead	ND	0.50		mg/L	1	11/2/2011 11:24 AM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

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Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *03-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B11-0
Lab Order:	120226	**Collection Date:**	10/6/2011 12:05:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120226-022A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
LEAD BY ATOMIC ABSORPTION						
WET			**WET DI/ EPA 7420**			
RunID: AA2_111102A	QC Batch: 76618				PrepDate: 10/30/2011	Analyst: **VV**
Lead	ND	0.50		mg/L	1	11/2/2011 11:24 AM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

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CLIENT: Geocon Consultants
Work Order: 120226
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_DI

Sample ID: **MB-76618A** SampType: **MBLK** TestCode: **7420_DI** Units: **mg/L** Prep Date: **10/30/2011** RunNo: **138083**
Client ID: **PBS** Batch ID: **76618** TestNo: **WET DI/ EPA WET** Analysis Date: **11/2/2011** SeqNo: **2269418**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	0.146	0.50									

Sample ID: **LCS-76618** SampType: **LCS** TestCode: **7420_DI** Units: **mg/L** Prep Date: **10/30/2011** RunNo: **138083**
Client ID: **LCSS** Batch ID: **76618** TestNo: **WET DI/ EPA WET** Analysis Date: **11/2/2011** SeqNo: **2269419**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.307	0.50	5.000	0.1462	103	80	120				

Sample ID: **120472-008A-MS** SampType: **MS** TestCode: **7420_DI** Units: **mg/L** Prep Date: **10/30/2011** RunNo: **138083**
Client ID: **ZZZZZZ** Batch ID: **76618** TestNo: **WET DI/ EPA WET** Analysis Date: **11/2/2011** SeqNo: **2269431**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.066	0.50	5.000	0	101	70	130				

Sample ID: **120472-008A-MSD** SampType: **MSD** TestCode: **7420_DI** Units: **mg/L** Prep Date: **10/30/2011** RunNo: **138083**
Client ID: **ZZZZZZ** Batch ID: **76618** TestNo: **WET DI/ EPA WET** Analysis Date: **11/2/2011** SeqNo: **2269432**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.226	0.50	5.000	0	105	70	130	5.066	3.10	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Rachelle Arada

From: Chris Giuntoli [giuntoli@geoconinc.com]
Sent: Friday, October 28, 2011 4:48 PM
To: Rachelle Arada
Cc: Luann Beadle
Subject: RE: Addendum report for 80/680/12 Interchange (120226)

Hi Rachelle,

For workorder no. 120226, please run DI-WET lead for samples B11-0 and B15-1 on a standard TAT.

Thanks,
Chris

From: Rachelle Arada [mailto:rachelle@atlglobal.com]
Sent: Friday, October 28, 2011 3:45 PM
To: giuntoli@geoconinc.com
Subject: Addendum report for 80/680/12 Interchange (120226)

Hi Chris,

Attached are the results for the above project.

Thanks,

Rachelle Arada
Project Manager

Advanced Technology Laboratories
www.atlglobal.com
Tel: (562) 989-4045 ext. 237
Fax: (562) 989-4040

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November 14, 2011

Chris Giuntoli
Geocon Consultants
4010 Technology Way, Suite D
Carson City, NV 89706

TEL: (775) 888-9900
FAX: (775) 888-9904

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Workorder No.: 120362

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on October 18, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

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3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

CLIENT: Geocon Consultants
Project: 80/680/12 Interchange, E8128-06-07
Lab Order: 120362

CASE NARRATIVE

Analytical Comments for Method 6010

Dilution was necessary for samples 120362-040A and 120362-046A, due to sample matrix.

Analytical Comments for Method 8015 (DRO/ORO)

Dilution was necessary for samples 120362-017A, 120362-032A, 120362-035A, 120362-038A and 120362-055A, due to sample matrix.

Surrogate recovery was diluted out for samples 120362-035A and 120362-038A.

RPD for Matrix Spike (MS)/Matrix Spike Duplicate (MSD) is outside criteria for sample 120362-015AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Analytical Comments for Method 8081

Surrogate recovery biased low for samples 120362-024A and 120362-044A, possibly due to matrix interferences.

Analytical Comments for Method 8270

Dilution was necessary for sample 120362-058A, due to high concentrations of non-target extractable analytes.

2-Chlorophenol biased high for sample LCS-76459, possibly due to prep error. The LCS was reanalyzed with similar results. All samples were ND for target analytes.

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B65-0
Lab Order:	120362	**Collection Date:**	10/13/2011 9:07:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-010A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
Aldrin	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
beta-BHC	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
Chlordane	ND	8.5		µg/Kg	1	10/24/2011 08:36 PM
delta-BHC	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
Dieldrin	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
Endrin	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/24/2011 08:36 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
Heptachlor	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/24/2011 08:36 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/24/2011 08:36 PM
Toxaphene	ND	50		µg/Kg	1	10/24/2011 08:36 PM
Surr: Decachlorobiphenyl	69.7	39-104		%REC	1	10/24/2011 08:36 PM
Surr: Tetrachloro-m-xylene	62.5	43-100		%REC	1	10/24/2011 08:36 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B65-2
Lab Order:	120362	**Collection Date:**	10/13/2011 9:08:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-014A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 04:29 PM
Arsenic	3.9	1.0		mg/Kg	1	10/29/2011 04:29 PM
Barium	77	1.0		mg/Kg	1	10/29/2011 04:29 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 04:29 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 04:29 PM
Chromium	12	1.0		mg/Kg	1	10/29/2011 04:29 PM
Cobalt	5.8	1.0		mg/Kg	1	10/29/2011 04:29 PM
Copper	17	2.0		mg/Kg	1	10/29/2011 04:29 PM
Lead	14	1.0		mg/Kg	1	10/29/2011 04:29 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 04:29 PM
Nickel	9.0	1.0		mg/Kg	1	10/29/2011 04:29 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 04:29 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 04:29 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 04:29 PM
Vanadium	30	1.0		mg/Kg	1	10/29/2011 04:29 PM
Zinc	31	1.0		mg/Kg	1	10/29/2011 04:29 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/24/2011 02:23 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS5-0
Lab Order:	120362	**Collection Date:**	10/13/2011 10:04:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-015A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	2.3	1.0		mg/Kg	1	10/25/2011 01:12 PM
ORO	3.3	1.0		mg/Kg	1	10/25/2011 01:12 PM
Surr: p-Terphenyl	65.3	39-123		%REC	1	10/25/2011 01:12 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS5-4
Lab Order:	120362	**Collection Date:**	10/13/2011 10:05:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-016A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate: 10/28/2011		Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 04:32 PM
Arsenic	1.4	1.0		mg/Kg	1	10/29/2011 04:32 PM
Barium	52	1.0		mg/Kg	1	10/29/2011 04:32 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 04:32 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 04:32 PM
Chromium	17	1.0		mg/Kg	1	10/29/2011 04:32 PM
Cobalt	9.3	1.0		mg/Kg	1	10/29/2011 04:32 PM
Copper	12	2.0		mg/Kg	1	10/29/2011 04:32 PM
Lead	5.2	1.0		mg/Kg	1	10/29/2011 04:32 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 04:32 PM
Nickel	24	1.0		mg/Kg	1	10/29/2011 04:32 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 04:32 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 04:32 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 04:32 PM
Vanadium	21	1.0		mg/Kg	1	10/29/2011 04:32 PM
Zinc	19	1.0		mg/Kg	1	10/29/2011 04:32 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 01:09 PM
Surr: Bromofluorobenzene (FID)	92.6	69-158		%REC	1	10/24/2011 01:09 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 01:09 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:09 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 01:09 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 01:09 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 01:09 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 01:09 PM
Surr: Bromofluorobenzene (PID)	93.4	65-140		%REC	1	10/24/2011 01:09 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS5-4
Lab Order:	120362	**Collection Date:**	10/13/2011 10:05:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-016A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA5_111025A	QC Batch: 76424			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/25/2011 12:18 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS4-0
Lab Order:	120362	**Collection Date:**	10/13/2011 10:46:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-017A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	110	5.0		mg/Kg	5	10/25/2011 03:27 PM
ORO	390	5.0		mg/Kg	5	10/25/2011 03:27 PM
Surr: p-Terphenyl	64.7	39-123		%REC	5	10/25/2011 03:27 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS4-4
Lab Order:	120362	**Collection Date:**	10/13/2011 10:47:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-018A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate: 10/28/2011		Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 04:35 PM
Arsenic	3.3	1.0		mg/Kg	1	10/29/2011 04:35 PM
Barium	640	1.0		mg/Kg	1	10/29/2011 04:35 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 04:35 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 04:35 PM
Chromium	6.4	1.0		mg/Kg	1	10/29/2011 04:35 PM
Cobalt	3.3	1.0		mg/Kg	1	10/29/2011 04:35 PM
Copper	7.7	2.0		mg/Kg	1	10/29/2011 04:35 PM
Lead	2.5	1.0		mg/Kg	1	10/29/2011 04:35 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 04:35 PM
Nickel	6.5	1.0		mg/Kg	1	10/29/2011 04:35 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 04:35 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 04:35 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 04:35 PM
Vanadium	17	1.0		mg/Kg	1	10/29/2011 04:35 PM
Zinc	16	1.0		mg/Kg	1	10/29/2011 04:35 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 01:24 PM
Surr: Bromofluorobenzene (FID)	114	69-158		%REC	1	10/24/2011 01:24 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 01:24 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:24 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 01:24 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 01:24 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 01:24 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 01:24 PM
Surr: Bromofluorobenzene (PID)	114	65-140		%REC	1	10/24/2011 01:24 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS4-4
Lab Order:	120362	**Collection Date:**	10/13/2011 10:47:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-018A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA5_111025A	QC Batch: 76424			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/25/2011 12:22 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B63-0
Lab Order:	120362	**Collection Date:**	10/13/2011 11:48:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-019A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 04:39 PM
Arsenic	4.4	1.0		mg/Kg	1	10/29/2011 04:39 PM
Barium	160	1.0		mg/Kg	1	10/29/2011 04:39 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 04:39 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 04:39 PM
Chromium	11	1.0		mg/Kg	1	10/29/2011 04:39 PM
Cobalt	8.0	1.0		mg/Kg	1	10/29/2011 04:39 PM
Copper	16	2.0		mg/Kg	1	10/29/2011 04:39 PM
Lead	60	1.0		mg/Kg	1	10/29/2011 04:39 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 04:39 PM
Nickel	11	1.0		mg/Kg	1	10/29/2011 04:39 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 04:39 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 04:39 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 04:39 PM
Vanadium	25	1.0		mg/Kg	1	10/29/2011 04:39 PM
Zinc	87	1.0		mg/Kg	1	10/29/2011 04:39 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM
Aldrin	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
beta-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
Chlordane	ND	8.5		µg/Kg	1	10/24/2011 09:04 PM
delta-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
Dieldrin	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM
Endrin	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/24/2011 09:04 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B63-0
Lab Order:	120362	**Collection Date:**	10/13/2011 11:48:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-019A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate: 10/24/2011		Analyst: **HL**
gamma-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
Heptachlor	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/24/2011 09:04 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/24/2011 09:04 PM
Toxaphene	ND	50		µg/Kg	1	10/24/2011 09:04 PM
Surr: Decachlorobiphenyl	78.4	39-104		%REC	1	10/24/2011 09:04 PM
Surr: Tetrachloro-m-xylene	67.9	43-100		%REC	1	10/24/2011 09:04 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate: 10/24/2011		Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/24/2011 02:26 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B64-0
Lab Order:	120362	**Collection Date:**	10/13/2011 11:58:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-020A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
Aldrin	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
beta-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
Chlordane	ND	8.5		µg/Kg	1	10/24/2011 09:31 PM
delta-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
Dieldrin	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
Endrin	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/24/2011 09:31 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
Heptachlor	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/24/2011 09:31 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/24/2011 09:31 PM
Toxaphene	ND	50		µg/Kg	1	10/24/2011 09:31 PM
Surr: Decachlorobiphenyl	70.2	39-104		%REC	1	10/24/2011 09:31 PM
Surr: Tetrachloro-m-xylene	56.3	43-100		%REC	1	10/24/2011 09:31 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B64-2
Lab Order:	120362	**Collection Date:**	10/13/2011 11:59:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-021A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76444			PrepDate:	10/25/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 04:42 PM
Arsenic	3.2	1.0		mg/Kg	1	10/29/2011 04:42 PM
Barium	310	1.0		mg/Kg	1	10/29/2011 04:42 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 04:42 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 04:42 PM
Chromium	9.9	1.0		mg/Kg	1	10/29/2011 04:42 PM
Cobalt	5.9	1.0		mg/Kg	1	10/29/2011 04:42 PM
Copper	13	2.0		mg/Kg	1	10/29/2011 04:42 PM
Lead	5.4	1.0		mg/Kg	1	10/29/2011 04:42 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 04:42 PM
Nickel	12	1.0		mg/Kg	1	10/29/2011 04:42 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 04:42 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 04:42 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 04:42 PM
Vanadium	24	1.0		mg/Kg	1	10/29/2011 04:42 PM
Zinc	26	1.0		mg/Kg	1	10/29/2011 04:42 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/24/2011 02:28 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS3-0
Lab Order:	120362	**Collection Date:**	10/13/2011 12:38:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-022A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	6.7	1.0		mg/Kg	1	10/25/2011 02:15 PM
ORO	17	1.0		mg/Kg	1	10/25/2011 02:15 PM
Surr: p-Terphenyl	49.7	39-123		%REC	1	10/25/2011 02:15 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS3-4
Lab Order:	120362	**Collection Date:**	10/13/2011 12:39:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-023A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate: 10/28/2011		Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 04:45 PM
Arsenic	3.3	1.0		mg/Kg	1	10/29/2011 04:45 PM
Barium	77	1.0		mg/Kg	1	10/29/2011 04:45 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 04:45 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 04:45 PM
Chromium	12	1.0		mg/Kg	1	10/29/2011 04:45 PM
Cobalt	7.7	1.0		mg/Kg	1	10/29/2011 04:45 PM
Copper	18	2.0		mg/Kg	1	10/29/2011 04:45 PM
Lead	4.9	1.0		mg/Kg	1	10/29/2011 04:45 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 04:45 PM
Nickel	15	1.0		mg/Kg	1	10/29/2011 04:45 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 04:45 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 04:45 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 04:45 PM
Vanadium	31	1.0		mg/Kg	1	10/29/2011 04:45 PM
Zinc	41	1.0		mg/Kg	1	10/29/2011 04:45 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 01:40 PM
Surr: Bromofluorobenzene (FID)	110	69-158		%REC	1	10/24/2011 01:40 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 01:40 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:40 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 01:40 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 01:40 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 01:40 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 01:40 PM
Surr: Bromofluorobenzene (PID)	110	65-140		%REC	1	10/24/2011 01:40 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS3-4
Lab Order:	120362	**Collection Date:**	10/13/2011 12:39:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-023A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA5_111025A	QC Batch: 76424			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/25/2011 12:24 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B36-0
Lab Order:	120362	**Collection Date:**	10/13/2011 2:19:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-024A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
4,4´-DDD	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
4,4´-DDE	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
4,4´-DDT	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
Aldrin	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
alpha-BHC	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
alpha-Chlordane	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
beta-BHC	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
Chlordane	ND	17		µg/Kg	1	10/24/2011 11:22 PM
delta-BHC	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
Dieldrin	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
Endosulfan I	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
Endosulfan II	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
Endosulfan sulfate	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
Endrin	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
Endrin aldehyde	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
Endrin ketone	ND	4.0		µg/Kg	1	10/24/2011 11:22 PM
gamma-BHC	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
gamma-Chlordane	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
Heptachlor	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
Heptachlor epoxide	ND	2.0		µg/Kg	1	10/24/2011 11:22 PM
Methoxychlor	ND	10		µg/Kg	1	10/24/2011 11:22 PM
Toxaphene	ND	100		µg/Kg	1	10/24/2011 11:22 PM
Surr: Decachlorobiphenyl	33.6	39-104	S	%REC	1	10/24/2011 11:22 PM
Surr: Tetrachloro-m-xylene	53.4	43-100		%REC	1	10/24/2011 11:22 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B36-2
Lab Order:	120362	**Collection Date:**	10/13/2011 2:20:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-025A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 04:56 PM
Arsenic	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Barium	22	1.0		mg/Kg	1	10/29/2011 04:56 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Chromium	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Cobalt	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Copper	ND	2.0		mg/Kg	1	10/29/2011 04:56 PM
Lead	1.9	1.0		mg/Kg	1	10/29/2011 04:56 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Nickel	1.8	1.0		mg/Kg	1	10/29/2011 04:56 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 04:56 PM
Vanadium	1.3	1.0		mg/Kg	1	10/29/2011 04:56 PM
Zinc	11	1.0		mg/Kg	1	10/29/2011 04:56 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/24/2011 02:30 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B3-0
Lab Order:	120362	**Collection Date:**	10/13/2011 2:23:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-026A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 04:59 PM
Arsenic	3.6	1.0		mg/Kg	1	10/29/2011 04:59 PM
Barium	130	1.0		mg/Kg	1	10/29/2011 04:59 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 04:59 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 04:59 PM
Chromium	18	1.0		mg/Kg	1	10/29/2011 04:59 PM
Cobalt	7.5	1.0		mg/Kg	1	10/29/2011 04:59 PM
Copper	13	2.0		mg/Kg	1	10/29/2011 04:59 PM
Lead	8.1	1.0		mg/Kg	1	10/29/2011 04:59 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 04:59 PM
Nickel	18	1.0		mg/Kg	1	10/29/2011 04:59 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 04:59 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 04:59 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 04:59 PM
Vanadium	29	1.0		mg/Kg	1	10/29/2011 04:59 PM
Zinc	33	1.0		mg/Kg	1	10/29/2011 04:59 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	4.6	1.0		mg/Kg	1	10/25/2011 02:25 PM
ORO	20	1.0		mg/Kg	1	10/25/2011 02:25 PM
Surr: p-Terphenyl	55.4	39-123		%REC	1	10/25/2011 02:25 PM
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	0.21	0.10		mg/Kg	1	10/24/2011 02:32 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B3-1
Lab Order:	120362	**Collection Date:**	10/13/2011 2:24:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-027A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029A	QC Batch: 76585			PrepDate: 10/28/2011		Analyst: **CBB**
Lead	15	1.0		mg/Kg	1	10/29/2011 05:02 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 01:55 PM
Surr: Bromofluorobenzene (FID)	114	69-158		%REC	1	10/24/2011 01:55 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 01:55 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:55 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 01:55 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 01:55 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 01:55 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 01:55 PM
Surr: Bromofluorobenzene (PID)	114	65-140		%REC	1	10/24/2011 01:55 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B3-2
Lab Order:	120362	**Collection Date:**	10/13/2011 2:25:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-028A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585				PrepDate: 10/28/2011	Analyst: **CBB**
Lead	4.6	1.0		mg/Kg	1	10/29/2011 05:06 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B2-0
Lab Order:	120362	**Collection Date:**	10/13/2011 2:32:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-029A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Lead	7.1	1.0		mg/Kg	1	10/29/2011 05:09 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	11	1.0		mg/Kg	1	10/25/2011 02:56 PM
ORO	46	1.0		mg/Kg	1	10/25/2011 02:56 PM
Surr: p-Terphenyl	56.2	39-123		%REC	1	10/25/2011 02:56 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B2-1
Lab Order:	120362	**Collection Date:**	10/13/2011 2:33:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-030A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029A	QC Batch: 76585			PrepDate: 10/28/2011		Analyst: **CBB**
Lead	6.4	1.0		mg/Kg	1	10/29/2011 05:12 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 02:11 PM
Surr: Bromofluorobenzene (FID)	113	69-158		%REC	1	10/24/2011 02:11 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 02:11 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 02:11 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 02:11 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 02:11 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 02:11 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 02:11 PM
Surr: Bromofluorobenzene (PID)	113	65-140		%REC	1	10/24/2011 02:11 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B2-2
Lab Order:	120362	**Collection Date:**	10/13/2011 2:34:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-031A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585				PrepDate: 10/28/2011	Analyst: **CBB**
Lead	89	1.0		mg/Kg	1	10/29/2011 05:15 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B1-0
Lab Order:	120362	**Collection Date:**	10/13/2011 2:41:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-032A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Lead	25	1.0		mg/Kg	1	10/29/2011 05:18 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	37	2.0		mg/Kg	2	10/25/2011 03:06 PM
ORO	190	2.0		mg/Kg	2	10/25/2011 03:06 PM
Surr: p-Terphenyl	57.6	39-123		%REC	2	10/25/2011 03:06 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT: Geocon Consultants
Lab Order: 120362
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120362-033A

Client Sample ID: B1-1
Collection Date: 10/13/2011 2:42:00 PM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate: 10/28/2011		Analyst: **CBB**
Lead	19	1.0		mg/Kg	1	10/29/2011 05:22 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 02:26 PM
Surr: Bromofluorobenzene (FID)	109	69-158		%REC	1	10/24/2011 02:26 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 02:26 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 02:26 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 02:26 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 02:26 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 02:26 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 02:26 PM
Surr: Bromofluorobenzene (PID)	110	65-140		%REC	1	10/24/2011 02:26 PM
PH						
				EPA 9045C		
RunID: WETCHEM_111025A	QC Batch: R137773			PrepDate:		Analyst: **PT**
pH	6.3	0.10		pH Units	1	10/25/2011

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B1-2
Lab Order:	120362	**Collection Date:**	10/13/2011 2:43:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-034A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585				PrepDate: 10/28/2011	Analyst: **CBB**
Lead	44	1.0		mg/Kg	1	10/29/2011 05:25 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B5-0
Lab Order:	120362	**Collection Date:**	10/13/2011 2:57:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-035A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Lead	2.5	1.0		mg/Kg	1	10/29/2011 05:35 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	580	20		mg/Kg	10	10/25/2011 03:38 PM
ORO	2300	20		mg/Kg	10	10/25/2011 03:38 PM
Surr: p-Terphenyl	0	39-123	SDO	%REC	10	10/25/2011 03:38 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B5-1
Lab Order:	120362	**Collection Date:**	10/13/2011 2:58:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-036A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate: 10/28/2011		Analyst: **CBB**
Lead	3.3	1.0		mg/Kg	1	10/29/2011 05:38 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 02:42 PM
Surr: Bromofluorobenzene (FID)	109	69-158		%REC	1	10/24/2011 02:42 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 02:42 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 02:42 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 02:42 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 02:42 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 02:42 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 02:42 PM
Surr: Bromofluorobenzene (PID)	109	65-140		%REC	1	10/24/2011 02:42 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT: Geocon Consultants
Lab Order: 120362
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120362-037A

Client Sample ID: B5-2
Collection Date: 10/13/2011 2:59:00 PM
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 05:41 PM
Arsenic	2.6	1.0		mg/Kg	1	10/29/2011 05:41 PM
Barium	91	1.0		mg/Kg	1	10/29/2011 05:41 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 05:41 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 05:41 PM
Chromium	14	1.0		mg/Kg	1	10/29/2011 05:41 PM
Cobalt	5.9	1.0		mg/Kg	1	10/29/2011 05:41 PM
Copper	15	2.0		mg/Kg	1	10/29/2011 05:41 PM
Lead	9.5	1.0		mg/Kg	1	10/29/2011 05:41 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 05:41 PM
Nickel	12	1.0		mg/Kg	1	10/29/2011 05:41 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 05:41 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 05:41 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 05:41 PM
Vanadium	33	1.0		mg/Kg	1	10/29/2011 05:41 PM
Zinc	28	1.0		mg/Kg	1	10/29/2011 05:41 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	0.28	0.10		mg/Kg	1	10/24/2011 02:34 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

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ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B6-0
Lab Order:	120362	**Collection Date:**	10/13/2011 3:03:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-038A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029A	QC Batch: 76585			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 05:45 PM
Arsenic	ND	1.0		mg/Kg	1	10/29/2011 05:45 PM
Barium	38	1.0		mg/Kg	1	10/29/2011 05:45 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 05:45 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 05:45 PM
Chromium	20	1.0		mg/Kg	1	10/29/2011 05:45 PM
Cobalt	14	1.0		mg/Kg	1	10/29/2011 05:45 PM
Copper	27	2.0		mg/Kg	1	10/29/2011 05:45 PM
Lead	5.1	1.0		mg/Kg	1	10/29/2011 05:45 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 05:45 PM
Nickel	27	1.0		mg/Kg	1	10/29/2011 05:45 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 05:45 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 05:45 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 05:45 PM
Vanadium	87	1.0		mg/Kg	1	10/29/2011 05:45 PM
Zinc	68	1.0		mg/Kg	1	10/29/2011 05:45 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	120	20		mg/Kg	10	10/25/2011 03:17 PM
ORO	720	20		mg/Kg	10	10/25/2011 03:17 PM
Surr: p-Terphenyl	0	39-123	SDO	%REC	10	10/25/2011 03:17 PM
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/24/2011 02:40 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B6-1
Lab Order:	120362	**Collection Date:**	10/13/2011 3:04:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-039A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029C	QC Batch: 76586			PrepDate: 10/28/2011		Analyst: **CBB**
Lead	85	1.0		mg/Kg	1	10/29/2011 07:06 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 02:57 PM
Surr: Bromofluorobenzene (FID)	106	69-158		%REC	1	10/24/2011 02:57 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 02:57 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 02:57 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 02:57 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 02:57 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 02:57 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 02:57 PM
Surr: Bromofluorobenzene (PID)	107	65-140		%REC	1	10/24/2011 02:57 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B6-2
Lab Order:	120362	**Collection Date:**	10/13/2011 3:05:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-040A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029C	QC Batch: 76586			PrepDate: 10/28/2011		Analyst: **CBB**
Lead	ND	2.0		mg/Kg	2	10/30/2011 10:01 AM
PH						
				EPA 9045C		
RunID: WETCHEM_111025A	QC Batch: R137773			PrepDate:		Analyst: **PT**
pH	4.5	0.10		pH Units	1	10/25/2011

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B7-0
Lab Order:	120362	**Collection Date:**	10/13/2011 3:08:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-041A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029C	QC Batch: 76586			PrepDate:	10/28/2011	Analyst: **CBB**
Lead	15	1.0		mg/Kg	1	10/29/2011 07:12 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	1.4	1.0		mg/Kg	1	10/25/2011 12:52 PM
ORO	3.2	1.0		mg/Kg	1	10/25/2011 12:52 PM
Surr: p-Terphenyl	48.2	39-123		%REC	1	10/25/2011 12:52 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B7-1
Lab Order:	120362	**Collection Date:**	10/13/2011 3:09:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-042A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029C	QC Batch: 76586			PrepDate: 10/28/2011		Analyst: **CBB**
Lead	4.2	1.0		mg/Kg	1	10/29/2011 07:15 PM
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 04:06 PM
Surr: Bromofluorobenzene (FID)	105	69-158		%REC	1	10/24/2011 04:06 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 04:06 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 04:06 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 04:06 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 04:06 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 04:06 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 04:06 PM
Surr: Bromofluorobenzene (PID)	105	65-140		%REC	1	10/24/2011 04:06 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B7-2
Lab Order:	120362	**Collection Date:**	10/13/2011 3:10:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-043A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029C	QC Batch: 76586				PrepDate: 10/28/2011	Analyst: **CBB**
Lead	4.6	1.0		mg/Kg	1	10/29/2011 07:18 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B37-0
Lab Order:	120362	**Collection Date:**	10/13/2011 3:30:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-044A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029C	QC Batch: 76586			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 07:21 PM
Arsenic	1.2	1.0		mg/Kg	1	10/29/2011 07:21 PM
Barium	45	1.0		mg/Kg	1	10/29/2011 07:21 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 07:21 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 07:21 PM
Chromium	12	1.0		mg/Kg	1	10/29/2011 07:21 PM
Cobalt	13	1.0		mg/Kg	1	10/29/2011 07:21 PM
Copper	24	2.0		mg/Kg	1	10/29/2011 07:21 PM
Lead	14	1.0		mg/Kg	1	10/29/2011 07:21 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 07:21 PM
Nickel	26	1.0		mg/Kg	1	10/29/2011 07:21 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 07:21 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 07:21 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 07:21 PM
Vanadium	62	1.0		mg/Kg	1	10/29/2011 07:21 PM
Zinc	66	1.0		mg/Kg	1	10/29/2011 07:21 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
	EPA 3550B			**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
4,4´-DDD	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM
4,4´-DDE	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM
4,4´-DDT	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM
Aldrin	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
alpha-BHC	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
alpha-Chlordane	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
beta-BHC	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
Chlordane	ND	17		µg/Kg	1	10/24/2011 11:49 PM
delta-BHC	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
Dieldrin	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM
Endosulfan I	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
Endosulfan II	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM
Endosulfan sulfate	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM
Endrin	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM
Endrin aldehyde	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM
Endrin ketone	ND	4.0		µg/Kg	1	10/24/2011 11:49 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B37-0
Lab Order:	120362	**Collection Date:**	10/13/2011 3:30:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-044A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
gamma-BHC	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
gamma-Chlordane	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
Heptachlor	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
Heptachlor epoxide	ND	2.0		µg/Kg	1	10/24/2011 11:49 PM
Methoxychlor	ND	10		µg/Kg	1	10/24/2011 11:49 PM
Toxaphene	ND	100		µg/Kg	1	10/24/2011 11:49 PM
Surr: Decachlorobiphenyl	25.8	39-104	S	%REC	1	10/24/2011 11:49 PM
Surr: Tetrachloro-m-xylene	56.5	43-100		%REC	1	10/24/2011 11:49 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/24/2011 02:42 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B38-0
Lab Order:	120362	**Collection Date:**	10/13/2011 3:37:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-045A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
4,4´-DDE	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
4,4´-DDT	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
Aldrin	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
alpha-BHC	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
beta-BHC	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
Chlordane	ND	8.5		µg/Kg	1	10/25/2011 12:17 AM
delta-BHC	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
Dieldrin	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
Endosulfan I	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
Endosulfan II	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
Endrin	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
Endrin ketone	ND	2.0		µg/Kg	1	10/25/2011 12:17 AM
gamma-BHC	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
Heptachlor	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/25/2011 12:17 AM
Methoxychlor	ND	5.0		µg/Kg	1	10/25/2011 12:17 AM
Toxaphene	ND	50		µg/Kg	1	10/25/2011 12:17 AM
Surr: Decachlorobiphenyl	40.5	39-104		%REC	1	10/25/2011 12:17 AM
Surr: Tetrachloro-m-xylene	53.7	43-100		%REC	1	10/25/2011 12:17 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B38-2
Lab Order:	120362	**Collection Date:**	10/13/2011 3:38:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-046A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029C	QC Batch: 76586			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	4.0		mg/Kg	2	10/30/2011 10:05 AM
Arsenic	2.4	2.0		mg/Kg	2	10/30/2011 10:05 AM
Barium	47	2.0		mg/Kg	2	10/30/2011 10:05 AM
Beryllium	ND	2.0		mg/Kg	2	10/30/2011 10:05 AM
Cadmium	ND	2.0		mg/Kg	2	10/30/2011 10:05 AM
Chromium	4.2	2.0		mg/Kg	2	10/30/2011 10:05 AM
Cobalt	5.7	2.0		mg/Kg	2	10/30/2011 10:05 AM
Copper	10	4.0		mg/Kg	2	10/30/2011 10:05 AM
Lead	5.6	2.0		mg/Kg	2	10/30/2011 10:05 AM
Molybdenum	ND	2.0		mg/Kg	2	10/30/2011 10:05 AM
Nickel	4.4	2.0		mg/Kg	2	10/30/2011 10:05 AM
Selenium	ND	2.0		mg/Kg	2	10/30/2011 10:05 AM
Silver	ND	2.0		mg/Kg	2	10/30/2011 10:05 AM
Thallium	ND	2.0		mg/Kg	2	10/30/2011 10:05 AM
Vanadium	19	2.0		mg/Kg	2	10/30/2011 10:05 AM
Zinc	20	2.0		mg/Kg	2	10/30/2011 10:05 AM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/24/2011 02:44 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS1-0
Lab Order:	120362	**Collection Date:**	10/13/2011 4:16:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-047A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	2.3	1.0		mg/Kg	1	10/25/2011 01:22 PM
ORO	8.9	1.0		mg/Kg	1	10/25/2011 01:22 PM
Surr: p-Terphenyl	65.6	39-123		%REC	1	10/25/2011 01:22 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT: Geocon Consultants
Client Sample ID: BS1-4
Lab Order: 120362
Collection Date: 10/13/2011 4:17:00 PM
Project: 80/680/12 Interchange, E8128-06-07
Matrix: SOIL
Lab ID: 120362-048A

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029C	QC Batch: 76586			PrepDate: 10/28/2011		Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 07:35 PM
Arsenic	2.1	1.0		mg/Kg	1	10/29/2011 07:35 PM
Barium	170	1.0		mg/Kg	1	10/29/2011 07:35 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 07:35 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 07:35 PM
Chromium	8.0	1.0		mg/Kg	1	10/29/2011 07:35 PM
Cobalt	7.1	1.0		mg/Kg	1	10/29/2011 07:35 PM
Copper	10	2.0		mg/Kg	1	10/29/2011 07:35 PM
Lead	3.3	1.0		mg/Kg	1	10/29/2011 07:35 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 07:35 PM
Nickel	9.7	1.0		mg/Kg	1	10/29/2011 07:35 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 07:35 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 07:35 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 07:35 PM
Vanadium	16	1.0		mg/Kg	1	10/29/2011 07:35 PM
Zinc	22	1.0		mg/Kg	1	10/29/2011 07:35 PM
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B(M)			
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 04:53 PM
Surr: Bromofluorobenzene (FID)	112	69-158		%REC	1	10/24/2011 04:53 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
			EPA 8021B			
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 04:53 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 04:53 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 04:53 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 04:53 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 04:53 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 04:53 PM
Surr: Bromofluorobenzene (PID)	111	65-140		%REC	1	10/24/2011 04:53 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS1-4
Lab Order:	120362	**Collection Date:**	10/13/2011 4:17:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-048A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA5_111025A	QC Batch: 76424			PrepDate: 10/24/2011		Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/25/2011 12:26 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B52-0
Lab Order:	120362	**Collection Date:**	10/13/2011 5:11:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-049A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	4.5	1.0		mg/Kg	1	10/25/2011 01:02 PM
ORO	4.2	1.0		mg/Kg	1	10/25/2011 01:02 PM
Surr: p-Terphenyl	54.8	39-123		%REC	1	10/25/2011 01:02 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B52-4
Lab Order:	120362	**Collection Date:**	10/13/2011 5:12:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-050A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029C	QC Batch: 76586			PrepDate: 10/28/2011		Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 07:38 PM
Arsenic	3.7	1.0		mg/Kg	1	10/29/2011 07:38 PM
Barium	120	1.0		mg/Kg	1	10/29/2011 07:38 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 07:38 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 07:38 PM
Chromium	18	1.0		mg/Kg	1	10/29/2011 07:38 PM
Cobalt	6.2	1.0		mg/Kg	1	10/29/2011 07:38 PM
Copper	14	2.0		mg/Kg	1	10/29/2011 07:38 PM
Lead	4.8	1.0		mg/Kg	1	10/29/2011 07:38 PM
Molybdenum	1.1	1.0		mg/Kg	1	10/29/2011 07:38 PM
Nickel	8.4	1.0		mg/Kg	1	10/29/2011 07:38 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 07:38 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 07:38 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 07:38 PM
Vanadium	23	1.0		mg/Kg	1	10/29/2011 07:38 PM
Zinc	27	1.0		mg/Kg	1	10/29/2011 07:38 PM
GASOLINE RANGE ORGANICS BY GC/FID						
			EPA 8015B(M)			
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 05:08 PM
Surr: Bromofluorobenzene (FID)	109	69-158		%REC	1	10/24/2011 05:08 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
			EPA 8021B			
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 05:08 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 05:08 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 05:08 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 05:08 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 05:08 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 05:08 PM
Surr: Bromofluorobenzene (PID)	109	65-140		%REC	1	10/24/2011 05:08 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B52-4
Lab Order:	120362	**Collection Date:**	10/13/2011 5:12:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-050A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
			EPA 7471A			
RunID: AA5_111025A	QC Batch: 76424			PrepDate: 10/24/2011		Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/25/2011 12:28 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B66-0
Lab Order:	120362	**Collection Date:**	10/13/2011 5:45:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-051A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
Aldrin	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
beta-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
Chlordane	ND	8.5		µg/Kg	1	10/24/2011 09:59 PM
delta-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
Dieldrin	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
Endrin	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/24/2011 09:59 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
Heptachlor	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/24/2011 09:59 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/24/2011 09:59 PM
Toxaphene	ND	50		µg/Kg	1	10/24/2011 09:59 PM
Surr: Decachlorobiphenyl	81.3	39-104		%REC	1	10/24/2011 09:59 PM
Surr: Tetrachloro-m-xylene	60.6	43-100		%REC	1	10/24/2011 09:59 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B66-2
Lab Order:	120362	**Collection Date:**	10/13/2011 5:46:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-052A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3050B			**EPA 6010B**		
RunID: ICP8_111029C	QC Batch: 76586			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 07:41 PM
Arsenic	4.3	1.0		mg/Kg	1	10/29/2011 07:41 PM
Barium	120	1.0		mg/Kg	1	10/29/2011 07:41 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 07:41 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 07:41 PM
Chromium	8.5	1.0		mg/Kg	1	10/29/2011 07:41 PM
Cobalt	4.8	1.0		mg/Kg	1	10/29/2011 07:41 PM
Copper	13	2.0		mg/Kg	1	10/29/2011 07:41 PM
Lead	3.1	1.0		mg/Kg	1	10/29/2011 07:41 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 07:41 PM
Nickel	7.6	1.0		mg/Kg	1	10/29/2011 07:41 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 07:41 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 07:41 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 07:41 PM
Vanadium	25	1.0		mg/Kg	1	10/29/2011 07:41 PM
Zinc	23	1.0		mg/Kg	1	10/29/2011 07:41 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/24/2011 02:46 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

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ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS4
Lab Order:	120362	**Collection Date:**	10/13/2011 11:18:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-053A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS11_111024A	QC Batch: A11VW206			PrepDate:		Analyst: **BD**
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,1,1-Trichloroethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,1,2-Trichloroethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,1-Dichloroethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,1-Dichloroethene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,1-Dichloropropene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2,3-Trichloropropane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2,4-Trichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2-Dibromo-3-chloropropane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2-Dibromoethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2-Dichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2-Dichloroethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,2-Dichloropropane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,3-Dichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,3-Dichloropropane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
1,4-Dichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
2,2-Dichloropropane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
2-Chlorotoluene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
4-Chlorotoluene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
4-Isopropyltoluene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Benzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Bromobenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Bromodichloromethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Bromoform	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Bromomethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Carbon tetrachloride	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Chlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Chloroethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Chloroform	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Chloromethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
cis-1,2-Dichloroethene	ND	0.50		µg/L	1	10/24/2011 04:31 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS4
Lab Order:	120362	**Collection Date:**	10/13/2011 11:18:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-053A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS11_111024A	QC Batch:	A11VW206		PrepDate:		Analyst: **BD**
cis-1,3-Dichloropropene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Dibromochloromethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Dibromomethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Dichlorodifluoromethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Ethylbenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Hexachlorobutadiene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Isopropylbenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
m,p-Xylene	ND	1.0		µg/L	1	10/24/2011 04:31 PM
Methylene chloride	ND	1.0		µg/L	1	10/24/2011 04:31 PM
n-Butylbenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
n-Propylbenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Naphthalene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
o-Xylene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
sec-Butylbenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Styrene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
tert-Butylbenzene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Tetrachloroethene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Toluene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
trans-1,2-Dichloroethene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Trichloroethene	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Trichlorofluoromethane	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Vinyl chloride	ND	0.50		µg/L	1	10/24/2011 04:31 PM
Surr: 1,2-Dichloroethane-d4	92.4	70-130		%REC	1	10/24/2011 04:31 PM
Surr: 4-Bromofluorobenzene	98.6	70-130		%REC	1	10/24/2011 04:31 PM
Surr: Dibromofluoromethane	97.8	70-130		%REC	1	10/24/2011 04:31 PM
Surr: Toluene-d8	106	70-130		%REC	1	10/24/2011 04:31 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS4
Lab Order:	120362	**Collection Date:**	10/13/2011 11:18:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-053B		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC19_111024A QC Batch: M11VW208 PrepDate: Analyst: **DMP**						
GRO	0.19	0.050	B	mg/L	1	10/24/2011 06:01 PM
Surr: Bromofluorobenzene (FID)	99.7	70-130		%REC	1	10/24/2011 06:01 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC19_111024A QC Batch: M11VW208 PrepDate: Analyst: **DMP**						
Benzene	ND	0.50		µg/L	1	10/24/2011 06:01 PM
Ethylbenzene	ND	0.50		µg/L	1	10/24/2011 06:01 PM
m,p-Xylene	ND	1.0		µg/L	1	10/24/2011 06:01 PM
Methyl tert-butyl ether	ND	0.50		µg/L	1	10/24/2011 06:01 PM
o-Xylene	ND	0.50		µg/L	1	10/24/2011 06:01 PM
Toluene	ND	0.50		µg/L	1	10/24/2011 06:01 PM
Surr: Bromofluorobenzene (PID)	98.8	70-130		%REC	1	10/24/2011 06:01 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT: Geocon Consultants
Lab Order: 120362
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120362-053C

Client Sample ID: BS4
Collection Date: 10/13/2011 11:18:00 AM
Matrix: GROUNDWATER

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3010A			**EPA 6010B**		
RunID: ICP8_111026A	QC Batch: 76443			PrepDate:	10/25/2011	Analyst: **CBB**
Antimony	ND	0.0050		mg/L	1	10/26/2011 02:24 PM
Arsenic	ND	0.010		mg/L	1	10/26/2011 02:24 PM
Barium	1.7	0.0030		mg/L	1	10/26/2011 02:24 PM
Beryllium	ND	0.0030		mg/L	1	10/26/2011 02:24 PM
Cadmium	ND	0.0030		mg/L	1	10/26/2011 02:24 PM
Chromium	0.031	0.0030		mg/L	1	10/26/2011 02:24 PM
Cobalt	0.012	0.0030		mg/L	1	10/26/2011 02:24 PM
Copper	0.069	0.0050		mg/L	1	10/26/2011 02:24 PM
Lead	0.024	0.0050		mg/L	1	10/26/2011 02:24 PM
Molybdenum	0.012	0.0050		mg/L	1	10/26/2011 02:24 PM
Nickel	0.024	0.0050		mg/L	1	10/26/2011 02:24 PM
Selenium	ND	0.010		mg/L	1	10/26/2011 02:24 PM
Silver	ND	0.0030		mg/L	1	10/26/2011 02:24 PM
Thallium	ND	0.015		mg/L	1	10/26/2011 02:24 PM
Vanadium	0.069	0.0030		mg/L	1	10/26/2011 02:24 PM
Zinc	0.097	0.010		mg/L	1	10/26/2011 02:24 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7470A		
RunID: AA1_111025A	QC Batch: 76416			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	ND	0.20		µg/L	1	10/25/2011 11:44 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS4
Lab Order:	120362	**Collection Date:**	10/13/2011 11:18:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-053D		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3510C			**EPA 8015B(M)**			
RunID: GC16_111021B	QC Batch: 76377			PrepDate:	10/20/2011	Analyst: **CBR**
DRO	0.056	0.050		mg/L	1	10/21/2011 12:03 PM
ORO	0.064	0.050		mg/L	1	10/21/2011 12:03 PM
Surr: p-Terphenyl	85.0	48-124		%REC	1	10/21/2011 12:03 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS1
Lab Order:	120362	**Collection Date:**	10/13/2011 4:43:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-054A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS11_111024A	QC Batch: A11VW206			PrepDate:		Analyst: **BD**
1,1,1,2-Tetrachloroethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,1,1-Trichloroethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,1,2,2-Tetrachloroethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,1,2-Trichloroethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,1-Dichloroethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,1-Dichloroethene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,1-Dichloropropene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2,3-Trichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2,3-Trichloropropane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2,4-Trichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2,4-Trimethylbenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2-Dibromo-3-chloropropane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2-Dibromoethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2-Dichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2-Dichloroethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,2-Dichloropropane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,3,5-Trimethylbenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,3-Dichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,3-Dichloropropane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
1,4-Dichlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
2,2-Dichloropropane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
2-Chlorotoluene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
4-Chlorotoluene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
4-Isopropyltoluene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Benzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Bromobenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Bromodichloromethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Bromoform	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Bromomethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Carbon tetrachloride	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Chlorobenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Chloroethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Chloroform	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Chloromethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
cis-1,2-Dichloroethene	ND	0.50		µg/L	1	10/24/2011 04:50 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS1
Lab Order:	120362	**Collection Date:**	10/13/2011 4:43:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-054A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
			EPA 8260B			
RunID: MS11_111024A	QC Batch:	A11VW206		PrepDate:		Analyst: **BD**
cis-1,3-Dichloropropene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Dibromochloromethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Dibromomethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Dichlorodifluoromethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Ethylbenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Hexachlorobutadiene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Isopropylbenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
m,p-Xylene	ND	1.0		µg/L	1	10/24/2011 04:50 PM
Methylene chloride	ND	1.0		µg/L	1	10/24/2011 04:50 PM
n-Butylbenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
n-Propylbenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Naphthalene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
o-Xylene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
sec-Butylbenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Styrene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
tert-Butylbenzene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Tetrachloroethene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Toluene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
trans-1,2-Dichloroethene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Trichloroethene	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Trichlorofluoromethane	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Vinyl chloride	ND	0.50		µg/L	1	10/24/2011 04:50 PM
Surr: 1,2-Dichloroethane-d4	96.2	70-130		%REC	1	10/24/2011 04:50 PM
Surr: 4-Bromofluorobenzene	100	70-130		%REC	1	10/24/2011 04:50 PM
Surr: Dibromofluoromethane	101	70-130		%REC	1	10/24/2011 04:50 PM
Surr: Toluene-d8	105	70-130		%REC	1	10/24/2011 04:50 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS1
Lab Order:	120362	**Collection Date:**	10/13/2011 4:43:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-054B		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
EPA 8015B(M)						
RunID: GC19_111024A QC Batch: M11VW208 PrepDate: Analyst: **DMP**						
GRO	0.19	0.050	B	mg/L	1	10/24/2011 06:21 PM
Surr: Bromofluorobenzene (FID)	99.5	70-130		%REC	1	10/24/2011 06:21 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
EPA 8021B						
RunID: GC19_111024A QC Batch: M11VW208 PrepDate: Analyst: **DMP**						
Benzene	ND	0.50		µg/L	1	10/24/2011 06:21 PM
Ethylbenzene	ND	0.50		µg/L	1	10/24/2011 06:21 PM
m,p-Xylene	ND	1.0		µg/L	1	10/24/2011 06:21 PM
Methyl tert-butyl ether	ND	0.50		µg/L	1	10/24/2011 06:21 PM
o-Xylene	ND	0.50		µg/L	1	10/24/2011 06:21 PM
Toluene	ND	0.50		µg/L	1	10/24/2011 06:21 PM
Surr: Bromofluorobenzene (PID)	98.5	70-130		%REC	1	10/24/2011 06:21 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS1
Lab Order:	120362	**Collection Date:**	10/13/2011 4:43:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-054C		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
	EPA 3010A			**EPA 6010B**		
RunID: ICP8_111026A	QC Batch: 76443			PrepDate:	10/25/2011	Analyst: **CBB**
Antimony	ND	0.0050		mg/L	1	10/26/2011 02:28 PM
Arsenic	0.028	0.010		mg/L	1	10/26/2011 02:28 PM
Barium	1.1	0.0030		mg/L	1	10/26/2011 02:28 PM
Beryllium	ND	0.0030		mg/L	1	10/26/2011 02:28 PM
Cadmium	0.0041	0.0030		mg/L	1	10/26/2011 02:28 PM
Chromium	0.15	0.0030		mg/L	1	10/26/2011 02:28 PM
Cobalt	0.036	0.0030		mg/L	1	10/26/2011 02:28 PM
Copper	0.15	0.0050		mg/L	1	10/26/2011 02:28 PM
Lead	0.028	0.0050		mg/L	1	10/26/2011 02:28 PM
Molybdenum	0.041	0.0050		mg/L	1	10/26/2011 02:28 PM
Nickel	0.14	0.0050		mg/L	1	10/26/2011 02:28 PM
Selenium	ND	0.010		mg/L	1	10/26/2011 02:28 PM
Silver	ND	0.0030		mg/L	1	10/26/2011 02:28 PM
Thallium	ND	0.015		mg/L	1	10/26/2011 02:28 PM
Vanadium	0.29	0.0030		mg/L	1	10/26/2011 02:28 PM
Zinc	0.42	0.010		mg/L	1	10/26/2011 02:28 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7470A		
RunID: AA1_111025A	QC Batch: 76416			PrepDate:	10/24/2011	Analyst: **VV**
Mercury	0.24	0.20		µg/L	1	10/25/2011 11:46 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	BS1
Lab Order:	120362	**Collection Date:**	10/13/2011 4:43:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	GROUNDWATER
Lab ID:	120362-054D		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3510C			**EPA 8015B(M)**			
RunID: GC16_111021B	QC Batch: 76377			PrepDate:	10/20/2011	Analyst: **CBR**
DRO	ND	0.12		mg/L	1	10/21/2011 11:30 AM
ORO	ND	0.12		mg/L	1	10/21/2011 11:30 AM
Surr: p-Terphenyl	87.1	48-124		%REC	1	10/21/2011 11:30 AM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT: Geocon Consultants
Lab Order: 120362
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120362-055A

Client Sample ID: Composite B70-0, B71-0, B72-0
Collection Date: 10/13/2011
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B			**EPA 6010B**			
RunID: ICP8_111029C	QC Batch: 76586			PrepDate:	10/28/2011	Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 07:45 PM
Arsenic	ND	1.0		mg/Kg	1	10/29/2011 07:45 PM
Barium	38	1.0		mg/Kg	1	10/29/2011 07:45 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 07:45 PM
Cadmium	1.2	1.0		mg/Kg	1	10/29/2011 07:45 PM
Chromium	9.9	1.0		mg/Kg	1	10/29/2011 07:45 PM
Cobalt	18	1.0		mg/Kg	1	10/29/2011 07:45 PM
Copper	36	2.0		mg/Kg	1	10/29/2011 07:45 PM
Lead	1.4	1.0		mg/Kg	1	10/29/2011 07:45 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 07:45 PM
Nickel	15	1.0		mg/Kg	1	10/29/2011 07:45 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 07:45 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 07:45 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 07:45 PM
Vanadium	110	1.0		mg/Kg	1	10/29/2011 07:45 PM
Zinc	54	1.0		mg/Kg	1	10/29/2011 07:45 PM
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B			**EPA 8015B(M)**			
RunID: GC16_111025B	QC Batch: 76437			PrepDate:	10/24/2011	Analyst: **CBR**
DRO	42	2.0		mg/Kg	2	10/26/2011 05:03 PM
ORO	220	2.0		mg/Kg	2	10/26/2011 05:03 PM
Surr: p-Terphenyl	69.2	39-123		%REC	2	10/26/2011 05:03 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B			**EPA 8081A**			
RunID: GC10_111024A	QC Batch: 76434			PrepDate:	10/24/2011	Analyst: **HL**
4,4´-DDD	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
Aldrin	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
beta-BHC	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
Chlordane	ND	8.5		µg/Kg	1	10/24/2011 10:26 PM
delta-BHC	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B70-0, B71-0, B72-0
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-055A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate: 10/24/2011		Analyst: **HL**
Dieldrin	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
Endrin	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/24/2011 10:26 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
Heptachlor	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/24/2011 10:26 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/24/2011 10:26 PM
Toxaphene	ND	50		µg/Kg	1	10/24/2011 10:26 PM
Surr: Decachlorobiphenyl	75.2	39-104		%REC	1	10/24/2011 10:26 PM
Surr: Tetrachloro-m-xylene	60.2	43-100		%REC	1	10/24/2011 10:26 PM
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA1_111024B	QC Batch: 76417			PrepDate: 10/24/2011		Analyst: **VV**
Mercury	0.97	0.10		mg/Kg	1	10/24/2011 02:48 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B70-2, B71-2, B72-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-056A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_111024A	QC Batch:	E11VS366		PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 05:23 PM
Surr: Bromofluorobenzene (FID)	107	69-158		%REC	1	10/24/2011 05:23 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_111024A	QC Batch:	E11VS366		PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 05:23 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 05:23 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 05:23 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 05:23 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 05:23 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 05:23 PM
Surr: Bromofluorobenzene (PID)	107	65-140		%REC	1	10/24/2011 05:23 PM
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS5_111024A	QC Batch:	T11VS218		PrepDate:		Analyst: **DDC**
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	10/24/2011 12:42 PM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B70-2, B71-2, B72-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-056A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS5_111024A	QC Batch: T11VS218			PrepDate:		Analyst: **DDC**
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
2-Chlorotoluene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
4-Chlorotoluene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Benzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Bromobenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Bromodichloromethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Bromoform	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Bromomethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Carbon tetrachloride	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Chlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Chloroethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Chloroform	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Chloromethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
cis-1,3-Dichloropropene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Dibromochloromethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Dibromomethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Isopropylbenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 12:42 PM
Methylene chloride	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
n-Butylbenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
n-Propylbenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Naphthalene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
sec-Butylbenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Styrene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
tert-Butylbenzene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Tetrachloroethene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT: Geocon Consultants
Lab Order: 120362
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120362-056A

Client Sample ID: Composite B70-2, B71-2, B72-2
Collection Date: 10/13/2011
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS5_111024A	QC Batch:	T11VS218		PrepDate:		Analyst: **DDC**
Trichloroethene	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Vinyl chloride	ND	5.0		µg/Kg	1	10/24/2011 12:42 PM
Surr: 1,2-Dichloroethane-d4	78.2	70-130		%REC	1	10/24/2011 12:42 PM
Surr: 4-Bromofluorobenzene	81.0	70-130		%REC	1	10/24/2011 12:42 PM
Surr: Dibromofluoromethane	85.0	70-130		%REC	1	10/24/2011 12:42 PM
Surr: Toluene-d8	86.0	70-130		%REC	1	10/24/2011 12:42 PM
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS						
	EPA 3550B			**EPA 8270C**		
RunID: MS 13_111025B	QC Batch:	76459		PrepDate:	10/25/2011	Analyst: **JSD**
1,2,4-Trichlorobenzene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
1,2-Dichlorobenzene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
1,3-Dichlorobenzene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
1,4-Dichlorobenzene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2,4,5-Trichlorophenol	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2,4,6-Trichlorophenol	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2,4-Dichlorophenol	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
2,4-Dimethylphenol	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2,4-Dinitrophenol	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
2,4-Dinitrotoluene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2,6-Dinitrotoluene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2-Chloronaphthalene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2-Chlorophenol	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2-Methylnaphthalene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2-Methylphenol	ND	330		µg/Kg	1	10/25/2011 06:12 PM
2-Nitroaniline	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
2-Nitrophenol	ND	330		µg/Kg	1	10/25/2011 06:12 PM
3,3´-Dichlorobenzidine	ND	660		µg/Kg	1	10/25/2011 06:12 PM
3-Nitroaniline	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
4,6-Dinitro-2-methylphenol	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
4-Bromophenyl-phenylether	ND	330		µg/Kg	1	10/25/2011 06:12 PM
4-Chloro-3-methylphenol	ND	660		µg/Kg	1	10/25/2011 06:12 PM
4-Chloroaniline	ND	660		µg/Kg	1	10/25/2011 06:12 PM
4-Chlorophenyl-phenylether	ND	330		µg/Kg	1	10/25/2011 06:12 PM
4-Methylphenol	ND	330		µg/Kg	1	10/25/2011 06:12 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B70-2, B71-2, B72-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-056A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 3550B				**EPA 8270C**		
RunID: MS 13_111025B	QC Batch: 76459			PrepDate:	10/25/2011	Analyst: **JSD**
4-Nitroaniline	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
4-Nitrophenol	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
Acenaphthene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Acenaphthylene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Anthracene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Benzidine (M)	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
Benzo(a)anthracene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Benzo(a)pyrene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Benzo(b)fluoranthene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Benzo(g,h,i)perylene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Benzo(k)fluoranthene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Benzoic acid	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
Benzyl alcohol	ND	660		µg/Kg	1	10/25/2011 06:12 PM
Bis(2-chloroethoxy)methane	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Bis(2-chloroethyl)ether	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Bis(2-chloroisopropyl)ether	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Bis(2-ethylhexyl)phthalate	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Butylbenzylphthalate	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Chrysene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Di-n-butylphthalate	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Di-n-octylphthalate	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Dibenz(a,h)anthracene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Dibenzofuran	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Diethylphthalate	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Dimethylphthalate	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Fluoranthene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Fluorene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Hexachlorobenzene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Hexachlorobutadiene	ND	660		µg/Kg	1	10/25/2011 06:12 PM
Hexachlorocyclopentadiene	ND	660		µg/Kg	1	10/25/2011 06:12 PM
Hexachloroethane	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Indeno(1,2,3-cd)pyrene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Isophorone	ND	330		µg/Kg	1	10/25/2011 06:12 PM
N-Nitrosodi-n-propylamine	ND	330		µg/Kg	1	10/25/2011 06:12 PM
N-Nitrosodiphenylamine	ND	330		µg/Kg	1	10/25/2011 06:12 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B70-2, B71-2, B72-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-056A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 3550B				**EPA 8270C**		
RunID: MS 13_111025B	QC Batch: 76459			PrepDate: 10/25/2011		Analyst: **JSD**
Naphthalene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Nitrobenzene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Pentachlorophenol	ND	1600		µg/Kg	1	10/25/2011 06:12 PM
Phenanthrene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Phenol	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Pyrene	ND	330		µg/Kg	1	10/25/2011 06:12 PM
Surr: 1,2-Dichlorobenzene-d4	89.9	47-99		%REC	1	10/25/2011 06:12 PM
Surr: 2,4,6-Tribromophenol	87.3	25-116		%REC	1	10/25/2011 06:12 PM
Surr: 2-Chlorophenol-d4	93.5	45-102		%REC	1	10/25/2011 06:12 PM
Surr: 2-Fluorobiphenyl	91.7	56-107		%REC	1	10/25/2011 06:12 PM
Surr: 2-Fluorophenol	88.4	39-100		%REC	1	10/25/2011 06:12 PM
Surr: 4-Terphenyl-d14	92.6	52-123		%REC	1	10/25/2011 06:12 PM
Surr: Nitrobenzene-d5	88.1	41-102		%REC	1	10/25/2011 06:12 PM
Surr: Phenol-d5	87.8	42-104		%REC	1	10/25/2011 06:12 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B73-0, B74-0, B75-0
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-057A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
DIESEL & MOTOR OIL RANGE ORGANICS BY GC/FID						
EPA 3550B				**EPA 8015B(M)**		
RunID: GC16_111025B	QC Batch: 76437			PrepDate: 10/24/2011	Analyst: **CBR**	
DRO	5.2	1.0		mg/Kg	1	10/25/2011 02:36 PM
ORO	24	1.0		mg/Kg	1	10/25/2011 02:36 PM
Surr: p-Terphenyl	55.0	39-123		%REC	1	10/25/2011 02:36 PM
ORGANOCHLORINE PESTICIDES BY GC/ECD						
EPA 3550B				**EPA 8081A**		
RunID: GC10_111024A	QC Batch: 76434			PrepDate: 10/24/2011	Analyst: **HL**	
4,4´-DDD	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
4,4´-DDE	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
4,4´-DDT	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
Aldrin	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
alpha-BHC	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
alpha-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
beta-BHC	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
Chlordane	ND	8.5		µg/Kg	1	10/24/2011 10:54 PM
delta-BHC	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
Dieldrin	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
Endosulfan I	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
Endosulfan II	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
Endosulfan sulfate	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
Endrin	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
Endrin aldehyde	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
Endrin ketone	ND	2.0		µg/Kg	1	10/24/2011 10:54 PM
gamma-BHC	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
gamma-Chlordane	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
Heptachlor	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
Heptachlor epoxide	ND	1.0		µg/Kg	1	10/24/2011 10:54 PM
Methoxychlor	ND	5.0		µg/Kg	1	10/24/2011 10:54 PM
Toxaphene	ND	50		µg/Kg	1	10/24/2011 10:54 PM
Surr: Decachlorobiphenyl	74.6	39-104		%REC	1	10/24/2011 10:54 PM
Surr: Tetrachloro-m-xylene	61.1	43-100		%REC	1	10/24/2011 10:54 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B73-2, B74-2, B75-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-058A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
ICP METALS						
EPA 3050B				**EPA 6010B**		
RunID: ICP8_111029C	QC Batch: 76586			PrepDate: 10/28/2011		Analyst: **CBB**
Antimony	ND	2.0		mg/Kg	1	10/29/2011 07:48 PM
Arsenic	2.8	1.0		mg/Kg	1	10/29/2011 07:48 PM
Barium	130	1.0		mg/Kg	1	10/29/2011 07:48 PM
Beryllium	ND	1.0		mg/Kg	1	10/29/2011 07:48 PM
Cadmium	ND	1.0		mg/Kg	1	10/29/2011 07:48 PM
Chromium	7.9	1.0		mg/Kg	1	10/29/2011 07:48 PM
Cobalt	5.6	1.0		mg/Kg	1	10/29/2011 07:48 PM
Copper	12	2.0		mg/Kg	1	10/29/2011 07:48 PM
Lead	9.1	1.0		mg/Kg	1	10/29/2011 07:48 PM
Molybdenum	ND	1.0		mg/Kg	1	10/29/2011 07:48 PM
Nickel	6.8	1.0		mg/Kg	1	10/29/2011 07:48 PM
Selenium	ND	1.0		mg/Kg	1	10/29/2011 07:48 PM
Silver	ND	1.0		mg/Kg	1	10/29/2011 07:48 PM
Thallium	ND	1.0		mg/Kg	1	10/29/2011 07:48 PM
Vanadium	19	1.0		mg/Kg	1	10/29/2011 07:48 PM
Zinc	23	1.0		mg/Kg	1	10/29/2011 07:48 PM
GASOLINE RANGE ORGANICS BY GC/FID						
				EPA 8015B(M)		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
GRO	ND	1.0		mg/Kg	1	10/24/2011 05:39 PM
Surr: Bromofluorobenzene (FID)	114	69-158		%REC	1	10/24/2011 05:39 PM
VOLATILE ORGANIC COMPOUNDS BY GC/PID						
				EPA 8021B		
RunID: GC2_111024A	QC Batch: E11VS366			PrepDate:		Analyst: **TP**
Benzene	ND	5.0		µg/Kg	1	10/24/2011 05:39 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 05:39 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 05:39 PM
Methyl tert-butyl ether	ND	5.0		µg/Kg	1	10/24/2011 05:39 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 05:39 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 05:39 PM
Surr: Bromofluorobenzene (PID)	113	65-140		%REC	1	10/24/2011 05:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B73-2, B74-2, B75-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-058A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
MERCURY BY COLD VAPOR TECHNIQUE						
				EPA 7471A		
RunID: AA5_111025A	QC Batch: 76424			PrepDate: 10/24/2011		Analyst: **VV**
Mercury	ND	0.10		mg/Kg	1	10/25/2011 12:34 PM
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
				EPA 8260B		
RunID: MS5_111024A	QC Batch: T11VS218			PrepDate:		Analyst: **DDC**
1,1,1,2-Tetrachloroethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,1,1-Trichloroethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,1,2,2-Tetrachloroethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,1,2-Trichloroethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,1-Dichloroethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,1-Dichloroethene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,1-Dichloropropene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,2,3-Trichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,2,3-Trichloropropane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,2,4-Trichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,2,4-Trimethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,2-Dibromo-3-chloropropane	ND	10		µg/Kg	1	10/24/2011 01:01 PM
1,2-Dibromoethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,2-Dichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,2-Dichloroethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,2-Dichloropropane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,3,5-Trimethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,3-Dichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,3-Dichloropropane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
1,4-Dichlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
2,2-Dichloropropane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
2-Chlorotoluene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
4-Chlorotoluene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
4-Isopropyltoluene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Benzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Bromobenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Bromodichloromethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Bromoform	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Bromomethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Carbon tetrachloride	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Chlorobenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B73-2, B74-2, B75-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-058A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
VOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 8260B						
RunID: MS5_111024A	QC Batch: T11VS218			PrepDate:		Analyst: **DDC**
Chloroethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Chloroform	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Chloromethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
cis-1,2-Dichloroethene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
cis-1,3-Dichloropropene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Dibromochloromethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Dibromomethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Dichlorodifluoromethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Ethylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Hexachlorobutadiene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Isopropylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
m,p-Xylene	ND	10		µg/Kg	1	10/24/2011 01:01 PM
Methylene chloride	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
n-Butylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
n-Propylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Naphthalene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
o-Xylene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
sec-Butylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Styrene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
tert-Butylbenzene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Tetrachloroethene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Toluene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
trans-1,2-Dichloroethene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Trichloroethene	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Trichlorofluoromethane	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Vinyl chloride	ND	5.0		µg/Kg	1	10/24/2011 01:01 PM
Surr: 1,2-Dichloroethane-d4	77.3	70-130		%REC	1	10/24/2011 01:01 PM
Surr: 4-Bromofluorobenzene	88.3	70-130		%REC	1	10/24/2011 01:01 PM
Surr: Dibromofluoromethane	76.6	70-130		%REC	1	10/24/2011 01:01 PM
Surr: Toluene-d8	88.3	70-130		%REC	1	10/24/2011 01:01 PM
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 3550B				**EPA 8270C**		
RunID: MS 13_111025B	QC Batch: 76459			PrepDate:	10/25/2011	Analyst: **JSD**
1,2,4-Trichlorobenzene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
1,2-Dichlorobenzene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B73-2, B74-2, B75-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-058A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 3550B				**EPA 8270C**		
RunID: MS 13_111025B	QC Batch: 76459				PrepDate: 10/25/2011	Analyst: **JSD**
1,3-Dichlorobenzene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
1,4-Dichlorobenzene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2,4,5-Trichlorophenol	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2,4,6-Trichlorophenol	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2,4-Dichlorophenol	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
2,4-Dimethylphenol	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2,4-Dinitrophenol	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
2,4-Dinitrotoluene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2,6-Dinitrotoluene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2-Chloronaphthalene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2-Chlorophenol	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2-Methylnaphthalene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2-Methylphenol	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
2-Nitroaniline	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
2-Nitrophenol	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
3,3´-Dichlorobenzidine	ND	3300		µg/Kg	5	10/25/2011 06:39 PM
3-Nitroaniline	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
4,6-Dinitro-2-methylphenol	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
4-Bromophenyl-phenylether	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
4-Chloro-3-methylphenol	ND	3300		µg/Kg	5	10/25/2011 06:39 PM
4-Chloroaniline	ND	3300		µg/Kg	5	10/25/2011 06:39 PM
4-Chlorophenyl-phenylether	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
4-Methylphenol	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
4-Nitroaniline	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
4-Nitrophenol	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
Acenaphthene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Acenaphthylene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Anthracene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Benzidine (M)	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
Benzo(a)anthracene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Benzo(a)pyrene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Benzo(b)fluoranthene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Benzo(g,h,i)perylene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Benzo(k)fluoranthene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Benzoic acid	ND	8200		µg/Kg	5	10/25/2011 06:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS
Print Date: *14-Nov-11*

CLIENT: Geocon Consultants
Lab Order: 120362
Project: 80/680/12 Interchange, E8128-06-07
Lab ID: 120362-058A

Client Sample ID: Composite B73-2, B74-2, B75-2
Collection Date: 10/13/2011
Matrix: SOIL

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 3550B			**EPA 8270C**			
RunID: MS 13_111025B	QC Batch: 76459			PrepDate:	10/25/2011	Analyst: **JSD**
Benzyl alcohol	ND	3300		µg/Kg	5	10/25/2011 06:39 PM
Bis(2-chloroethoxy)methane	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Bis(2-chloroethyl)ether	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Bis(2-chloroisopropyl)ether	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Bis(2-ethylhexyl)phthalate	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Butylbenzylphthalate	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Chrysene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Di-n-butylphthalate	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Di-n-octylphthalate	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Dibenz(a,h)anthracene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Dibenzofuran	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Diethylphthalate	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Dimethylphthalate	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Fluoranthene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Fluorene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Hexachlorobenzene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Hexachlorobutadiene	ND	3300		µg/Kg	5	10/25/2011 06:39 PM
Hexachlorocyclopentadiene	ND	3300		µg/Kg	5	10/25/2011 06:39 PM
Hexachloroethane	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Indeno(1,2,3-cd)pyrene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Isophorone	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
N-Nitrosodi-n-propylamine	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
N-Nitrosodiphenylamine	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Naphthalene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Nitrobenzene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Pentachlorophenol	ND	8200		µg/Kg	5	10/25/2011 06:39 PM
Phenanthrene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Phenol	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Pyrene	ND	1600		µg/Kg	5	10/25/2011 06:39 PM
Surr: 1,2-Dichlorobenzene-d4	86.9	47-99		%REC	5	10/25/2011 06:39 PM
Surr: 2,4,6-Tribromophenol	76.2	25-116		%REC	5	10/25/2011 06:39 PM
Surr: 2-Chlorophenol-d4	89.4	45-102		%REC	5	10/25/2011 06:39 PM
Surr: 2-Fluorobiphenyl	95.8	56-107		%REC	5	10/25/2011 06:39 PM
Surr: 2-Fluorophenol	82.6	39-100		%REC	5	10/25/2011 06:39 PM
Surr: 4-Terphenyl-d14	99.6	52-123		%REC	5	10/25/2011 06:39 PM

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range
H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *14-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	Composite B73-2, B74-2, B75-2
Lab Order:	120362	**Collection Date:**	10/13/2011
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-058A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
SEMIVOLATILE ORGANIC COMPOUNDS BY GC/MS						
EPA 3550B				**EPA 8270C**		
RunID: MS 13_111025B	QC Batch: 76459				PrepDate: 10/25/2011	Analyst: **JSD**
Surr: Nitrobenzene-d5	79.9	41-102		%REC	5	10/25/2011 06:39 PM
Surr: Phenol-d5	82.9	42-104		%REC	5	10/25/2011 06:39 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-76585** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137974**
Client ID: **PBS** Batch ID: **76585** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2266876**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.139	2.0									
Arsenic	ND	1.0									
Barium	ND	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	0.150	1.0									
Cobalt	ND	1.0									
Copper	0.386	2.0									
Lead	0.075	1.0									
Molybdenum	ND	1.0									
Nickel	0.098	1.0									
Selenium	0.215	1.0									
Silver	0.029	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-76585** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137974**
Client ID: **LCSS** Batch ID: **76585** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2266877**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	45.957	2.0	50.00	0.1393	91.6	80	120				
Arsenic	43.274	1.0	50.00	0	86.5	80	120				
Barium	46.700	1.0	50.00	0	93.4	80	120				
Beryllium	46.713	1.0	50.00	0	93.4	80	120				
Cadmium	44.229	1.0	50.00	0	88.5	80	120				
Chromium	47.197	1.0	50.00	0.1496	94.1	80	120				
Cobalt	47.497	1.0	50.00	0	95.0	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-76585** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137974**
Client ID: **LCSS** Batch ID: **76585** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2266877**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Copper	46.361	2.0	50.00	0.3857	92.0	80	120				
Lead	46.793	1.0	50.00	0.07499	93.4	80	120				
Molybdenum	46.614	1.0	50.00	0	93.2	80	120				
Nickel	45.639	1.0	50.00	0.09775	91.1	80	120				
Selenium	42.507	1.0	50.00	0.2147	84.6	80	120				
Silver	43.157	1.0	50.00	0.02879	86.3	80	120				
Thallium	46.746	1.0	50.00	0	93.5	80	120				
Vanadium	46.425	1.0	50.00	0	92.8	80	120				
Zinc	44.986	1.0	50.00	0	90.0	80	120				

Sample ID: **120362-038A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137974**
Client ID: **B6-0** Batch ID: **76585** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2266898**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	85.939	2.0	125.0	0	68.8	44	105				
Arsenic	94.427	1.0	125.0	0.9453	74.8	57	103				
Barium	137.314	1.0	125.0	38.22	79.3	36	134				
Beryllium	96.597	1.0	125.0	0	77.3	64	106				
Cadmium	87.210	1.0	125.0	0.9397	69.0	58	102				
Chromium	108.029	1.0	125.0	19.75	70.6	55	105				
Cobalt	105.170	1.0	125.0	13.50	73.3	59	105				
Copper	130.572	2.0	125.0	27.35	82.6	64	117				
Lead	100.011	1.0	125.0	5.134	75.9	46	116				
Molybdenum	92.869	1.0	125.0	0	74.3	59	108				
Nickel	114.135	1.0	125.0	26.70	69.9	52	109				
Selenium	80.965	1.0	125.0	0	64.8	56	100				
Silver	101.631	1.0	125.0	0	81.3	65	107				
Thallium	84.902	1.0	125.0	0	67.9	47	100				
Vanadium	168.782	1.0	125.0	86.51	65.8	64	110				
Zinc	132.760	1.0	125.0	68.41	51.5	37	123				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
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DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **120362-038A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137974**
Client ID: **B6-0** Batch ID: **76585** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2266899**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	87.046	2.0	125.0	0	69.6	44	105	85.94	1.28	20	
Arsenic	93.463	1.0	125.0	0.9453	74.0	57	103	94.43	1.03	20	
Barium	132.750	1.0	125.0	38.22	75.6	36	134	137.3	3.38	20	
Beryllium	95.118	1.0	125.0	0	76.1	64	106	96.60	1.54	20	
Cadmium	85.912	1.0	125.0	0.9397	68.0	58	102	87.21	1.50	20	
Chromium	110.137	1.0	125.0	19.75	72.3	55	105	108.0	1.93	20	
Cobalt	106.402	1.0	125.0	13.50	74.3	59	105	105.2	1.16	20	
Copper	131.216	2.0	125.0	27.35	83.1	64	117	130.6	0.492	20	
Lead	95.278	1.0	125.0	5.134	72.1	46	116	100.0	4.85	20	
Molybdenum	91.914	1.0	125.0	0	73.5	59	108	92.87	1.03	20	
Nickel	117.139	1.0	125.0	26.70	72.3	52	109	114.1	2.60	20	
Selenium	79.166	1.0	125.0	0	63.3	56	100	80.96	2.25	20	
Silver	100.027	1.0	125.0	0	80.0	65	107	101.6	1.59	20	
Thallium	83.823	1.0	125.0	0	67.1	47	100	84.90	1.28	20	
Vanadium	169.877	1.0	125.0	86.51	66.7	64	110	168.8	0.647	20	
Zinc	129.082	1.0	125.0	68.41	48.5	37	123	132.8	2.81	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **MB-76586** SampType: **MBLK** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137978**
Client ID: **PBS** Batch ID: **76586** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2266999**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	0.160	2.0									
Arsenic	ND	1.0									
Barium	0.052	1.0									
Beryllium	ND	1.0									
Cadmium	ND	1.0									
Chromium	0.151	1.0									
Cobalt	ND	1.0									
Copper	0.180	2.0									
Lead	ND	1.0									
Molybdenum	0.087	1.0									
Nickel	0.116	1.0									
Selenium	0.160	1.0									
Silver	0.033	1.0									
Thallium	ND	1.0									
Vanadium	ND	1.0									
Zinc	ND	1.0									

Sample ID: **LCS-76586** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137978**
Client ID: **LCSS** Batch ID: **76586** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2267000**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	46.731	2.0	50.00	0.1605	93.1	80	120				
Arsenic	44.359	1.0	50.00	0	88.7	80	120				
Barium	47.983	1.0	50.00	0.05174	95.9	80	120				
Beryllium	47.915	1.0	50.00	0	95.8	80	120				
Cadmium	45.293	1.0	50.00	0	90.6	80	120				
Chromium	48.109	1.0	50.00	0.1510	95.9	80	120				
Cobalt	51.330	1.0	50.00	0	103	80	120				
Copper	46.728	2.0	50.00	0.1799	93.1	80	120				
Lead	47.726	1.0	50.00	0	95.5	80	120				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **LCS-76586** SampType: **LCS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137978**
Client ID: **LCSS** Batch ID: **76586** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2267000**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Molybdenum	47.646	1.0	50.00	0.08692	95.1	80	120				
Nickel	46.623	1.0	50.00	0.1156	93.0	80	120				
Selenium	43.004	1.0	50.00	0.1603	85.7	80	120				
Silver	44.509	1.0	50.00	0.03254	89.0	80	120				
Thallium	48.029	1.0	50.00	0	96.1	80	120				
Vanadium	46.761	1.0	50.00	0	93.5	80	120				
Zinc	46.108	1.0	50.00	0	92.2	80	120				

Sample ID: **120362-058A-MS** SampType: **MS** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137978**
Client ID: **Composite B73-2, B** Batch ID: **76586** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2267011**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	92.342	2.0	125.0	0.2047	73.7	44	105				
Arsenic	95.831	1.0	125.0	2.789	74.4	57	103				
Barium	246.256	1.0	125.0	126.3	96.0	36	134				
Beryllium	103.851	1.0	125.0	0.3702	82.8	64	106				
Cadmium	92.757	1.0	125.0	0.2455	74.0	58	102				
Chromium	111.148	1.0	125.0	7.921	82.6	55	105				
Cobalt	113.764	1.0	125.0	5.598	86.5	59	105				
Copper	122.434	2.0	125.0	12.22	88.2	64	117				
Lead	111.830	1.0	125.0	9.063	82.2	46	116				
Molybdenum	94.978	1.0	125.0	0	76.0	59	108				
Nickel	105.336	1.0	125.0	6.777	78.8	52	109				
Selenium	84.829	1.0	125.0	0	67.9	56	100				
Silver	102.385	1.0	125.0	0	81.9	65	107				
Thallium	98.725	1.0	125.0	0	79.0	47	100				
Vanadium	128.235	1.0	125.0	19.33	87.1	64	110				
Zinc	124.323	1.0	125.0	22.90	81.1	37	123				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
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Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_S

Sample ID: **120362-058A-MSD** SampType: **MSD** TestCode: **6010_S** Units: **mg/Kg** Prep Date: **10/28/2011** RunNo: **137978**
Client ID: **Composite B73-2, B** Batch ID: **76586** TestNo: **EPA 6010B** **EPA 3050B** Analysis Date: **10/29/2011** SeqNo: **2267012**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Antimony	90.603	2.0	125.0	0.2047	72.3	44	105	92.34	1.90	20	
Arsenic	93.959	1.0	125.0	2.789	72.9	57	103	95.83	1.97	20	
Barium	243.254	1.0	125.0	126.3	93.6	36	134	246.3	1.23	20	
Beryllium	102.269	1.0	125.0	0.3702	81.5	64	106	103.9	1.54	20	
Cadmium	91.046	1.0	125.0	0.2455	72.6	58	102	92.76	1.86	20	
Chromium	108.655	1.0	125.0	7.921	80.6	55	105	111.1	2.27	20	
Cobalt	112.578	1.0	125.0	5.598	85.6	59	105	113.8	1.05	20	
Copper	120.763	2.0	125.0	12.22	86.8	64	117	122.4	1.37	20	
Lead	107.683	1.0	125.0	9.063	78.9	46	116	111.8	3.78	20	
Molybdenum	93.358	1.0	125.0	0	74.7	59	108	94.98	1.72	20	
Nickel	103.585	1.0	125.0	6.777	77.4	52	109	105.3	1.68	20	
Selenium	83.294	1.0	125.0	0	66.6	56	100	84.83	1.83	20	
Silver	100.755	1.0	125.0	0	80.6	65	107	102.4	1.61	20	
Thallium	97.459	1.0	125.0	0	78.0	47	100	98.72	1.29	20	
Vanadium	123.729	1.0	125.0	19.33	83.5	64	110	128.2	3.58	20	
Zinc	120.828	1.0	125.0	22.90	78.3	37	123	124.3	2.85	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_W

Sample ID: **MB-76443** SampType: **MBLK** TestCode: **6010_W** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137818**
Client ID: **PBW** Batch ID: **76443** TestNo: **EPA 6010B** **EPA 3010A** Analysis Date: **10/25/2011** SeqNo: **2264069**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Cadmium	0.0003	0.0030									
Chromium	ND	0.0030									
Lead	0.002	0.0050									
Nickel	ND	0.0050									
Zinc	0.005	0.010									

Sample ID: **LCS-76443** SampType: **LCS** TestCode: **6010_W** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137818**
Client ID: **LCSW** Batch ID: **76443** TestNo: **EPA 6010B** **EPA 3010A** Analysis Date: **10/25/2011** SeqNo: **2264070**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Cadmium	0.922	0.0030	1.000	0.0002998	92.2	85	115				
Chromium	0.919	0.0030	1.000	0	91.9	85	115				
Lead	0.970	0.0050	1.000	0.001982	96.8	85	115				
Nickel	0.961	0.0050	1.000	0	96.1	85	115				
Zinc	0.933	0.010	1.000	0.005011	92.8	85	115				

Sample ID: **120362-054C-MS** SampType: **MS** TestCode: **6010_W** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137818**
Client ID: **BS1** Batch ID: **76443** TestNo: **EPA 6010B** **EPA 3010A** Analysis Date: **10/25/2011** SeqNo: **2264073**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Cadmium	2.153	0.0030	2.500	0.003460	86.0	76	117				
Chromium	2.251	0.0030	2.500	0.1391	84.5	75	110				
Lead	2.242	0.0050	2.500	0.02878	88.5	78	117				
Nickel	2.290	0.0050	2.500	0.1197	86.8	75	118				
Zinc	2.521	0.010	2.500	0.3348	87.5	73	119				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 6010_W

Sample ID: **120362-054C-MSD** SampType: **MSD** TestCode: **6010_W** Units: **mg/L** Prep Date: **10/25/2011** RunNo: **137818**
Client ID: **BS1** Batch ID: **76443** TestNo: **EPA 6010B** **EPA 3010A** Analysis Date: **10/25/2011** SeqNo: **2264074**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Cadmium	2.026	0.0030	2.500	0.003460	80.9	76	117	2.153	6.04	20	
Chromium	2.102	0.0030	2.500	0.1391	78.5	75	110	2.251	6.84	20	
Lead	2.101	0.0050	2.500	0.02878	82.9	78	117	2.242	6.50	20	
Nickel	2.151	0.0050	2.500	0.1197	81.3	75	118	2.290	6.24	20	
Zinc	2.381	0.010	2.500	0.3348	81.9	73	119	2.521	5.71	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
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CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7470_W

Sample ID: **MB-76416** SampType: **MBLK** TestCode: **7470_W** Units: **µg/L** Prep Date: **10/24/2011** RunNo: **137776**
Client ID: **PBW** Batch ID: **76416** TestNo: **EPA 7470A** Analysis Date: **10/25/2011** SeqNo: **2263389**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.20									

Sample ID: **LCS-76416** SampType: **LCS** TestCode: **7470_W** Units: **µg/L** Prep Date: **10/24/2011** RunNo: **137776**
Client ID: **LCSW** Batch ID: **76416** TestNo: **EPA 7470A** Analysis Date: **10/25/2011** SeqNo: **2263390**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	9.801	0.20	10.00	0	98.0	85	115				

Sample ID: **120362-053C-MS** SampType: **MS** TestCode: **7470_W** Units: **µg/L** Prep Date: **10/24/2011** RunNo: **137776**
Client ID: **BS4** Batch ID: **76416** TestNo: **EPA 7470A** Analysis Date: **10/25/2011** SeqNo: **2263391**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	9.588	0.20	10.00	0.1101	94.8	70	130				

Sample ID: **120362-053C-MSD** SampType: **MSD** TestCode: **7470_W** Units: **µg/L** Prep Date: **10/24/2011** RunNo: **137776**
Client ID: **BS4** Batch ID: **76416** TestNo: **EPA 7470A** Analysis Date: **10/25/2011** SeqNo: **2263392**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	9.744	0.20	10.00	0.1101	96.3	70	130	9.588	1.61	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
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DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-76417** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137750**
Client ID: **PBS** Batch ID: **76417** TestNo: **EPA 7471A** Analysis Date: **10/24/2011** SeqNo: **2262982**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-76417** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137750**
Client ID: **LCSS** Batch ID: **76417** TestNo: **EPA 7471A** Analysis Date: **10/24/2011** SeqNo: **2262983**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.827	0.10	0.8300	0	99.6	80	120				

Sample ID: **120362-014A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137750**
Client ID: **B65-2** Batch ID: **76417** TestNo: **EPA 7471A** Analysis Date: **10/24/2011** SeqNo: **2262984**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.985	0.10	0.8300	0.03372	115	70	130				

Sample ID: **120362-014A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137750**
Client ID: **B65-2** Batch ID: **76417** TestNo: **EPA 7471A** Analysis Date: **10/24/2011** SeqNo: **2262985**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.991	0.10	0.8300	0.03372	115	70	130	0.9852	0.555	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7471_S

Sample ID: **MB-76424** SampType: **MBLK** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137777**
Client ID: **PBS** Batch ID: **76424** TestNo: **EPA 7471A** Analysis Date: **10/25/2011** SeqNo: **2263395**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	ND	0.10									

Sample ID: **LCS-76424** SampType: **LCS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137777**
Client ID: **LCSS** Batch ID: **76424** TestNo: **EPA 7471A** Analysis Date: **10/25/2011** SeqNo: **2263396**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.889	0.10	0.8300	0	107	80	120				

Sample ID: **120362-016A-MS** SampType: **MS** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137777**
Client ID: **BS5-4** Batch ID: **76424** TestNo: **EPA 7471A** Analysis Date: **10/25/2011** SeqNo: **2263397**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.855	0.10	0.8300	0.007417	102	70	130				

Sample ID: **120362-016A-MSD** SampType: **MSD** TestCode: **7471_S** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137777**
Client ID: **BS5-4** Batch ID: **76424** TestNo: **EPA 7471A** Analysis Date: **10/25/2011** SeqNo: **2263398**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	0.870	0.10	0.8300	0.007417	104	70	130	0.8551	1.71	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_DM LL

Sample ID: **MB-76437** SampType: **MBLK** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137827**
Client ID: **PBS** Batch ID: **76437** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2264182**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	1.0									
ORO	ND	1.0									
Surr: p-Terphenyl	1.711		2.670		64.1	39	123				

Sample ID: **LCS-76437** SampType: **LCS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137827**
Client ID: **LCSS** Batch ID: **76437** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2264183**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	18.179	1.0	33.00	0	55.1	37	109				
Surr: p-Terphenyl	1.898		2.670		71.1	39	123				

Sample ID: **120362-015AMS** SampType: **MS** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137827**
Client ID: **BS5-0** Batch ID: **76437** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2264193**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	16.023	1.0	33.00	2.275	41.7	29	107				
Surr: p-Terphenyl	1.578		2.670		59.1	39	123				

Sample ID: **120362-015AMSD** SampType: **MSD** TestCode: **8015_S_DM L** Units: **mg/Kg** Prep Date: **10/24/2011** RunNo: **137827**
Client ID: **BS5-0** Batch ID: **76437** TestNo: **EPA 8015B(M EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2264194**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	12.696	1.0	33.00	2.275	31.6	29	107	16.02	23.2	20	R
Surr: p-Terphenyl	1.178		2.670		44.1	39	123		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **E111024LC1** SampType: **LCS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137754**
Client ID: **LCSS** Batch ID: **E11VS366** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2263509**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.609	1.0	5.000	0	92.2	70	130				
Surr: Bromofluorobenzene (FID)	122.360		100.0		122	69	158				

Sample ID: **E111024MB1MS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137754**
Client ID: **ZZZZZZ** Batch ID: **E11VS366** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2263510**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.589	1.0	5.000	0	91.8	46	135				
Surr: Bromofluorobenzene (FID)	120.958		100.0		121	69	158				

Sample ID: **E111024MB1MSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137754**
Client ID: **ZZZZZZ** Batch ID: **E11VS366** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2263511**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.471	1.0	5.000	0	89.4	46	135	4.589	2.60	20	
Surr: Bromofluorobenzene (FID)	121.451		100.0		121	69	158		0	0	

Sample ID: **E111024MB1** SampType: **MBLK** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137754**
Client ID: **PBS** Batch ID: **E11VS366** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2263512**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	ND	1.0									
Surr: Bromofluorobenzene (FID)	90.677		100.0		90.7	69	158				

Sample ID: **120362-030AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137754**
Client ID: **B2-1** Batch ID: **E11VS366** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2263516**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.839	1.0	5.000	0	96.8	46	135				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_S_GAS

Sample ID: **120362-030AMS** SampType: **MS** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137754**
Client ID: **B2-1** Batch ID: **E11VS366** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2263516**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (FID)	123.907		100.0		124	69	158				

Sample ID: **120362-030AMSD** SampType: **MSD** TestCode: **8015_S_GAS** Units: **mg/Kg** Prep Date: RunNo: **137754**
Client ID: **B2-1** Batch ID: **E11VS366** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2263517**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	4.959	1.0	5.000	0	99.2	46	135	4.839	2.45	20	
Surr: Bromofluorobenzene (FID)	128.819		100.0		129	69	158		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_W_DM_LL

Sample ID: **MB-76377** SampType: **MBLK** TestCode: **8015_W_DM_** Units: **mg/L** Prep Date: **10/20/2011** RunNo: **137718**
Client ID: **PBW** Batch ID: **76377** TestNo: **EPA 8015B(M EPA 3510C** Analysis Date: **10/21/2011** SeqNo: **2262333**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	ND	0.050									
ORO	ND	0.050									
Surr: p-Terphenyl	0.061		0.08000		76.7	48	124				

Sample ID: **LCS-76377** SampType: **LCS** TestCode: **8015_W_DM_** Units: **mg/L** Prep Date: **10/20/2011** RunNo: **137718**
Client ID: **LCSW** Batch ID: **76377** TestNo: **EPA 8015B(M EPA 3510C** Analysis Date: **10/21/2011** SeqNo: **2262334**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	0.770	0.050	1.000	0	77.0	45	109				
Surr: p-Terphenyl	0.065		0.08000		80.6	48	124				

Sample ID: **MB-76377MS** SampType: **MS** TestCode: **8015_W_DM_** Units: **mg/L** Prep Date: **10/20/2011** RunNo: **137718**
Client ID: **ZZZZZZ** Batch ID: **76377** TestNo: **EPA 8015B(M EPA 3510C** Analysis Date: **10/21/2011** SeqNo: **2262335**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	0.775	0.050	1.000	0	77.5	45	109				
Surr: p-Terphenyl	0.067		0.08000		84.0	48	124				

Sample ID: **MB-76377MSD** SampType: **MSD** TestCode: **8015_W_DM_** Units: **mg/L** Prep Date: **10/20/2011** RunNo: **137718**
Client ID: **ZZZZZZ** Batch ID: **76377** TestNo: **EPA 8015B(M EPA 3510C** Analysis Date: **10/21/2011** SeqNo: **2262336**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
DRO	0.710	0.050	1.000	0	71.0	45	109	0.7101	0	20	
Surr: p-Terphenyl	0.061		0.08000		76.4	48	124		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
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ANALYTICAL QC SUMMARY REPORT

TestCode: 8015_W_GP LL

Sample ID: **M111024LCS1** SampType: **LCS** TestCode: **8015_W_GP** Units: **mg/L** Prep Date: RunNo: **137768**
Client ID: **LCSW** Batch ID: **M11VW208** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2269545**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	1.098	0.050	1.000	0.1980	90.0	70	130				B
Surr: Bromofluorobenzene (FID)	99.658		100.0		99.7	70	130				

Sample ID: **M111024MB1MS** SampType: **MS** TestCode: **8015_W_GP** Units: **mg/L** Prep Date: RunNo: **137768**
Client ID: **ZZZZZZ** Batch ID: **M11VW208** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2269546**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	1.101	0.050	1.000	0.1980	90.3	70	130				B
Surr: Bromofluorobenzene (FID)	99.523		100.0		99.5	70	130				

Sample ID: **M111024MB1MSD** SampType: **MSD** TestCode: **8015_W_GP** Units: **mg/L** Prep Date: RunNo: **137768**
Client ID: **ZZZZZZ** Batch ID: **M11VW208** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2269547**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	1.105	0.050	1.000	0.1980	90.7	70	130	1.101	0.363	20	B
Surr: Bromofluorobenzene (FID)	100.880		100.0		101	70	130		0	0	

Sample ID: **M111024MB1** SampType: **MBLK** TestCode: **8015_W_GP** Units: **mg/L** Prep Date: RunNo: **137768**
Client ID: **PBW** Batch ID: **M11VW208** TestNo: **EPA 8015B(M** Analysis Date: **10/24/2011** SeqNo: **2269548**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
GRO	0.198	0.050									
Surr: Bromofluorobenzene (FID)	97.690		100.0		97.7	70	130				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E111024LC2** SampType: **LCS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137754**
Client ID: **LCSS** Batch ID: **E11VS366** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2263525**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	102.275	5.0	100.0	0	102	70	130				
Ethylbenzene	103.280	5.0	100.0	0	103	70	130				
m,p-Xylene	209.179	10	200.0	0	105	70	130				
Methyl tert-butyl ether	98.219	5.0	100.0	0	98.2	70	130				
o-Xylene	103.781	5.0	100.0	0	104	70	130				
Toluene	104.220	5.0	100.0	0	104	70	130				
Surr: Bromofluorobenzene (PID)	96.648		100.0		96.6	65	140				

Sample ID: **E111024MB1MS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137754**
Client ID: **ZZZZZZ** Batch ID: **E11VS366** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2263527**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	36.539	5.0	22.15	0	165	69	264				
Ethylbenzene	58.276	5.0	42.30	0	138	37	161				
m,p-Xylene	200.025	10	180.2	0	111	30	149				
Methyl tert-butyl ether	401.926	5.0	578.9	0	69.4	39	121				
o-Xylene	74.169	5.0	64.80	0	114	31	166				
Toluene	184.809	5.0	172.6	0	107	44	150				
Surr: Bromofluorobenzene (PID)	102.226		100.0		102	65	140				

Sample ID: **E111024MB1MSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137754**
Client ID: **ZZZZZZ** Batch ID: **E11VS366** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2263528**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	35.646	5.0	22.15	0	161	69	264	36.54	2.47	20	
Ethylbenzene	56.653	5.0	42.30	0	134	37	161	58.28	2.82	20	
m,p-Xylene	194.809	10	180.2	0	108	30	149	200.0	2.64	20	
Methyl tert-butyl ether	391.456	5.0	578.9	0	67.6	39	121	401.9	2.64	20	
o-Xylene	72.162	5.0	64.80	0	111	31	166	74.17	2.74	20	
Toluene	180.599	5.0	172.6	0	105	44	150	184.8	2.30	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **E111024MB1MSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137754**
Client ID: **ZZZZZZ** Batch ID: **E11VS366** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2263528**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	101.129		100.0		101	65	140		0	20	

Sample ID: **E111024MB1** SampType: **MBLK** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137754**
Client ID: **PBS** Batch ID: **E11VS366** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2263529**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	5.0									
Ethylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methyl tert-butyl ether	ND	5.0									
o-Xylene	ND	5.0									
Toluene	ND	5.0									
Surr: Bromofluorobenzene (PID)	94.506		100.0		94.5	65	140				

Sample ID: **120362-030AMS** SampType: **MS** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137754**
Client ID: **B2-1** Batch ID: **E11VS366** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2263532**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	38.418	5.0	22.15	0	173	69	264				
Ethylbenzene	58.664	5.0	42.30	0	139	37	161				
m,p-Xylene	203.529	10	180.2	0	113	30	149				
Methyl tert-butyl ether	397.764	5.0	578.9	0	68.7	39	121				
o-Xylene	76.142	5.0	64.80	0	118	31	166				
Toluene	191.078	5.0	172.6	0	111	44	150				
Xylenes, Total	279.671	15	245.0	0	114	30	149				
Surr: Bromofluorobenzene (PID)	115.877		100.0		116	65	140				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_S_BTEX

Sample ID: **120362-030AMSD** SampType: **MSD** TestCode: **8021_S_BTE** Units: **µg/Kg** Prep Date: RunNo: **137754**
Client ID: **B2-1** Batch ID: **E11VS366** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2263533**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	40.611	5.0	22.15	0	183	69	264	38.42	5.55	20	
Ethylbenzene	61.301	5.0	42.30	0	145	37	161	58.66	4.40	20	
m,p-Xylene	213.581	10	180.2	0	119	30	149	203.5	4.82	20	
Methyl tert-butyl ether	437.235	5.0	578.9	0	75.5	39	121	397.8	9.45	20	
o-Xylene	80.099	5.0	64.80	0	124	31	166	76.14	5.07	20	
Toluene	201.973	5.0	172.6	0	117	44	150	191.1	5.54	20	
Xylenes, Total	293.680	15	245.0	0	120	30	149	279.7	4.89	20	
Surr: Bromofluorobenzene (PID)	121.418		100.0		121	65	140		0	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_WP_BTEX

Sample ID: **M111024LCS2** SampType: **LCS** TestCode: **8021_WP_BT** Units: **µg/L** Prep Date: RunNo: **137768**
Client ID: **LCSW** Batch ID: **M11VW208** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2269559**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	94.751	0.50	100.0	0	94.8	70	130				
Toluene	96.859	0.50	100.0	0	96.9	70	130				
Ethylbenzene	98.472	0.50	100.0	0	98.5	70	130				
m,p-Xylene	196.594	1.0	200.0	0	98.3	70	130				
o-Xylene	96.452	0.50	100.0	0	96.5	70	130				
Methyl tert-butyl ether	95.568	0.50	100.0	0	95.6	70	130				
Surr: Bromofluorobenzene (PID)	98.266		100.0		98.3	70	130				

Sample ID: **M111024MB1MS** SampType: **MS** TestCode: **8021_WP_BT** Units: **µg/L** Prep Date: RunNo: **137768**
Client ID: **ZZZZZZ** Batch ID: **M11VW208** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2269561**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	6.706	0.50	6.400	0	105	70	130				
Toluene	35.527	0.50	33.85	0	105	70	130				
Ethylbenzene	11.384	0.50	10.95	0	104	70	130				
m,p-Xylene	39.044	1.0	42.40	0	92.1	70	130				
o-Xylene	14.482	0.50	13.35	0	108	70	130				
Methyl tert-butyl ether	102.466	0.50	131.8	0	77.7	70	130				
Surr: Bromofluorobenzene (PID)	98.317		100.0		98.3	70	130				

Sample ID: **M111024MB1MSD** SampType: **MSD** TestCode: **8021_WP_BT** Units: **µg/L** Prep Date: RunNo: **137768**
Client ID: **ZZZZZZ** Batch ID: **M11VW208** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2269562**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	6.525	0.50	6.400	0	102	70	130	6.706	2.74	20	
Toluene	35.470	0.50	33.85	0	105	70	130	35.53	0.161	20	
Ethylbenzene	11.150	0.50	10.95	0	102	70	130	11.38	2.08	20	
m,p-Xylene	38.604	1.0	42.40	0	91.0	70	130	39.04	1.13	20	
o-Xylene	14.273	0.50	13.35	0	107	70	130	14.48	1.45	20	
Methyl tert-butyl ether	103.981	0.50	131.8	0	78.9	70	130	102.5	1.47	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8021_WP_BTEX

Sample ID: **M111024MB1MSD** SampType: **MSD** TestCode: **8021_WP_BT** Units: **µg/L** Prep Date: RunNo: **137768**
Client ID: **ZZZZZZ** Batch ID: **M11VW208** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2269562**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Bromofluorobenzene (PID)	99.442		100.0		99.4	70	130		0	0	

Sample ID: **M111024MB1** SampType: **MBLK** TestCode: **8021_WP_BT** Units: **µg/L** Prep Date: RunNo: **137768**
Client ID: **PBW** Batch ID: **M11VW208** TestNo: **EPA 8021B** Analysis Date: **10/24/2011** SeqNo: **2269563**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzene	ND	0.50									
Toluene	ND	0.50									
Ethylbenzene	ND	0.50									
m,p-Xylene	ND	1.0									
o-Xylene	ND	0.50									
Methyl tert-butyl ether	ND	0.50									
Surr: Bromofluorobenzene (PID)	97.592		100.0		97.6	70	130				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **MB-76434** SampType: **MBLK** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/24/2011** RunNo: **137764**
Client ID: **PBS** Batch ID: **76434** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/24/2011** SeqNo: **2263149**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDD	ND	2.0									
4,4´-DDE	ND	2.0									
4,4´-DDT	ND	2.0									
Aldrin	ND	1.0									
alpha-BHC	ND	1.0									
alpha-Chlordane	ND	1.0									
beta-BHC	ND	1.0									
Chlordane	ND	8.5									
delta-BHC	ND	1.0									
Dieldrin	ND	2.0									
Endosulfan I	ND	1.0									
Endosulfan II	ND	2.0									
Endosulfan sulfate	ND	2.0									
Endrin	ND	2.0									
Endrin aldehyde	ND	2.0									
Endrin ketone	ND	2.0									
gamma-BHC	ND	1.0									
gamma-Chlordane	ND	1.0									
Heptachlor	ND	1.0									
Heptachlor epoxide	ND	1.0									
Methoxychlor	ND	5.0									
Toxaphene	ND	50									
Surr: Tetrachloro-m-xylene	13.710		16.67		82.2	43	100				
Surr: Decachlorobiphenyl	13.271		16.67		79.6	39	104				

Sample ID: **LCS-76434** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/24/2011** RunNo: **137764**
Client ID: **LCSS** Batch ID: **76434** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/24/2011** SeqNo: **2263150**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Aldrin	13.699	1.0	16.67	0	82.2	56	108				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **LCS-76434** SampType: **LCS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/24/2011** RunNo: **137764**
Client ID: **LCSS** Batch ID: **76434** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/24/2011** SeqNo: **2263150**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Dieldrin	13.319	2.0	16.67	0	79.9	53	115				
Endrin	12.710	2.0	16.67	0	76.2	55	125				
gamma-BHC	14.251	1.0	16.67	0	85.5	59	110				
Heptachlor	15.473	1.0	16.67	0	92.8	53	114				
Surr: Tetrachloro-m-xylene	13.136		16.67		78.8	43	100				
Surr: Decachlorobiphenyl	12.676		16.67		76.0	39	104				

Sample ID: **120446-007AMS** SampType: **MS** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/24/2011** RunNo: **137764**
Client ID: **ZZZZZZ** Batch ID: **76434** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/24/2011** SeqNo: **2263151**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	11.771	2.0	16.67	0	70.6	17	165				
Aldrin	10.638	1.0	16.67	0	63.8	34	130				
Dieldrin	10.888	2.0	16.67	0	65.3	33	143				
Endrin	10.618	2.0	16.67	0	63.7	39	152				
gamma-BHC	11.252	1.0	16.67	0	67.5	37	131				
Heptachlor	12.485	1.0	16.67	0	74.9	31	140				
Surr: Tetrachloro-m-xylene	9.113		16.67		54.7	43	100				
Surr: Decachlorobiphenyl	9.749		16.67		58.5	39	104				

Sample ID: **120446-007AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/24/2011** RunNo: **137764**
Client ID: **ZZZZZZ** Batch ID: **76434** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/24/2011** SeqNo: **2263152**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
4,4´-DDT	12.428	2.0	16.67	0	74.6	17	165	11.77	5.43	20	
Aldrin	11.190	1.0	16.67	0	67.1	34	130	10.64	5.06	20	
Dieldrin	11.475	2.0	16.67	0	68.8	33	143	10.89	5.25	20	
Endrin	11.195	2.0	16.67	0	67.2	39	152	10.62	5.30	20	
gamma-BHC	11.878	1.0	16.67	0	71.3	37	131	11.25	5.42	20	
Heptachlor	13.223	1.0	16.67	0	79.3	31	140	12.48	5.75	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8081_S

Sample ID: **120446-007AMSD** SampType: **MSD** TestCode: **8081_S** Units: **µg/Kg** Prep Date: **10/24/2011** RunNo: **137764**
Client ID: **ZZZZZZ** Batch ID: **76434** TestNo: **EPA 8081A** **EPA 3550B** Analysis Date: **10/24/2011** SeqNo: **2263152**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Tetrachloro-m-xylene	9.626		16.67		57.7	43	100		0	0	
Surr: Decachlorobiphenyl	9.783		16.67		58.7	39	104		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
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CLIENT: Geocon Consultants
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ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: **T111024LCS1** SampType: **LCS** TestCode: **8260_S** Units: **µg/Kg** Prep Date: RunNo: **137745**
Client ID: **LCSS** Batch ID: **T11VS218** TestNo: **EPA 8260B** Analysis Date: **10/24/2011** SeqNo: **2262876**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	39.380	5.0	50.00	0	78.8	70	130				
Benzene	89.050	5.0	100.0	0	89.0	70	130				
Chlorobenzene	51.830	5.0	50.00	0	104	82	130				
MTBE	39.500	5.0	50.00	0	79.0	70	130				
Toluene	93.400	5.0	100.0	0	93.4	70	130				
Trichloroethene	49.630	5.0	50.00	0	99.3	77	130				
Surr: 1,2-Dichloroethane-d4	38.640		50.00		77.3	70	130				
Surr: 4-Bromofluorobenzene	44.100		50.00		88.2	70	130				
Surr: Dibromofluoromethane	41.100		50.00		82.2	70	130				
Surr: Toluene-d8	43.430		50.00		86.9	70	130				

Sample ID: **T111024MB1** SampType: **MBLK** TestCode: **8260_S** Units: **µg/Kg** Prep Date: RunNo: **137745**
Client ID: **PBS** Batch ID: **T11VS218** TestNo: **EPA 8260B** Analysis Date: **10/24/2011** SeqNo: **2262879**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	5.0									
1,1,1-Trichloroethane	ND	5.0									
1,1,2,2-Tetrachloroethane	ND	5.0									
1,1,2-Trichloroethane	ND	5.0									
1,1-Dichloroethane	ND	5.0									
1,1-Dichloroethene	ND	5.0									
1,1-Dichloropropene	ND	5.0									
1,2,3-Trichlorobenzene	ND	5.0									
1,2,3-Trichloropropane	ND	5.0									
1,2,4-Trichlorobenzene	ND	5.0									
1,2,4-Trimethylbenzene	ND	5.0									
1,2-Dibromo-3-chloropropane	ND	10									
1,2-Dibromoethane	ND	5.0									
1,2-Dichlorobenzene	ND	5.0									
1,2-Dichloroethane	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: **T111024MB1** SampType: **MBLK** TestCode: **8260_S** Units: **µg/Kg** Prep Date: RunNo: **137745**
Client ID: **PBS** Batch ID: **T11VS218** TestNo: **EPA 8260B** Analysis Date: **10/24/2011** SeqNo: **2262879**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2-Dichloropropane	ND	5.0									
1,3,5-Trimethylbenzene	ND	5.0									
1,3-Dichlorobenzene	ND	5.0									
1,3-Dichloropropane	ND	5.0									
1,4-Dichlorobenzene	ND	5.0									
2,2-Dichloropropane	ND	5.0									
2-Chlorotoluene	ND	5.0									
4-Chlorotoluene	ND	5.0									
4-Isopropyltoluene	ND	5.0									
Benzene	ND	5.0									
Bromobenzene	ND	5.0									
Bromodichloromethane	ND	5.0									
Bromoform	ND	5.0									
Bromomethane	ND	5.0									
Carbon tetrachloride	ND	5.0									
Chlorobenzene	ND	5.0									
Chloroethane	ND	5.0									
Chloroform	ND	5.0									
Chloromethane	ND	5.0									
cis-1,2-Dichloroethene	ND	5.0									
cis-1,3-Dichloropropene	ND	5.0									
Dibromochloromethane	ND	5.0									
Dibromomethane	ND	5.0									
Dichlorodifluoromethane	ND	5.0									
Ethylbenzene	ND	5.0									
Hexachlorobutadiene	ND	5.0									
Isopropylbenzene	ND	5.0									
m,p-Xylene	ND	10									
Methylene chloride	ND	5.0									
MTBE	ND	5.0									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_S

Sample ID: **T111024MB1** SampType: **MBLK** TestCode: **8260_S** Units: **µg/Kg** Prep Date: RunNo: **137745**
Client ID: **PBS** Batch ID: **T11VS218** TestNo: **EPA 8260B** Analysis Date: **10/24/2011** SeqNo: **2262879**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
n-Butylbenzene	ND	5.0									
n-Propylbenzene	ND	5.0									
Naphthalene	ND	5.0									
o-Xylene	ND	5.0									
sec-Butylbenzene	ND	5.0									
Styrene	ND	5.0									
tert-Butylbenzene	ND	5.0									
Tetrachloroethene	ND	5.0									
Toluene	ND	5.0									
trans-1,2-Dichloroethene	ND	5.0									
Trichloroethene	ND	5.0									
Trichlorofluoromethane	ND	5.0									
Vinyl chloride	ND	5.0									
Surr: 1,2-Dichloroethane-d4	38.410		50.00		76.8	70	130				
Surr: 4-Bromofluorobenzene	42.250		50.00		84.5	70	130				
Surr: Dibromofluoromethane	39.190		50.00		78.4	70	130				
Surr: Toluene-d8	43.760		50.00		87.5	70	130				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_WP_LL

Sample ID: **A111024LCS1** SampType: **LCS** TestCode: **8260_WP_LL** Units: **µg/L** Prep Date: RunNo: **137770**
Client ID: **LCSW** Batch ID: **A11VW206** TestNo: **EPA 8260B** Analysis Date: **10/24/2011** SeqNo: **2263247**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1-Dichloroethene	17.050	0.50	20.00	0	85.2	70	130				
Benzene	38.570	0.50	40.00	0	96.4	70	130				
Chlorobenzene	20.590	0.50	20.00	0	103	70	130				
MTBE	17.540	0.50	20.00	0	87.7	70	130				
Toluene	40.390	0.50	40.00	0	101	70	130				
Trichloroethene	20.110	0.50	20.00	0	101	70	130				
Surr: 1,2-Dichloroethane-d4	23.540		25.00		94.2	70	130				
Surr: 4-Bromofluorobenzene	25.580		25.00		102	70	130				
Surr: Dibromofluoromethane	23.950		25.00		95.8	70	130				
Surr: Toluene-d8	26.450		25.00		106	70	130				

Sample ID: **A111024MB1** SampType: **MBLK** TestCode: **8260_WP_LL** Units: **µg/L** Prep Date: RunNo: **137770**
Client ID: **PBW** Batch ID: **A11VW206** TestNo: **EPA 8260B** Analysis Date: **10/24/2011** SeqNo: **2263249**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,1,1,2-Tetrachloroethane	ND	0.50									
1,1,1-Trichloroethane	ND	0.50									
1,1,2,2-Tetrachloroethane	ND	0.50									
1,1,2-Trichloroethane	ND	0.50									
1,1-Dichloroethane	ND	0.50									
1,1-Dichloroethene	ND	0.50									
1,1-Dichloropropene	ND	0.50									
1,2,3-Trichlorobenzene	ND	0.50									
1,2,3-Trichloropropane	ND	0.50									
1,2,4-Trichlorobenzene	ND	0.50									
1,2,4-Trimethylbenzene	ND	0.50									
1,2-Dibromo-3-chloropropane	ND	0.50									
1,2-Dibromoethane	ND	0.50									
1,2-Dichlorobenzene	ND	0.50									
1,2-Dichloroethane	ND	0.50									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_WP_LL

Sample ID: **A111024MB1** SampType: **MBLK** TestCode: **8260_WP_LL** Units: **µg/L** Prep Date: RunNo: **137770**
Client ID: **PBW** Batch ID: **A11VW206** TestNo: **EPA 8260B** Analysis Date: **10/24/2011** SeqNo: **2263249**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2-Dichloropropane	ND	0.50									
1,3,5-Trimethylbenzene	ND	0.50									
1,3-Dichlorobenzene	ND	0.50									
1,3-Dichloropropane	ND	0.50									
1,4-Dichlorobenzene	ND	0.50									
2,2-Dichloropropane	ND	0.50									
2-Chlorotoluene	ND	0.50									
4-Chlorotoluene	ND	0.50									
4-Isopropyltoluene	ND	0.50									
Benzene	ND	0.50									
Bromobenzene	ND	0.50									
Bromodichloromethane	ND	0.50									
Bromoform	ND	0.50									
Bromomethane	ND	0.50									
Carbon tetrachloride	ND	0.50									
Chlorobenzene	ND	0.50									
Chloroethane	ND	0.50									
Chloroform	ND	0.50									
Chloromethane	ND	0.50									
cis-1,2-Dichloroethene	ND	0.50									
cis-1,3-Dichloropropene	ND	0.50									
Dibromochloromethane	ND	0.50									
Dibromomethane	ND	0.50									
Dichlorodifluoromethane	ND	0.50									
Ethylbenzene	ND	0.50									
Hexachlorobutadiene	ND	0.50									
Isopropylbenzene	ND	0.50									
m,p-Xylene	ND	1.0									
Methylene chloride	ND	1.0									
MTBE	ND	0.50									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8260_WP_LL

Sample ID: **A111024MB1** SampType: **MBLK** TestCode: **8260_WP_LL** Units: **µg/L** Prep Date: RunNo: **137770**
Client ID: **PBW** Batch ID: **A11VW206** TestNo: **EPA 8260B** Analysis Date: **10/24/2011** SeqNo: **2263249**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
n-Butylbenzene	ND	0.50									
n-Propylbenzene	ND	0.50									
Naphthalene	ND	0.50									
o-Xylene	ND	0.50									
sec-Butylbenzene	ND	0.50									
Styrene	ND	0.50									
tert-Butylbenzene	ND	0.50									
Tetrachloroethene	ND	0.50									
Toluene	ND	0.50									
trans-1,2-Dichloroethene	ND	0.50									
Trichloroethene	ND	0.50									
Trichlorofluoromethane	ND	0.50									
Vinyl chloride	ND	0.50									
Surr: 1,2-Dichloroethane-d4	21.790		25.00		87.2	70	130				
Surr: 4-Bromofluorobenzene	24.520		25.00		98.1	70	130				
Surr: Dibromofluoromethane	23.840		25.00		95.4	70	130				
Surr: Toluene-d8	26.050		25.00		104	70	130				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S_FULL

Sample ID: **MB-76459** SampType: **MBLK** TestCode: **8270_S_FULL** Units: **µg/Kg** Prep Date: **10/25/2011** RunNo: **137809**
Client ID: **PBS** Batch ID: **76459** TestNo: **EPA 8270C** **EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2263903**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2,4-Trichlorobenzene	ND	330									
1,2-Dichlorobenzene	ND	330									
1,3-Dichlorobenzene	ND	330									
1,4-Dichlorobenzene	ND	330									
2,4,5-Trichlorophenol	ND	330									
2,4,6-Trichlorophenol	ND	330									
2,4-Dichlorophenol	ND	1600									
2,4-Dimethylphenol	ND	330									
2,4-Dinitrophenol	ND	1600									
2,4-Dinitrotoluene	ND	330									
2,6-Dinitrotoluene	ND	330									
2-Chloronaphthalene	ND	330									
2-Chlorophenol	ND	330									
2-Methylnaphthalene	ND	330									
2-Methylphenol	ND	330									
2-Nitroaniline	ND	1600									
2-Nitrophenol	ND	330									
3,3´-Dichlorobenzidine	ND	660									
3-Nitroaniline	ND	1600									
4,6-Dinitro-2-methylphenol	ND	1600									
4-Bromophenyl-phenylether	ND	330									
4-Chloro-3-methylphenol	ND	660									
4-Chloroaniline	ND	660									
4-Chlorophenyl-phenylether	ND	330									
4-Methylphenol	ND	330									
4-Nitroaniline	ND	1600									
4-Nitrophenol	ND	1600									
Acenaphthene	ND	330									
Acenaphthylene	ND	330									
Anthracene	ND	330									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S_FULL

Sample ID: **MB-76459**	SampType: **MBLK**	TestCode: **8270_S_FULL**	Units: **µg/Kg**	Prep Date: **10/25/2011**	RunNo: **137809**
Client ID: **PBS**	Batch ID: **76459**	TestNo: **EPA 8270C**	**EPA 3550B**	Analysis Date: **10/25/2011**	SeqNo: **2263903**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Benzidine (M)	ND	1600									
Benzo(a)anthracene	ND	330									
Benzo(a)pyrene	ND	330									
Benzo(b)fluoranthene	ND	330									
Benzo(g,h,i)perylene	ND	330									
Benzo(k)fluoranthene	ND	330									
Benzoic acid	ND	1600									
Benzyl alcohol	ND	660									
Bis(2-chloroethoxy)methane	ND	330									
Bis(2-chloroethyl)ether	ND	330									
Bis(2-chloroisopropyl)ether	ND	330									
Bis(2-ethylhexyl)phthalate	ND	330									
Butylbenzylphthalate	ND	330									
Chrysene	ND	330									
Di-n-butylphthalate	ND	330									
Di-n-octylphthalate	ND	330									
Dibenz(a,h)anthracene	ND	330									
Dibenzofuran	ND	330									
Diethylphthalate	ND	330									
Dimethylphthalate	ND	330									
Fluoranthene	ND	330									
Fluorene	ND	330									
Hexachlorobenzene	ND	330									
Hexachlorobutadiene	ND	660									
Hexachlorocyclopentadiene	ND	660									
Hexachloroethane	ND	330									
Indeno(1,2,3-cd)pyrene	ND	330									
Isophorone	ND	330									
N-Nitrosodi-n-propylamine	ND	330									
N-Nitrosodiphenylamine	ND	330									

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S_FULL

Sample ID: **MB-76459** SampType: **MBLK** TestCode: **8270_S_FULL** Units: **µg/Kg** Prep Date: **10/25/2011** RunNo: **137809**
Client ID: **PBS** Batch ID: **76459** TestNo: **EPA 8270C** **EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2263903**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Naphthalene	ND	330									
Nitrobenzene	ND	330									
Pentachlorophenol	ND	1600									
Phenanthrene	ND	330									
Phenol	ND	330									
Pyrene	ND	330									
Surr: 1,2-Dichlorobenzene-d4	2962.667		3330		89.0	47	99				
Surr: 2,4,6-Tribromophenol	2806.333		3330		84.3	25	116				
Surr: 2-Chlorophenol-d4	3107.333		3330		93.3	45	102				
Surr: 2-Fluorobiphenyl	3075.000		3330		92.3	56	107				
Surr: 2-Fluorophenol	2985.333		3330		89.6	39	100				
Surr: 4-Terphenyl-d14	3093.667		3330		92.9	52	123				
Surr: Nitrobenzene-d5	2958.333		3330		88.8	41	102				
Surr: Phenol-d5	2917.000		3330		87.6	42	104				

Sample ID: **120362-056AMS** SampType: **MS** TestCode: **8270_S_FULL** Units: **µg/Kg** Prep Date: **10/25/2011** RunNo: **137809**
Client ID: **Composite B70-2, B** Batch ID: **76459** TestNo: **EPA 8270C** **EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2263905**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2,4-Trichlorobenzene	3163.000	330	3330	0	95.0	59	105				
1,4-Dichlorobenzene	2858.000	330	3330	0	85.8	52	102				
2,4-Dinitrotoluene	3739.000	330	3330	0	112	67	126				
2-Chlorophenol	3085.333	330	3330	0	92.7	53	101				
4-Chloro-3-methylphenol	3483.333	660	3330	0	105	62	114				
4-Nitrophenol	3395.333	1600	3330	0	102	45	125				
Acenaphthene	3402.667	330	3330	0	102	67	113				
N-Nitrosodi-n-propylamine	2503.333	330	3330	0	75.2	53	112				
Pentachlorophenol	3122.000	1600	3330	0	93.8	27	114				
Phenol	3100.667	330	3330	0	93.1	54	104				
Pyrene	3364.667	330	3330	0	101	65	121				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S_FULL

Sample ID: **120362-056AMS** SampType: **MS** TestCode: **8270_S_FULL** Units: **µg/Kg** Prep Date: **10/25/2011** RunNo: **137809**
Client ID: **Composite B70-2, B** Batch ID: **76459** TestNo: **EPA 8270C EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2263905**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: 1,2-Dichlorobenzene-d4	2750.667		3330		82.6	47	99				
Surr: 2,4,6-Tribromophenol	3224.333		3330		96.8	25	116				
Surr: 2-Chlorophenol-d4	2876.333		3330		86.4	45	102				
Surr: 2-Fluorobiphenyl	3027.333		3330		90.9	56	107				
Surr: 2-Fluorophenol	2748.333		3330		82.5	39	100				
Surr: 4-Terphenyl-d14	3572.667		3330		107	52	123				
Surr: Nitrobenzene-d5	2785.667		3330		83.7	41	102				
Surr: Phenol-d5	2704.667		3330		81.2	42	104				

Sample ID: **120362-056AMSD** SampType: **MSD** TestCode: **8270_S_FULL** Units: **µg/Kg** Prep Date: **10/25/2011** RunNo: **137809**
Client ID: **Composite B70-2, B** Batch ID: **76459** TestNo: **EPA 8270C EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2263906**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2,4-Trichlorobenzene	3112.000	330	3330	0	93.5	59	105	3163	1.63	20	
1,4-Dichlorobenzene	2825.333	330	3330	0	84.8	52	102	2858	1.15	20	
2,4-Dinitrotoluene	3843.000	330	3330	0	115	67	126	3739	2.74	20	
2-Chlorophenol	3036.667	330	3330	0	91.2	53	101	3085	1.59	20	
4-Chloro-3-methylphenol	3536.667	660	3330	0	106	62	114	3483	1.52	20	
4-Nitrophenol	3453.000	1600	3330	0	104	45	125	3395	1.68	20	
Acenaphthene	3462.333	330	3330	0	104	67	113	3403	1.74	20	
N-Nitrosodi-n-propylamine	2546.000	330	3330	0	76.5	53	112	2503	1.69	20	
Pentachlorophenol	3287.000	1600	3330	0	98.7	27	114	3122	5.15	20	
Phenol	3068.333	330	3330	0	92.1	54	104	3101	1.05	20	
Pyrene	3483.000	330	3330	0	105	65	121	3365	3.46	20	
Surr: 1,2-Dichlorobenzene-d4	2707.333		3330		81.3	47	99		0	0	
Surr: 2,4,6-Tribromophenol	3273.667		3330		98.3	25	116		0	0	
Surr: 2-Chlorophenol-d4	2835.333		3330		85.1	45	102		0	0	
Surr: 2-Fluorobiphenyl	3047.667		3330		91.5	56	107		0	0	
Surr: 2-Fluorophenol	2689.333		3330		80.8	39	100		0	0	
Surr: 4-Terphenyl-d14	3672.000		3330		110	52	123		0	0	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 8270_S_FULL

Sample ID: **120362-056AMSD** SampType: **MSD** TestCode: **8270_S_FULL** Units: **µg/Kg** Prep Date: **10/25/2011** RunNo: **137809**
Client ID: **Composite B70-2, B** Batch ID: **76459** TestNo: **EPA 8270C** **EPA 3550B** Analysis Date: **10/25/2011** SeqNo: **2263906**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Surr: Nitrobenzene-d5	2750.333		3330		82.6	41	102		0	0	
Surr: Phenol-d5	2648.000		3330		79.5	42	104		0	0	

Sample ID: **LCS-76459** SampType: **LCS** TestCode: **8270_S_FULL** Units: **µg/Kg** Prep Date: **10/25/2011** RunNo: **137809**
Client ID: **LCSS** Batch ID: **76459** TestNo: **EPA 8270C** **EPA 3550B** Analysis Date: **10/26/2011** SeqNo: **2263984**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
1,2,4-Trichlorobenzene	2829.667	330	3330	0	85.0	70	98				
1,4-Dichlorobenzene	2804.000	330	3330	0	84.2	66	94				
2,4-Dinitrotoluene	3045.000	330	3330	0	91.4	78	118				
2-Chlorophenol	3057.000	330	3330	0	91.8	65	90				S
4-Chloro-3-methylphenol	3055.000	660	3330	0	91.7	72	105				
4-Nitrophenol	2784.667	1600	3330	0	83.6	61	116				
Acenaphthene	2798.333	330	3330	0	84.0	72	110				
N-Nitrosodi-n-propylamine	2924.000	330	3330	0	87.8	66	102				
Pentachlorophenol	3251.000	1600	3330	0	97.6	54	103				
Phenol	3001.667	330	3330	0	90.1	65	94				
Pyrene	2737.000	330	3330	0	82.2	71	117				
Surr: 1,2-Dichlorobenzene-d4	2665.000		3330		80.0	47	99				
Surr: 2,4,6-Tribromophenol	2624.667		3330		78.8	25	116				
Surr: 2-Chlorophenol-d4	2823.333		3330		84.8	45	102				
Surr: 2-Fluorobiphenyl	2518.000		3330		75.6	56	107				
Surr: 2-Fluorophenol	2721.000		3330		81.7	39	100				
Surr: 4-Terphenyl-d14	3013.000		3330		90.5	52	123				
Surr: Nitrobenzene-d5	2453.333		3330		73.7	41	102				
Surr: Phenol-d5	2642.000		3330		79.3	42	104				

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 *Tel: 562. 989.4045* *Fax: 562.989.4040*

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: 10/20/11

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt: 2.4
1. CHILLED Y ☐ N ☐ 4. SEALED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐ 5. # OF SPLS MATCH COC Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐ 6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien / Josh Ewert (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien / Josh Ewert	10/17/11	1500	ONTRAC	10/17/11	1500
			Mary	10/18/11	8:14

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Josh Ewert 10/17/11
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:
Please composite samples as shown. Do not run discrete at this time

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested — SPECIFY APPROPRIATE MATRIX

ITEM	LAB USE ONLY: Lab No.	Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SVOCs	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	1203362-001	B70-0	10/13/11	0856	X								X	X				X					E	1	P	T	C	composite
	2	B71-0 composite		0925	X								X	X														
	3	B72-0		0931	X								X	X														
	4	B70-2		0857		X									X		X											composite
	5	B71-2 composite		0926		X									X		X											
	6	B72-2		0932		X									X		X											
	7	B73-0		0954	X									X														composite
	8	~~B73-0~~ B74-0 composite		0938	X									X														
	9	B75-0		0946	X									X														
	10	B65-0		0907	X																							

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐
4. SEALED Y ☐ N ☐
5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien / Josh Ewert (Signature)

Relinquished by: (Signature and Printed Name) Mike O'Brien / Josh Ewert Date: 10/17/11 Time: 1500
Received by: (Signature and Printed Name) ONTRAC Date: 10/17/11 Time: 1500

Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Mary Date: 10/18/11 Time: 8:14

Relinquished by: (Signature and Printed Name) Date: Time:
Received by: (Signature and Printed Name) Date: Time:

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Josh Ewert 10/17/11
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	5 wks	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	1203682-11	B73-2	10/13/11	0955			X					X		X		X		X					E	1	P T	C	composite
	12	B74-2		0939			X					X		X		X											
	13	B75-2		0947			X					X		X		X											
		~~B65-2~~		~~0908~~																							
	14	B65-2		0908								X															
	15	B55-0		1004										X													
	16	B55-4		1005								X			X												
	17	B54-0		1046										X													
	18	B54-4		1047								X			X												
	19	B63-0		1148	X							X															

- TAT starts 8AM the following day if samples received after 3 PM

TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

Container Types: T=Tube V=VOA L=Liter P=Pint J=Jar B=Tedlar G=Glass P=Plastic M=Metal

Preservatives:
H=HCl N=HNO_3 S=H_2SO_4 C=4°C
Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐
4. SEALED Y ☐ N ☐
5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien / Josh Ewert (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien / Josh Ewert	10/17/11	1500	ONTRAC	10/17/11	1500
			Mark	10/18/11	8:14

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Josh Ewert 10/17/11
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

SPECIFY APPROPRIATE MATRIX

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
		~~B63-2~~	~~10/13/11~~	~~1149~~													X					E	1	P T	C	
	120862-20	B64-0	10/13/11	1158	X																					
	21	B64-2		1159								X														
	22	BS3-0		1238									X													
	23	BS3-4		1239								X		X												
	24	B36-0		1419	X																					
	25	B36-2		1420								X														
	26	B3-0		1423								X	X	X												
	27	B3-1		1424									X	X	X											
	28	B3-2		1425									X	X	X											

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TAT: A = Overnight ≤ 24 hrs; B = Emergency Next Workday; C = Critical 2 Workdays; D = Urgent 3 Workdays; E = Routine 7 Workdays

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Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

CHAIN OF CUSTODY RECORD

Advanced Technology Laboratories
3275 Walnut Avenue
Signal Hill, CA 90755
Tel: (562) 989-4045 • Fax: (562) 989-4040

FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
3. CONTAINER INTACT Y ☐ N ☐
4. SEALED Y ☐ N ☐
5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien / Josh Ewert (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien / Josh Ewert	10/17/11	1500	ONTRAC	10/17/11	1500
			Margo	10/18/11	8:14

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Josh Ewert 10/17/11
Print Name Date
Signature

Send Report To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Bill To:
Attn:
Co: SAME AS ABOVE
Addr:
City: State: Zip:

Special Instructions/Comments:

Sample/Records - Archival & Disposal
Unless otherwise requested by client, all samples will be disposed 45 days after receipt and records will be disposed 1 year after submittal of final report.

Storage Fees (applies when storage is requested):
- Sample :$2.00 / sample /mo (after 45 days)
- Records: $1 /ATL workorder /mo (after 1 year)

Circle or Add Analysis(es) Requested

QA/QC: RTNE ☑ CT ☐ SWRCB ☐ Logcode_____ OTHER _____

ITEM	LAB USE ONLY: Lab No.	Sample Description: Sample ID / Location	Date	Time	8081A (Pesticides)	8082 (PCB)	8260B (Volatiles)	8270C (BNA)	6010B (Total Metal)	8015B (GRO) / 8020 (BTEX)	8015B (DRO)	8021 (BTEX)	TITLE 22 / CAM 17 (6010 / 7000)	TPHd/TPHmo (8015)	TPHg/BTEX/MTBE (8015/8021B)	Lead (6010B)	pH	SOIL	WATER	GROUND WATER	WASTEWATER	CARBON	TAT	Container(s) #	Container(s) Type	PRESERVATION	REMARKS
	120362-29	B2-0	10/13/11	1432									X		X			X					E	1	P T	C	
	30	B2-1		1433										X	X												
	31	B2-2		1434											X												
	32	B1-0		1441									X		X												
	33	B1-1		1442										X	X	X											
	34	B1-2		1443											X												
	35	B5-0		1457									X		X												
	36	B5-1		1458										X	X												
	37	B5-2		1459								X															
	38	B6-0		1503								X	X														

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Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

CHAIN OF CUSTODY RECORD

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FOR LABORATORY USE ONLY

P.O. #: _____
Logged By: _____ Date: _____

Method of Transport: Client ☐ ATL ☐ CA OverN ☐ FedEx ☐ Other: _____

Sample Condition Upon Receipt:
1. CHILLED Y ☐ N ☐
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5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

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Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien / Josh Ewert (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien / Josh Ewert	10/17/11	1500	ONTRAC	10/17/11	1500
			Mago	10/18/11	8:14

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Josh Ewert
Print Name Date
Signature

Send Report To: Attn: _____ Co: SAME AS ABOVE Addr: _____ City: State: Zip:

Bill To: Attn: _____ Co: SAME AS ABOVE Addr: _____ City: State: Zip:

Special Instructions/Comments:

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	120362-39	B6-1	10/13/11	1504										X		X		X					E	1	P T	C	
	40	B6-2		1505												X	X										
	41	B7-0		1508									X			X											
	42	B7-1		1509										X		X											
	43	B7-2		1516												X											
	44	B37-0		1530	X							X															
		~~B37-2~~		~~1531~~																							
	45	B38-0		1537	X																						
	46	B38-2		1538								X															
	47	B51-0		1616								~~X~~	X														

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			Mgr	10/18/11	8:14

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Project Mgr /Submitter: Josh Ewert 10/17/11
Print Name Date
Signature

Send Report To:
Attn: _____
Co: SAME AS ABOVE
Addr: _____
City: State: Zip:

Bill To:
Attn: _____
Co: SAME AS ABOVE
Addr: _____
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	120362-48	BS1-4	10/17/11	1617								X		X			X					E	1	P/J	C	
	49	BS2-0		1711									X													
	50	BS2-4		1712								X		X												
	51	BG6-0		1745	X																					
	52	BG6-2		1746								X														

RS 10/17/11

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CHAIN OF CUSTODY RECORD

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P.O. #: _____
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1. CHILLED Y ☐ N ☐
2. HEADSPACE (VOA) Y ☐ N ☐
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4. SEALED Y ☐ N ☐
5. # OF SPLS MATCH COC Y ☐ N ☐
6. PRESERVED Y ☐ N ☐

Client: GEOCON Consultants, Inc
Attention: Chris Giuntoli
Address: 6671 Brisa Street
City: Livermore State: CA Zip Code: 94550
Tel: 925.371.5900
Fax: 925.371.5915

Project Name: 80/680/12 Interchange
Project #: E8128-06-07
Sampler: (Printed Name) Mike O'Brien / Josh Ewert (Signature)

Relinquished by: (Signature and Printed Name)	Date:	Time:	Received by: (Signature and Printed Name)	Date:	Time:
Mike O'Brien / Josh Ewert	10/17/11	1500	ON TRAC	10/17/11	1500
			Mark	10/18/11	8:14

I hereby authorize ATL to perform the work indicated below:
Project Mgr /Submitter: Josh Ewert 10/17/11
Print Name Date
Signature

Send Report To: Attn: _____ Co: SAME AS ABOVE Addr: _____ City: State: Zip:

Bill To: Attn: _____ Co: SAME AS ABOVE Addr: _____ City: State: Zip:

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	120362 SB	BS4	10/13/11	1118			X							X				X				E	5	V G	H/C	
		BS4		1118								X											1	Poly	C	
		BS4		1118									X										2	L G	C	
		~~BS3~~					X							X									5	V G	H/C	
		~~BS3~~										X											1	Poly	C	
		~~BS3~~											X										2	L G	C	
	54	BS1		1643			X							X									5	V G	H/C	
		BS1		1643								X											1	Poly	C	
		BS1		1643									X										2	L G	C	

- TAT starts 8AM the following day if samples received after 3 PM

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Preservatives: H=HCl N=HNO_3 S=H_2SO_4 C=4°C Z=$Zn(AC)_2$ O=NaOH T=$Na_2S_2O_3$

November 18, 2011

ELAP No.: 1838
NELAP No.: 02107CA
CSDLAC No.: 10196
ORELAP No.: CA300003

Chris Giuntoli
Geocon Consultants
4010 Technology Way, Suite D
Carson City, NV 89706

TEL: (775) 888-9900
FAX: (775) 888-9904

Workorder No.: 120362

RE: 80/680/12 Interchange, E8128-06-07

Attention: Chris Giuntoli

Enclosed are the results for sample(s) received on October 18, 2011 by Advanced Technology Laboratories . The sample(s) are tested for the parameters as indicated in the enclosed chain of custody in accordance with the applicable laboratory certifications.

This is an addendum report. Please incorporate with documentation previously submitted.

Thank you for the opportunity to service the needs of your company.

Please feel free to call me at (562)989-4045 if I can be of further assistance to your company.

Sincerely,

Eddie F. Rodriguez
Laboratory Director

The cover letter is an integral part of this analytical report. This Laboratory Report cannot be reproduced in part or in its entirety without written permission from the client and Advanced Technology Laboratories.

Advanced Technology Laboratories
3275 Walnut Avenue Signal Hill, CA 90755 Tel: 562 989-4045 Fax: 562 989-4040

Advanced Technology Laboratories

Date: *18-Nov-11*

CLIENT: Geocon Consultants
Project: 80/680/12 Interchange, E8128-06-07
Lab Order: 120362

CASE NARRATIVE

Analytical Comments for Method 7420

Dilution was necessary for sample 120362-039A, due to sample matrix.

Matrix Spike (MS) and /or Matrix Spike Duplicate (MSD) are/is outside recovery criteria for samples 120362-039AMS and 120362-039AMSD; however, the analytical batch was validated by the Laboratory Control Sample (LCS).

Advanced Technology Laboratories
3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *18-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B63-0
Lab Order:	120362	**Collection Date:**	10/13/2011 11:48:00 AM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-019A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
LEAD BY ATOMIC ABSORPTION						
WET			**WET DI/ EPA 7420**			
RunID: AA2_111118C QC Batch: 76867				PrepDate: 11/16/2011	Analyst: **VV**	
Lead	ND	0.50		mg/L	1	11/18/2011 03:08 PM
LEAD BY ATOMIC ABSORPTION (STLC)						
WET			**WET/ EPA 7420**			
RunID: AA2_111118D QC Batch: 76868				PrepDate: 11/16/2011	Analyst: **VV**	
Lead	2.8	0.50		mg/L	1	11/18/2011 03:19 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *18-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B2-2
Lab Order:	120362	**Collection Date:**	10/13/2011 2:34:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-031A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
LEAD BY ATOMIC ABSORPTION						
WET			**WET DI/ EPA 7420**			
RunID: AA2_111118C QC Batch: 76867				PrepDate: 11/16/2011	Analyst: **VV**	
Lead	ND	0.50		mg/L	1	11/18/2011 03:08 PM
LEAD BY ATOMIC ABSORPTION (STLC)						
WET			**WET/ EPA 7420**			
RunID: AA2_111118D QC Batch: 76868				PrepDate: 11/16/2011	Analyst: **VV**	
Lead	3.8	0.50		mg/L	1	11/18/2011 03:19 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

3275 Walnut Avenue, Signal Hill, CA 90755 Tel: 562. 989.4045 Fax: 562.989.4040

Advanced Technology Laboratories

ANALYTICAL RESULTS

Print Date: *18-Nov-11*

CLIENT:	Geocon Consultants	**Client Sample ID:**	B6-1
Lab Order:	120362	**Collection Date:**	10/13/2011 3:04:00 PM
Project:	80/680/12 Interchange, E8128-06-07	**Matrix:**	SOIL
Lab ID:	120362-039A		

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
LEAD BY ATOMIC ABSORPTION						
WET			**WET DI/ EPA 7420**			
RunID: AA2_111118C QC Batch: 76867				PrepDate: 11/16/2011	Analyst: **VV**	
Lead	ND	0.50		mg/L	1	11/18/2011 03:08 PM
LEAD BY ATOMIC ABSORPTION (STLC)						
WET			**WET/ EPA 7420**			
RunID: AA2_111118D QC Batch: 76868				PrepDate: 11/16/2011	Analyst: **VV**	
Lead	75	5.0		mg/L	10	11/18/2011 03:21 PM

Qualifiers:				
	B	Analyte detected in the associated Method Blank	E	Value above quantitation range
	H	Holding times for preparation or analysis exceeded	ND	Not Detected at the Reporting Limit
	S	Spike/Surrogate outside of limits due to matrix interference		Results are wet unless otherwise specified
	DO	Surrogate Diluted Out		

Advanced Technology Laboratories

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CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_DI

Sample ID: **MB-76867A** SampType: **MBLK** TestCode: **7420_DI** Units: **mg/L** Prep Date: **11/16/2011** RunNo: **138352**
Client ID: **PBS** Batch ID: **76867** TestNo: **WET DI/ EPA WET** Analysis Date: **11/18/2011** SeqNo: **2273958**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Sample ID: **LCS-76867** SampType: **LCS** TestCode: **7420_DI** Units: **mg/L** Prep Date: **11/16/2011** RunNo: **138352**
Client ID: **LCSS** Batch ID: **76867** TestNo: **WET DI/ EPA WET** Analysis Date: **11/18/2011** SeqNo: **2273959**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.032	0.50	5.000	0	101	80	120				

Sample ID: **120362-039A-MS** SampType: **MS** TestCode: **7420_DI** Units: **mg/L** Prep Date: **11/16/2011** RunNo: **138352**
Client ID: **B6-1** Batch ID: **76867** TestNo: **WET DI/ EPA WET** Analysis Date: **11/18/2011** SeqNo: **2273964**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	4.942	0.50	5.000	0.1270	96.3	70	130				

Sample ID: **120362-039A-MSD** SampType: **MSD** TestCode: **7420_DI** Units: **mg/L** Prep Date: **11/16/2011** RunNo: **138352**
Client ID: **B6-1** Batch ID: **76867** TestNo: **WET DI/ EPA WET** Analysis Date: **11/18/2011** SeqNo: **2273965**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.157	0.50	5.000	0.1270	101	70	130	4.942	4.26	20	

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

CLIENT: Geocon Consultants
Work Order: 120362
Project: 80/680/12 Interchange, E8128-06-07

ANALYTICAL QC SUMMARY REPORT

TestCode: 7420_ST

Sample ID: **MB-76868A** SampType: **MBLK** TestCode: **7420_ST** Units: **mg/L** Prep Date: **11/16/2011** RunNo: **138353**
Client ID: **PBS** Batch ID: **76868** TestNo: **WET/ EPA 74 WET** Analysis Date: **11/18/2011** SeqNo: **2273974**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	ND	0.50									

Sample ID: **LCS-76868** SampType: **LCS** TestCode: **7420_ST** Units: **mg/L** Prep Date: **11/16/2011** RunNo: **138353**
Client ID: **LCSS** Batch ID: **76868** TestNo: **WET/ EPA 74 WET** Analysis Date: **11/18/2011** SeqNo: **2273975**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	5.074	0.50	5.000	0	101	80	120				

Sample ID: **120362-039A-MS** SampType: **MS** TestCode: **7420_ST** Units: **mg/L** Prep Date: **11/16/2011** RunNo: **138353**
Client ID: **B6-1** Batch ID: **76868** TestNo: **WET/ EPA 74 WET** Analysis Date: **11/18/2011** SeqNo: **2273980**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	77.992	5.0	5.000	74.97	60.5	80	120				S

Sample ID: **120362-039A-MSD** SampType: **MSD** TestCode: **7420_ST** Units: **mg/L** Prep Date: **11/16/2011** RunNo: **138353**
Client ID: **B6-1** Batch ID: **76868** TestNo: **WET/ EPA 74 WET** Analysis Date: **11/18/2011** SeqNo: **2273981**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Lead	78.173	5.0	5.000	74.97	64.1	80	120	77.99	0.231	20	S

Qualifiers:

B	Analyte detected in the associated Method Blank	E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
ND	Not Detected at the Reporting Limit	R	RPD outside accepted recovery limits	S	Spike/Surrogate outside of limits due to matrix interference
DO	Surrogate Diluted Out		Calculations are based on raw values		

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Rachelle Arada

From: Chris Giuntoli [giuntoli@geoconinc.com]
Sent: Tuesday, November 15, 2011 8:30 AM
To: Diane Galvan
Subject: RE: Results/EDD - 80/680/12 Interchange (120362)

Hi Diane,

For workorder 120362, please run WETs and DI-WETs on a 72-hr TAT for the following samples:

B2-2,
B6-1, and
B63-0.

Thanks,
Chris

From: Diane Galvan [mailto:diane@atlglobal.com]
Sent: Monday, November 14, 2011 7:18 PM
To: giuntoli@geoconinc.com
Cc: livermore@geoconinc.com
Subject: Results/EDD - 80/680/12 Interchange (120362)

Hi Chris,

Here are the results and Excel EDD.

Thanks,

Diane Galvan
Project Manager

Advanced Technology Laboratories
www.atlglobal.com
Tel: (562) 989-4045 ext. 238
Fax: (562) 989-4040

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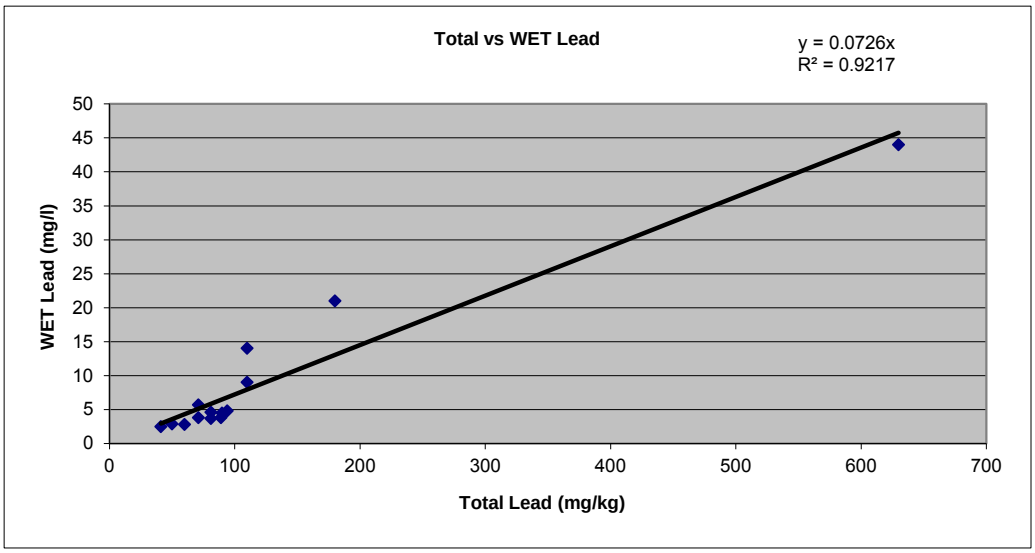
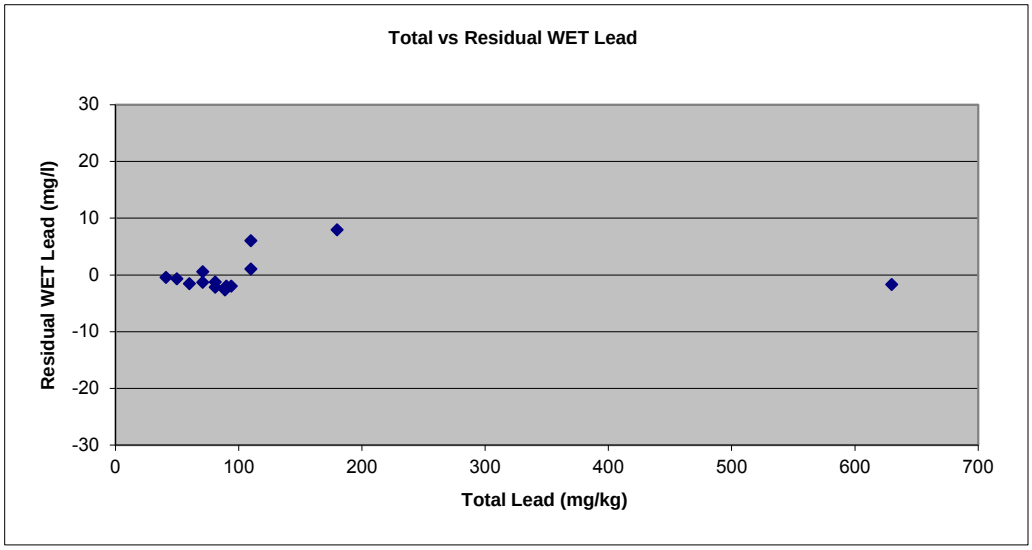
APPENDIX C

APPENDIX C

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	Residual WET Lead (mg/l)	Squared Residual WET Lead (mg/l)
B6-1	1	41	2.5	-0.48	0.23
B21-1.0	1	71	5.7	0.54	0.30
B23-1.0	1	50	2.9	-0.73	0.53
B22-1.0	1	110	9.0	1.01	1.02
B21-0.0	0	81	4.6	-1.28	1.64
B24-0.0	0	71	3.8	-1.36	1.84
B63-0	0	60	2.8	-1.56	2.42
B11-0	0	630	44	-1.75	3.06
B69-0	0	94	4.8	-2.03	4.10
B20-0.0	0	90	4.5	-2.04	4.14
B19-0.0	0	81	3.7	-2.18	4.76
B2-2	2	89	3.8	-2.66	7.09
B15-1	1	110	14	6.01	36.15
B23-0.0	0	180	21	7.93	62.87





A1-0

Number of Valid Observations	5
Number of Distinct Observations	5
Minimum	7.1
Maximum	25
Mean	13.44
Median	13
SD	7.121
Variance	50.71
Coefficient of Variation	0.53
Skewness	1.313
Mean of log data	2.495
SD of log data	0.5
90% Standard Bootstrap UCL	**17.06**
95% Standard Bootstrap UCL	**18.24**

A1-1

Number of Valid Observations	4
Number of Distinct Observations	4
Minimum	6.4
Maximum	19

A1-2

Number of Valid Observations	5
Number of Distinct Observations	5
Minimum	1.9
Maximum	89
Mean	29.02
Median	5.6
SD	37.76
Variance	1426
Coefficient of Variation	1.301
Skewness	1.33
Mean of log data	2.433
SD of log data	1.627
90% Standard Bootstrap UCL	**48.43**
95% Standard Bootstrap UCL	**53.91**

B-0

Number of Valid Observations	15
Number of Distinct Observations	14
Minimum	1.4
Maximum	630
Mean	85.45
Median	46
SD	158.4
Variance	25103
Coefficient of Variation	1.854
Skewness	3.291
Mean of log data	3.134
SD of log data	1.898
90% Standard Bootstrap UCL	**136**
95% Standard Bootstrap UCL	**149.5**

B-1

Number of Valid Observations	15
Number of Distinct Observations	14
Minimum	2.5
Maximum	110
Mean	33.4
Median	22
SD	36.78
Variance	1353
Coefficient of Variation	1.101
Skewness	1.337
Mean of log data	2.846
SD of log data	1.28
90% Standard Bootstrap UCL	**45.09**
95% Standard Bootstrap UCL	**48.22**

B-2

Number of Valid Observations	15
Number of Distinct Observations	15
Minimum	2.5
Maximum	31
Mean	9.007
Median	5.9
SD	8.364
Variance	69.96
Coefficient of Variation	0.929
Skewness	1.775
Mean of log data	1.887
SD of log data	0.773
90% Standard Bootstrap UCL	**11.63**
95% Standard Bootstrap UCL	**12.37**

C-0

Number of Valid Observations	10
Number of Distinct Observations	9
Minimum	6
Maximum	49
Mean	16.36
Median	13.5
SD	12.49
Variance	155.9
Coefficient of Variation	0.763
Skewness	2.296
Mean of log data	2.605
SD of log data	0.616
90% Standard Bootstrap UCL	**21.2**
95% Standard Bootstrap UCL	**22.44**

C-1.5

Number of Valid Observations	6
Number of Distinct Observations	5
Minimum	5.1
Maximum	8.3
Mean	6.517
Median	6.7
SD	1.13
Variance	1.278
Coefficient of Variation	0.173
Skewness	0.379
Mean of log data	1.862
SD of log data	0.173
90% Standard Bootstrap UCL	**7.059**
95% Standard Bootstrap UCL	**7.216**

As

Number of Valid Observations	43
Number of Distinct Observations	30
Minimum	0.5
Maximum	11
Mean	3.195
Median	3.3
SD	1.962
Variance	3.848
Coefficient of Variation	0.614
Skewness	1.47
Mean of log data	0.933
SD of log data	0.775
95% Standard Bootstrap UCL	**3.7**

Pb

Number of Valid Observations	98
Number of Distinct Observations	69
Minimum	1
Maximum	630
Mean	27.66
Median	8.15
SD	68.55
Variance	4700
Coefficient of Variation	2.479
Skewness	7.31
Mean of log data	2.38
SD of log data	1.243
95% Standard Bootstrap UCL	**39.06**

V

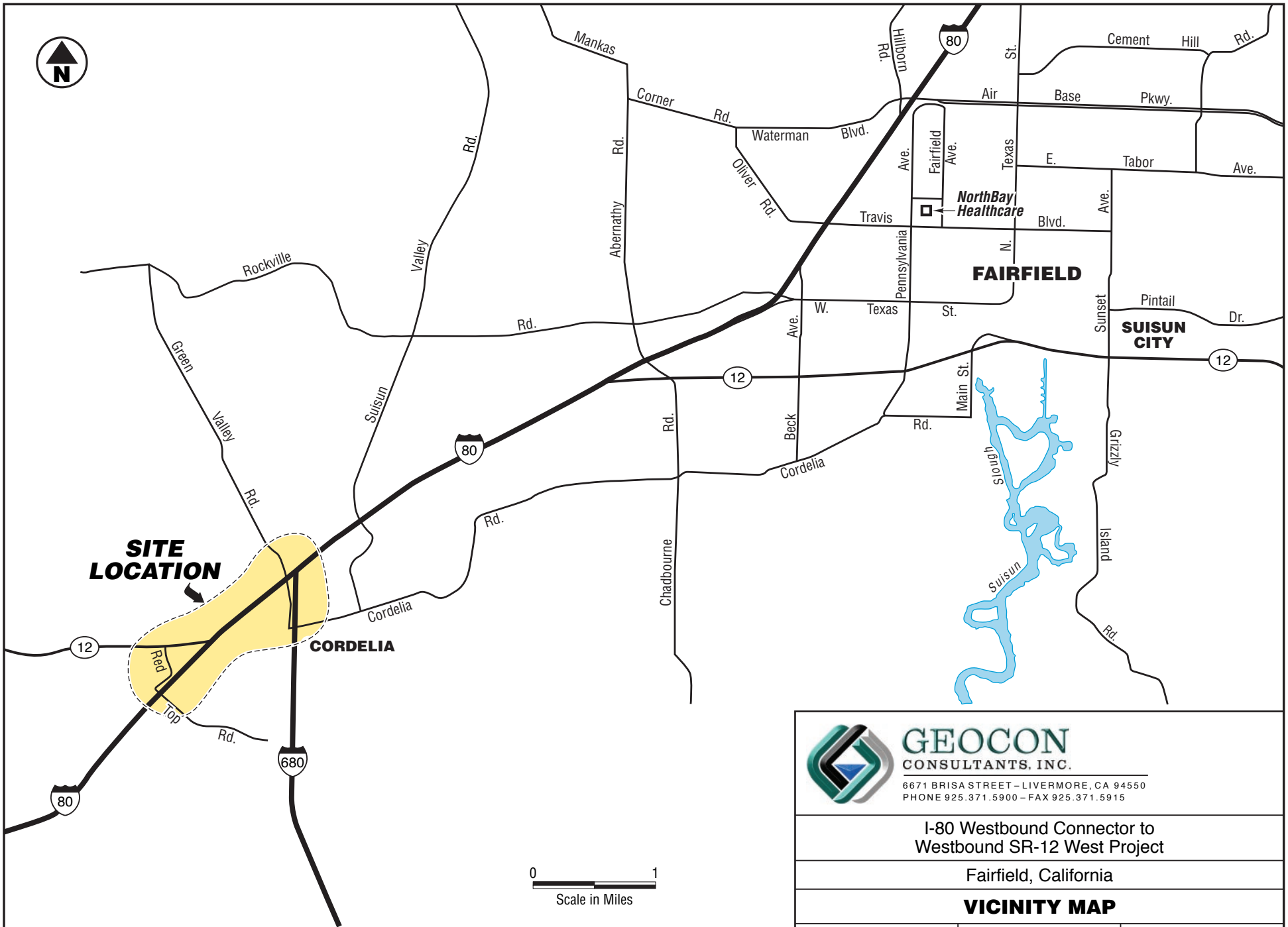
Number of Valid Observations	43
Number of Distinct Observations	25
Minimum	1.3
Maximum	110
Mean	33.31
Median	29
SD	21.11
Variance	445.7
Coefficient of Variation	0.634
Skewness	2.036
Mean of log data	3.327
SD of log data	0.675
95% Standard Bootstrap UCL	**38.6**

TPHd

Number of Valid Observations	29
Number of Distinct Observations	27
Minimum	1.4
Maximum	2400
Mean	308.3
Median	42
SD	600.2
Variance	360214
Coefficient of Variation	1.947
Skewness	2.809
Mean of log data	3.965
SD of log data	2.145
95% Standard Bootstrap UCL	**488.8**

TPHmo

Number of Valid Observations	29
Number of Distinct Observations	29
Minimum	3.2
Maximum	14000
Mean	1628
Median	220
SD	3380
Variance	11422657
Coefficient of Variation	2.076
Skewness	2.976
Mean of log data	5.409
SD of log data	2.405
95% Standard Bootstrap UCL	**2642**



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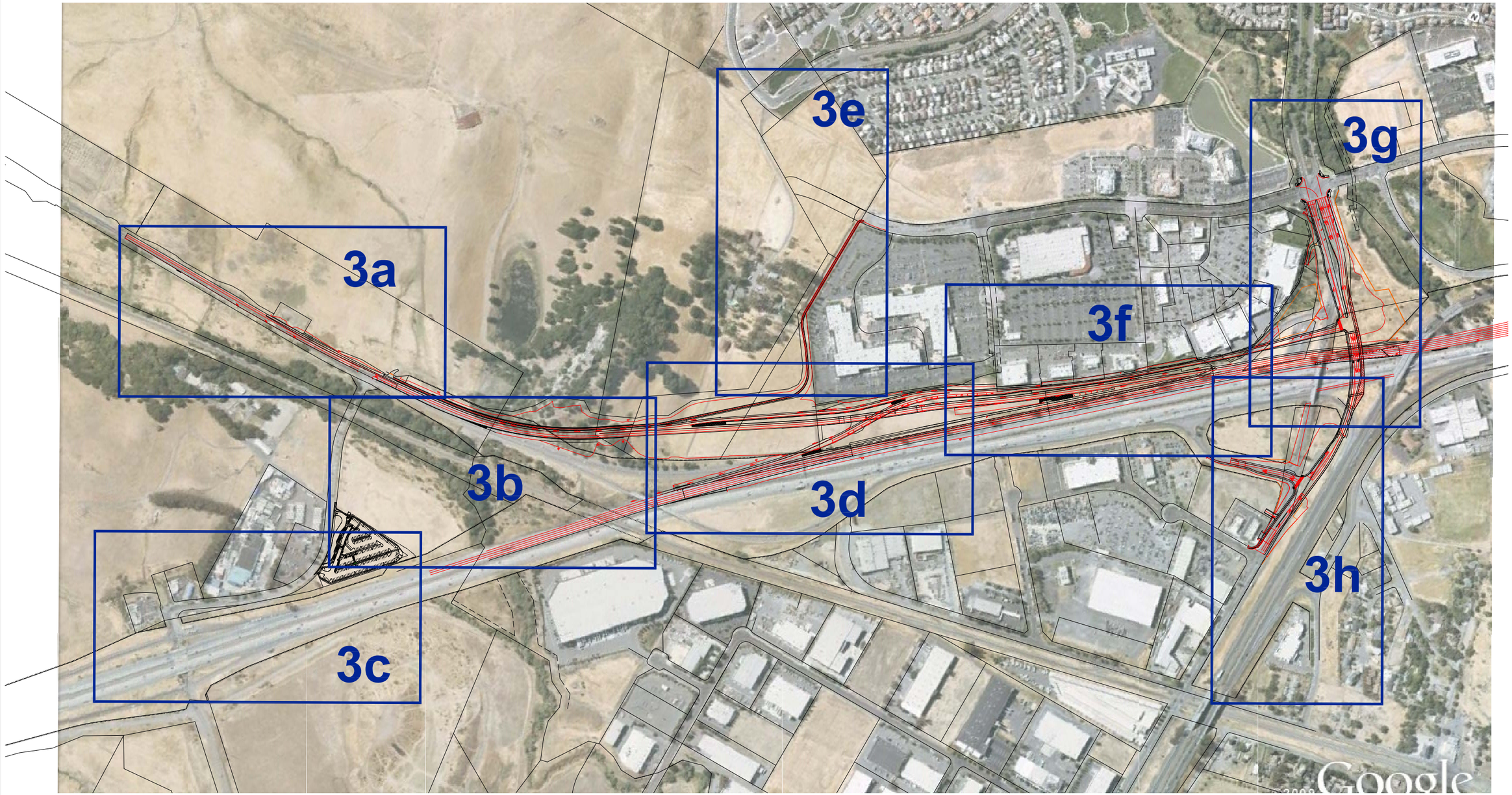
PHONE 925.371.5900 – FAX 925.371.5915

I-80 Westbound Connector to
Westbound SR-12 West Project

Fairfield, California

VICINITY MAP

E8128-06-07	December 2011	Figure 1



N

0 600 1,200

Approximate Scale: feet

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I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	SITE PLAN (KEY)	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 2

SITE1211

N

0 125 250

Approximate Scale: feet

LEGEND:

Soil Boring Location

GEOCON CONSULTANTS, INC.

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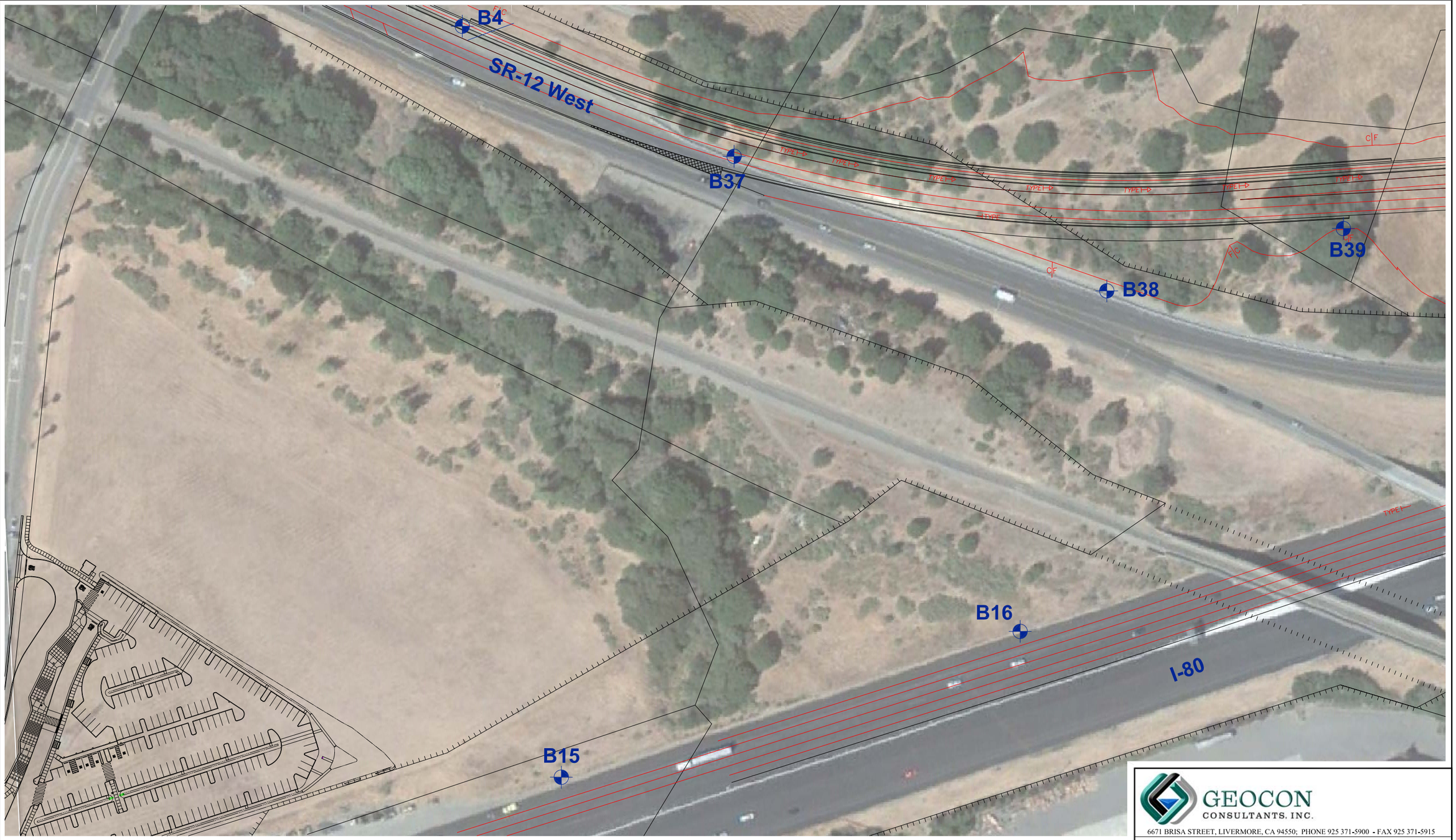
I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	SITE PLAN	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 3a

SITE1211



0 125 250

Approximate Scale: feet

LEGEND:

Soil Boring Location

GEOCON CONSULTANTS, INC.

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I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	SITE PLAN	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 3b

SITE1211

0 125 250

Approximate Scale: feet

LEGEND:

Soil Boring Location

GEOCON CONSULTANTS, INC.

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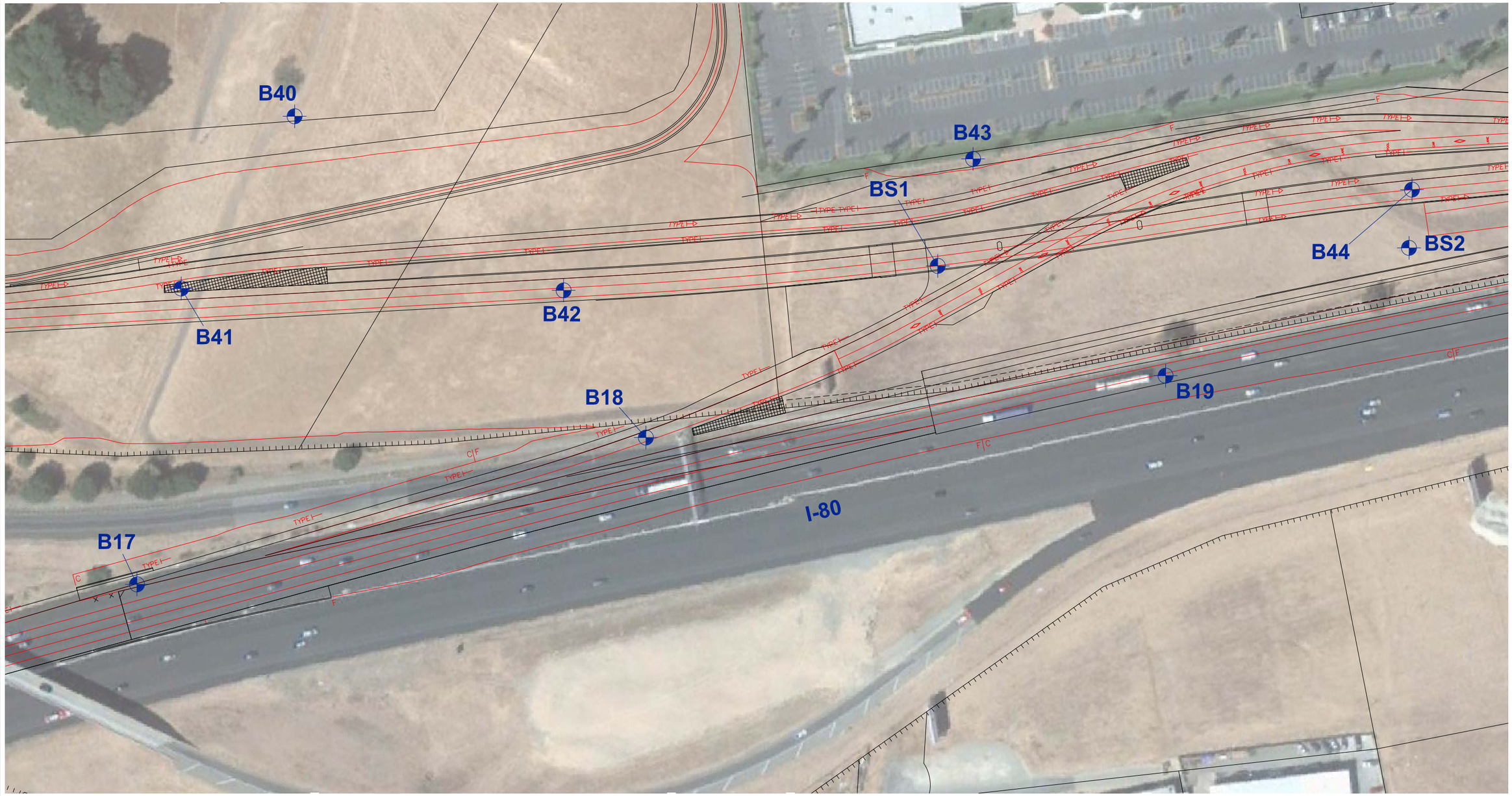
I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	**SITE PLAN**	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 3c

SITE1211



0 125 250

Approximate Scale: feet

LEGEND:

Soil Boring Location

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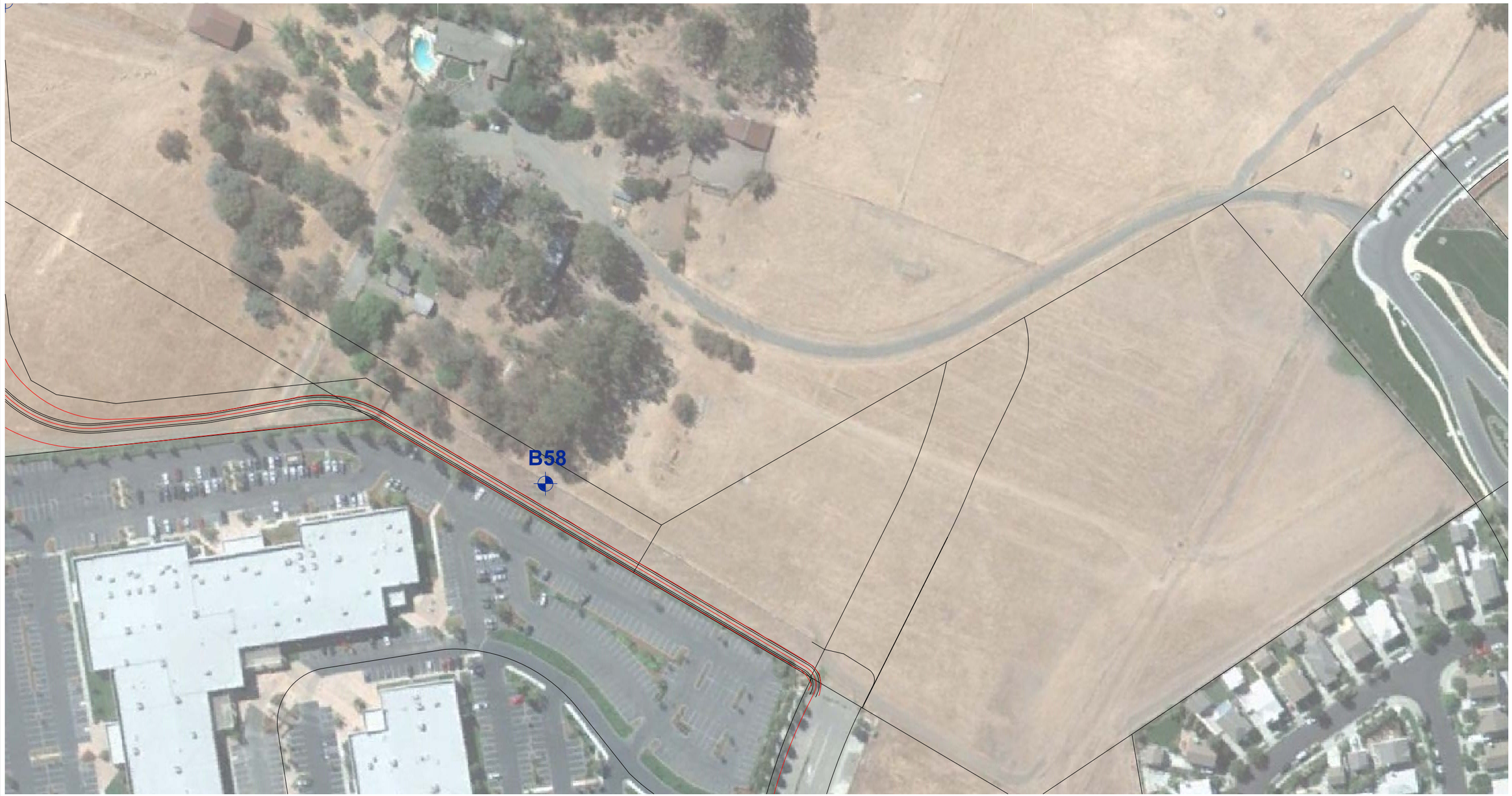
I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	**SITE PLAN**	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 3d

SITE1211



N

0 125 250

Approximate Scale: feet

LEGEND:

Soil Boring Location

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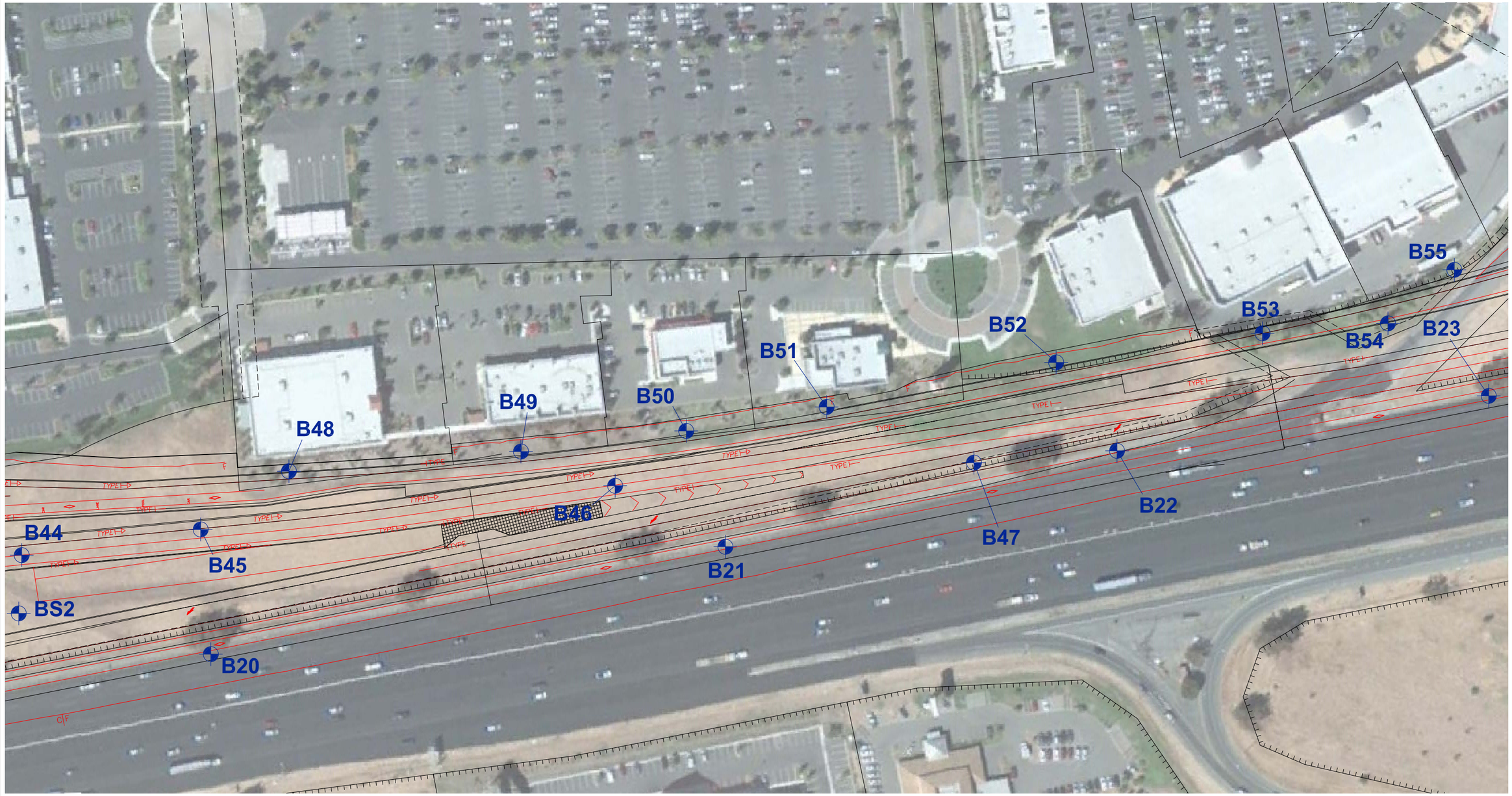
I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	SITE PLAN	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 3e

SITE1211



0 125 250

Approximate Scale: feet

LEGEND:

Soil Boring Location

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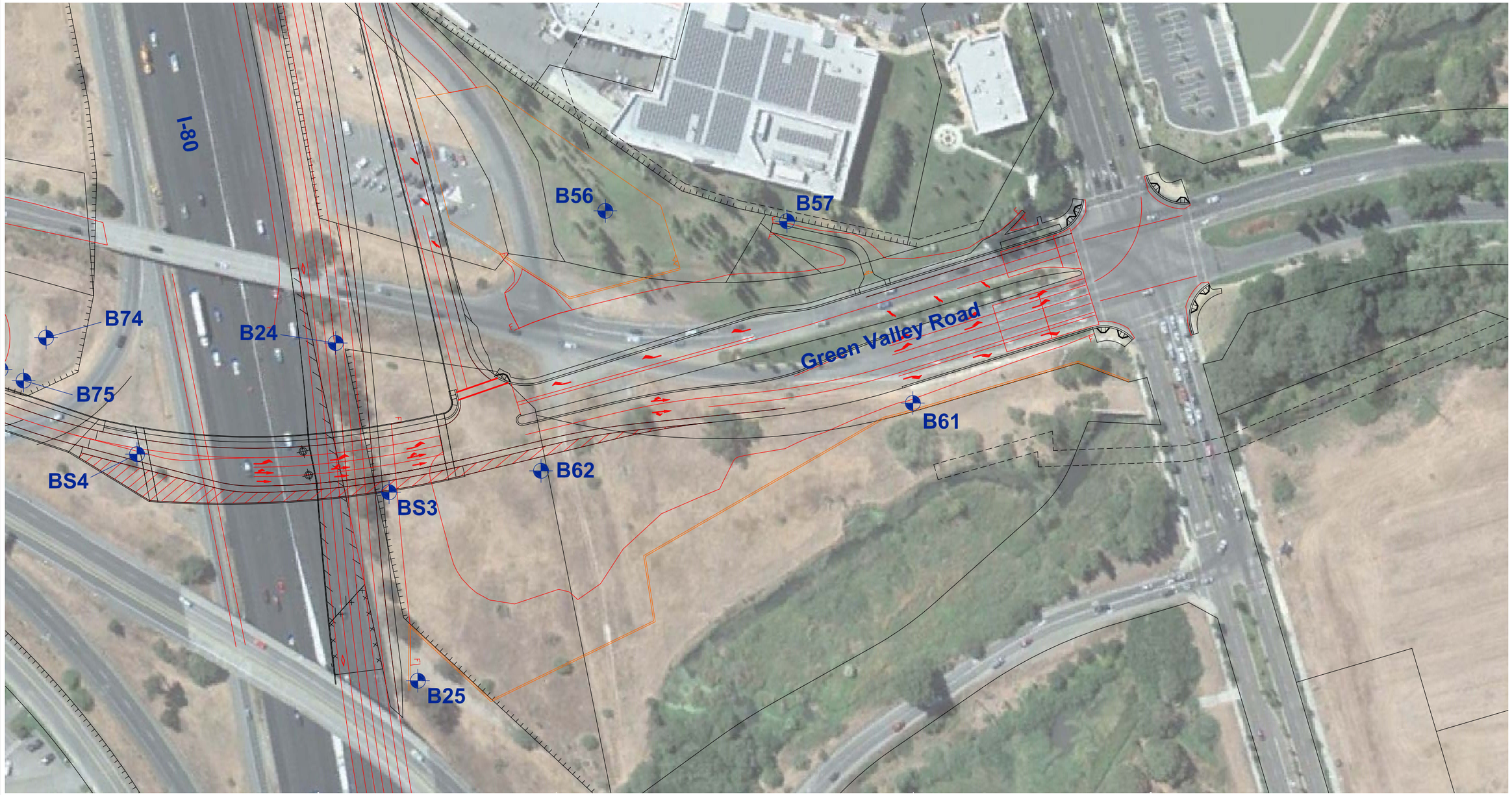
I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	SITE PLAN	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 3f

SITE1211



N

0 125 250

Approximate Scale: feet

LEGEND:

Soil Boring Location

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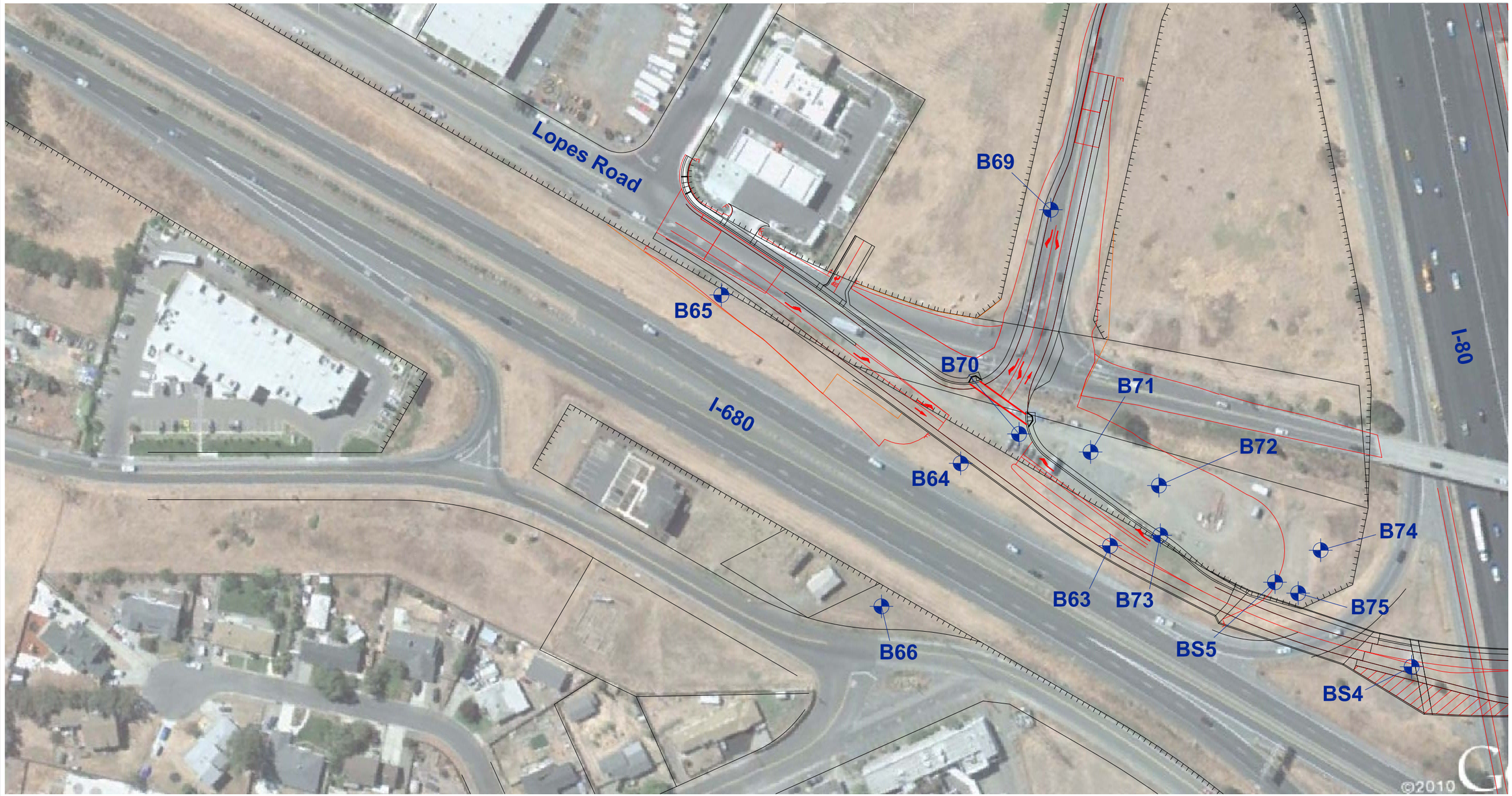
I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	SITE PLAN	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 3g

SITE1211



N

0 125 250

Approximate Scale: feet

LEGEND:

Soil Boring Location

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I-80 Westbound Connector to Westbound SR-12 West Project

Fairfield, California	SITE PLAN	
GEOCON Proj. No. E8128-06-07	December 2011	Figure 3h

SITE1211

TABLE 1
Boring Coordinates
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Boring	Northing	Easting	Latitude	Longitude
B1	1,837,530.336	6,514,958.309	38.2077660	-122.1625898
B2	1,837,531.543	6,516,086.090	38.2077748	-122.1586651
B3	1,837,529.560	6,516,478.469	38.2077713	-122.1572997
B4	1,837,582.105	6,517,026.569	38.2079181	-122.1553926
B5	1,837,458.972	6,515,245.075	38.2075715	-122.1615914
B6	1,837,458.690	6,515,497.434	38.2075719	-122.1607132
B7	1,837,443.701	6,516,597.079	38.2075361	-122.1568864
B11	1,835,256.332	6,516,254.410	38.2015283	-122.1580656
B12	1,835,687.108	6,516,664.883	38.2027130	-122.1566399
B13	1,835,974.274	6,516,861.870	38.2035025	-122.1559561
B14	1,836,259.513	6,517,149.179	38.2042871	-122.1549581
B15	1,836,785.681	6,517,637.909	38.2057341	-122.1532605
B16	1,837,257.028	6,518,067.856	38.2070303	-122.1517670
B17	1,837,877.698	6,518,656.353	38.2087373	-122.1497227
B18	1,838,362.393	6,519,122.845	38.2100703	-122.1481020
B19	1,838,760.480	6,519,655.195	38.2111657	-122.1462516
B20	1,839,132.872	6,520,078.917	38.2121901	-122.1447791
B21	1,839,577.672	6,520,576.730	38.2134137	-122.1430490
B22	1,839,931.778	6,520,946.594	38.2143876	-122.1417637
B23	1,840,228.276	6,521,320.601	38.2152033	-122.1404637
B24	1,840,539.852	6,521,656.595	38.2160603	-122.1392960
B25	1,840,844.616	6,521,975.788	38.2168984	-122.1381867
B36	1,837,555.645	6,516,903.102	38.2078449	-122.1558221
B37	1,837,612.822	6,517,424.746	38.2080043	-122.1540071
B38	1,837,705.322	6,517,941.594	38.2082607	-122.1522090
B39	1,837,933.638	6,518,171.806	38.2088887	-122.1514092
B40	1,838,492.722	6,518,532.483	38.2104255	-122.1501573
B41	1,838,231.258	6,518,517.155	38.2097075	-122.1502091
B42	1,838,472.024	6,518,938.888	38.2103705	-122.1487428
B43*	1,838,876.657	6,519,305.783	---	---
B44*	1,839,121.569	6,519,808.071	---	---
B45*	1,839,263.469	6,519,988.619	---	---
B46*	1,839,574.687	6,520,416.775	---	---
B47*	1,839,827.961	6,520,796.752	---	---
B48*	1,839,383.503	6,520,048.671	---	---
B49*	1,839,552.529	6,520,291.423	---	---
B50*	1,839,680.079	6,520,460.163	---	---
B51*	1,839,795.625	6,520,599.414	---	---
B52*	1,839,990.322	6,520,823.576	---	---
B53*	1,840,153.390	6,521,032.091	---	---
B54	1,840,243.889	6,521,163.753	38.2152455	-122.1410096
B55	1,840,344.906	6,521,202.729	38.2155230	-122.1408745
B56	1,840,752.471	6,521,340.072	38.2166427	-122.1403987

TABLE 1
Boring Coordinates
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Boring	Northing	Easting	Latitude	Longitude
B57	1,840,958.867	6,521,236.111	38.2172090	-122.1407617
B58	1,839,392.923	6,518,720.223	38.2128982	-122.1495091
B61	1,841,212.795	6,521,356.133	38.2179068	-122.1403453
B62	1,840,846.851	6,521,666.743	38.2169033	-122.1392623
B63	1,839,983.446	6,521,963.416	38.2145337	-122.1382252
B64	1,839,766.824	6,521,967.745	38.2139389	-122.1382090
B65	1,839,396.720	6,521,934.673	38.2129226	-122.1383221
B66	1,839,770.413	6,522,175.235	38.2139574	-122.1374957
B69	1,839,705.007	6,521,631.849	38.2137678	-122.1393776
B70	1,839,812.355	6,521,898.404	38.2140637	-122.1384505
B71	1,839,902.480	6,521,872.782	38.2143110	-122.1385402
B72	1,839,998.948	6,521,866.257	38.2145759	-122.1385634
B73	1,840,032.017	6,521,920.029	38.2146669	-122.1383764
B74	1,840,217.846	6,521,834.630	38.2151768	-122.1386746
B75	1,840,220.396	6,521,896.126	38.2151841	-122.1384606
BS1	1,838,736.503	6,519,334.834	38.2110985	-122.1473664
BS2	1,839,055.643	6,519,841.762	38.2119605	-122.1456647
BS3	1,840,693.214	6,521,786.849	38.2164819	-122.1388435
BS4	1,840,391.899	6,521,904.973	38.2156550	-122.1384307
BS5	1,840,187.938	6,521,898.774	38.2150950	-122.1384512

Coordinates are shown in feet, NAD 83 (Zone 2)
* - Denotes coordinates estimated due to satellite/gps unit transmission error

TABLE 2
Summary of Lead and pH Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B1-0	0	25	---	---	---	---
B1-1	1	19	---	---	---	6.3
B1-2	2	44	---	---	---	---
B2-0	0	7.1	---	---	---	---
B2-1	1	6.4	---	---	---	---
B2-2	2	89	3.8	<0.50	---	---
B3-0	0	8.1	---	---	---	---
B3-1	1	15	---	---	---	---
B3-2	2	4.6	---	---	---	---
B4-0	0	13	---	---	---	8.0
B4-1	1	9.8	---	---	---	---
B5-0	0	2.5	---	---	---	---
B5-1	1	3.3	---	---	---	---
B5-2	2	9.5	---	---	---	---
B6-0	0	5.1	---	---	---	---
B6-1R	1	*41*	*2.5*	---	---	---
B6-2	2	<2.0	---	---	---	4.5
B7-0	0	15	---	---	---	---
B7-1	1	4.2	---	---	---	---
B7-2	2	4.6	---	---	---	---
B11-0	0	630	44	<0.50	0.89	---
B11-1	1	5.9	---	---	---	---
B11-2	2	5.7	---	---	---	---
B12-0	0	1.7	---	---	---	---
B12-1	1	3.6	---	---	---	8.4
B12-2	2	3.1	---	---	---	---
B13-0	0	1.8	---	---	---	---
B13-1	1	7.8				
B13-2	2	3.4	---	---	---	---
B14-0	0	4.7	---	---	---	---
B14-1	1	3.0	---	---	---	---
B14-2	2	3.2	---	---	---	---

TABLE 2
Summary of Lead and pH Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B15-0	0	46	---	---	---	---
B15-1	1	110	14	<0.50	<0.50	---
B15-2	2	3.0	---	---	---	---
B16-0	0	3.1	---	---	---	8.2
B16-1	1	33	---	---	---	---
B16-2	2	5.9	---	---	---	---
B17-0	0	1.4	---	---	---	---
B17-1	1	8.2	---	---	---	---
B17-2	2	6.7	---	---	---	---
B18-0.0	0	29	---	---	---	---
B18-1.0	1	12	---	---	---	---
B18-2.0	2	6.3	---	---	---	---
B19-0.0	0	81	3.7	---	---	---
B19-1.0	1	24	---	---	---	7.8
B19-2.0	2	9.0	---	---	---	---
B20-0.0	0	90	4.5	---	---	---
B20-1.0	1	38	---	---	---	---
B20-2.0	2	19	---	---	---	---
B21-0.0	0	81	4.6	---	---	---
B21-1.0	1	71	5.7	<0.50	<0.50	---
B21-2.0	2	9.2	---	---	---	---
B22-0.0	0	47	---	---	---	7.8
B22-1.0	1	110	9.0	<0.50	<0.50	---
B22-2.0	2	31	---	---	---	---
B23-0.0	0	180	21	<0.50	<0.50	---
B23-1.0	1	50	2.9	---	---	---
B23-2.0	2	<5.0	---	---	---	---
B24-0.0	0	71	3.8	---	---	---
B24-1.0	1	22	---	---	---	---
B24-2.0	2	5.1	---	---	---	---
B25-0.0	0	14	---	---	---	---
B25-1.0	1	<5.0	---	---	---	8.7
B25-2.0	2	22	---	---	---	---

TABLE 2
Summary of Lead and pH Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B36-2	2	1.9	---	---	---	---
B37-0	0	14	---	---	---	---
B38-2	2	5.6	---	---	---	---
B39-0	0	49	---	---	---	---
B40-0	0	15	---	---	---	---
B41-0	0	21	---	---	---	---
B42-0	0	19	---	---	---	---
B43-1.5	1.5	5.5	---	---	---	---
B44/B47 Comp	0	15	---	---	---	---
B48-1.5	1.5	5.1	---	---	---	---
B49-0	0	6.4	---	---	---	---
B50-1.5	1.5	6.6	---	---	---	---
B51-0	0	9.2	---	---	---	---
B52-1.5	1.5	6.8	---	---	---	---
B53-0.0	0	11	---	---	---	---
B54-1.5	1.5	6.8	---	---	---	---
B55-0.0	0	12	---	---	---	---
B56-1.5	1.5	8.3	---	---	---	---
B57-0.0	0	6.0	---	---	---	---
B58-0	0	32	---	---	---	---
B61/B62 Comp	0	5.6	---	---	---	---
B63-0	0	60	2.8	<0.50	---	---

TABLE 2
Summary of Lead and pH Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (feet)	Total Lead (mg/kg)	WET Lead (mg/l)	DI-WET Lead (mg/l)	TCLP Lead (mg/l)	pH
B64-2	2	5.4	---	---	---	---
B65-2	2	14	---	---	---	---
B66-2	2	3.1	---	---	---	---
B69-0	0	94	4.8	---	---	---
B70-0,B71-0, B72-0 Comp	0	1.4	---	---	---	---
B73-2,B74-2, B75-2 Comp	2	5.1	---	---	---	---
BS1-4	4	3.3	---	---	---	---
BS2-4	4	4.8	---	---	---	---
BS3-4	4	4.9	---	---	---	---
BS4-4	4	2.5	---	---	---	---
BS5-4	4	5.2	---	---	---	---
Hazardous Waste Criteria						
TTLC (mg/kg)		1,000	---	---	---	---
STLC (mg/l)		---	5.0	---	---	---
TCLP (mg/l)		---	---	---	5.0	---

Notes:

mg/kg = Milligrams per kilogram
mg/l = Milligrams per liter
--- = Not analyzed
<5.0 = Not detected above the laboratory reporting limit
WET = Waste Extraction Test using citric acid as the extraction fluid
DI-WET = Waste Extraction Test using deionized water as the extraction fluid
TCLP = Toxicity Characteristic Leaching Procedure
TTLC = Total Threshold Limit Concentration
STLC = Soluble Threshold Limit Concentration

Italics indicate re-analysis results of sample due to inconsistent initial results original results (total lead 85 mg/kg; WET lead 75 mg/kg; DI-WET lead <0.50 mg/l) were not used in data calculations and are considered anomalous

TABLE 3
Summary of CAM 17 Metals Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
B3-0	0	<2.0	3.6	130	<1.0	<1.0	18	7.5	13	8.1	0.21	<1.0	18	<1.0	<1.0	<1.0	29	33
B4-1	1	<2.0	<1.0	29	<1.0	1.1	16	14	31	9.8	0.38	<1.0	23	<1.0	<1.0	<1.0	81	54
B5-2	2	<2.0	2.6	91	<1.0	<1.0	14	5.9	15	9.5	0.28	<1.0	12	<1.0	<1.0	<1.0	33	28
B6-0	0	<2.0	<1.0	38	<1.0	<1.0	20	14	27	5.1	<0.10	<1.0	27	<1.0	<1.0	<1.0	87	68
B11-2	2	<2.0	6.2	40	<1.0	<1.0	12	1.5	4.0	5.7	<0.10	<1.0	9.1	<1.0	<1.0	<1.0	13	10
B13-1	1	<2.0	<1.0	11	<1.0	<1.0	9.3	15	21	7.8	0.46	<1.0	19	<1.0	<1.0	<1.0	81	140
B16-0	0	<2.0	<1.0	39	<1.0	<1.0	20	14	20	3.1	<0.10	<1.0	30	<1.0	<1.0	<1.0	35	31
B19-0	0	<2.0	7.2	59	<1.0	<1.0	19	6.3	21	81	<0.10	<1.0	20	<1.0	<1.0	<1.0	32	120
B22-0	0	<2.0	2.8	91	<1.0	<1.0	7.6	3.9	10	47	<0.10	<1.0	6.7	<1.0	<1.0	<1.0	17	52
B25-2	2	<2.0	2.4	65	<1.0	<1.0	9.6	3.9	9.9	22	<0.10	<1.0	13	<1.0	<1.0	<1.0	13	42
B36-2	2	<2.0	<1.0	22	<1.0	<1.0	<1.0	<1.0	<1.0	1.9	<0.10	<1.0	1.8	<1.0	<1.0	<1.0	1.3	11
B37-0	0	<2.0	1.2	45	<1.0	<1.0	12	13	24	14	<0.10	<1.0	26	<1.0	<1.0	<1.0	62	66
B38-2	2	<4.0	2.4	47	<2.0	<2.0	4.2	5.7	10	5.6	<0.10	<2.0	4.4	<2.0	<2.0	<2.0	19	20

TABLE 3
Summary of CAM 17 Metals Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
B39-0	0	<2.0	11	160	<1.0	1.1	4.8	4.3	16	49	0.12	<1.0	7.6	<1.0	<1.0	<1.0	40	68
B40-0	0	<2.0	4.5	110	<1.0	<1.0	12	11	9.1	15	<0.10	<1.0	10	<1.0	<1.0	<1.0	32	21
B41-0	0	<2.0	1.7	120	<1.0	<1.0	25	7.6	14	21	0.18	<1.0	17	<1.0	<1.0	<1.0	25	28
B42-0	0	<2.0	4.2	200	<1.0	<1.0	13	6.9	16	19	<0.10	<1.0	15	<1.0	<1.0	<1.0	33	47
B43-1.5	1.5	<2.0	4.1	61	<1.0	<1.0	12	6.7	15	5.5	<0.10	<1.0	9.1	<1.0	<1.0	<1.0	29	31
B44-0/B47-0 Comp	0	<2.0	4.9	190	<1.0	<1.0	15	8.5	19	15	<0.10	<1.0	12	<1.0	<1.0	<1.0	35	42
B48-1.5	1.5	<2.0	3.5	150	<1.0	<1.0	12	6.7	17	5.1	<0.10	<1.0	12	<1.0	<1.0	<1.0	28	28
B49-0	0	<2.0	3.6	140	<1.0	<1.0	22	7.1	15	6.4	<0.10	<1.0	20	<1.0	<1.0	<1.0	29	30
B50-1.5	1.5	<2.0	3.4	200	<1.0	<1.0	13	7.3	17	6.6	<0.10	<1.0	12	<1.0	<1.0	<1.0	32	31
B51-0	0	<2.0	4.0	170	<1.0	<1.0	12	9.8	16	9.2	<0.10	<1.0	12	<1.0	<1.0	<1.0	32	31
B52-1.5	1.5	<2.0	2.8	110	<1.0	<1.0	11	5.5	17	6.8	<0.10	<1.0	10	<1.0	<1.0	<1.0	24	26
B53-0	0	<2.0	2.9	140	<1.0	<1.0	12	5.9	17	11	<0.10	<1.0	10	<1.0	<1.0	<1.0	26	58
B54-1.5	1.5	<2.0	5.0	520	<1.0	<1.0	16	10	14	6.8	<0.10	<1.0	11	<1.0	<1.0	<1.0	36	27

TABLE 3
Summary of CAM 17 Metals Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
B55-0	0	<2.0	4.0	150	<1.0	<1.0	16	6.7	15	12	<0.10	<1.0	12	<1.0	<1.0	<1.0	31	36
B56-1.5	1.5	<2.0	1.6	120	<1.0	<1.0	14	8.7	16	8.3	<0.10	<1.0	14	<1.0	<1.0	<1.0	43	34
B57-0	0	<2.0	3.8	120	<1.0	<1.0	13	5.5	15	6.0	<0.10	<1.0	11	<1.0	<1.0	<1.0	28	35
B58-0	0	<2.0	3.7	260	<1.0	1.2	7.7	15	18	34	<0.10	<1.0	12	<1.0	<1.0	<1.0	23	220
B61/B62 Comp	0	<2.0	2.6	80	<1.0	<1.0	7.3	3.9	9.3	5.6	<0.10	<1.0	9.1	<1.0	<1.0	<1.0	17	35
B63-0	0	<2.0	4.4	160	<1.0	<1.0	11	8.0	16	60	<0.10	<1.0	11	<1.0	<1.0	<1.0	25	87
B64-2	2	<2.0	3.2	310	<1.0	<1.0	9.9	5.9	13	5.4	<0.10	<1.0	12	<1.0	<1.0	<1.0	24	26
B65-2	2	<2.0	3.9	77	<1.0	<1.0	12	5.8	17	14	<0.10	<1.0	9.0	<1.0	<1.0	<1.0	30	31
B66-2	2	<2.0	4.3	120	<1.0	<1.0	8.5	4.8	13	3.1	<0.10	<1.0	7.6	<1.0	<1.0	<1.0	25	23
B69-0	0	<2.0	2.3	91	<1.0	<1.0	16	7.9	21	94	0.31	<1.0	12	<1.0	<1.0	<1.0	45	87
B70-0,B71-0,B72-0 COMP	0	<2.0	<1.0	38	<1.0	1.2	9.9	18	36	1.4	0.97	<1.0	15	<1.0	<1.0	<1.0	110	54
B73-2,B74-2,B75-2 COMP	2	<2.0	2.8	130	<1.0	<1.0	7.9	5.6	12	9.1	<0.10	<1.0	6.8	<1.0	<1.0	<1.0	19	23
BS1-4	4	<2.0	2.1	170	<1.0	<1.0	8.0	7.1	10	3.3	<0.10	<1.0	9.7	<1.0	<1.0	<1.0	16	22

TABLE 3
Summary of CAM 17 Metals Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
BS2-4	4	<2.0	3.7	120	<1.0	<1.0	18	6.2	14	4.8	<0.10	1.1	8.4	<1.0	<1.0	<1.0	23	27
BS3-4	4	<2.0	3.3	77	<1.0	<1.0	12	7.7	18	4.9	<0.10	<1.0	15	<1.0	<1.0	<1.0	31	41
BS4-4	4	<2.0	3.3	640	<1.0	<1.0	6.4	3.3	7.7	2.5	<0.10	<1.0	6.5	<1.0	<1.0	<1.0	17	16
BS5-4	4	<2.0	1.4	52	<1.0	<1.0	17	9.3	12	5.2	<0.10	<1.0	24	<1.0	<1.0	<1.0	21	19
ESLs																		
Residential Land Use		6.3	0.39	750	4.0	1.7	750	40	230	200	1.3	40	150	10	20	1.3	16	600
Comm/Ind Land Use		40	1.6	1,500	8.0	7.4	750	80	230	750	10	40	150	10	40	16	200	600
Construction Exposure		310	15	2,600	98	39	#######	94	310,000	750	58	78	260	3,900	3,900	62	770	230,000
Hazardous Waste Criteria																		
TTLC		500	500	10,000	75	100	2,500*	8,000	2,500	1,000	20	3,500	2,000	100	500	700	2,400	5,000
STLC		15	5.0	100	0.75	1.0	5.0**	80	25	5.0	0.2	350	20	1.0	5.0	7.0	24	250
TCLP		---	5.0	100	---	1.0	6.0	---	---	5.0	0.2	---	---	1.0	5.0	---	---	---

Notes:

Results are shown in milligrams per kilogram (mg/kg)
Values listed for chromium are for Chromium III, as there is no standard for total chromium
< = Analyte was not detected above the laboratory reporting limit
ESLs = Environmental Screening Levels, Tables A and K-3, SFRWQCB, Revised May 2008.
TTLC = total threshold limit concentration
STLC = soluble threshold limit concentration
TCLP = toxicity characteristic leaching procedure
Soluble chromium and nickel concentrations shown in italics in mg/l

TABLE 4
Summary of Organic Compounds Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (ug/kg)	MTBE (ug/kg)	Pesticides (ug/kg)	VOCs (ug/kg)	SVOCs (ug/kg)
B1-0	0	---	37	190	---	---	---	---	---
B1-1	1	<1.0	---	---	ND	<5.0	---	---	---
B2-0	0	---	11	46	---	---	---	---	---
B2-1	1	<1.0	---	---	ND	<5.0	---	---	---
B3-0	0	---	4.6	20	---	---	---	---	---
B3-1	1	<1.0	---	---	ND	<5.0	---	---	---
B4-0	0	---	940	4,700	---	---	---	---	---
B4-1	1	<1.0	---	---	ND	<5.0	---	---	---
B5-0	0	---	580	2,300	---	---	---	---	---
B5-1	1	<1.0	---	---	ND	<5.0	---	---	---
B6-0	0	---	120	720	---	---	---	---	---
B6-1	1	<1.0	---	---	ND	<5.0	---	---	---
B7-0	0	---	1.4	3.2	---	---	---	---	---
B7-1	1	<1.0	---	---	ND	<5.0	---	---	---
B11-0	0	---	130	760	---	---	---	---	---
B11-1	1	<1.0	---	---	ND	<5.0	---	---	---
B12-0	0	---	2,400	14,000	---	---	---	---	---
B12-1	1	<1.0	---	---	ND	<5.0	---	---	---
B13-0	0	---	690	4,300	---	---	---	---	---
B13-1	1	<1.0	---	---	ND	<5.0	---	---	---
B14-0	0	---	15	69	---	---	---	---	---
B14-1	1	<1.0	---	---	ND	<5.0	---	---	---

TABLE 4
Summary of Organic Compounds Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (ug/kg)	MTBE (ug/kg)	Pesticides (ug/kg)	VOCs (ug/kg)	SVOCs (ug/kg)
B15-0	0	---	140	740	---	---	---	---	---
B15-1	1	<1.0	---	---	ND	<5.0	---	---	---
B16-0	0	---	13	74	---	---	---	---	---
B16-1	1	<1.0	---	---	ND	<5.0	---	---	---
B17-0	0	---	2,200	12,000	---	---	---	---	---
B17-1	1	<1.0	---	---	ND	<5.0	---	---	---
B18-0	0	---	27	160	---	---	---	---	---
B18-1	1	<1.0	---	---	ND	<5.0	---	---	---
B19-0	0	---	81	590	---	---	---	---	---
B19-1	1	<1.0	---	---	ND	<5.0	---	---	---
B20-0	0	---	420	1,600	---	---	---	---	---
B20-1	1	<1.0	---	---	ND	<5.0	---	---	---
B21-0	0	---	400	1,900	---	---	---	---	---
B21-1	1	<1.0	---	---	ND	<5.0	---	---	---
B22-0	0	---	34	210	---	---	---	---	---
B22-1	1	<1.0	---	---	ND	<5.0	---	---	---
B23-0	0	---	210	810	---	---	---	---	---
B23-1	1	<1.0	---	---	ND	<5.0	---	---	---
B24-0	0	---	13	54	---	---	---	---	---
B24-1	1	<1.0	---	---	ND	<5.0	---	---	---
B25-0	0	---	300	1,300	---	---	---	---	---
B25-1	1	<1.0	---	---	ND	<5.0	---	---	---

TABLE 4
Summary of Organic Compounds Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (ug/kg)	MTBE (ug/kg)	Pesticides (ug/kg)	VOCs (ug/kg)	SVOCs (ug/kg)
B36-0	0	---	---	---	---	---	ND	---	---
B37-0	0	---	---	---	---	---	ND	---	---
B38-0	0	---	---	---	---	---	ND	---	---
B39-0	0	---	---	---	---	---	4,4'-DDE=2.1 4,4'-DDT=2.9	---	---
B40-0	0	---	---	---	---	---	ND	---	---
B41-0	0	---	---	---	---	---	ND	---	---
B42-0	0	---	---	---	---	---	ND	---	---
B43-0-0	0	---	---	---	---	---	ND	---	---
B44/B47 Comp	0	---	---	---	---	---	ND	---	---
B48-0	0	---	---	---	---	---	ND	---	---
B49-0	0	---	---	---	---	---	ND	---	---
B50-0	0	---	---	---	---	---	ND	---	---
B51-0	0	---	---	---	---	---	ND	---	---
B52-0	0	---	---	---	---	---	ND	---	---
B53-0	0	---	---	---	---	---	ND	---	---
B54-0	0	---	---	---	---	---	ND	---	---

TABLE 4
Summary of Organic Compounds Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (ug/kg)	MTBE (ug/kg)	Pesticides (ug/kg)	VOCs (ug/kg)	SVOCs (ug/kg)
B55-0	0	---	---	---	---	---	ND	---	---
B56-0	0	---	---	---	---	---	ND	---	---
B57-0	0	---	---	---	---	---	ND	---	---
B58-0	0	---	---	---	---	---	ND	---	---
B61/B62 Comp	0	---	---	---	---	---	ND	---	---
B63-0	0	---	---	---	---	---	ND	---	---
B64-0	0	---	---	---	---	---	ND	---	---
B65-0	0	---	---	---	---	---	ND	---	---
B66-0	0	---	---	---	---	---	ND	---	---
B69-0	0	---	---	---	---	---	ND	---	---
B70-0,B71-0,B72-0 COMP	0	---	42	220	---	---	ND	---	---
B70-2,B71-2,B72-2 COMP	2	<1.0	---	---	ND	<5.0	---	ND	ND
B73-0,B74-0,B75-0 COMP	0	---	5.2	24	---	---	ND	---	---
B73-2,B74-2,B75-2 COMP	2	<1.0	---	---	ND	<5.0	---	ND	ND
BS1-0	0	---	2.3	8.9	---	---	---	---	---
BS1-4	0	<1.0	---	---	ND	<5.0	---	---	---
BS2-0	0	---	4.5	4.2	---	---	ND	---	---
BS2-4	4	<1.0	---	---	ND	<5.0	---	---	---

TABLE 4
Summary of Organic Compounds Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (ft)	TPHg (mg/kg)	TPHd (mg/kg)	TPHmo (mg/kg)	BTEX (ug/kg)	MTBE (ug/kg)	Pesticides (ug/kg)	VOCs (ug/kg)	SVOCs (ug/kg)
BS3-0	0	---	6.7	17	---	---	---	---	---
BS3-4	4	<1.0	---	---	ND	<5.0	---	---	---
BS4-0	0	---	110	390	---	---	---	---	---
BS4-4	4	<1.0	---	---	ND	<5.0	---	---	---
BS5-0	0	---	2.3	3.3	---	---	---	---	---
BS5-4	4	<1.0	---	---	ND	<5.0	---	---	---
	ESLs								
	Residential	83	83	370	---	23	4,4'-DDE=1,700 4,4'-DDT=1,700	---	---
	Commercial/Industrial	83	83	2,500	---	23	4,4'-DDE=4,000 4,4'-DDT=4,000	---	---
	Construction Exposure	4,200	4,200	12,000	---	2.8E+06	4,4'-DDE=87,000 4,4'-DDT=87,000	---	---

Notes:
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
TPHg = Total petroleum hydrocarbons as gasoline
TPHd = Total petroleum hydrocarbons as diesel
TPHmo = Total petroleum hydrocarbons as motor oil
BTEX = Benzene, toluene, ethylbenzene, and xylenes
MTBE = Methyl tert-butyl ether
--- = Not Analyzed or no standard for this compound
< = Not detected above the stated laboratory reporting limit
ND = None detected
ESLs = Environmental Screening Levels, Tables A and K-3, SFRWQCB, Revised May 2008

TABLE 5
Summary of NOA Results - Soil
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Sample Depth (feet)	Asbestos Content (% dry weight)
B1-2	2	None Detected
BS2-4	4	None Detected
B6-2	2	None Detected
B19-2	2	None Detected
B22-2	2	None Detected
B25-2	2	None Detected
B36-2	2	None Detected
B37-2	2	None Detected
B38-2	2	None Detected
B39-1.25	1.25	None Detected
B40-1.5	1.5	None Detected
B41-1.5	1.5	None Detected
B42-1.5	1.5	None Detected
B43-1.5	1.5	None Detected
B44-1.5	1.5	None Detected
B45-1.5	1.5	None Detected
B46-1.5	1.5	None Detected
B47-1.5	1.5	None Detected
B48-1.5	1.5	None Detected
B49-1.5	1.5	None Detected
B50-1.5	1.5	None Detected
B51-1.5	1.5	None Detected
B51-4	4	None Detected
B52-1.5	1.5	None Detected
B53-1.5	1.5	None Detected
B53-4	4	None Detected
B54-4	4	None Detected
B55-4	4	None Detected
B58-1.5	1.5	None Detected
B63-2	2	None Detected
B64-2	2	None Detected
B65-2	2	None Detected
B66-2	2	None Detected
B70-2	2	None Detected
B71-2	2	None Detected
B72-2	2	None Detected
B73-2	2	None Detected
B74-2	2	None Detected
B75-2	2	None Detected

TABLE 6
Summary of CAM 17 Metals Results - Groundwater
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
BS1	<0.0050	0.028	1.1	<0.0030	<0.0030	0.15	0.035	0.15	0.028	0.24	0.041	0.14	<0.010	<0.0030	<0.015	0.29	0.42
BS4	<0.0050	<0.010	1.7	<0.0030	<0.0030	0.0031	0.012	0.069	0.024	<0.20	0.012	0.024	<0.010	<0.0030	<0.015	0.069	0.097
ESLs																	
GW is current/potential source	0.006	0.036	1.0	0.00053	0.00025	0.05	0.003	0.0031	0.0025	0.035	0.0082	0.005	0.00019	0.002	0.015	0.081	0.025
GW not current/potential source	0.030	0.036	1.0	0.00053	0.00025	0.18	0.003	0.0031	0.0025	0.24	0.0082	0.005	0.00019	0.004	0.019	0.081	0.025
Surface Water - Freshwater	0.006	0.00014	1.0	0.0027	0.00025	0.05	0.003	0.009	0.0025	0.035	0.052	0.005	0.00034	0.002	0.015	0.12	0.025
Surface Water - Marine	0.5	0.00014	1.0	0.00053	0.0093	0.18	0.003	0.0031	0.0056	0.24	0.0082	0.071	0.00019	0.004	0.019	0.081	0.025
Surface Water - Estuarine	0.03	0.00014	1.0	0.00053	0.00025	0.18	0.003	0.0031	0.0025	0.24	0.0082	0.005	0.00019	0.004	0.019	0.081	0.025

Notes:

Data are shown in units of milligrams per liter (mg/l), except for mercury which is shown in units of micrograms per liter (ug/l)
Values listed for chromium are for Chromium III, as there is no standard for total chromium.
< = Analyte was not detected above the laboratory reporting limit.
ESLs = Environmental Screening Levels, Tables A, B, & F, SFRWQCB, Revised May 2008

TABLE 7
Summary of Organic Compounds Results - Groundwater
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

Sample ID	TPHg (mg/l)	TPHd (mg/l)	TPHmo (mg/l)	BTEX (ug/l)	MTBE (ug/l)	VOCs (ug/l)
BS1	0.19	<0.12	<0.12	ND	<0.50	ND
BS4	0.19	0.056	0.064	ND	<0.50	ND
ESLs						
GW is current/potential source	0.10	0.10	0.10	---	5.0	---
GW not current/potential source	0.21	0.21	0.21	---	1,800	---
Surface Water - Freshwater	0.10	0.10	0.10	---	5.0	---
Surface Water - Marine	0.21	0.21	0.21	---	180	---
Surface Water - Estuarine	0.21	0.21	0.21	---	180	---

Notes:
mg/l = milligrams per liter
µg/l = micrograms per liter
TPHg = Total petroleum hydrocarbons as gasoline
TPHd = Total petroleum hydrocarbons as diesel
TPHmo = Total petroleum hydrocarbons as motor oil
BTEX = Benzene, toluene, ethylbenzene, and xylenes
MTBE = Methyl tert-butyl ether
VOCs = Volatile organic compounds
< = Not detected above the stated laboratory reporting limit
ND = Not detected above the respective laboratory reporting limits for these compou
--- = No standard
ESLs = Environmental Screening Levels, Tables A, B & F, SFRWQCB, Revised May

TABLE 8
Summary of Lead Statistical Analysis
I-80 Westbound Connector to Westbound SR-12 Project
Solano County, California

WB I-80 Shoulder (borings B11 to B25)

TOTAL LEAD UCLs

	Total Lead (mg/kg)	
	90% UCL	**95% UCL**
0 to 0.5 foot	136.0	149.5
1.0 to 1.5 feet	45.1	48.2
2.0 to 2.5 feet	11.6	12.4

EXCAVATION SCENARIOS

	Weighted Averages		
	90% UCL		95% UCL
Excavation Depth	**Total Lead (mg/kg)**	**WET Lead* (mg/l)**	**Total Lead (mg/kg)**
0 to 1.0 foot	136.0	9.9	149.5
Underlying Soil (1.0 to 2.5 feet)	*33.9*	*2.5*	*36.3*
0 to 2.0 feet	90.5	6.6	98.9
Underlying Soil (2.0 to 2.5 feet)	*11.6*	*0.8*	*12.4*
0 to 2.5 feet	74.8	5.4	81.6

Notes:
Weighted average values are based upon calculated UCLs for each depth interval.
UCL = Upper Confidence Limit (90% UCL is applicable for waste classification; 95% UCL applicable for risk assessment)
mg/kg = milligrams per kilogram
mg/l = milligrams per liter
* = Soluble (WET) lead concentrations are predicted using slope of regression line,
where y = predicted soluble (WET) lead and x = total lead.

Regression Line Slope: y = 0.0726 x

ASBESTOS AND LEAD-CONTAINING PAINT SURVEY REPORT

GREEN VALLEY ROAD OVERCROSSING
BRIDGE 23-0138
04-SOL-80, POST MILE 12.74
FAIRFIELD, CALIFORNIA

PREPARED FOR:
MARK THOMAS & COMPANY, INC.
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CALIFORNIA 94597

PREPARED BY:
GEOCON CONSULTANTS, INC.
6671 BRISA STREET
LIVERMORE, CALIFORNIA 94550

GEOCON

GEOCON PROJECT NO. E8128-06-07

DECEMBER 2011

DRAFT

Project No. E8128-06-07
December 20, 2011

Mike Lohman
Mark Thomas & Company, Inc.
3000 Oak Road, Suite 650
Walnut Creek, California 94597

Subject: ASBESTOS AND LEAD-CONTAINING PAINT SURVEY REPORT
GREEN VALLEY ROAD OVERCROSSING (23-0138)
04-SOL-80, POST MILE 12.74
FAIRFIELD, CALIFORNIA

Dear Mr. Lohman:

We have performed an asbestos and lead-containing paint survey at the subject site. The scope of services provided by Geocon included surveying the subject bridge for suspect asbestos-containing materials and lead-containing paint, collecting bulk samples, and submitting the samples to laboratories for analyses.

The accompanying report summarizes the services performed and the results of laboratory testing.

The contents of this report reflect the views of Geocon, who are responsible for the facts and accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation.

If there are questions concerning the contents of this report, or if we may be of further service, please contact us at your convenience.

Sincerely,

GEOCON CONSULTANTS, INC.

David Watts, CAC
Senior Project Scientist

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ASBESTOS AND LEAD-CONTAINING PAINT SURVEY REPORT

1.0 INTRODUCTION

1.1 Site Description

The subject site (Site) consists of the Green Valley Road Overcrossing (23-0138) located at Post Mile 12.74 on Interstate 80 in Fairfield, California. The approximate project location is depicted on the Vicinity Map, Figure 1, and Site Plan, Figure 2.

1.2 Objectives

Our objectives were to assess the potential presence and quantity of asbestos and lead-containing paint (LCP) at the Site prior to planned improvements to the interchange. The information obtained from this investigation will be used by Mark Thomas & Company, Inc. (MTCo) for waste profiling, determining California Occupational Safety and Health Administration (Cal/OSHA) applicability, and coordinating asbestos and LCP disturbance activities.

> *It was <u>not</u> Geocon's intent during this inspection to conduct an evaluation of lead-based paint hazards in accordance with United States Department of Housing and Urban Development (HUD) guidelines.*

2.0 BACKGROUND

2.1 Asbestos

The *Code of Federal Regulations (CFR)*, 40 CFR 61, Subpart M, National Emissions Standards for Hazardous Air Pollutants (NESHAP) and Federal Occupational Safety and Health Administration (FED OSHA) classify asbestos-containing material (ACM) as any material or product that contains *greater than* 1% asbestos. Nonfriable ACM is classified by NESHAP as either Category I or Category II material defined as follows:

- **Category I** – asbestos-containing packings, gaskets, resilient floor coverings, and asphalt roofing products.
- **Category II** – all remaining types of nonfriable asbestos-containing material not included in Category I that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Regulated asbestos-containing material (RACM), a hazardous waste when friable, is classified as any manufactured material that contains *greater than* 1% asbestos by dry weight *and* is:

- Friable (can be crumbled, pulverized, or reduced to powder by hand pressure); or
- Category I material that has become friable; or

- Category I material that has been subjected to sanding, grinding, cutting, or abrading; or
- Category II nonfriable material that has a high probability of becoming crumbled, pulverized, or reduced to a powder during demolition or renovation activities.

Activities that disturb materials containing *any* amount of asbestos are subject to certain requirements of the Cal/OSHA asbestos standard contained in Title 8, CCR Section 1529. Typically, removal or disturbance of more than 100 square feet of material containing more than 0.1% asbestos must be performed by a registered asbestos abatement contractor, but associated waste labeling is not required if the material contains 1% or less asbestos. When the asbestos content of a material exceeds 1%, virtually all requirements of the standard become effective.

Materials containing more than 1% asbestos are also subject to NESHAP regulations (40 CFR Part 61, Subpart M). RACM (friable ACM and nonfriable ACM that will become friable during demolition operations) must be removed from structures prior to demolition. Certain nonfriable ACM and materials containing 1% or less asbestos may remain in structures during demolition; however, there are waste handling/disposal issues and Cal/OSHA work requirements that must be addressed. Contractors are responsible for segregating and characterizing waste streams prior to disposal.

With respect to potential worker exposure, notification, and registration requirements, Cal/OSHA defines asbestos-containing construction material (ACCM) as construction material that contains more than 0.1% asbestos (Title 8, CCR 341.6).

2.2 Lead Paint

Construction activities (including demolition) that disturb materials or paints containing *any* amount of lead are subject to certain requirements of the Cal/OSHA lead standard contained in Title 8, CCR, Section 1532.1. Deteriorated paint is defined by Title 17, CCR, Division 1, Chapter 8, §35022 as a surface coating that is cracking, chalking, flaking, chipping, peeling, non-intact, failed, or otherwise separating from a substrate. Demolition of a deteriorated LCP component would require waste characterization and appropriate disposal. Intact LCP on a component is currently accepted by most landfills and recycling facilities; however, contractors are responsible for segregating and characterizing waste streams prior to disposal.

For a solid waste containing lead, the waste is classified as California hazardous when: 1) the total lead content equals or exceeds the respective Total Threshold Limit Concentration (TTLC) of 1,000 milligrams per kilogram (mg/kg); or 2) the soluble lead content equals or exceeds the respective Soluble Threshold Limit Concentration (STLC) of 5 milligrams per liter (mg/l) based on the standard Waste Extraction Test (WET). A waste has the potential for exceeding the lead STLC when the waste's total lead content is greater than or equal to ten times the respective STLC value since the WET uses a 1:10 dilution ratio. Hence, when total lead is detected at a concentration greater than or equal to

50 mg/kg, and assuming that 100 percent of the total lead is soluble, soluble lead analysis is required. Lead-containing waste is classified as "Resource, Conservation, and Recovery Act" (RCRA) hazardous, or Federal hazardous, when the soluble lead content equals or exceeds the Federal regulatory level of 5 mg/l based on the Toxicity Characteristic Leaching Procedure (TCLP).

The above regulatory criteria are based on chemical concentrations. Wastes may also be classified as hazardous based on other criteria such as ignitability; however, for the purposes of this investigation, toxicity (i.e., lead concentration) is the primary factor considered for waste classification since waste generated during the construction activities would not likely warrant testing for ignitability or other criteria. Waste that is classified as either California-hazardous or RCRA-hazardous requires management as a hazardous waste.

Potential hazards exist to workers who remove or cut through LCP coatings during demolition. Dust containing hazardous concentrations of lead may be generated during scraping or cutting materials coated with lead-containing paint. Torching of these materials may produce lead oxide fumes. Therefore, air monitoring and/or respiratory protection may be required during the demolition of materials coated with LCP. Guidelines regarding regulatory provisions for construction work where workers may be exposed to lead are presented in Title 8, CCR, Section 1532.1.

3.0 SCOPE OF SERVICES

Mr. David Watts, a California-Certified Asbestos Consultant (CAC), certification No. 98-2404 (expiration September 16, 2012), and Certified Lead Paint Inspector/Assessor and Project Monitor with the California Department of Public Health (DPH), certification numbers I-1734 and M-1734 (expiration December 4, 2012), performed the asbestos and LCP survey at the Site on November 11, 2011.

3.1 Asbestos

Suspect ACM were grouped into homogeneous areas with representative samples randomly collected from each. In addition, each potential ACM was evaluated for quantity and friability. A total of six bulk asbestos samples were collected during our survey.

Geocon's procedures for inspection and sampling are discussed below:

- Collected bulk asbestos samples after first wetting friable material with a light mist of water. The samples were then cut from the substrate and transferred to labeled containers. Note that when multiple samples were collected, the sampling locations were distributed throughout the homogeneous area (spaces where the material was observed).
- Relinquished bulk asbestos samples to EMSL Analytical, Inc., a California-licensed laboratory, for asbestos analysis in accordance with EPA Test Method 600/R-93/116 using polarized light microscopy (PLM) under standard chain-of-custody procedures. EMSL Analytical, Inc. is a laboratory accredited by the National Institute of Standards and Technology National

Voluntary Laboratory Accreditation Program (NIST-NVLAP) for bulk asbestos fiber analysis. The laboratory analyses were requested on a 5-day turnaround time.

Sample identification numbers, material descriptions, approximate quantities, friability assessments, and photo references are summarized in Table 1. Sample locations are presented on the Site Plan, Figure 2. Materials represented by the samples collected are shown in the attached photographs.

3.2 Lead Paint

Two bulk samples of intact paint applied to the bridge girder and truss system were collected during our survey. Our sampling procedures are discussed below:

- Collected the bulk samples using techniques presented in HUD guidelines. The painted areas were evaluated for deterioration.
- Relinquished the bulk LCP samples under chain-of-custody protocol to McCampbell Analytical, Inc. (MAI), a California-licensed and Caltrans-approved subcontractor, for lead analysis in accordance with EPA Test Method 6010B. MAI is accredited by the DPH for lead analysis. The laboratory analyses were requested on a 5-day turnaround time.

Paint sample identification numbers, the paint description, and our peeling and flaking assessment are summarized in Table 2. Sample locations are presented on the Site Plan, Figure 2. Materials represented by the samples collected are shown in the attached photographs.

4.0 INVESTIGATIVE RESULTS

4.1 Asbestos

Chrysotile asbestos at a concentration of 15% was detected in samples representing approximately 40 square feet of nonfriable sheet packing used as shims on the bridge barrier rail system.

No asbestos was detected in samples of the remaining suspect materials collected during our survey. A summary of the analytical laboratory test results for asbestos is presented on Table 1. Reproductions of the laboratory report and chain-of-custody documentation are presented in Appendix A.

4.2 Lead Paint

Samples of intact paint applied to the bridge girder and truss system exhibited total lead concentrations of 56,000 and 70,000 mg/kg. The composite sample exhibited a TCLP lead concentration of 100 mg/l.

A summary of the analytical laboratory test results for paint is presented on Table 2. Reproductions of the laboratory report and chain-of-custody documentation are presented in Appendix A.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Asbestos

NESHAP regulations do not require that asbestos-containing sheet packing (a Category I nonfriable/nonhazardous material) identified during our survey be removed prior to demolition or renovation, or be treated as a hazardous waste. However, the disturbance of the material is still covered by the Cal/OSHA asbestos standard (Title 8, CCR Section 1529).

We recommend that a licensed contractor registered with Cal/OSHA for asbestos-related work perform any activities that would *disturb* the asbestos-containing sheet packing identified during our survey. Contractors are responsible for informing the landfill of the contractor's intent to dispose of asbestos waste. Some landfills and recycling facilities may require additional waste characterization. Contractors are responsible for segregating and characterizing waste streams prior to disposal.

Geocon also recommends the notification of contractors (that will be conducting renovation or related activities) of the presence of asbestos in their work areas (i.e., provide contractor[s] with a copy of this report and a list of asbestos removed during subsequent activities). Contractors not trained for asbestos work should be instructed not to disturb asbestos during their activities.

In accordance with Bay Area Air Quality Management District (BAAQMD) Regulation 11, Rule 2, written notification is required ten working days prior to commencement of *any* demolition activity (whether asbestos is present or not).

5.2 Lead Paint

Paint applied to the bridge girder and truss system identified during our survey would be classified as California and Federal hazardous waste based on lead content if stripped, blasted, or otherwise separated from the substrate.

We recommend that all paints at the Site (traffic striping, graffiti, graffiti abatement, signage, etc.) be treated as lead-containing for purposes of determining the applicability of the Cal/OSHA lead standard during any maintenance, renovation, or demolition activities. This recommendation is based on LCP sample results and the fact that lead was a common ingredient of paints manufactured before 1978, and is still an ingredient of some paints. Compliance and training requirements regarding construction activities where workers may be exposed to lead are presented in Title 8, CCR, Section 1532.1, subsections (e) and (l), respectively. Contractors are responsible for segregating and characterizing waste streams prior to disposal. Some landfills and recycling facilities may require additional waste characterization.

6.0 REPORT LIMITATIONS

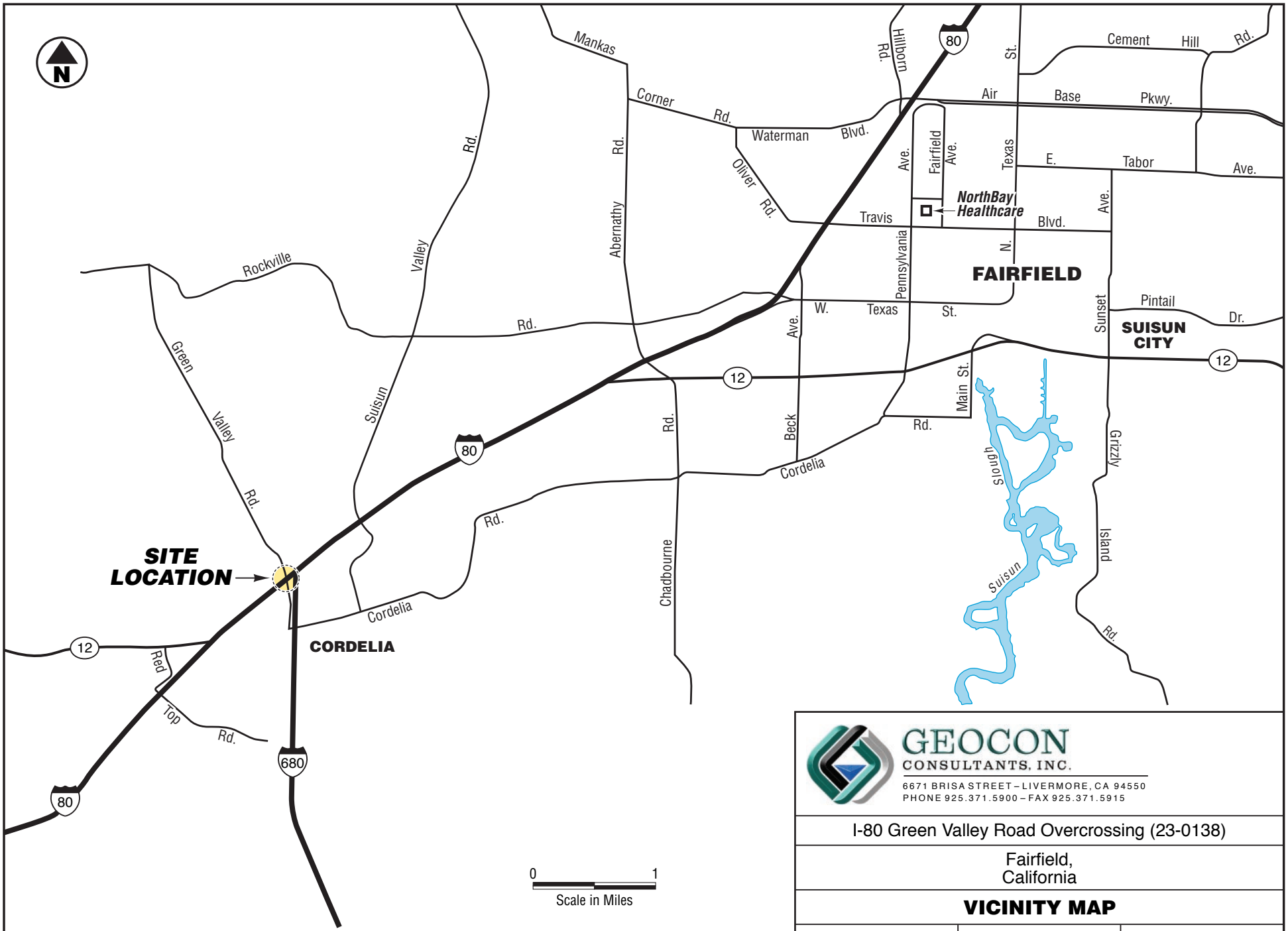
This report has been prepared exclusively for MTCo. The information contained herein is only valid as of the date of the report and will require an update to reflect additional information obtained.

The asbestos and LCP survey was conducted in conformance with generally accepted standards of practice for identifying and evaluating asbestos and LCP in structures. The survey addressed only the structure identified in Section 1.1. Due to the nature of structure surveys, asbestos and LCP use, and laboratory analytical limitations, some asbestos or LCP in the structure may not have been identified. Spaces, such as cavities, crawlspaces, voids, and pipe chases, may have been concealed to our investigator. Previous renovation work may have concealed or covered spaces or materials, or may have partially demolished materials and left debris in inaccessible areas. Additionally, renovation activities may have partially replaced asbestos with indistinguishable non-asbestos. Asbestos and/or LCP may exist in areas not accessible or sampled in conjunction with our scope of services.

During renovation or demolition operations, suspect materials may be uncovered which are different from those accessible for sampling during this assessment. Personnel in charge of renovation/demolition should be alerted to note materials uncovered during such activities that differ substantially from those included in this or previous assessment reports. If additional suspect materials are found, they should be treated as ACM and/or LCP until/unless sampling and analysis indicate otherwise.

This report is not a comprehensive site characterization and should not be construed as such. The findings as presented in this report are predicated on the results of the limited sampling and laboratory testing performed. In addition, the information obtained is not intended to address potential impacts related to sources other than those specified herein. Therefore, the report should be deemed conclusive with respect to only the information obtained. We make no warranty, express or implied, with respect to the content of this report or any subsequent reports, correspondence, or consultation. Geocon strived to perform the services summarized herein in accordance with the local standard of care in the geographic region at the time the services were rendered.

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation.



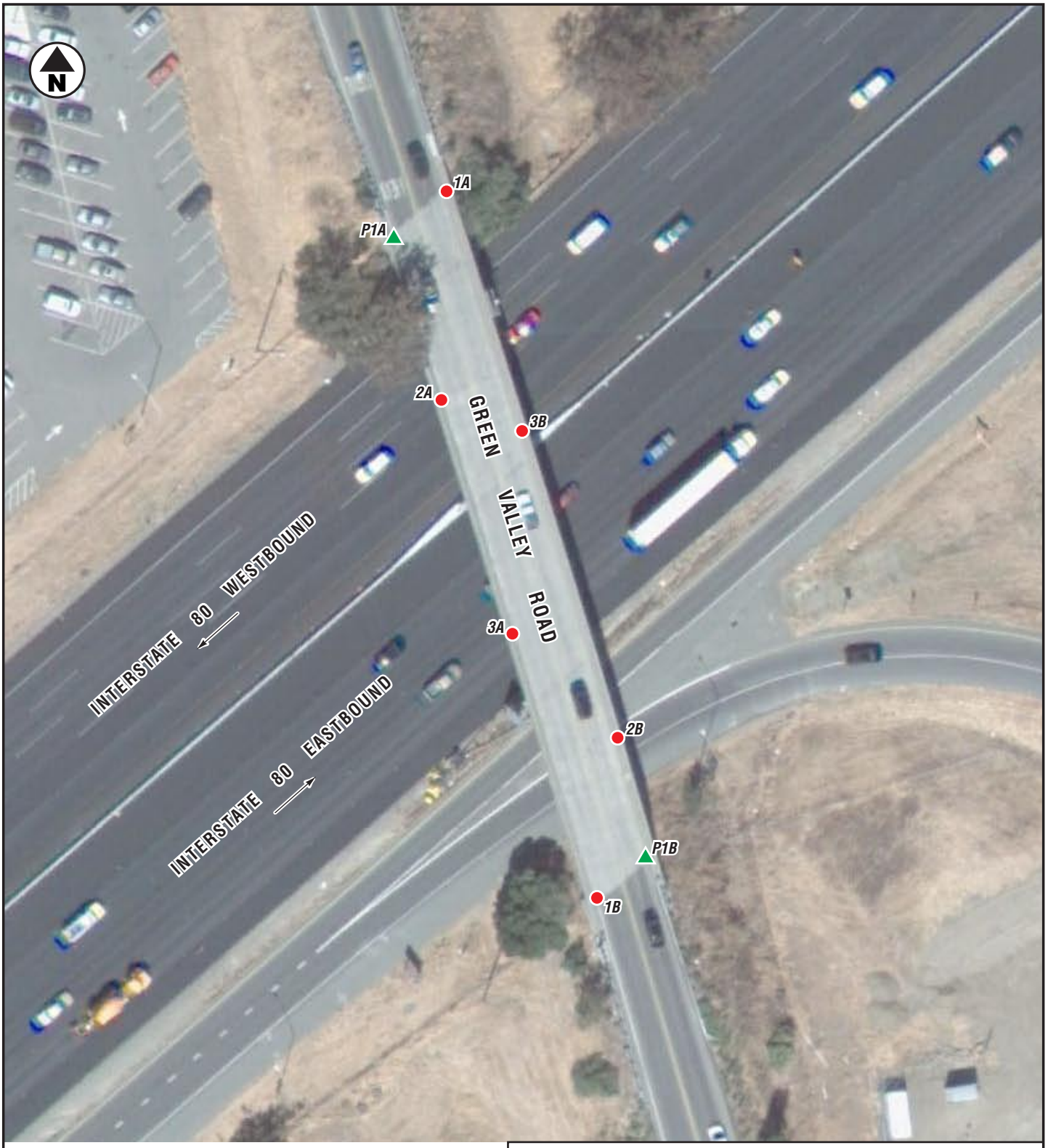
GEOCON
CONSULTANTS, INC.
6671 BRISA STREET – LIVERMORE, CA 94550
PHONE 925.371.5900 – FAX 925.371.5915

I-80 Green Valley Road Overcrossing (23-0138)

Fairfield,
California

VICINITY MAP

E8128-06-07	December 2011	Figure 1



LEGEND:

- Approximate Asbestos Sample Location
- Approximate Paint Sample Location

0 60
Scale in Feet

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CONSULTANTS, INC.
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PHONE 925.371.5900 – FAX 925.371.5915

I-80 Green Valley Road Overcrossing (23-0138)

Fairfield,
California

SITE PLAN

E8128-06-07	December 2011	Figure 2

Photo 1 – Green Valley Road Overcrossing (23-0138) on Interstate 80 in Fairfield, California

Photo 2 – Expansion joint fill material

Photo 3 – Abutment, girder, and headwall

Photo 4 – Girder and truss system

Photo 5 – Deck joint (non-suspect)

Photo 6 – Barrier rail system (shims are asbestos-containing)

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CONSULTANTS, INC.
6671 BRISA STREET – LIVERMORE, CA 94550
PHONE 925.371.5900 – FAX 925.371.5915

PHOTOGRAPHS 4, 5, & 6		
I-80 Green Valley Road Overcrossing (23-0138) Fairfield, California		
E8128-06-07		December 2011

TABLE 1
SUMMARY OF ANALYTICAL LABORATORY TEST RESULTS - ASBESTOS
I-80 GREEN VALLEY ROAD OVERCROSSING (23-0138)
FAIRFIELD, CALIFORNIA

Polarized Light Microscopy (PLM) - EPA Test Method 600/R-93/116

Sample ID	Description of Material	Approximate Quantity	Friable	Site Photos	Asbestos Content
1A 1B	Expansion joint fill material	NA	NA	2	ND ND
2A **2B**	**Sheet packing (barrier rail shims)**	**40 square feet**	**No**	**6**	**15%** **15%**
3A 3B	Thread compound	NA	NA	6	ND ND

Notes:

NA = Not applicable

ND = No asbestos fibers detected

TABLE 2
SUMMARY OF ANALYTICAL LABORATORY TEST RESULTS - PAINT
I-80 GREEN VALLEY ROAD OVERCROSSING (23-0138)
FAIRFIELD, CALIFORNIA

Total and Soluble Lead

Sample ID	Paint Description	Approximate Quantity Peeling and Flaking	Site Photos	Total Lead (mg/kg)	TCLP Lead (mg/l)
P1A P1B	Girder and truss system	Intact	1, 3, and 4	56,000 70,000	100

Notes:

mg/kg = milligrams per kilogram (EPA Test Method 6010)
TCLP = Toxicity Characteristic Leaching Procedure (EPA Test Method 1311)
mg/l = milligrams per liter

APPENDIX A

EMSL Analytical, Inc
2235 Polvorosa Ave , Suite 230, San Leandro, CA 94577
Phone: (510) 895-3675 Fax: (510) 895-3680 Email: sanleandrolab@emsl.com

Attn: **Dave Watts**
Geocon Consultants, Inc.
6671 Brisa Street

Livermore, CA 94550

Fax: (925) 371-5915 Phone: (925) 371-5900
Project: **E8128-06-07**

Customer ID: GECN21
Customer PO: E8128-06-07
Received: 11/15/11 11:00 AM
EMSL Order: 091112917

EMSL Proj:
Analysis Date: 11/21/2011

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 and/or EPA 600/M4-82-020 Method(s) using Polarized Light Microscopy

Sample	Description	Appearance	Non-Asbestos %	Fibrous	Non-Asbestos %	Non-Fibrous	Asbestos %	Type
1A-Joint Fill Material *091112917-0001*		Brown Fibrous Homogeneous	99%	Cellulose	1%	Non-fibrous (other)		**None Detected**
1B-Joint Fill Material *091112917-0002*		Brown Fibrous Homogeneous	99%	Cellulose	1%	Non-fibrous (other)		**None Detected**
2A-Sheet Packing (Shims) *091112917-0003*		White/Black Fibrous Homogeneous			85%	Non-fibrous (other)	**15%**	**Chrysotile**
2B-Joint Fill Material *091112917-0004*		White/Black Fibrous Homogeneous			85%	Non-fibrous (other)	**15%**	**Chrysotile**
3A-Thread Compound *091112917-0005*		Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**
3B-Thread Compound *091112917-0006*		Gray Non-Fibrous Homogeneous			100%	Non-fibrous (other)		**None Detected**

Initial report from 11/21/2011 12:36:22

Analyst(s)

Kenneth Dunbar (6)

Baojia Ke, Laboratory Manager
or other approved signatory

Due to magnification limitations inherent in PLM, asbestos fibers in dimensions below the resolution capability of PLM may not be detected. Samples reported as <1% or none detected may require additional testing by TEM to confirm asbestos quantities. The above test report relates only to the items tested and may not be reproduced in any form without the express written approval of EMSL Analytical, Inc. EMSL's liability is limited to the cost of analysis. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client.Samples received in good condition unless otherwise noted.
Samples analyzed by EMSL Analytical, Inc San Leandro, CA NVLAP Lab Code 101048-3, MA AA000201, WA C2007

THIS IS THE LAST PAGE OF THE REPORT.

091112917

091112917

EMSL Analytical, Inc.
Revised 07/07/99

CHAIN OF CUSTODY

Asbestos

EMSL Rep: T. LANZING

Your Company Name: GEOCON
Street: 6671 BRISA ST.
Box #:
City/State: LIVERMORE, CA Zip: 94550

Phone Results to:
Name: D. WATTS
Telephone #: 925-371-5900
Project Name/Number: E8128-06-07

Third Party Billing requires written authorization from third party

EMSL-Bill to: SAME
Street:
Box #:
City/State: Zip:

Fax Results to:
Name:
Fax #:
Purchase Order #:

MATRIX			TURNAROUND			
☐ Air	☐ Floor Tile	☐ Soil	☐ 3 hrs	☐ 6 Hours	☐ Same Day or 12 Hours*	☐ 24 Hours 1 day
☒ Bulk	☐ Drinking Water	☐ Dust	☐ 48 Hours 2 days	☐ 72 Hours 3 days	☐ 96 Hours 4 days	☒ 120 Hours 5 Days
☐ Wipe	☐ Wastewater	☐ Micro-Vac	☐ 144+ hours 6-10 Days			

TEM AIR, 3 hours, 6 hours, Please call ahead to schedule. There is a premium charge for 3 hour tat, please call 1-800-220-3675 for price prior to sending samples. You will be asked to sign and authorization form for this service. 12 hours (must arrive by 11:00 a.m Mon - Fri..), Please Refer to Price Quote

PCM - Air
- ☐ NIOSH 7400
- ☐ OSHA
- ☐ Other:

TEM AIR
- ☐ AHERA
- ☐ NIOSH 7402
- ☐ EPA Level II

TEM WATER
- ☐ Wastewater
- ☐ Drinking Water EPA 100.1
- ☐ Water - NY Wastewater
- ☐ Water-NY Drinking Water

PLM - Bulk
- ☒ EPA 600/R-93/116
- ☐ EPA Point Count
- ☐ NY Stratified Point Count
- ☐ PLM NOB (Gravimetric) NY 198.1
- ☐ Other:

TEM BULK/misc
- ☐ Drop Mount (Qualitative)
- ☐ Chatfield
- ☐ TEM NOB (Gravimetric) NY 198.4

TEM MICROVAC / WIPE
- ☐ ASTM D 5755-95 quantitative method

XRD
- ☐ Asbestos
- ☐ Silica

SEM Air or Bulk
- ☐ Qualitative
- ☐ Quantitative

OTHER
- ☐

SAMPLE NUMBER	LOCATION	VOLUME (If Applicable)
1A + B	JOINT FILL MATERIAL	N/A
2A + B	SHEET ROKING (SHIMS)	↓
3A + B	THREAD COMPOUND	

Client Sample # (s) 1A - 3B Total Samples #: 6

Relinquished: [signature] Date: 13 NOV 2011 Time: 1600

Received: [signature] Date: 13 NOV 2011 Time: 1600

11/15/11 11am US mail

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Analytical Report

GEOCON Env. Consultants	Client Project ID: #E8128-06-07; Green Valley Rd	Date Sampled: 11/11/11
		Date Received: 11/11/11
6671 Brisa St	Client Contact: David A. Watts	Date Reported: 11/17/11
Livermore, CA 94550	Client P.O.:	Date Completed: 11/17/11

WorkOrder: 1111422

November 17, 2011

Dear David:

Enclosed within are:

1) The results of the **2** analyzed samples from your project: **#E8128-06-07; Green Valley Rd,**
2) A QC report for the above samples,
3) A copy of the chain of custody, and
4) An invoice for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits.

If you have any questions or concerns, please feel free to give me a call. Thank you for choosing McCampbell Analytical Laboratories for your analytical needs.

Best regards,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

The analytical results relate only to the items tested.

McCAMPBELL ANALYTICAL, INC.

1534 WILLOW PASS ROAD
PITTSBURG, CA 94565-1701
Website: www.mccampbell.com Email: main@mccampbell.com
Telephone: (877) 252-9262 Fax: (925) 252-9269

1111422

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

GeoTracker EDF ☐ PDF ☒ Excel ☐ Write On (DW) ☐

☐ Check if sample is effluent and "J" flag is required

Report To: D. WATTS Bill To: SAME

Company: GEOCON
6671 BRISA ST.
LIVERMORE, CA 94550 E-Mail: WATTS@GEOCONINC.COM

Tele: (925) 371-5900 Fax: (925) 371-5915

Project #: E8128-06-07 Project Name: GREEN VALLEY RD

Project Location: SOLANO COUNTY, CA

Sampler Signature: WATTS

SAMPLE ID	LOCATION/ Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other PAINT	METHOD PRESERVED ICE	HCL	HNO_3	Other	BTEX & TPH as Gas (602 / 8021 + 8015) / MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (1664 / 5520 E/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 502.2 / 601 / 8010 / 8021 (HVOCs)	MTBE / BTEX ONLY (EPA 602 / 8021)	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ONLY: Aroclors / Congeners	EPA 507 / 8141 (NP Pesticides)	EPA 515 / 8151 (Acidic Cl Herbicides)	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.7 / 200.8 / 6010 / 6020)	LUFT 5 Metals (200.7 / 200.8 / 6010 / 6020)	Lead (200.7 / 200.8 / 6010 / 6020)	Other	Filter sample for DISSOLVED metals analysis	Comments
P1A	TRUSS + GIRDER SYS	11/11/11	1424	1	Bag					X																				X				
P1B	↓	↓	1441	↓	↓					↓																				↓				

**MAI clients MUST disclose any dangerous chemicals known to be present in their submitted samples in concentrations that may cause immediate harm or serious future health endangerment as a result of brief, gloved, open air, sample handling by MAI staff. Non-disclosure incurs an immediate $250 surcharge and the client is subject to full legal liability for harm suffered. Thank you for your understanding and for allowing us to work safely.

Relinquished By:	Date:	Time:	Received By:
WATTS	11/11/11	1515	Mike Vall

ICE/t° N/A ✓
GOOD CONDITION ____
HEAD SPACE ABSENT ____
DECHLORINATED IN LAB ____
APPROPRIATE CONTAINERS ✓
PRESERVED IN LAB ____

PRESERVATION VOAS O&G METALS OTHER pH<2

COMMENTS: ANTICIPATE SOLUBLE REQUESTS

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1111422 **ClientCode: GECL**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Report to:
David A. Watts
GEOCON Env. Consultants
6671 Brisa St
Livermore, CA 94550
925-371-5900 FAX: 925-371-5915

Email: watts@geoconinc.com; Livermore@geoco
cc:
PO:
ProjectNo: #E8128-06-07; Green Valley Rd

Bill to:
Accounts Payable
GEOCON Env. Consultants
6671 Brisa St
Livermore, CA 94550

Requested TAT: 5 days

Date Received: **11/11/2011**
Date Printed: **11/18/2011**

Lab ID	Client ID	Matrix	Collection Date	Hold	1	2	3	4	5	6	7	8	9	10	11	12
					Requested Tests (See legend below)											
1111422-001	P1A	Paint Chips	11/11/2011 14:24	☐	A											
1111422-002	P1B	Paint Chips	11/11/2011 14:41	☐	A											

Test Legend:

1	PB_CHIP	2		3		4		5	
6		7		8		9		10	
11		12							

Prepared by: Melissa Valles

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Sample Receipt Checklist

Client Name: **GEOCON Env. Consultants**

Date and Time Received: **11/11/2011 3:54:27 PM**

Project Name: **#E8128-06-07; Green Valley Rd**

Checklist completed and reviewed by: Melissa Valles

WorkOrder N°: **1111422** Matrix: Paint Chips

Carrier: Client Drop-In

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Sample IDs noted by Client on COC?	Yes ☑	No ☐
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐
Sampler's name noted on COC?	Yes ☑	No ☐

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature	Cooler Temp:		NA ☑
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	No VOA vials submitted ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
Metal - pH acceptable upon receipt (pH<2)?	Yes ☐	No ☐	NA ☑
Samples Received on Ice?	Yes ☐	No ☑	

** NOTE: If the "No" box is checked, see comments below.*

Client contacted: Date contacted: Contacted by:

Comments:

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

GEOCON Env. Consultants	Client Project ID: #E8128-06-07; Green Valley Rd	Date Sampled: 11/11/11
6671 Brisa St		Date Received: 11/11/11
	Client Contact: David A. Watts	Date Extracted: 11/11/11
Livermore, CA 94550	Client P.O.:	Date Analyzed: 11/14/11

Lead by ICP*

Extraction method: SW3050B Analytical methods: SW6010B Work Order: 1111422

Lab ID	Client ID	Matrix	Extraction Type	Lead	DF	% SS	Comments
1111422-001A	P1A	C	TOTAL	56,000	1000	---#	
1111422-002A	P1B	C	TOTAL	70,000	1000	---#	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	TOTAL	NA	µg/L
	C	TOTAL	5.0	mg/Kg

*water samples are reported in µg/L, product/oil/non-aqueous liquid samples and all TCLP / STLC / DISTLC / SPLP extracts are reported in mg/L, soil/sludge/solid/paint chips samples in mg/kg, wipe samples in µg/wipe, filter samples in µg/filter.

means surrogate diluted out of range; ND means not detected above the reporting limit/method detection limit; N/A means not applicable to this sample or instrument.

TOTAL = Hot acid digestion of a representative sample aliquot.
TRM = Total recoverable metals is the "direct analysis" of a sample aliquot taken from its acid-preserved container.
DISS = Dissolved metals by direct analysis of 0.45 µm filtered and acidified sample.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR 6010B

W.O. Sample Matrix: Paint Chips | QC Matrix: Soil | WorkOrder: 1111422

EPA Method: SW6010B | **Extraction: SW3050B** | **BatchID: 62690** | **Spiked Sample ID: 1111433-013A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	Spiked	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/Kg	mg/Kg	% Rec.	% Rec.	% RPD	mg/Kg	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Lead	27	50	80.6	83.3	1.99	10	110	84.2	26.2	75 - 125	25	75 - 125	25
%SS:	117	500	117	115	1.81	500	101	91	10.5	70 - 130	20	70 - 130	20

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 62690 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1111422-001A	11/11/11 2:24 PM	11/11/11	11/14/11 6:30 PM	1111422-002A	11/11/11 2:41 PM	11/11/11	11/14/11 6:32 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

DHS ELAP Certification 1644

_____ QA/QC Officer

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Analytical Report

GEOCON Env. Consultants	Client Project ID: #E8128-06-07; Green Valley Rd	Date Sampled: 11/11/11
		Date Received: 11/11/11
6671 Brisa St	Client Contact: David A. Watts	Date Reported: 11/17/11
Livermore, CA 94550	Client P.O.:	Date Completed: 12/01/11

WorkOrder: 1111422 **A**

December 01, 2011

Dear David:

Enclosed within are:

1) The results of the **1** analyzed sample from your project: **#E8128-06-07; Green Valley Rd,**
2) A QC report for the above sample,
3) A copy of the chain of custody, and
4) An invoice for analytical services.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits.

If you have any questions or concerns, please feel free to give me a call. Thank you for choosing McCampbell Analytical Laboratories for your analytical needs.

Best regards,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

The analytical results relate only to the items tested.

McCAMPBELL ANALYTICAL, INC.

1534 WILLOW PASS ROAD
PITTSBURG, CA 94565-1701
Website: www.mccampbell.com Email: main@mccampbell.com
Telephone: (877) 252-9262 Fax: (925) 252-9269

1111422

CHAIN OF CUSTODY RECORD

TURN AROUND TIME ☐ RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☒ 5 DAY

GeoTracker EDF ☐ PDF ☒ Excel ☐ Write On (DW) ☐

☐ Check if sample is effluent and "J" flag is required

Report To: D. WATTS Bill To: SAME

Company: GEOCON
6671 BRISA ST.
LIVERMORE, CA 94550 E-Mail: WATTS@GEOCONINC.COM

Tele: (925) 371-5900 Fax: (925) 371-5915

Project #: E8128-06-07 Project Name: GREEN VALLEY RD

Project Location: SOLANO COUNTY, CA

Sampler Signature: WATTS

SAMPLE ID	LOCATION/ Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	Type Containers	MATRIX Water	MATRIX Soil	MATRIX Air	MATRIX Sludge	MATRIX Other PAINT	METHOD PRESERVED ICE	METHOD PRESERVED HCL	METHOD PRESERVED HNO_3	METHOD PRESERVED Other	BTEX & TPH as Gas (602 / 8021 + 8015) / MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (1664 / 5520 E/B&F)	Total Petroleum Hydrocarbons (418.1)	EPA 502.2 / 601 / 8010 / 8021 (HVOCs)	MTBE / BTEX ONLY (EPA 602 / 8021)	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ONLY; Aroclors / Congeners	EPA 507 / 8141 (NP Pesticides)	EPA 515 / 8151 (Acidic Cl Herbicides)	EPA 524.2 / 624 / 8260 (VOCs)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.7 / 200.8 / 6010 / 6020)	LUFT 5 Metals (200.7 / 200.8 / 6010 / 6020)	Lead (200.7 / 200.8 / 6010 / 6020)	Filter sample for DISSOLVED metals analysis	TCLP Pb 11/18/11	
P1A	TRUSS + GIRDER SYS	11/11/11	1424	1	Bag					X																				X		X	
P1B	↓	↓	1441	↓	↓					↓																				↓			

Comments: **Indicate here if these samples are potentially dangerous to handle:

**MAI clients MUST disclose any dangerous chemicals known to be present in their submitted samples in concentrations that may cause immediate harm or serious future health endangerment as a result of brief, gloved, open air, sample handling by MAI staff. Non-disclosure incurs an immediate $250 surcharge and the client is subject to full legal liability for harm suffered. Thank you for your understanding and for allowing us to work safely.

Relinquished By:	Date:	Time:	Received By:
WATTS	11/11/11	1515	Mike Vall
Relinquished By:	Date:	Time:	Received By:
Relinquished By:	Date:	Time:	Received By:

ICE/t° n/a ✓
GOOD CONDITION ____
HEAD SPACE ABSENT ____
DECHLORINATED IN LAB ✓
APPROPRIATE CONTAINERS ✓
PRESERVED IN LAB ____

PRESERVATION ____ VOAS ____ O&G ____ METALS ____ OTHER ____ pH<2 ____

COMMENTS: ANTICIPATE SOLUBLE REQUESTS

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1111422 A **ClientCode: GECL**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Report to:
David A. Watts
GEOCON Env. Consultants
6671 Brisa St
Livermore, CA 94550
925-371-5900 FAX: 925-371-5915

Email: watts@geoconinc.com; Livermore@geoco
cc:
PO:
ProjectNo: #E8128-06-07; Green Valley Rd

Bill to:
Accounts Payable
GEOCON Env. Consultants
6671 Brisa St
Livermore, CA 94550

Requested TAT: 5 days
Date Received: 11/11/2011
Date Add-On: 11/21/2011
Date Printed: 11/21/2011

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below) 1	2	3	4	5	6	7	8	9	10	11	12
1111422-001	P1A	Paint Chips	11/11/2011 14:24	☐	A											

Test Legend:

1	TCLP_PB_Chip	2		3		4		5	
6		7		8		9		10	
11		12							

Prepared by: Melissa Valles

Comments: TCLP Pb added 001 11/21/11.

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

GEOCON Env. Consultants	Client Project ID: #E8128-06-07; Green Valley Rd	Date Sampled: 11/11/11
6671 Brisa St		Date Received: 11/11/11
	Client Contact: David A. Watts	Date Extracted: 11/21/11-11/22/11
Livermore, CA 94550	Client P.O.:	Date Analyzed: 11/30/11

Lead by ICP*

Extraction method: SW1311/SW3050B Analytical methods: SW6010B Work Order: 1111422

Lab ID	Client ID	Matrix	Extraction Type	Lead	DF	% SS	Comments
1111422-001A	P1A	C	TCLP	100	1	N/A	

Reporting Limit for DF =1; ND means not detected at or above the reporting limit	W	TOTAL	NA	µg/L
	C	TCLP	0.2	mg/L

*water samples are reported in µg/L, product/oil/non-aqueous liquid samples and all TCLP / STLC / DISTLC / SPLP extracts are reported in mg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, filter samples in µg/filter.

means surrogate diluted out of range; ND means not detected above the reporting limit/method detection limit; N/A means not applicable to this sample or instrument.

TCLP = Toxicity Characteristic Leaching Procedure.
DI TCLP = Toxicity Characteristic Leaching Procedure using DI water.

%SS = Percent Recovery of Surrogate Standard
DF = Dilution Factor

DHS ELAP Certification 1644

Angela Rydelius, Lab Manager

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

QC SUMMARY REPORT FOR SW6010B

W.O. Sample Matrix: Paint Chips | QC Matrix: Soil | BatchID: 62907 | WorkOrder: 1111422

EPA Method: SW6010B **Extraction: SW1311/SW3050B** **Spiked Sample ID: N/A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	LCSD	LCS-LCSD	Acceptance Criteria (%)			
	mg/L	mg/L	% Rec.	% Rec.	% RPD	% Rec.	% Rec.	% RPD	MS / MSD	RPD	LCS/LCSD	RPD
Lead	N/A	1	N/A	N/A	N/A	85.9	89.3	3.87	N/A	N/A	75 - 125	25

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 62907 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1111422-001A	11/11/11 2:24 PM	11/21/11	11/30/11 8:44 PM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

DHS ELAP Certification 1644

_____ QA/QC Officer

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

COPY

Underground Classification

C050-095-13T

CALIF. DEPT. OF TRANSPORTATION
NAME OF TUNNEL OR MINE AND COMPANY NAME

of 111 GRAND AVENUE; OAKLAND, CA 94612-3717
MAILING ADDRESS

at INTERSTATES 80 AND 680 AND STATE HIGHWAY 12 INTERCHANGE PROJECT
LOCATION

has been classified as *** POTENTIALLY GASSY WITH SPECIAL CONDITIONS ***
CLASSIFICATION

as required by the California Labor Code § 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

*****SPECIAL CONDITIONS*****

1. **A Certified Gas Tester shall perform pre-entry and continuous monitoring of the underground environment to measure Oxygen and detect explosive, flammable, and toxic gasses whenever an employee is working in the underground environment.**
2. **Mechanical ventilation shall provide for continuous exhaust of fumes and air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.**
3. **The Division shall be notified immediately if any Flammable Gas or Petroleum Vapor exceeds 5% of the Lower Explosive Limit.**
4. **All utilities that may be in conflict with the project shall be identified and physically located (potholed) prior to the start of project operations.**

Two 60-inch-diameter, 33-foot-deep drilled shafts alongside Interstate 80, located approximately 500 feet northeast of the Green Valley Road overcrossing, Fairfield, Solano County.

This classification shall be conspicuously posted at the place of employment.

Date February 5, 2013

Douglas Patterson, Senior Engineer

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

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Two 60-inch-diameter, 33-foot-deep drilled shafts alongside Interstate 80, located approximately 1000 feet southwest of the Green Valley Road overcrossing, Fairfield, Solano County.

This classification shall be conspicuously posted at the place of employment.

Date February 5, 2013

Douglas Patterson, Senior Engineer

I-80/I-680/SR12 Interchange Project - Initial Construction Package
Solano County, California
EA 04-0A5344
December 2012

Storm Water Information Handout

Prepared For

Solano Transportation Authority

Caltrans

Prepared By

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Attachments

Attachment A Project Vicinity Map
Attachment B NOAA Precipitation Data
Attachment C Risk Level Determination
Attachment D Run-on Discharge Calculations
Attachment E Temporary Water Pollution Control Drawings

Disclaimer

A "Disclaimer" is required specifying that the information provided in the Storm Water Information Handout is just a guideline and is to be used for information purposes only and should not be considered a sole source document to adhere to the requirements of the National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP), Number CAS000002, adopted on September 2, 2009. The contractor is required to provide water quality monitoring, sampling and implement best management practices (BMPs) based on standard industry operations, field conditions and conditions encountered based on the contractor's means and methods. The information in this handout is not to be construed in any way as a waiver of the provisions in the CGP. Bidders and contractors are cautioned to make independent investigations and examinations as they deem necessary to satisfy the conditions encountered in performance of work, with respect to the following: sampling and monitoring locations, distribution of watershed areas for sizing of BMPs, and selection of BMPs in order to conform to the requirement of the contract documents and the CGP.

1 OVERVIEW

1.1 Intent of this Document

The objectives of this Water Quality Information Handout are: to summarize general water quality information of the Project; to summarize updated requirements per the new Construction General Permit (CGP), which became effective as of July 1, 2010; to provide general guidelines for contractors to bid on the project; to aid in developing the Storm Water Pollution Prevention Plan (SWPPP) of the project; and to highlight information necessary to file Project Registration Documents (PRDs) to the State Water Resources Control Board via the Stormwater Multi Application Reporting and Tracking System (SMARTS) and file the Notice of Intent at the start of construction.

1.2 Summary of New Requirements

The "National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities" (NPDES Number CAS000002), or CGP, regulates discharges from construction activities within the Project area.

The CGP is based on a risk level (RL) permitting approach. The RL is calculated by 1) project sediment risk and 2) receiving water risk. See the risk assessment calculations in Attachment C of this document for details.

A risk assessment was done for the **I-80/I-680/SR-12 Interchange Project – Initial Construction Package (EA 04-0A5344)**, and the Project was determined to be **RL 2.**

RL 2 projects will be subject to monitoring and sampling requirements, plus Numeric Action Levels (NALs) for pH and turbidity. All projects will have to upload storm water data into SMARTS, such as Notices of Intent (NOIs), SWPPPs, annual reports, and monitoring data.

2 GENERAL PROJECT INFORMATION

2.1 Location

The project is located in the vicinity of the City of Fairfield in Solano County at the interchanges between Interstate 80 (I-80), Interstate 680 (I-680), and State Route 12 (SR 12). See Vicinity Map, Attachment A.

2.2 Major Engineering Features

The proposed improvement will construct braided ramps on westbound I-80 between Green Valley Road Overcrossing and SR 12 and replace the Green Valley Road Overcrossing to improve traffic flow, pedestrian access and safety on the overcrossing.

The project proposes the following improvements:

- Reconstruct I-80/ Green Valley Road (GVR) interchange
- Reconstruct the westbound (WB) on-ramp to I-80 and including a connection from the on-ramp to the proposed WB I-80/ SR 12 west connector
- Reconstruct the eastbound (EB) off-ramp from I-80 to the reconstructed GVR.
- Reconstruct the EB on-ramp, including ramp metering, reconnecting to the exiting collector-distributor (CD) connector from EB I-80 to SB I-680 and NB I-680 to EB I-80
- Construct an interim overcrossing to carry GVR over the existing EB I-80 to SB I-680 connector
- Construct a two lane WB I-80/ WB SR 12W connector with a bridge crossing over the WB I-80 GVR on ramp
- The WB acceleration lane on SR 12 W after Red Top Road will be lengthened
- The left turn from WB SR 12W to Red Top Road will be closed
- Relocation of bike and pedestrian trail along I-80 between GVR IC and the SR 12W/ Red Top Road intersection to be from the end of Business Center Drive, adjacent to the new westbound connector to SR 12W to Jameson Canyon Road, opposite Red Top Road
- 3:1 (and flatter) (H:V) embankment and 2:1 (and flatter) (H:V) cut slopes
- Drainage improvements
- Signing and pavement delineation
- Construction of retaining walls

2.3 Receiving Water Bodies

Solano County is divided into two drainage provinces. They are San Francisco Bay Province and Sacramento River Province. The project site is located within the San Francisco Bay Province. There are two primary drainage patterns in Solano County. The drainages in the western third, which includes the project site, drains south into San Francisco Bay through Suisun Bay. The eastern two-thirds of Solano County drains east and southeast into Sacramento River.

The main drainage within the project limits include Green Valley Creek, and Jameson Canyon Creek, which both drain into San Francisco Bay through Suisun Bay.

There are no Drinking Water Reservoirs and/or recharge facilities within the project limits.

The Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments (hereto known as "303(d) List") is a list of water bodies that do not meet water quality standards. The State Water Resources Control Board (SWRCB, San Francisco Bay Region) developed this list and it is also approved by the United States Environmental Protection Agency (US EPA). These regulations require that the responsible jurisdictions establish a ranking system, by priority, for water bodies on the list; also, action plans need to be developed, such as Total Maximum Daily Loads (TMDLs), in order to improve water quality. The 303(d) List is typically revised every two years.

Green Valley Creek and Jameson Canyon Creek are not listed on the 303(d) List of Water Quality Limited Segments, but Suisun Marsh Wetlands are listed, with Mercury, Nutrients, Organic Enrichment/Low Dissolved Oxygen, and Salinity/TDS/Chlorides as the Pollutants of Concern.

2.4 Climate and Rainfall

A National Oceanic and Atmospheric Administration (NOAA) weather station located in Fairfield, approximately 2 miles northeast of the Project site, was used to obtain precipitation data (Attachment B).

Rainy days per year (assumed equal to precipitation 0.10 inches or greater): 41.6 days

Qualifying rain events per year (precipitation 0.5 inches or greater): 15.6 days

2.5 Soils and Geology

The soil on the proposed site, as mapped by the Natural Resources Conservation Service, consists mainly of Clear Lake Clay, Conejo Gravelly Loam, and Pescadero Clay. The Preliminary Geologic Evaluation for the project states that the I-80/I-680/SR 12 Interchange Project will not result in adverse geologic impacts. Design of the roadways and structures is in accordance with regulatory standards and design guidelines to address seismic risk. These include Caltrans Seismic Design Criteria and Caltrans Highway Design Manual. A Geotechnical Design and Materials Report (GDMR) has been prepared by Parikh Consultants, Inc. in November, 2010, and was finalized in December, 2012. Soil data collection together with site specific borings and penetrometer data has been conducted to determine foundation requirements. Soil laboratory test data has been conducted to determine site specific geotechnical design parameters.

2.6 Hazardous Waste

Recent studies have identified total lead in shallow soils near roadways attributed to the use of lead in gasoline, which was phased out beginning in the mid-1970s. Lead concentrations in shallow soils near roadways are affected by two factors: traffic volumes and wind patterns. ADL sampling was conducted as part of the Preliminary Site Investigation Report, prepared by Geocon, Inc., and there was evidence of exposed soils near roadways in the study area to have elevated concentrations of total and/or soluble lead due to the age and frequency of use of the project corridor by diesel trucks and vehicles using leaded gasoline prior to the mid1970s. Soils exceeding hazardous waste thresholds will be classified as a hazardous waste, once excavated, and could require special handling and disposal procedures. Soil with elevated lead concentrations could also be a health hazard to construction workers, who may have direct contact with soils during project construction activities.

In addition, heavy metals known as CAM 17 metals are typically present in California soils. The use of soils with CAM 17 metal concentrations exceeding acceptable levels may be restricted to certain land use type, and may be restricted to construction exposure. CAM 17 metal concentrations in groundwater generated during construction may require treatment to reduce metal content prior to discharge or disposal.

Other potential sources of hazardous waste include asbestos containing structures, lead containing paint and yellow thermoplastic and paint striping. Asbestos containing pipe and treated wood may also be encountered during construction of the interchange.

Comprehensive findings and recommendations can be found in the Preliminary Site Investigation Report, revised in September 2012 by GEOCON.

2.7 Existing (Pre-Construction) Control Practices

There are no existing treatment BMPs within the project limits.

3 CONSTRUCTION GENERAL PERMIT

To minimize the potential effects of construction runoff on the quality of the receiving water bodies, any construction activity affecting one acre or more must obtain coverage under the CGP. Permit applicants are required to prepare a SWPPP and implement BMPs to reduce construction effects on receiving water quality.

3.1 Risk Assessment

The CGP requirements include a risk assessment to determine the Project's impact risk to receiving water bodies. The risk assessment uses measurements of the Project's potential sediment risk and the sensitivity of the receiving water bodies to sediment to determine the RL of the Project. This Project has a **Medium Site Sediment Risk Factor** and a **High Receiving Water Risk Factor**; the combined risk is **Level 2** (See Attachment C). The risk factors are detailed in the following sections.

3.1.1 Sediment Risk

The sediment risk is based on the following equation from the adopted NPDES permit "Fact Sheet" (Section J.1.a pg. 28):

Equation 1 - Sediment Risk Equation
$A = (R)(K)(LS)(C)(P)$

Where:

R = Runoff erosivity factor
K = Soil erodibility factor
LS = Length-slope factor
C = Cover
P = Management operations and support practices
A = Rate of sheet and rill erosion (tons/acre)

The rainfall runoff erosivity factor (R) was determined from the United States Environmental Protection Agency (EPA) "Rainfall Erosivity Factor Calculator for Small Construction Sites." The erosivity index value for the Project was determined to be **40.0**.

The soil erodibility factor (K) was determined from the United States Department of Agriculture Natural Resources Conservation Services "Web Soil Survey." A weighted average of the soil erodibility factor by area was used; this value is **0.24**.

The length-slope factor (LS) was determined by examining the original grade delineated on the Typical Cross Sections included in the Contract Project Plans. Based on these cross sections, the weighted average LS factor was determined to be **4.59**.

The cover factor (C) and management operations and support practices (P) are given values of 1.0 by the adopted NPDES permit to simulate bare ground conditions.

Based on these factors, the rate of sheet and rill erosion (A) is **44.06** tons per acre. Because this value is greater than 15 tons per acre and less than 75 tons per acre, the project is classified as having a **medium** sediment risk.

3.1.2 Receiving Water Body Risk

The receiving water body risk is classified as **high** because Suisun Marsh Wetlands is a 303(d) listed water body impaired by sediment.

3.1.3 Combined Risk

With a medium sediment risk and a high receiving water body risk, the combined Risk Level is Level **2**.

3.2 Notice of Termination (NOT)

The CGP provides both revised and new requirements for completion and approval of the NOT. The NOT requirements are presented in Section II.D of the new CGP permit "Order." These requirements include demonstrating through photos, computational proof or other "custom methods," such as results of testing and analysis, that the terms of the NOT have been satisfied.

While these methods of demonstrating compliance are at the option of the contractor, should the RWQCB determine that the visual photos do not adequately show compliance, further computational efforts may be required. This computational proof is obtained through the use of the Revised Universal Soil Loss Equation 2 (RUSLE2) program.

3.3 Caltrans Forms

The following forms have been developed by the Division of Construction as of 09/2010:

- CEM-2030 "Stormwater Site Inspection Report"
  Visual inspection monitoring form

- CEM-2034 "Stormwater Best Management Status Report"
  Identifies BMP types and quantities to be installed on a weekly basis

- CEM-2035 "Stormwater Site Inspection Report Corrective Actions Summary"
  Describes actions taken for existing BMP failures

- CEM-2045 "Rain Event Action Plan-Highway Construction Phase"

REAP to be used during active work phase

- CEM-2046 "Rain Event Action Plan-Plant Establishment Phase"
  REAP to be used during plant establishment phase

- CEM-2047 "Rain Event Action Plan-Innactive Project"
  REAP to be used for inactive work phase

- CEM-2090 "Notice of Completion of Construction"
  Describes efforts to show compliance with NOT requirements

4 RUN-ON DISCHARGES

Run-on discharges are off-site storm water flows that can potentially run onto the site. The calculations are based on a rainfall intensity for a 2-year, 1-hour event per the Caltrans Computational Sheet for Determining Run-on Discharges. The runoff coefficient is calculated using an impervious/pervious surface map found in the Storm Water Data Report (SWDR). The area calculations use the watershed delineations provided in the Drainage Report for this project. See Attachment D for calculations.

The runoff coefficient is 0.67.

The rainfall intensity for a 2-year, 1-hour event is 0.50 in/hour.

The total disturbed area of the project is 35.1 acres.

The total watershed area drainage for the project is 199.1 acres.

The Site Area Run-on Discharge is 66.7 ft^3/s

5 PROJECT REGISTRATION DOCUMENTS

To obtain permit coverage under the CGP, all dischargers must electronically file PRDs, NOTs, changes of information, sampling and monitoring information, annual reporting, and other compliance documents required by this CGP through the SWRCB's SMARTS. The contractor will have to coordinate these submittals with Caltrans within the timeframe allotted in the contract special provisions and as specified in the permit. SMARTS is found under the following website:

https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.jsp

PRDs include the following information:

1. Notice of Intent (NOI)
2. Site Map(s) Includes:
    a. The project's surrounding area (vicinity)
    b. Site layout
    c. Construction site boundaries
    d. Drainage areas
    e. Discharge locations
    f. Sampling locations
    g. Areas of soil disturbance (temporary or permanent)
    h. Active areas of soil disturbance (cut or fill)
    i. Locations of all runoff BMPs
    j. Locations of all erosion control BMPs
    k. Locations of all sediment control BMPs
    l. ATS location (if applicable)
    m. Locations of sensitive habitats, watercourses, or other features which are not to be disturbed
    n. Locations of all post-construction BMPs
    o. Locations of storage areas for waste, vehicles, service, loading/unloading of materials, access (entrance/exits) points to construction site, fueling and water storage, water transfer for dust control and compaction practices

3. SWPPP

4. Risk Assessment

1. The Standard Risk Assessment includes utilization of the following:
    a. Receiving water Risk Assessment interactive map
    b. EPA Rainfall Erosivity Factor Calculator Website
    c. Sediment Risk interactive map
    d. Sediment sensitive water bodies list

2. The Site-Specific Risk Assessment includes the completion of the hand calculated R value Risk Calculator

5.1 General Information Included

The following is a list of information included in this Storm Water Information Handout that can be used for the PRDs:

- Vicinity Map
- Risk Assessment
- Temporary Water Pollution Control Plans (Site Map)

5.2 Storm Water Pollution Prevention Plan

The contractor for the Project is required to prepare a Storm Water Pollution Prevention Plan (SWPPP) because the Project involves disturbing more than 1 ac of soil. The SWPPP must include the following information:

- Active areas of cut and fill
- Areas of soil disturbance (temporary and permanent)
- Locations of storage areas for waste, vehicles, access, etc.
- Locations of all runoff BMPs
- Locations of all erosion control BMPs
- Locations of all sediment control BMPs

The SWPPP should be submitted with the PRDs and will be forthcoming from the Contractor.

5.3 Notice of Intent (NOI)

The NOI must be submitted once the contractor submits the SWPPP.

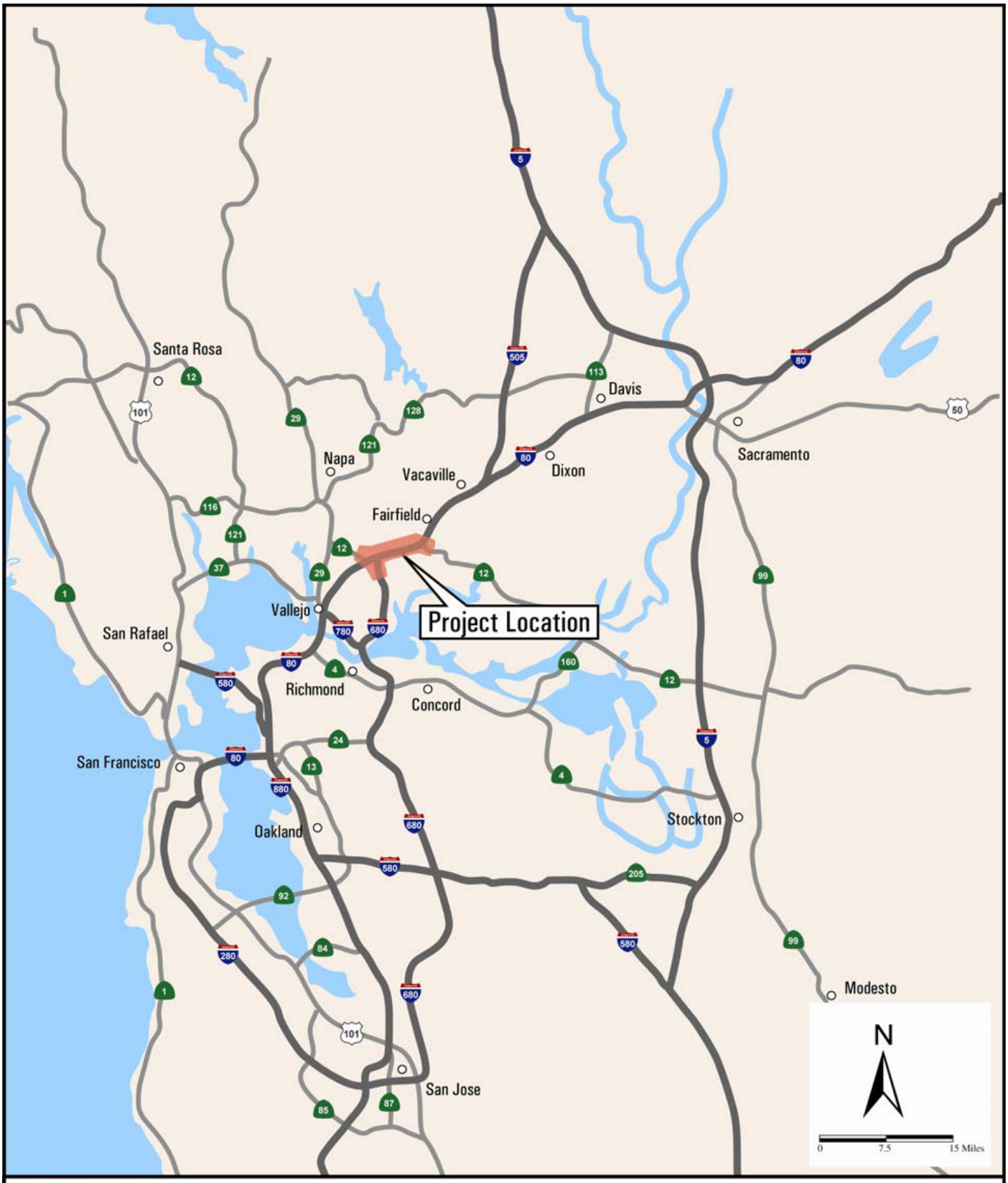
5.4 Site Maps

Registration requirements can be met by the inclusion of the Temporary Water Pollution Control Plans (Attachment E). Please note that the attached plans are not fully inclusive site maps and will need additional information to be considered complete:

- Discharge locations
- Sampling locations
- Storage locations

Attachment A

Project Vicinity Map



Solano Transportation Authority

I-80 / I-680 / SR12
Interchange Project

Location Map

ATTACHMENT A

Attachment B

NOAA Precipitation Data

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data,
and Information Service

Climatography of the United States No. 20 1971-2000

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801
www.ncdc.noaa.gov

Station: FAIRFIELD, CA **COOP ID: 042934**

Climate Division: CA 2 **NWS Call Sign:** **Elevation: 40 Feet** **Lat: 38°16N** **Lon: 122°04W**

Precipitation (inches)

	Precipitation Totals									Mean Number of Days (3)				Precipitation Probabilities (1) Probability that the monthly/annual precipitation will be equal to or less than the indicated amount										
	Means/ Medians(1)		Extremes							Daily Precipitation				Monthly/Annual Precipitation vs Probability Levels These values were determined from the incomplete gamma distribution										
Month	Mean	Med-ian	Highest Daily(2)	Year	Day	Highest Monthly(1)	Year	Lowest Monthly(1)	Year	>= 0.01	>= 0.10	>= 0.50	>= 1.00	.05	.10	.20	.30	.40	.50	.60	.70	.80	.90	.95
Jan	5.04	4.42	3.65	1979	11	12.47	1995	.30	1984	11.4	8.0	3.2	1.6	.41	.75	1.41	2.11	2.88	3.76	4.81	6.13	7.97	11.04	14.06
Feb	4.57	3.97	3.81	1998	3	14.71	1998	.14	1995	10.3	6.7	3.2	1.4	.24	.49	1.03	1.64	2.34	3.17	4.19	5.50	7.35	10.50	13.66
Mar	3.59	2.86	2.83	1983	13	10.89	1983	.14	1994	9.8	7.2	2.5	.8	.32	.57	1.06	1.55	2.10	2.72	3.45	4.37	5.64	7.75	9.83
Apr	1.12	.94	2.38	1982	11	5.05	1982	.06	1985	5.5	3.0	.5	.1	.07	.14	.28	.43	.60	.80	1.05	1.35	1.79	2.51	3.24
May	.64	.17	2.17	1996	16	3.29	1998	.00+	1992	3.2	1.6	.3	.1	.00	.00	.01	.05	.13	.25	.42	.67	1.06	1.80	2.58
Jun	.16	.01	1.63	1995	16	1.83	1995	.00+	1999	.7	.4	.1	@	.00	.00	.00	.00	.00	.00	.03	.10	.23	.51	.84
Jul	.03	.00	.49	1974	9	.60	1974	.00+	2000	.1	.1	.0	.0	**	**	**	**	**	**	**	**	**	**	**
Aug	.05	.00	1.01	1968	22	.66	1976	.00+	2000	.3	.2	.0	.0	.00	.00	.00	.00	.00	.00	.00	.00	.00	.10	.31
Sep	.30	.09	2.49	1959	18	1.37	1989	.00+	1997	1.8	1.0	.1	.0	.00	.00	.00	.00	.02	.09	.19	.33	.53	.88	1.24
Oct	1.24	.76	4.50	1962	13	4.60	1972	.00+	1995	3.4	2.4	1.0	.3	.00	.06	.24	.42	.63	.87	1.15	1.51	2.02	2.88	3.73
Nov	3.08	2.78	3.95	1977	22	7.20	1973	.08+	1995	7.7	5.3	2.3	.7	.13	.28	.62	1.03	1.50	2.07	2.77	3.68	4.98	7.21	9.46
Dec	3.64	2.59	4.41	1995	12	11.67	1996	.00	1989	9.0	5.7	2.4	.9	.20	.54	1.09	1.63	2.20	2.83	3.57	4.49	5.74	7.80	9.80
Ann	23.46	21.52	4.50	Oct 1962	13	14.71	Feb 1998	.00+	Aug 2000	63.2	41.6	15.6	5.9	10.47	12.55	15.45	17.80	20.00	22.21	24.58	27.29	30.71	35.90	40.59

+ Also occurred on an earlier date(s)
# Denotes amounts of a trace
@ Denotes mean number of days greater than 0 but less than .05
** Statistics not computed because less than six years out of thirty had measurable precipitation

(1) From the 1971-2000 Monthly Normals
(2) Derived from station's available digital record: 1950-2001
(3) Derived from 1971-2000 serially complete daily data

Complete documentation available from:
www.ncdc.noaa.gov/oa/climate/normals/usnormals.html

Attachment C

Risk Level Determination

	A	B	C
1	**Sediment Risk Factor Worksheet**		**Entry**
2	**A) R Factor**		
3	Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site.		
4	http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm		
5	**R Factor Value**		40.00
6	**B) K Factor (weighted average, by area, for all site soils)**		
7	The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted.		
8	Site-specific K factor guidance		
9	**K Factor Value**		0.24
10	**C) LS Factor (weighted average, by area, for all slopes)**		
11	The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction.		
12	LS Table		
13	**LS Factor Value**		4.59
14			
15	**Watershed Erosion Estimate (=RxKxLS) in tons/acre**	44.064	
16	**Site Sediment Risk Factor**	**Medium**	
17	Low Sediment Risk: < 15 tons/acre		
18	Medium Sediment Risk: >=15 and <75 tons/acre		
19	High Sediment Risk: >= 75 tons/acre		
20			

Receiving Water (RW) Risk Factor Worksheet	Entry	Score
A. Watershed Characteristics	**yes/no**	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment** (For help with impaired waterbodies please visit the link below) or has a **USEPA approved TMDL implementation plan for sediment**?: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml **OR** A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan) http://www.waterboards.ca.gov/waterboards_map.shtml	**yes**	**High**
Region 1 Basin Plan Region 2 Basin Plan Region 3 Basin Plan Region 4 Basin Plan Region 5 Basin Plan Region 6 Basin Plan Region 7 Basin Plan Region 8 Basin Plan Region 9 Basin Plan		
A.1 - Project runoff flows to Marsh Creek - listed as impaired by Sediment Toxicity - 303(d) list.		

Combined Risk Level Matrix

Receiving Water Risk	Sediment Risk: Low	Sediment Risk: Medium	Sediment Risk: High
Low	Level 1	Level 2	
High	Level 2		Level 3

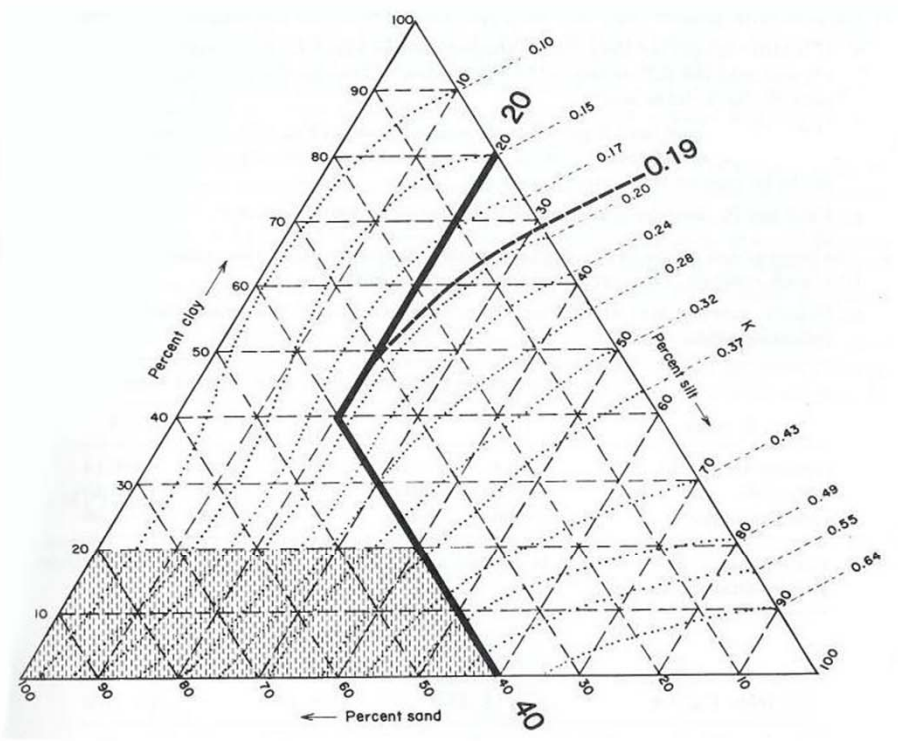
Project Sediment Risk: **Medium**

Project RW Risk: **High**

Project Combined Risk: **Level 2**

Soil Erodibility Factor (K)

The K factor can be determined by using the nomograph method, which requires that a particle size analysis (ASTM D-422) be done to determine the percentages of sand, very fine sand, silt and clay. Use the figure below to determine appropriate K value.



Erickson triangular nomograph used to estimate soil erodibility (K) factor.
The figure above is the USDA nomograph used to determine the K factor for a soil, based on its texture (% silt plus very fine sand, % sand, % organic matter, soil structure, and permeability). *Nomograph from Erickson 1977 as referenced in Goldman et. al., 1986.*

Sheet Flow Length (ft)	Average Watershed Slope (%) 0.2	0.5	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0	12.0	14.0	16.0	20.0	25.0	30.0	40.0	50.0	60.0
<3	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.35	0.36	0.38	0.39	0.41	0.45	0.48	0.53	0.58	0.63
6	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.37	0.41	0.45	0.49	0.56	0.64	0.72	0.85	0.97	1.07
9	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.38	0.45	0.51	0.56	0.67	0.80	0.91	1.13	1.31	1.47
12	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.39	0.47	0.55	0.62	0.76	0.93	1.08	1.37	1.62	1.84
15	0.05	0.07	0.09	0.13	0.17	0.20	0.23	0.26	0.32	0.40	0.49	0.58	0.67	0.84	1.04	1.24	1.59	1.91	2.19
25	0.05	0.07	0.10	0.16	0.21	0.26	0.31	0.36	0.45	0.57	0.71	0.85	0.98	1.24	1.56	1.86	2.41	2.91	3.36
50	0.05	0.08	0.13	0.21	0.30	0.38	0.46	0.54	0.70	0.91	1.15	1.40	1.64	2.10	2.67	3.22	4.24	5.16	5.97
75	0.05	0.08	0.14	0.25	0.36	0.47	0.58	0.69	0.91	1.20	1.54	1.87	2.21	2.86	3.67	4.44	5.89	7.20	8.37
100	0.05	0.09	0.15	0.28	0.41	0.55	0.68	0.82	1.10	1.46	1.88	2.31	2.73	3.57	4.59	5.58	7.44	9.13	10.63
150	0.05	0.09	0.17	0.33	0.50	0.68	0.86	1.05	1.43	1.92	2.51	3.09	3.68	4.85	6.30	7.70	10.35	12.75	14.89
200	0.06	0.10	0.18	0.37	0.57	0.79	1.02	1.25	1.72	2.34	3.07	3.81	4.56	6.04	7.88	9.67	13.07	16.16	18.92
250	0.06	0.10	0.19	0.40	0.64	0.89	1.16	1.43	1.99	2.72	3.60	4.48	5.37	7.16	9.38	11.55	15.67	19.42	22.78
300	0.06	0.10	0.20	0.43	0.69	0.98	1.28	1.60	2.24	3.09	4.09	5.11	6.15	8.23	10.81	13.35	18.17	22.57	26.51
400	0.06	0.11	0.22	0.48	0.80	1.14	1.51	1.90	2.70	3.75	5.01	6.30	7.60	10.24	13.53	16.77	22.95	28.60	33.67
600	0.06	0.12	0.24	0.56	0.96	1.42	1.91	2.43	3.52	4.95	6.67	8.45	10.26	13.94	18.57	23.14	31.89	39.95	47.18
800	0.06	0.12	0.26	0.63	1.10	1.65	2.25	2.89	4.24	6.03	8.17	10.40	12.69	17.35	23.24	29.07	40.29	50.63	59.93
1000	0.06	0.13	0.27	0.69	1.23	1.86	2.55	3.30	4.91	7.02	9.57	12.23	14.96	20.57	27.66	34.71	48.29	60.84	72.15

LS Factors for Construction Sites. *Table from Renard et. al., 1997.*

Marsh Creek Restoration Project

RISK ASSESSMENT R-FACTOR CALCULATION

1.	Estimated Start Date	9/1/2013					
2.	Construction Duration	500 working days (33 months)					
	Estimated End Construction Date	6/1/2016					
	Estimated Final Soil Stabilization Date	9/1/2016					
	(Assume 3 months for final stabilization)						
3.	EI (Erosivity Index)	20					
4.	Annual EI Value						
	Year	Start	End	% Start	% End	% Delta	
	2013	9/1/2013	12/31/2013	57.50%	100.00%	42.50%	
	2014	1/1/2014	12/31/2014	0.00%	100.00%	100.00%	
	2015	1/1/2015	12/31/2015	0.00%	100.00%	100.00%	
	2016	1/1/2016	6/1/2016	0.00%	45.20%	45.20%	
					Total % =	100.00%	
5.	Annual Isoerodent Value	40					
6.	R-Factor = Total % * Annual Isoerodent Value	40.00					

Custom Soil Resource Report
Soil Map

Map Scale: 1:13,300 if printed on A size (8.5" x 11") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1,000 2,000 3,000

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:13,300 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 10N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Solano County, California
Survey Area Data: Version 5, Dec 12, 2007

Date(s) aerial images were photographed: 6/30/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Solano County, California (CA095)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AsA	Antioch-San Ysidro complex, thick surface, 0 to 2 perce nt slopes	0.0	0.0%
CeA	Clear Lake clay, 0 to 2 percent slopes	54.8	49.9%
ClA	Clear Lake clay,saline, 0 to 2 percent slopes	15.0	13.6%
Co	Conejo gravelly loam	1.0	0.9%
DbE	Dibble-Los Osos loams, 9 to 30 percent slopes	2.7	2.5%
HaF	Hambright loam, 15 to 40 percent slopes	9.9	9.0%
Pe	Pescadero clay	2.6	2.4%
RoA	Rincon clay loam, 0 to 2 percent slope	17.0	15.5%
RoC	Rincon clay loam, 2 to 9 percent slopes	6.9	6.3%
Totals for Area of Interest		**109.9**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially

where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Attachment D

Run-on Discharge Calculations

Computation Sheet for Determining Runoff Coefficients

Total Site Area	=	35.1 Acres	(A)

Existing Site Conditions

Impervious Area	=	9.0 Acres	(B)
Impervious Area Runoff Coefficient	=	0.95	(C)
9.0 x 0.95	=	8.55 Acres	(B x C)
Pervious Area	=	26.1 Acres	(D)
Pervious Area Runoff Coefficient	=	0.4	(E)
26.1 x 0.4	=	10.44 Acres	(D x E)
Sum: 8.55 + 10.44	=	18.99	(B x C) + (D x E)
Divide: 18.99/35.1	=	0.54	$\frac{(B \times C) + (D \times E)}{(A)}$
Existing Area Runoff Coefficient	=	0.54	(F)

Proposed Site Conditions

Impervious Area	=	17.1 Acres	(G)
Impervious Area Runoff Coefficient	=	0.95	(H)
17.1 x 0.95	=	16.25 Acres	(G x H)
Pervious Area	=	18.00 Acres	(I)
Pervious Area Runoff Coefficient	=	0.4	(J)
18.00 x 0.4	=	7.2 Acres	(I x J)
Sum: 16.25 + 7.2	=	23.45	(G x H) + (I x J)
Divide: 23.45/35.1	=	0.67	$\frac{(G \times H) + (I \times J)}{(A)}$
Proposed Area Runoff Coefficient	=	0.67	(F)

Existing Site Conditions

Area Runoff Coefficient	=	0.67	(A)
Area Rainfall Intensity	=	0.50 in/hr	(B)
Total Watershed Drainage Area (from Drainage Report)	=	199.1 Acre	(C)
Site Area Run-on Discharge (A) x (B) x (C)	=	66.70 cfs	(D)

Figure 819.2A

Runoff Coefficients for Undeveloped Areas
Watershed Types

	Extreme	High	Normal	Low
Relief	**.28 -.35** Steep, rugged terrain with average slopes above 30%	**.20 -.28** Hilly, with average slopes of 10 to 30%	**.14 -.20** Rolling, with average slopes of 5 to 10%	**.08 -.14** Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	**.12 -.16** No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	**.08 -.12** Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	**.06 -.08** Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	**.04 -.06** High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	**.12 -.16** No effective plant cover, bare or very sparse cover	**.08 -.12** Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	**.06 -.08** Fair to good; about 50% of area in good grassland or wood-land, not more than 50% of area in cultivated crops	**.04 -.06** Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover.
Surface Storage	**.10 -.12** Negligible surface depression few and shallow; drainageways steep and small, no marshes	**.08 -.10** Low; well defined system of small drainageways; no ponds or marshes	**.06 -.08** Normal; considerable surface depression storage; lakes and pond marshes	**.04 -.06** High; surface stor-age, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes.

Given An undeveloped watershed consisting of;

1) rolling terrain with average slopes of 5%,
2) clay type soils,
3) good grassland area, and
4) normal surface depressions.

Solution:

Relief	0.14
Soil Infiltration	0.08
Vegetal Cover	0.04
Surface Storage	0.06
C=	0.32

Find The runoff coefficient, C, for the above watershed.

Table 819.2B

Runoff Coefficients for Developed Areas

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
Industrial:	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, cemeteries:	0.10 - 0.25
Playgrounds:	0.20 - 0.40
Railroad yard areas:	0.20 - 0.40
Unimproved areas:	0.10 - 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 - 0.10
Sandy soil, average, 2-7%	0.10 - 0.15
Sandy soil, steep, 7%	0.15 - 0.20
Heavy soil, flat, 2%	0.13 - 0.17
Heavy soil, average, 2-7%	0.18 - 0.25
Heavy soil, steep, 7%	0.25 - 0.35
Streets:	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and walks	0.75 - 0.85
Roofs:	0.75 - 0.95

Attachment E

Temporary Water Pollution Control Drawings

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.1/2.8, 12.0/13.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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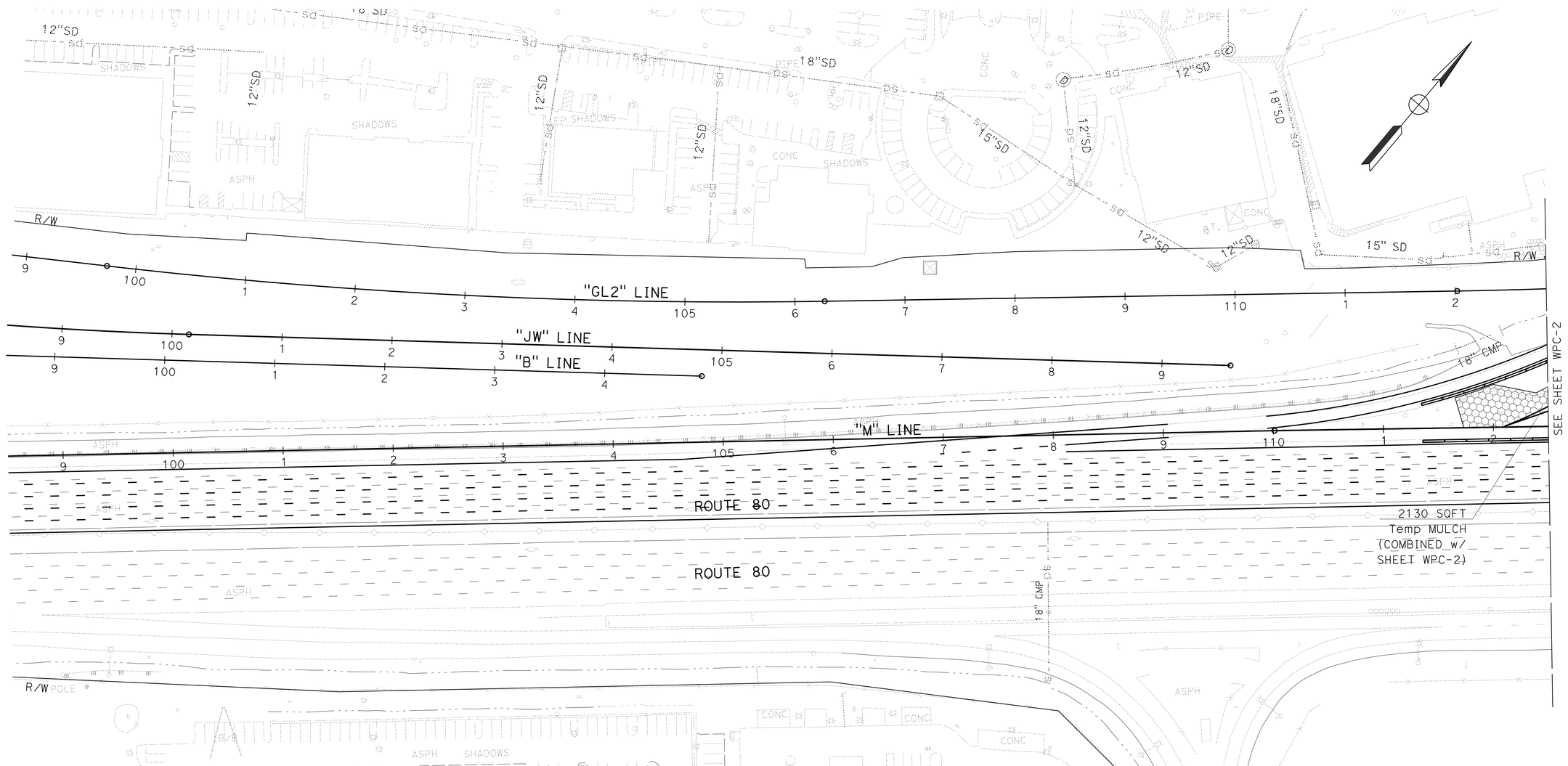
SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

NOTE:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

LEGEND:

- FR — TEMPORARY FIBER ROLL
- TEMPORARY HYDRAULIC MULCH (BONDED FIBER MATRIX)
- TEMPORARY SILT FENCE
- TEMPORARY CONSTRUCTION ENTRANCE
- TEMPORARY DRAINAGE INLET PROTECTION
- TEMPORARY CONCRETE WASHOUT
- CONSTRUCT THIS STAGE
- REMOVE THIS STAGE
- CONSTRUCT TEMPORARY PAVEMENT
- CONSTRUCT WITH LANE/RAMP CLOSURES AT NIGHT OR ON WEEKENDS
- CONSTRUCT TEMPORARY PAVEMENT WITH LANE/RAMP CLOSURES AT NIGHT OR ON WEEKENDS



FOR NOTES AND LEGEND SEE SHEET WPC-1

APPROVED FOR EROSION CONTROL WORK ONLY

WATER POLLUTION CONTROL PLAN

STAGE 1A

SCALE: 1" = 50'

WPC-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.1/2.8, 12.0/13.1		

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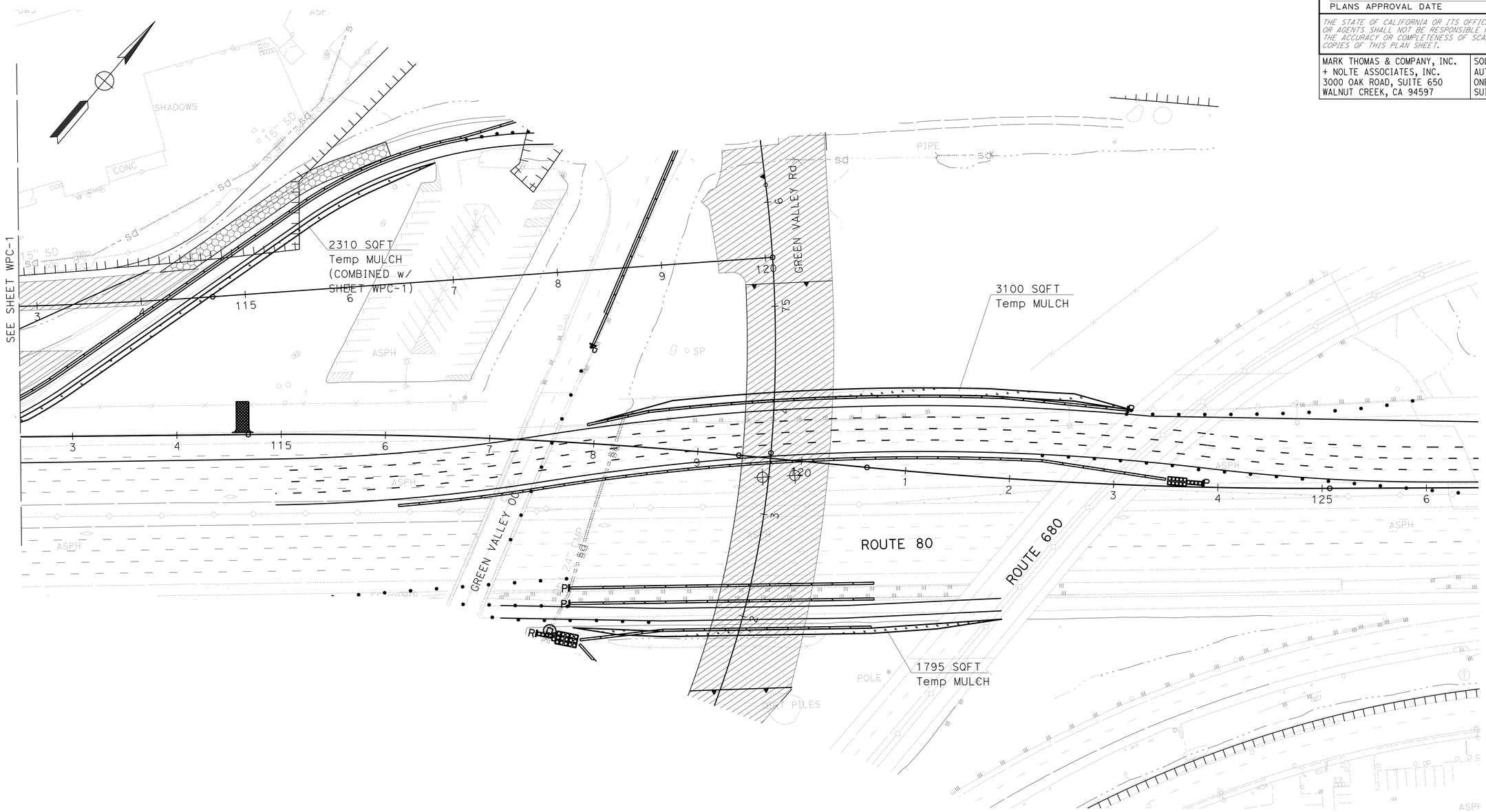

FOR NOTES AND LEGEND SEE SHEET WPC-1

APPROVED FOR EROSION CONTROL WORK ONLY

WATER POLLUTION CONTROL PLAN

STAGE 1A

SCALE: 1" = 50'

WPC-2

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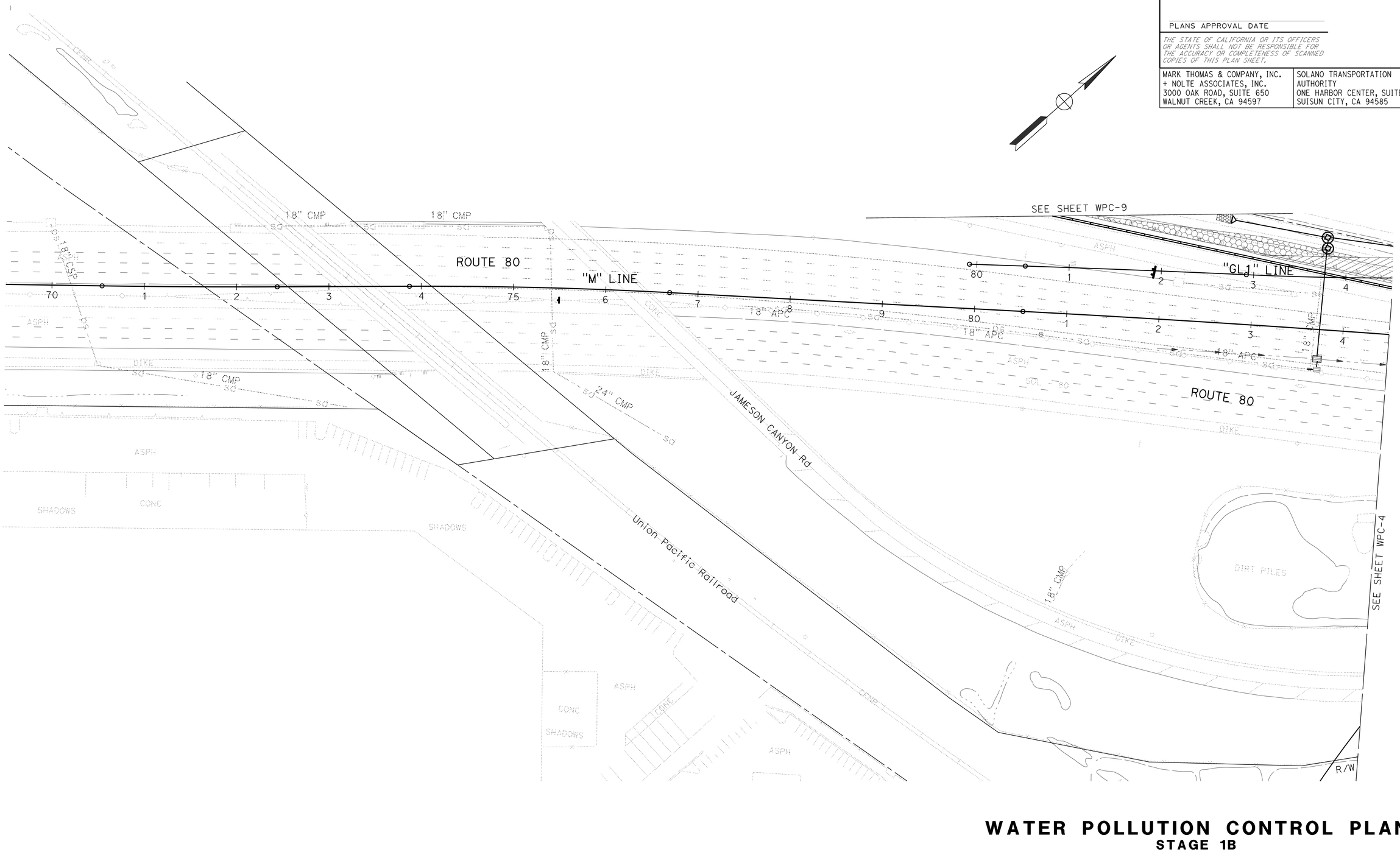

WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-3

FOR NOTES AND LEGEND SEE SHEET WPC-1

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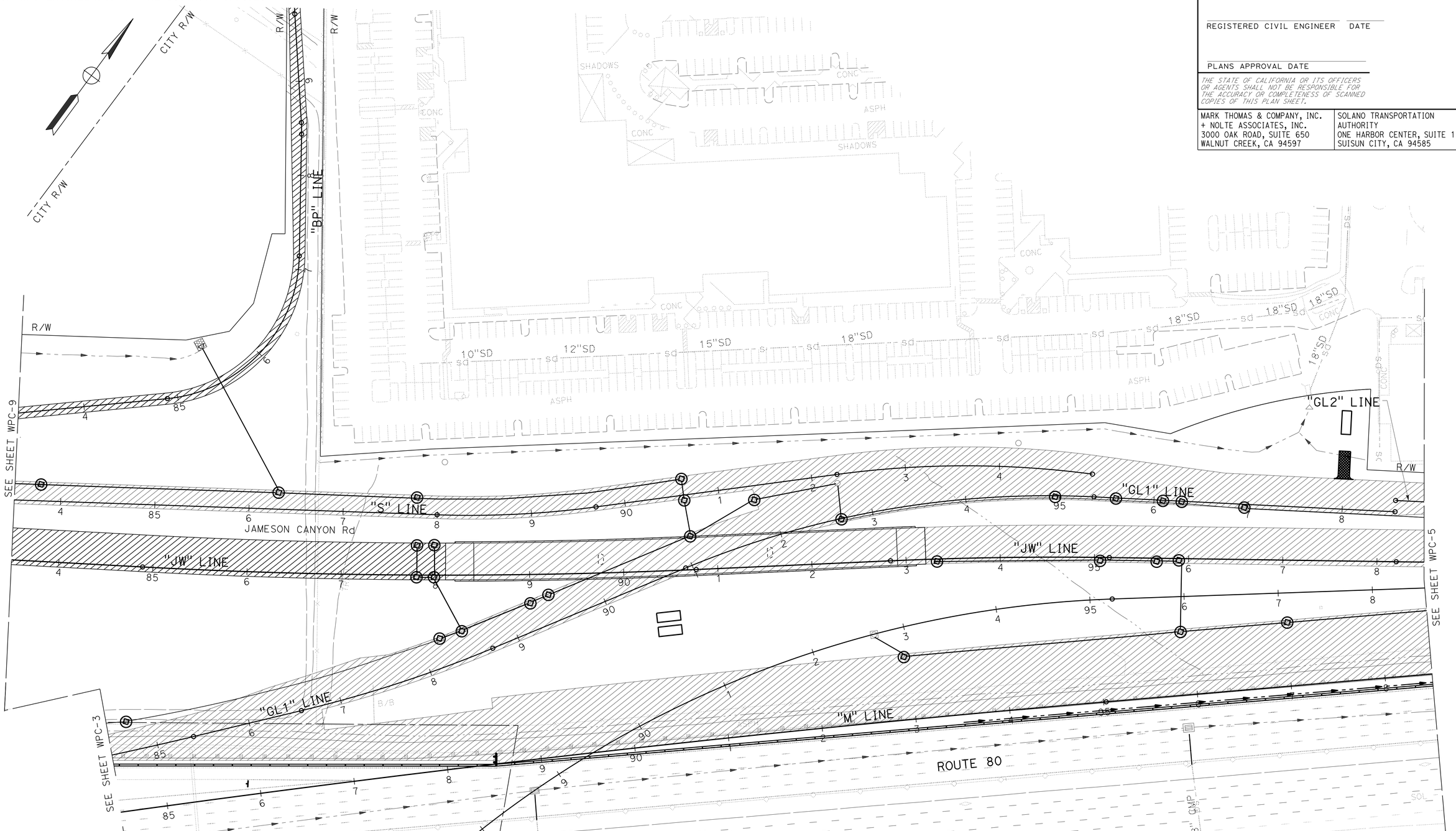

WATER POLLUTION CONTROL PLAN
STAGE 1B

SCALE: 1" = 50'

WPC-4

FOR NOTES AND LEGEND SEE SHEET WPC-1

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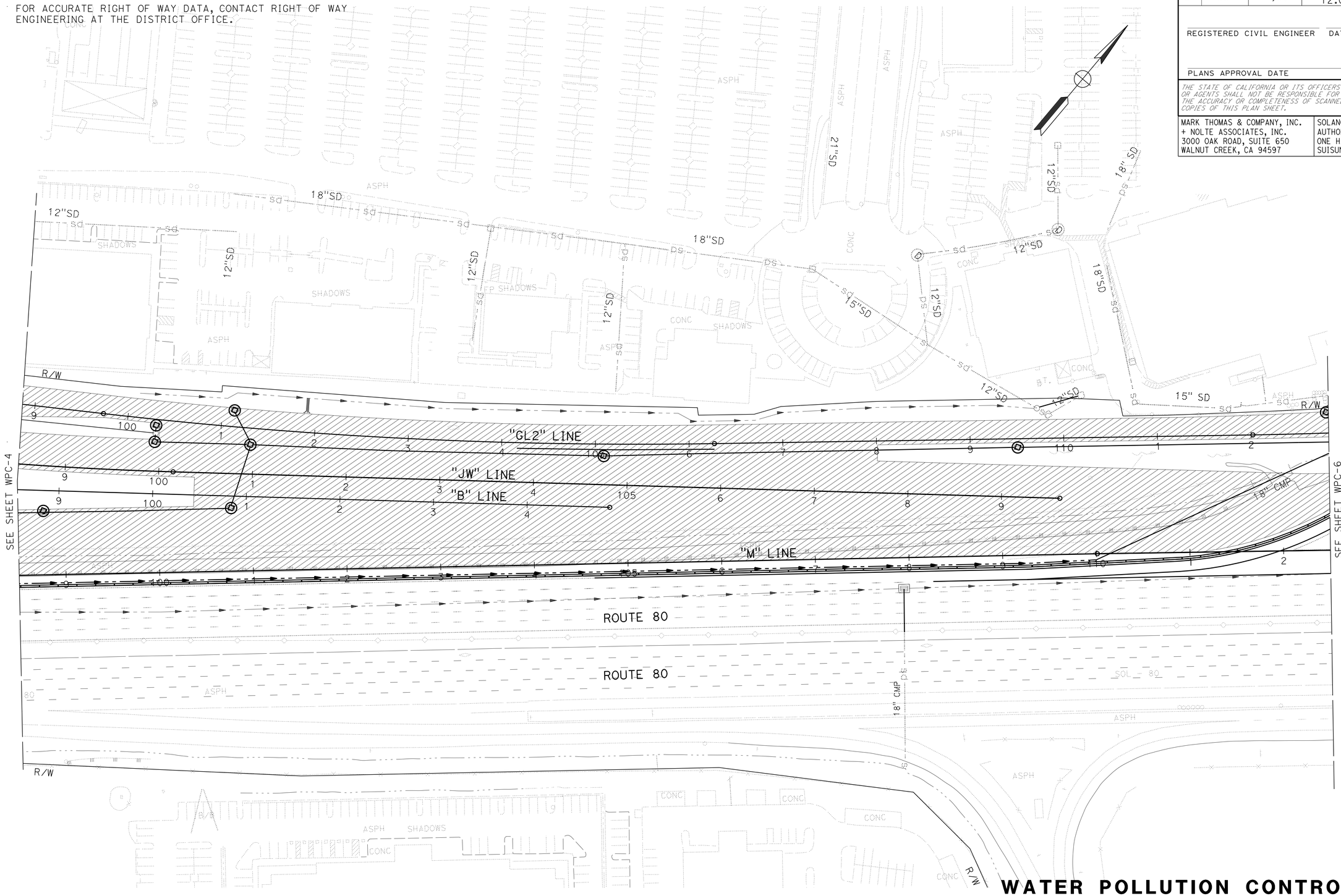

WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-5

FOR NOTES AND LEGEND SEE SHEET WPC-1

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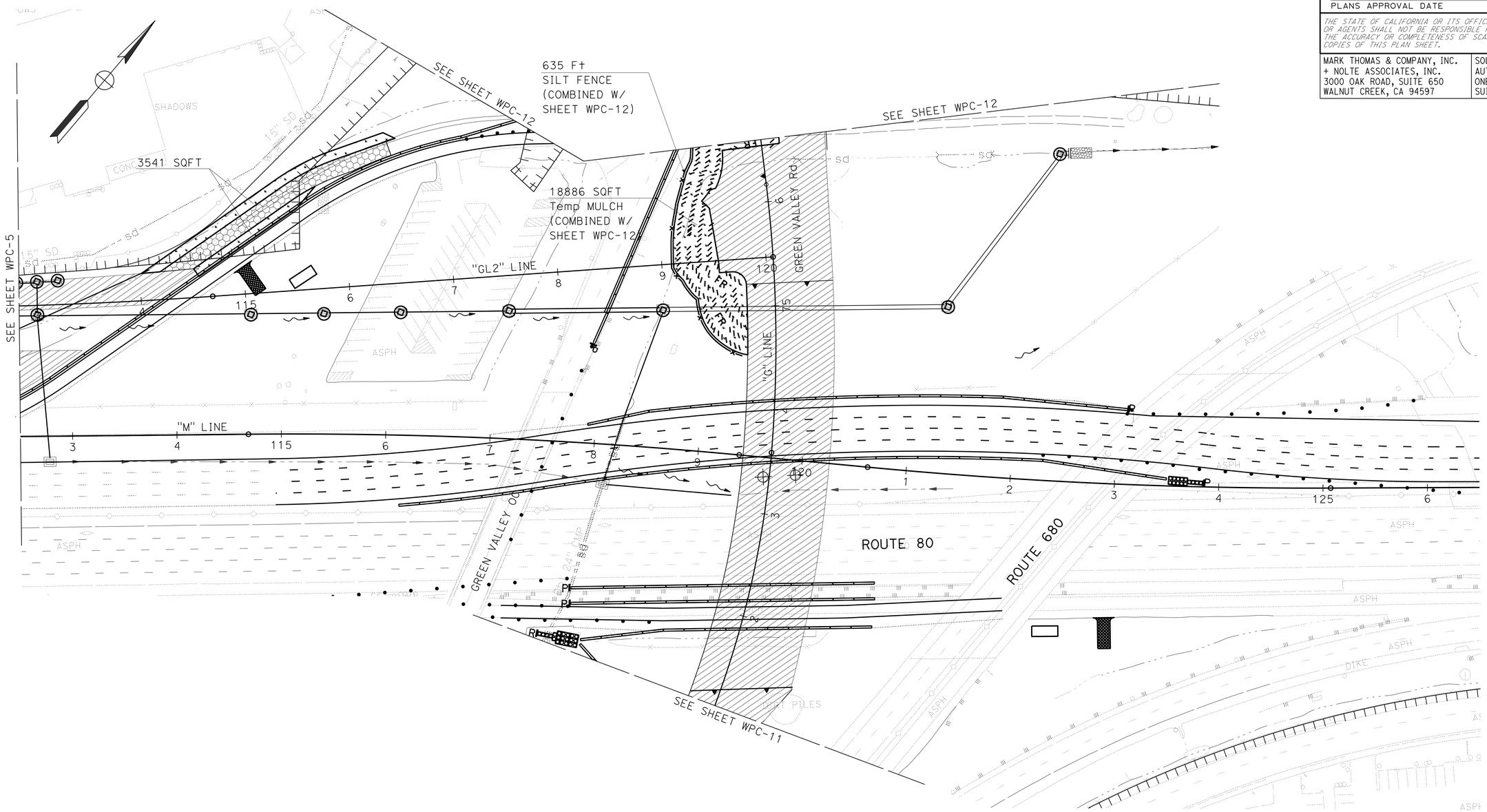

WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-6

FOR NOTES AND LEGEND SEE SHEET WPC-1

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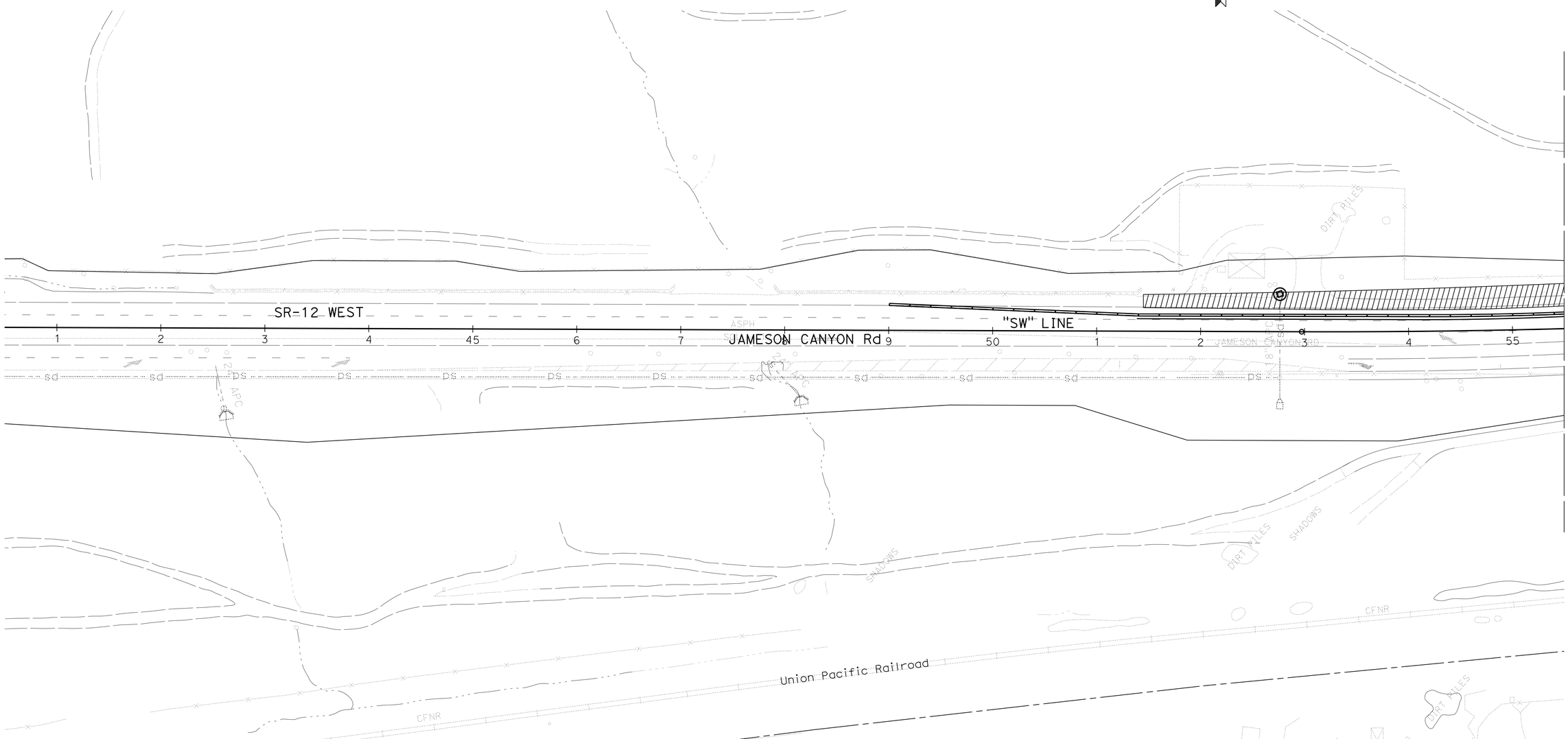

WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-7

FOR NOTES AND LEGEND SEE SHEET WPC-1

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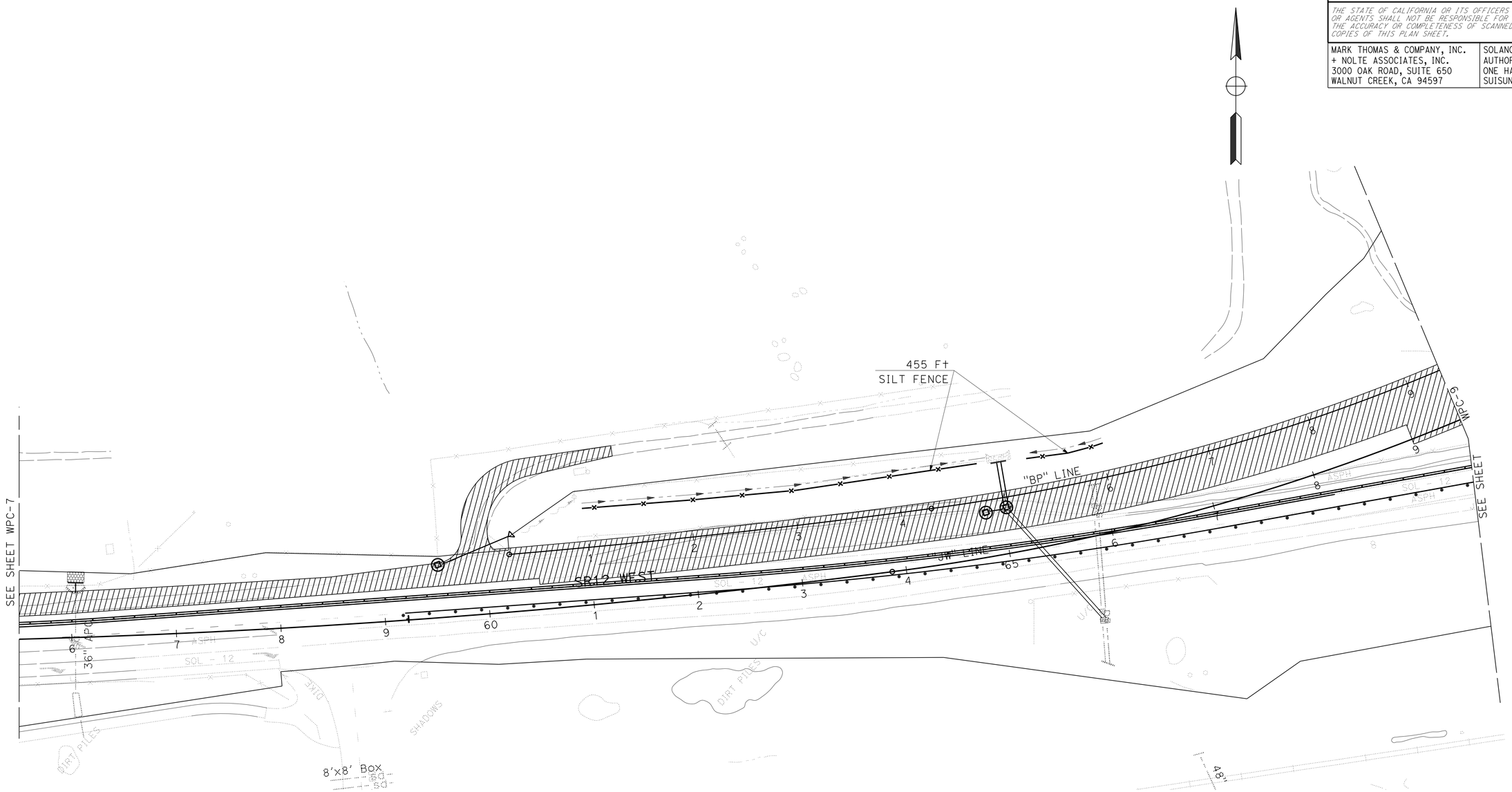

WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-8

FOR NOTES AND LEGEND SEE SHEET WPC-1

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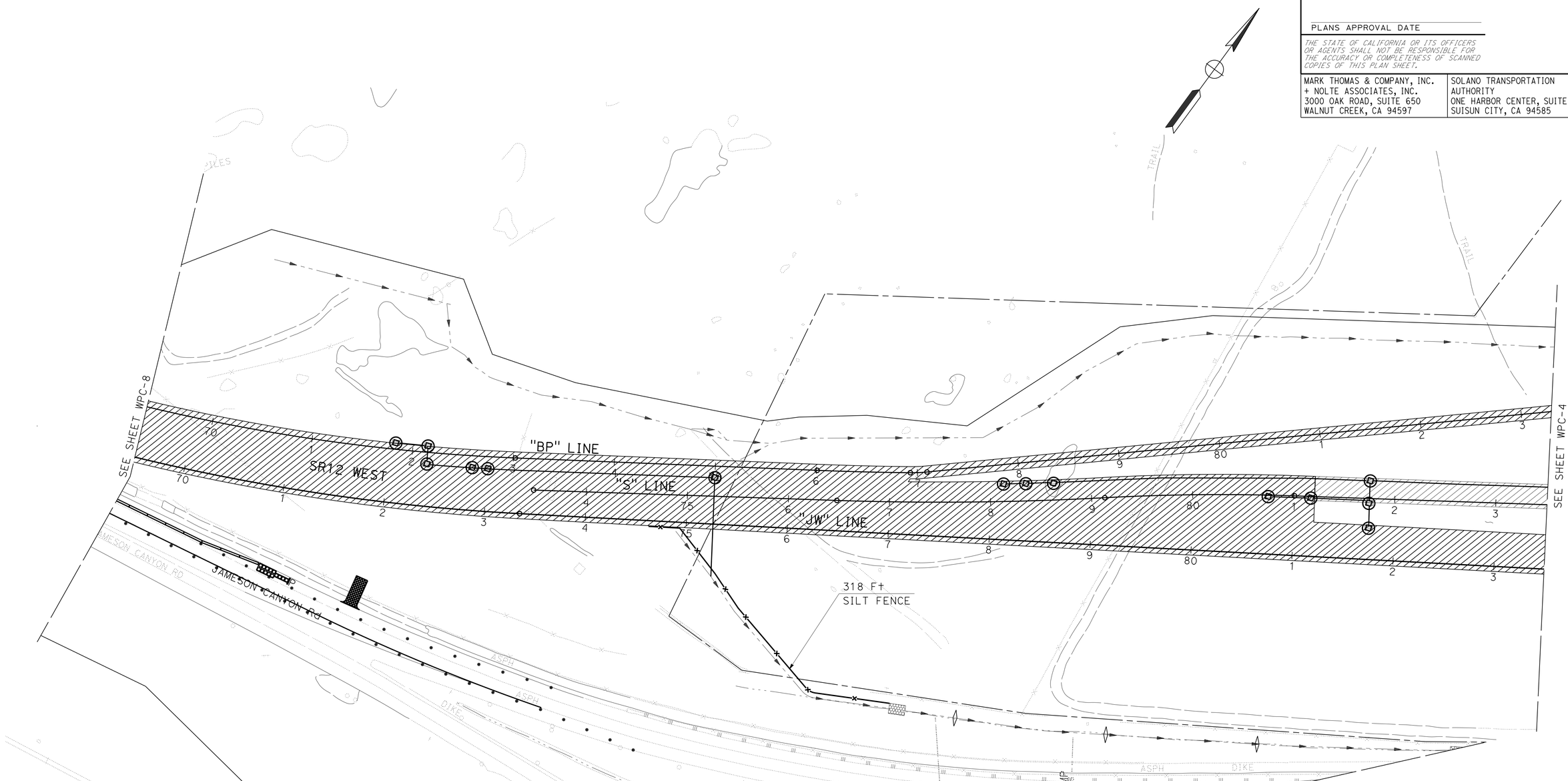

WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-9

FOR NOTES AND LEGEND SEE SHEET WPC-1

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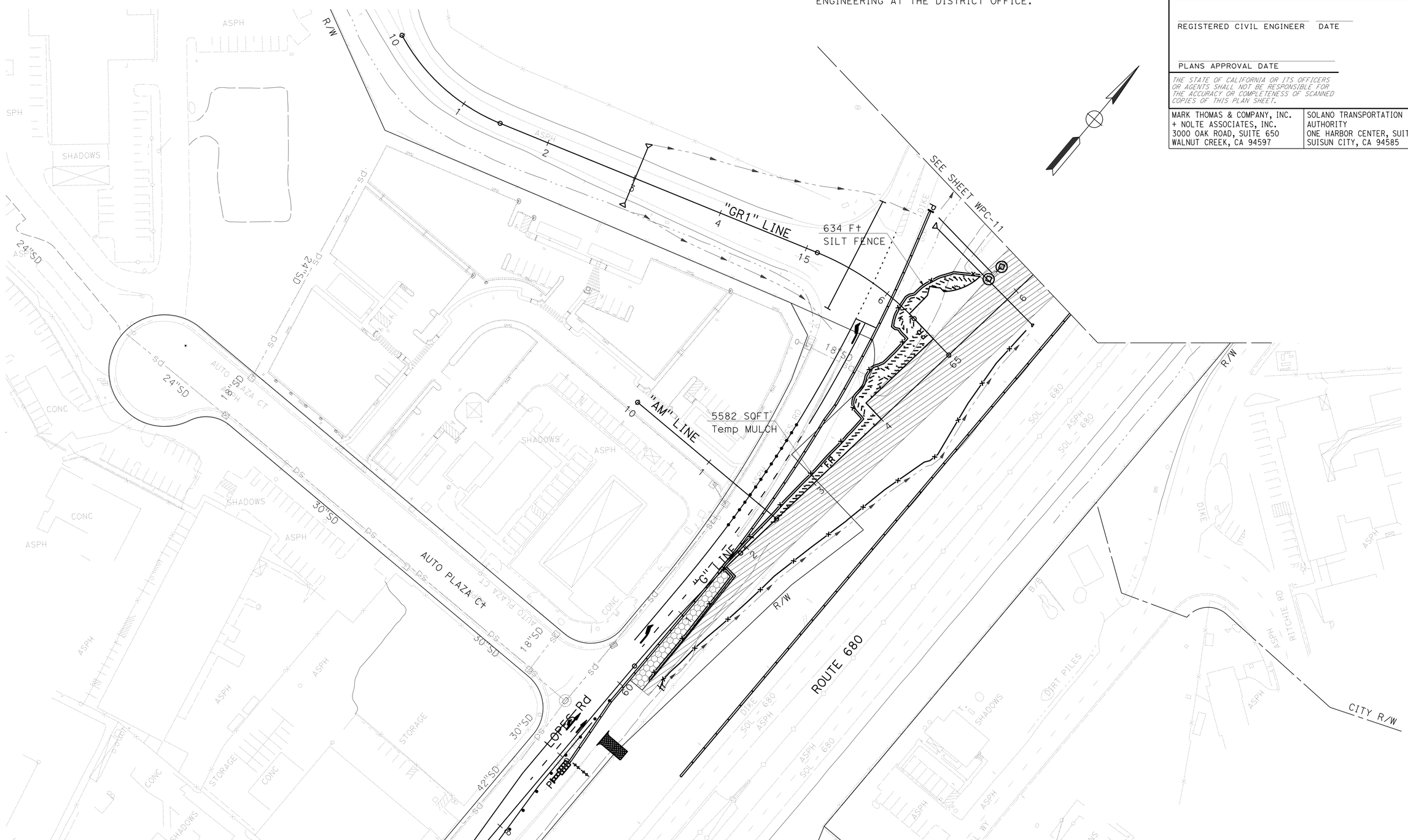

FOR NOTES AND LEGEND SEE SHEET WPC-1

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WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-10

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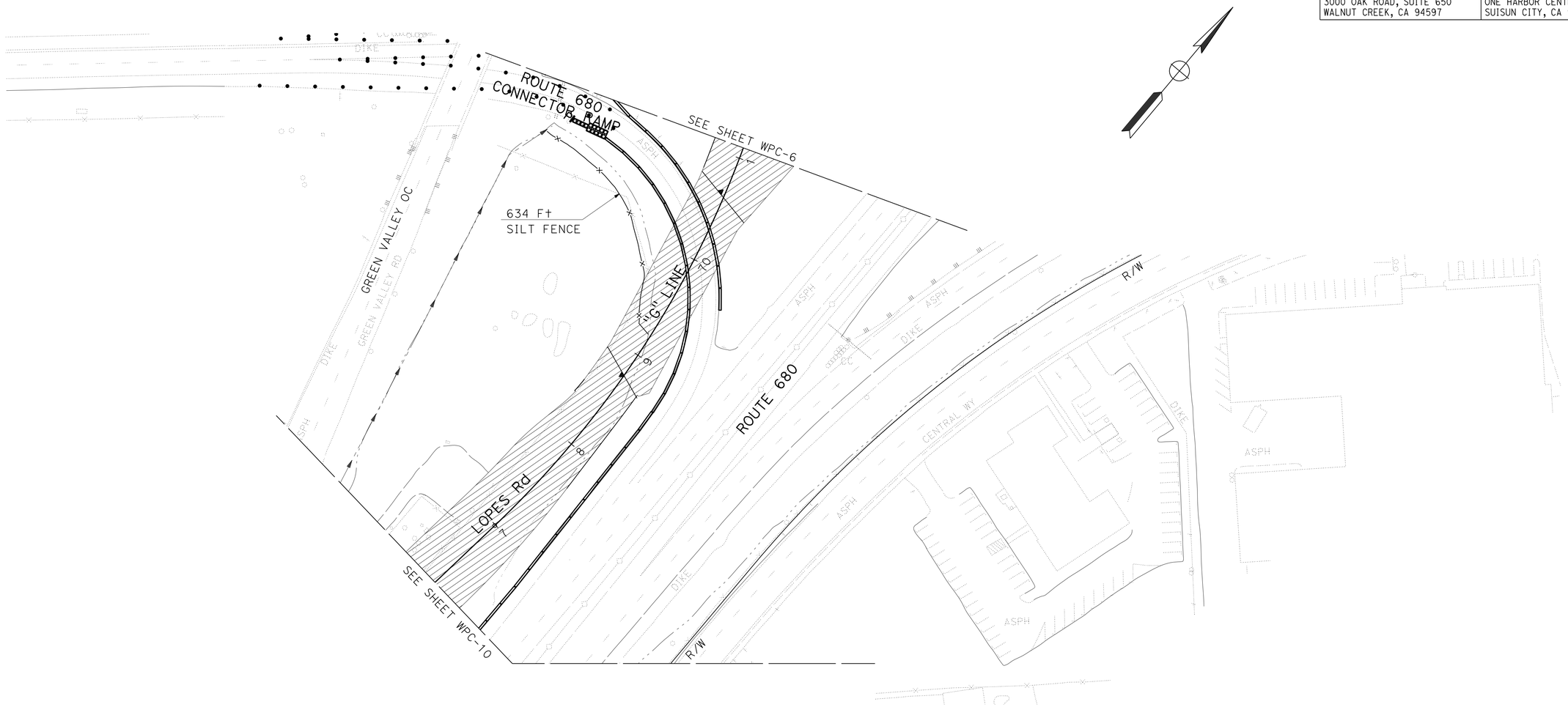

WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-11

FOR NOTES AND LEGEND SEE SHEET WPC-1

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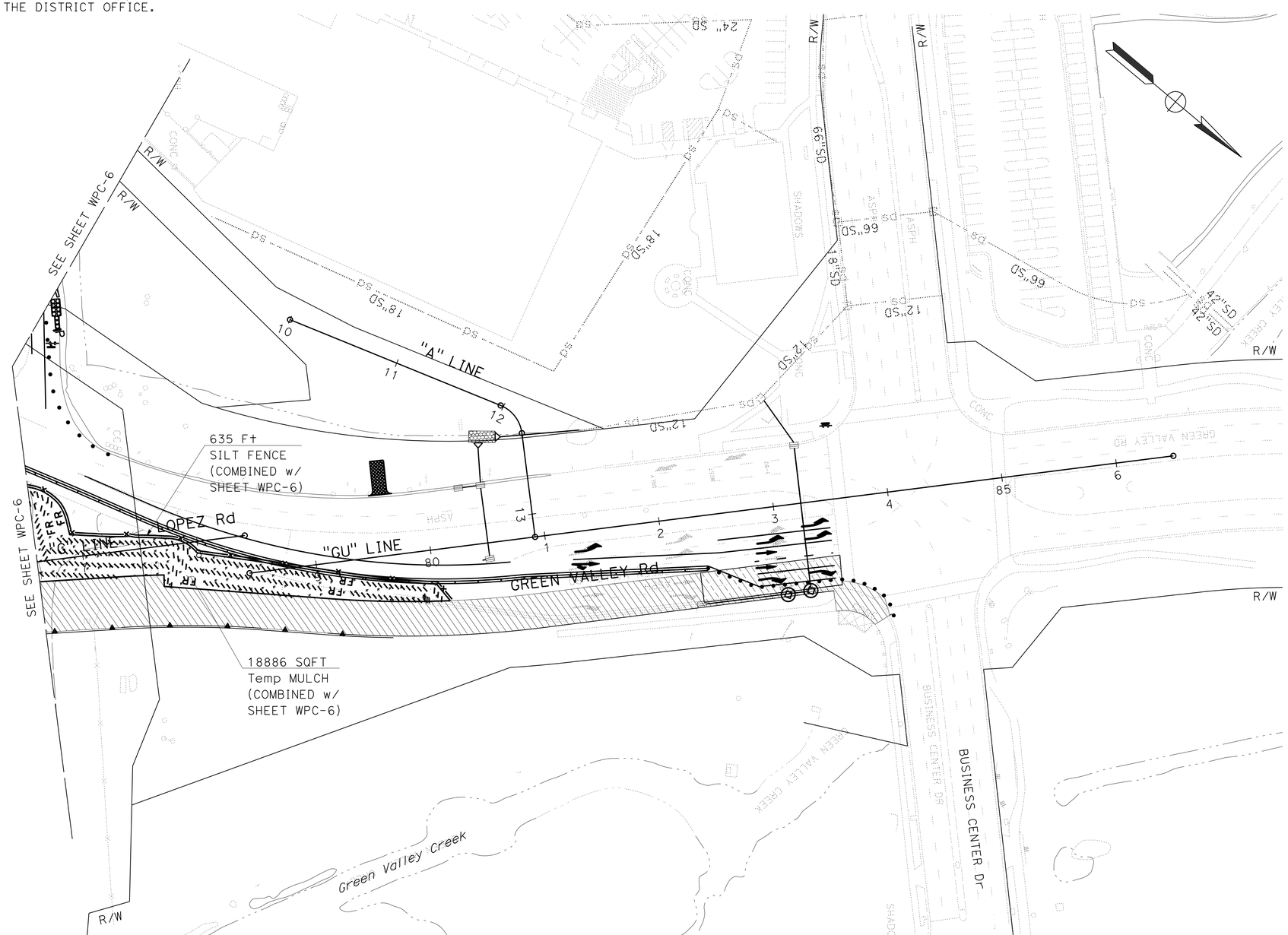

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WATER POLLUTION CONTROL PLAN

STAGE 1B

SCALE: 1" = 50'

WPC-12

FOR NOTES AND LEGEND SEE SHEET WPC-1

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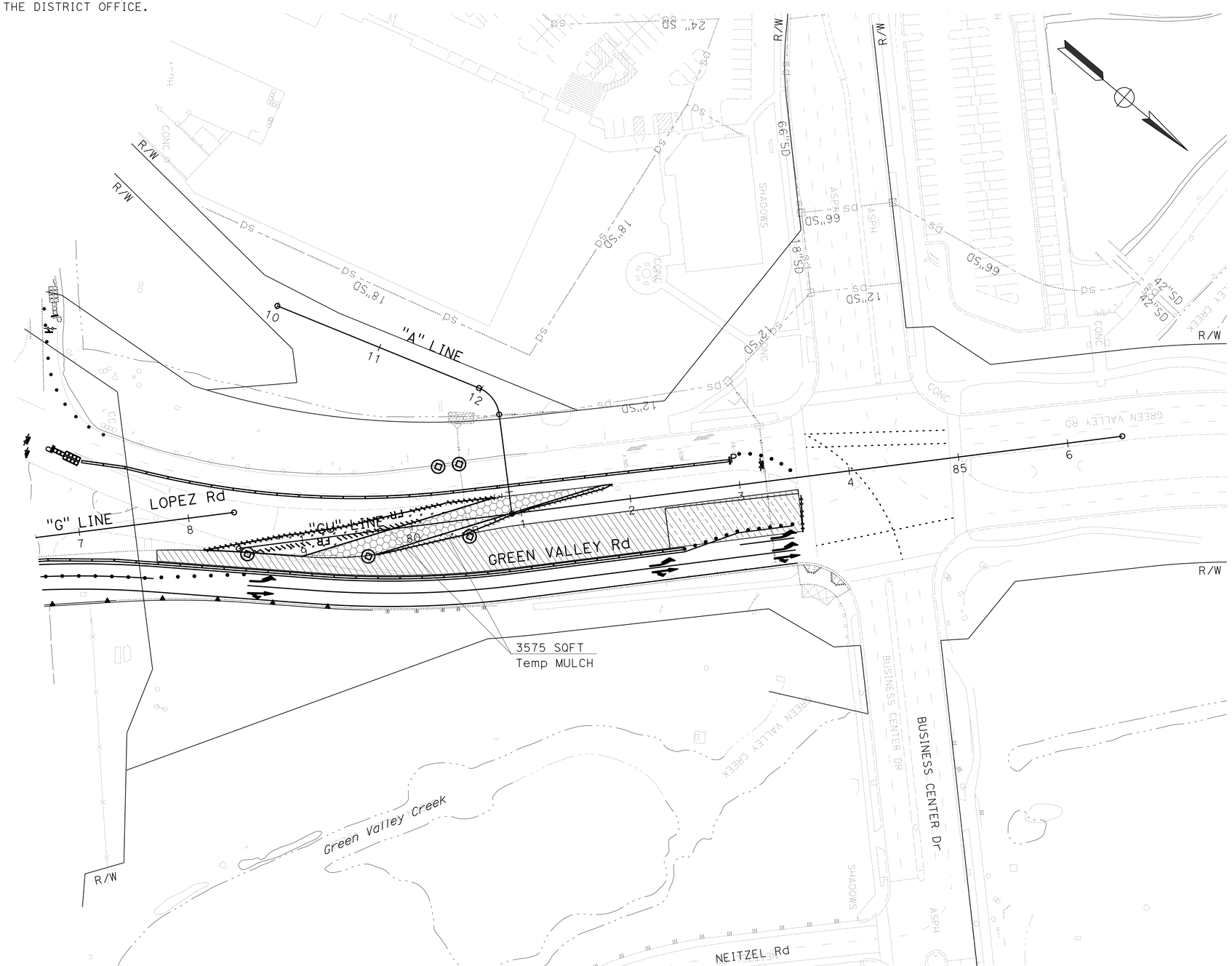

FOR NOTES AND LEGEND SEE SHEET WPC-1

APPROVED FOR EROSION CONTROL WORK ONLY

WATER POLLUTION CONTROL PLAN

STAGE 2

SCALE: 1" = 50'

WPC-13

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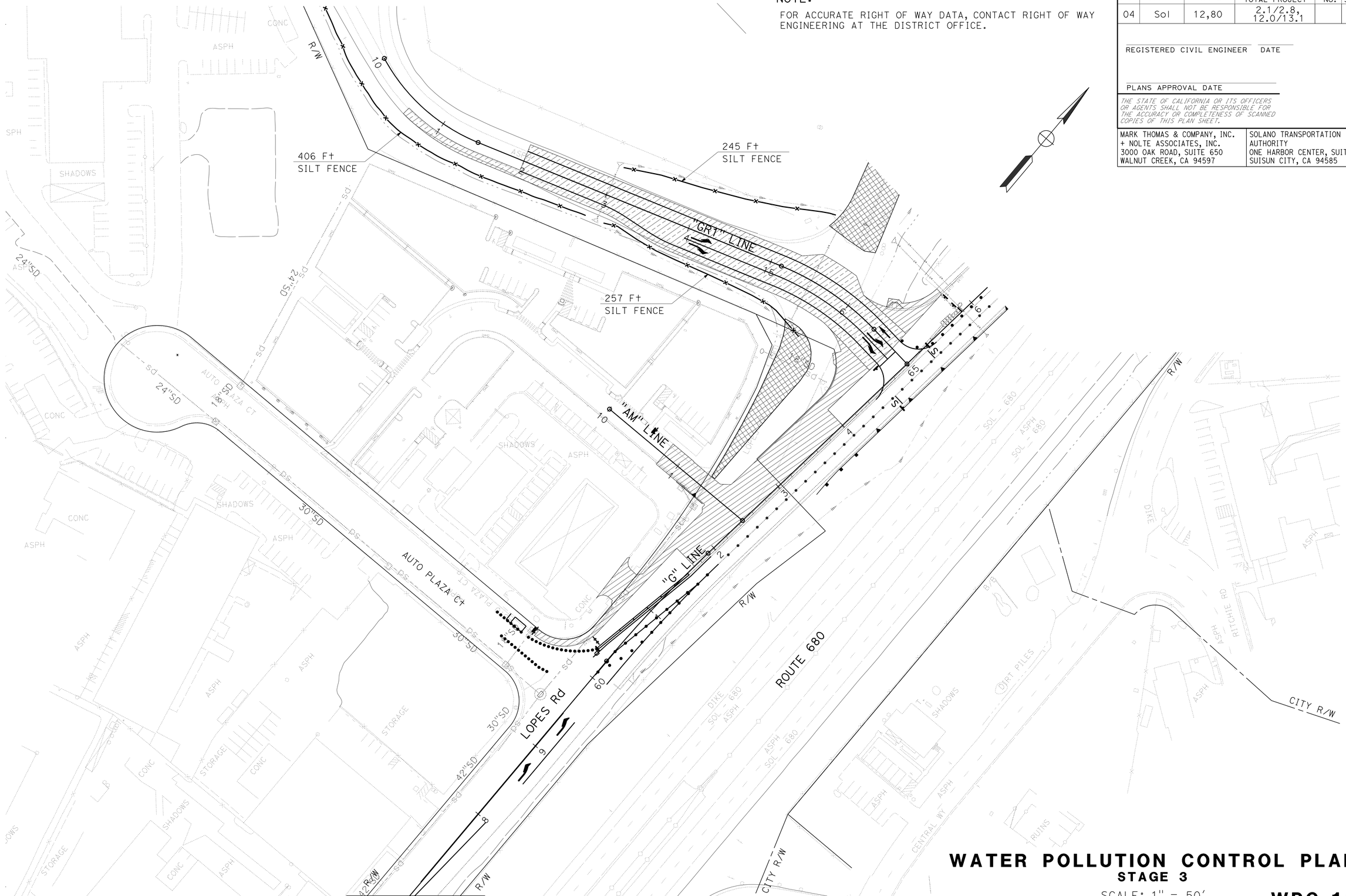

FOR NOTES AND LEGEND SEE SHEET WPC-1

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WATER POLLUTION CONTROL PLAN

STAGE 3

SCALE: 1" = 50'

WPC-14

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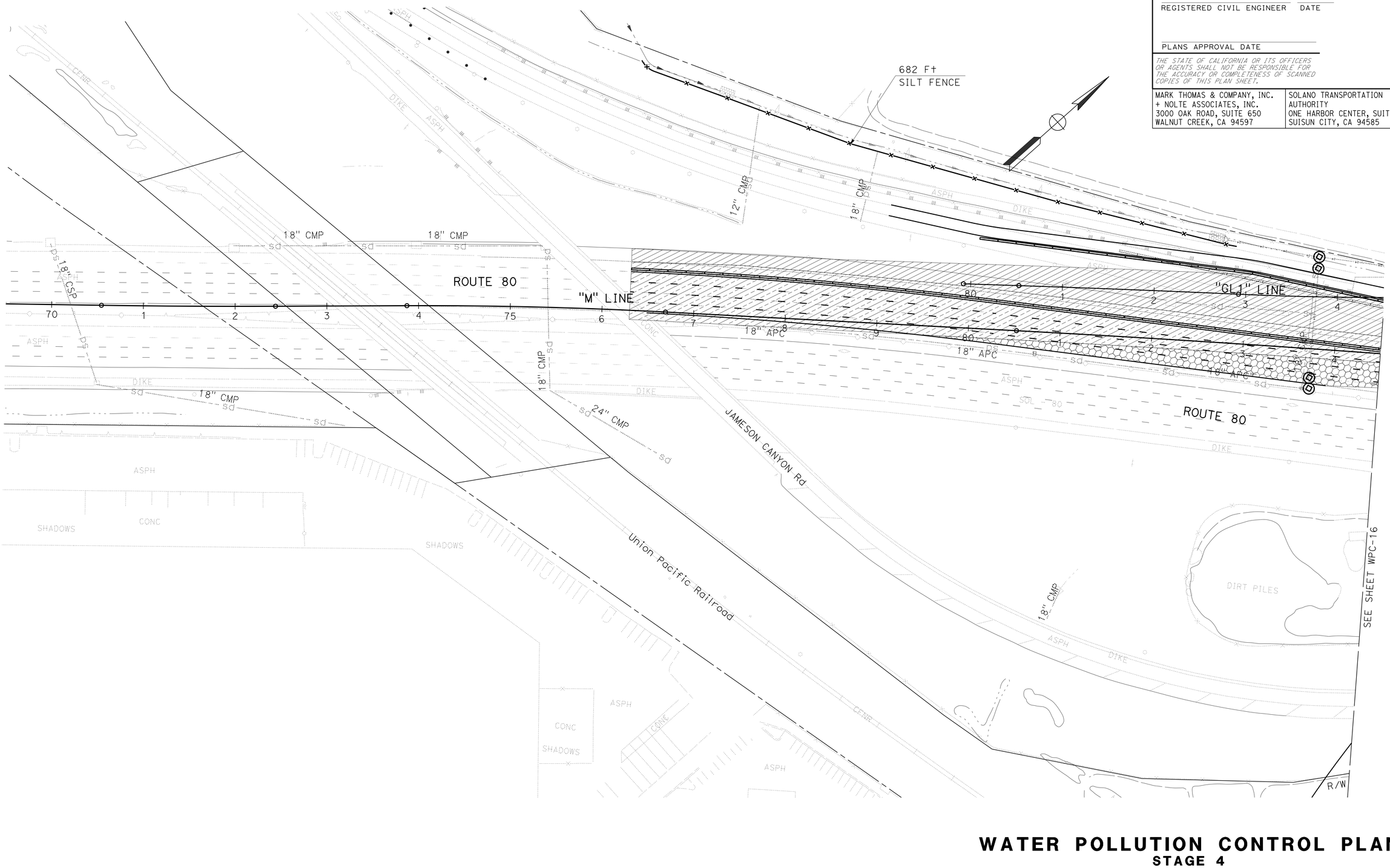

WATER POLLUTION CONTROL PLAN

STAGE 4

SCALE: 1" = 50'

WPC-15

FOR NOTES AND LEGEND SEE SHEET WPC-1

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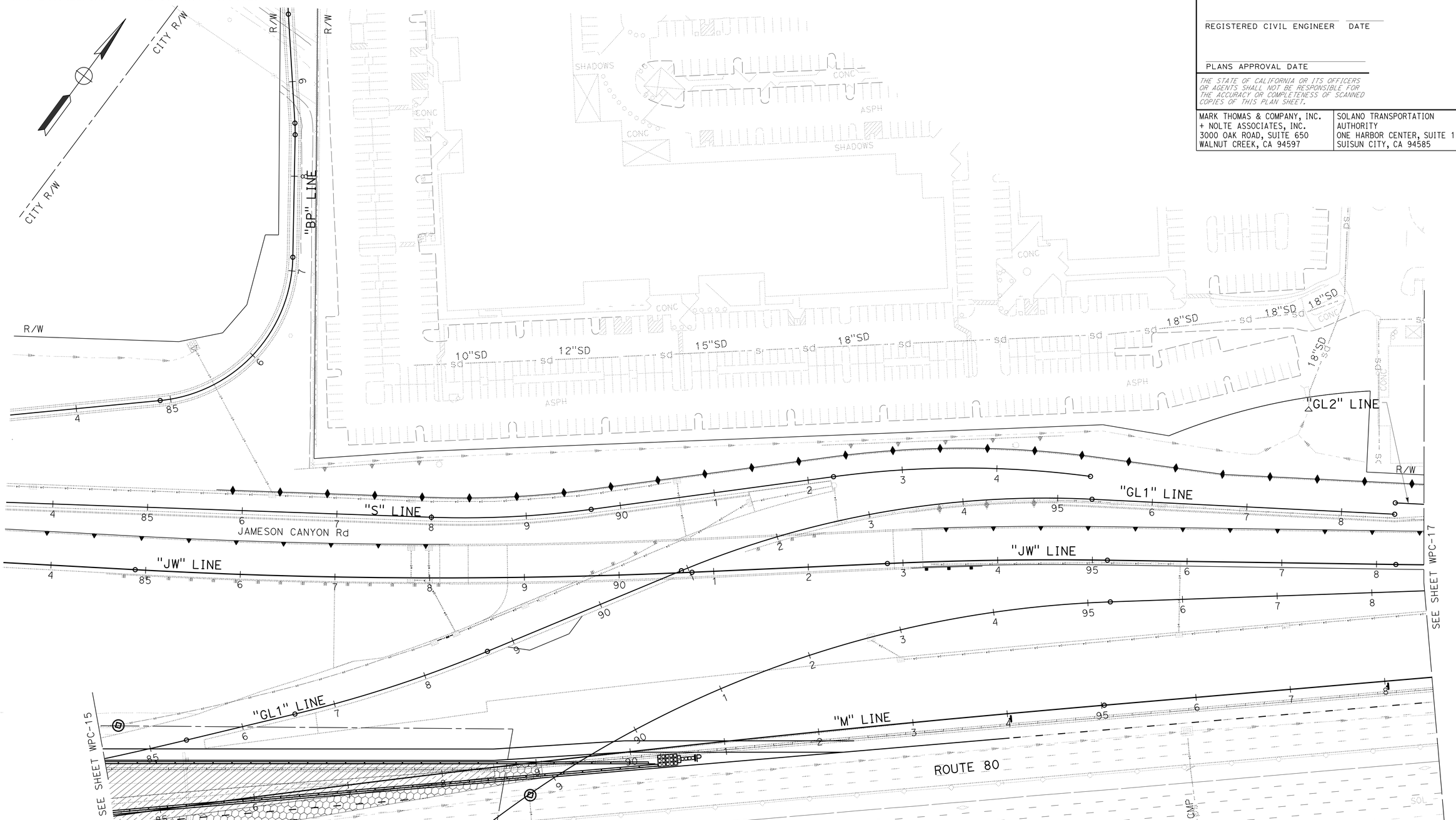

WATER POLLUTION CONTROL PLAN
STAGE 4
SCALE: 1" = 50'

WPC-16

FOR NOTES AND LEGEND SEE SHEET WPC-1

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04	Sol	12,80	2.1/2.8, 12.0/13.1		

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WATER POLLUTION CONTROL PLAN

STAGE 4

SCALE: 1" = 50'

WPC-17

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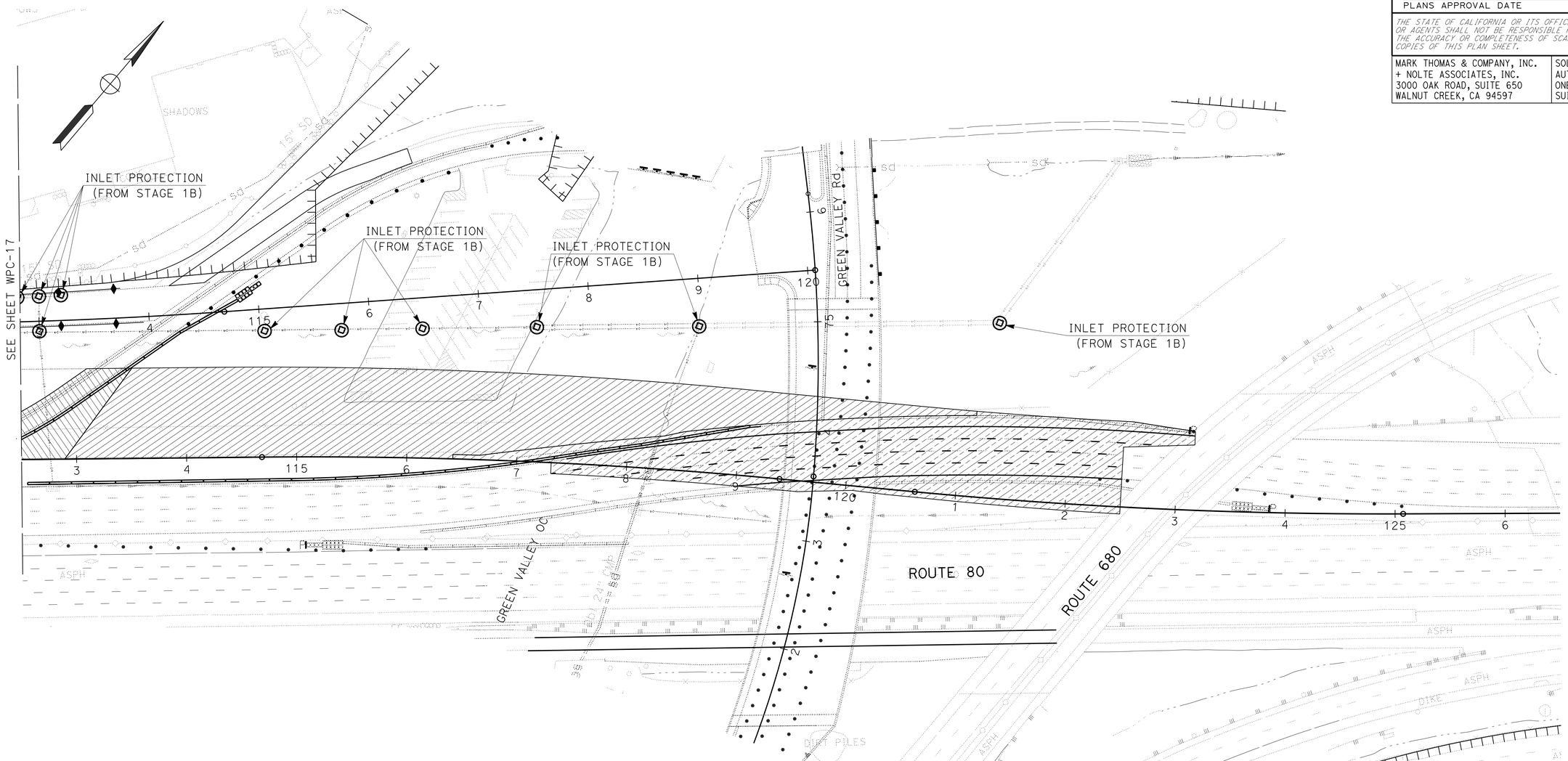

WATER POLLUTION CONTROL PLAN

STAGE 4

SCALE: 1" = 50'

WPC-18

FOR NOTES AND LEGEND SEE SHEET WPC-1

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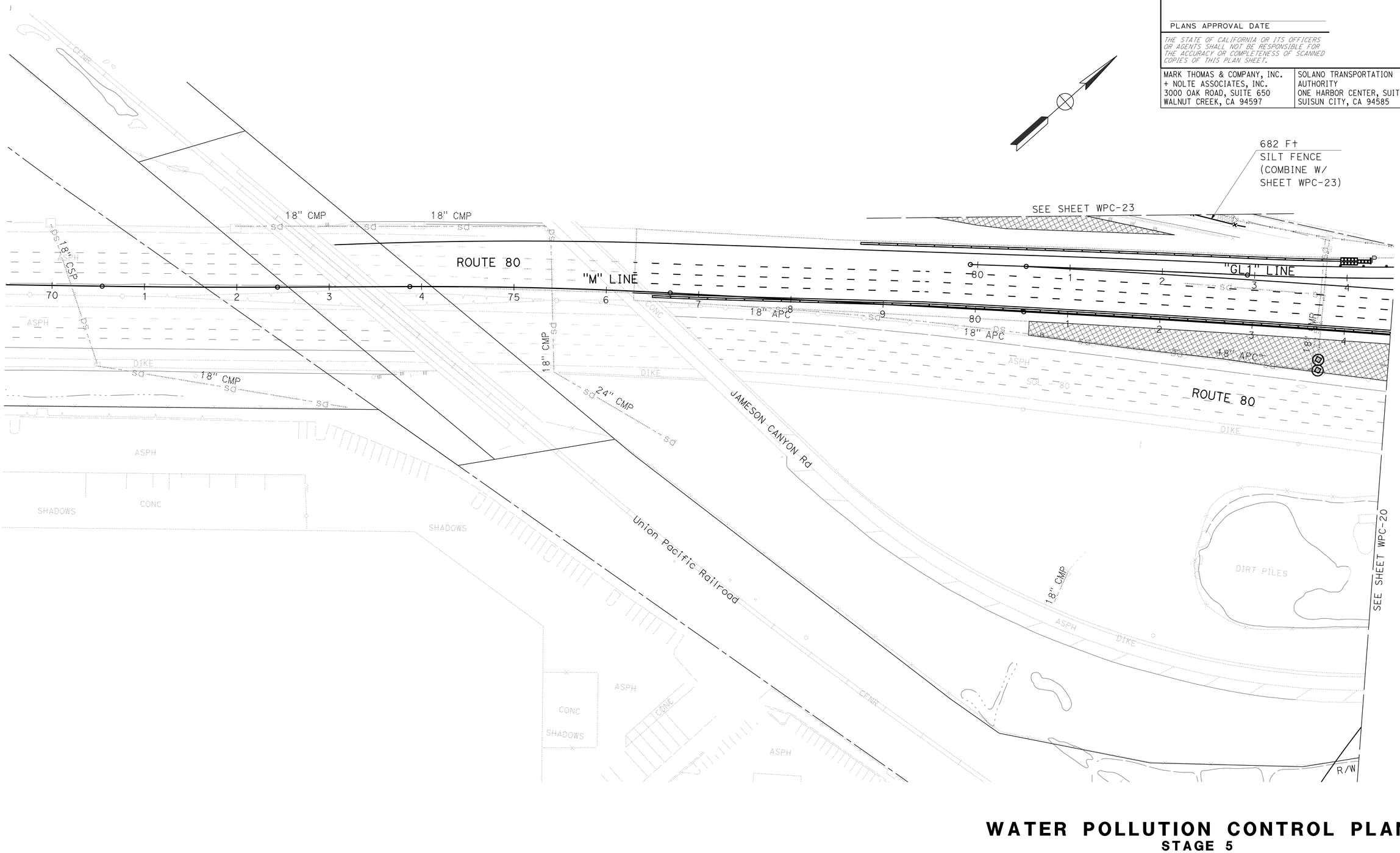

WATER POLLUTION CONTROL PLAN

STAGE 5

SCALE: 1" = 50'

WPC-19

FOR NOTES AND LEGEND SEE SHEET WPC-1

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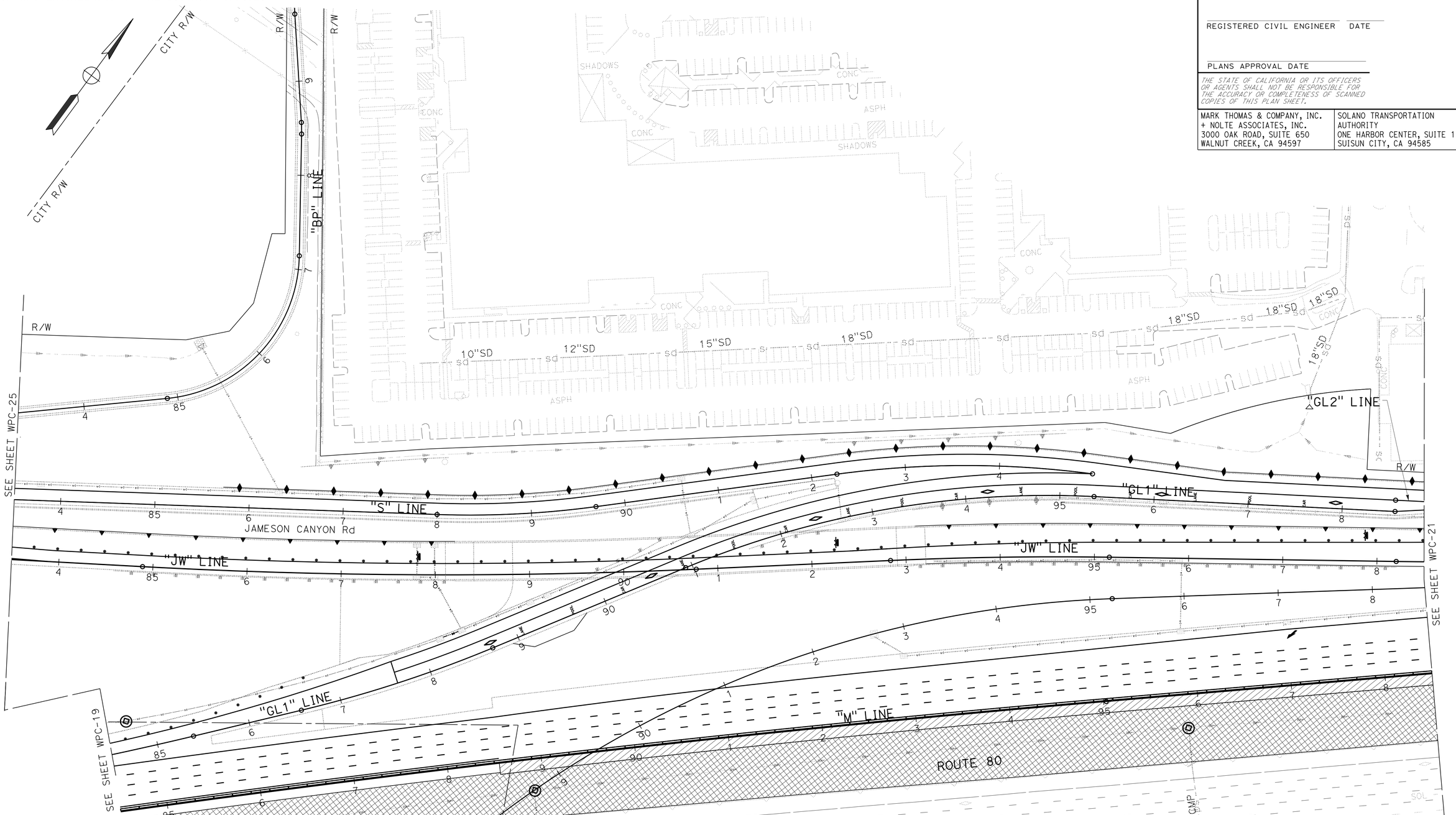

WATER POLLUTION CONTROL PLAN
STAGE 5

SCALE: 1" = 50'

WPC-20

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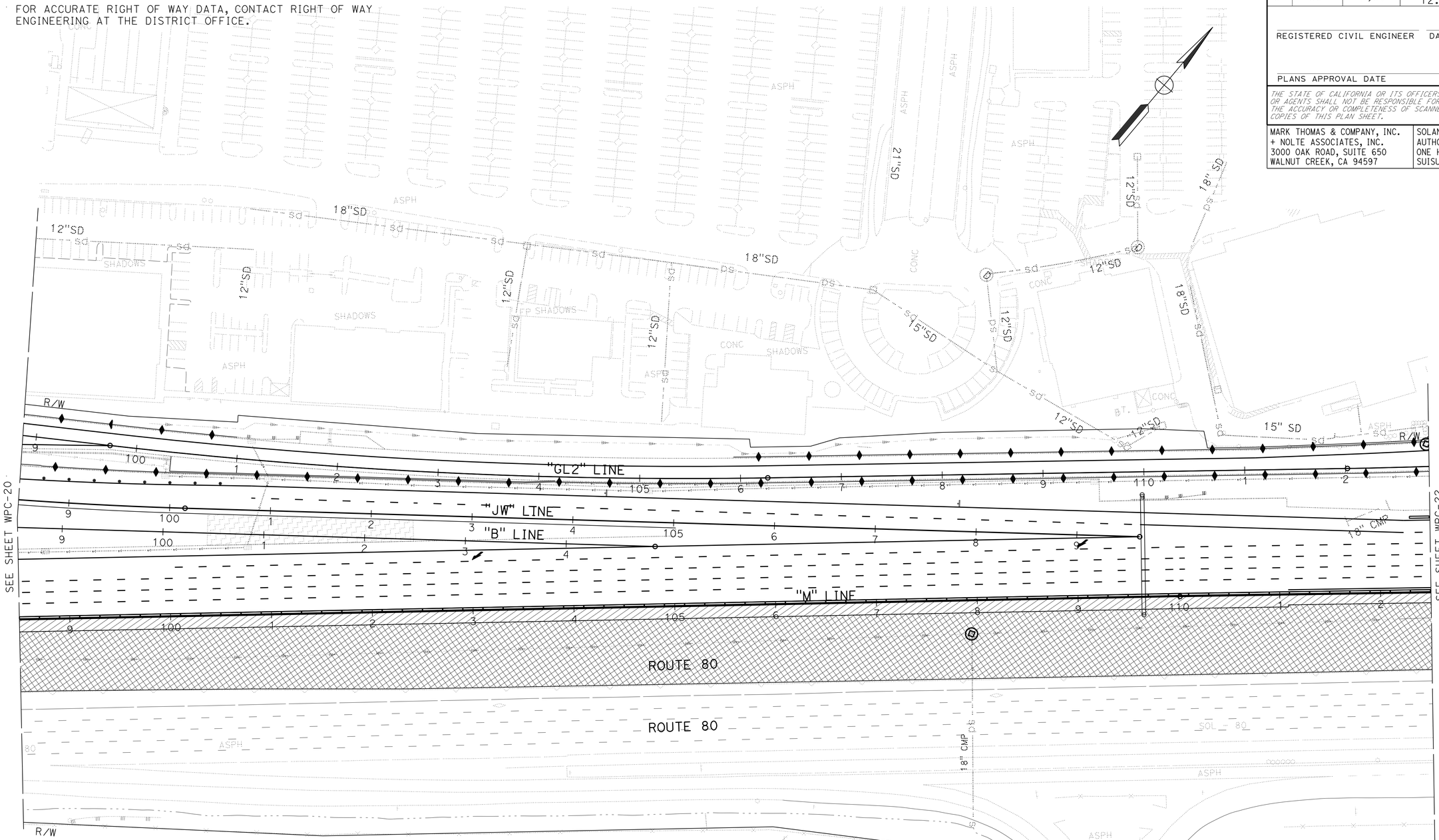

WATER POLLUTION CONTROL PLAN

STAGE 5

SCALE: 1" = 50'

WPC-21

FOR NOTES AND LEGEND SEE SHEET WPC-1

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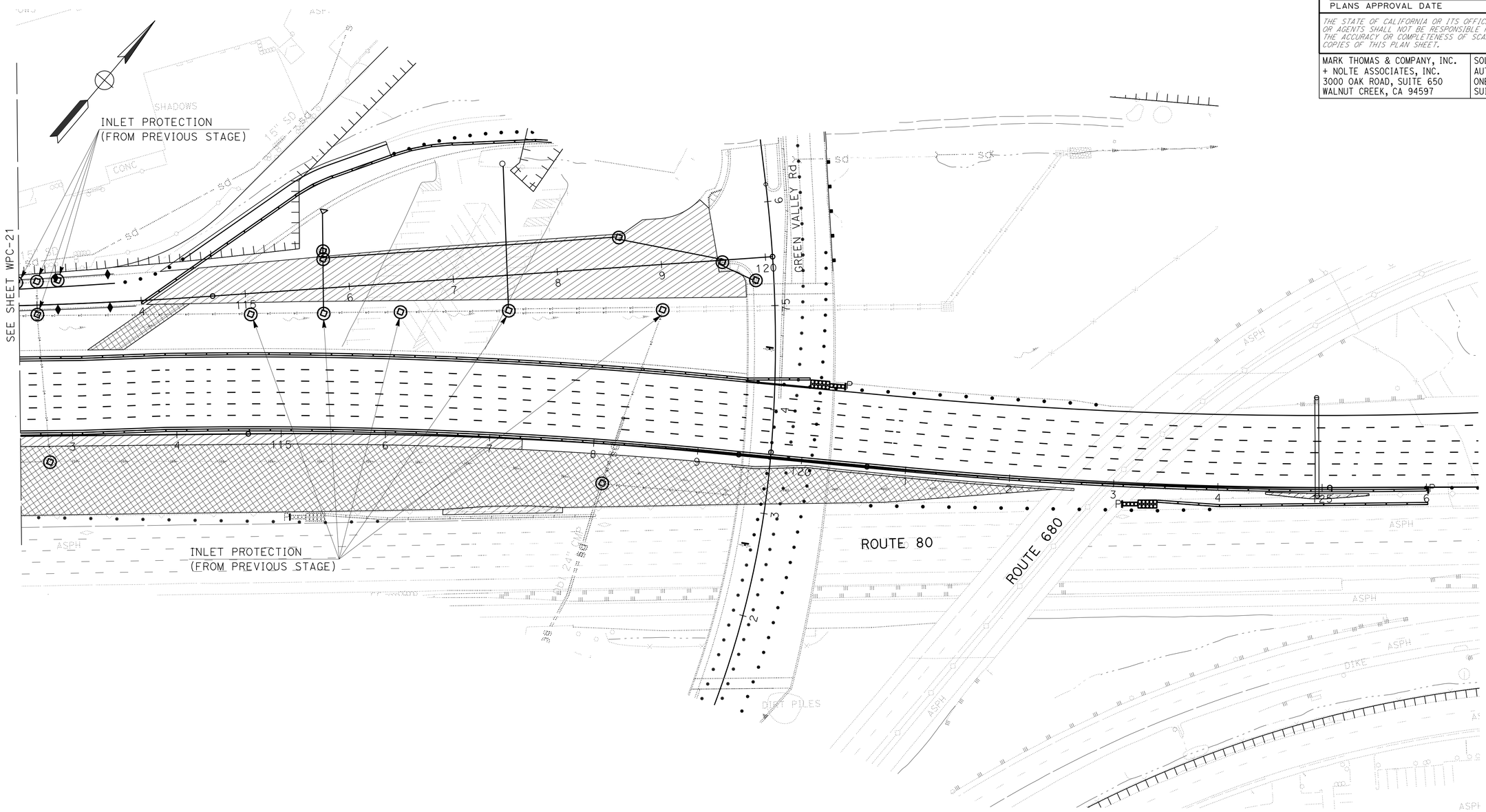

WATER POLLUTION CONTROL PLAN

STAGE 5

SCALE: 1" = 50'

WPC-22

FOR NOTES AND LEGEND SEE SHEET WPC-1

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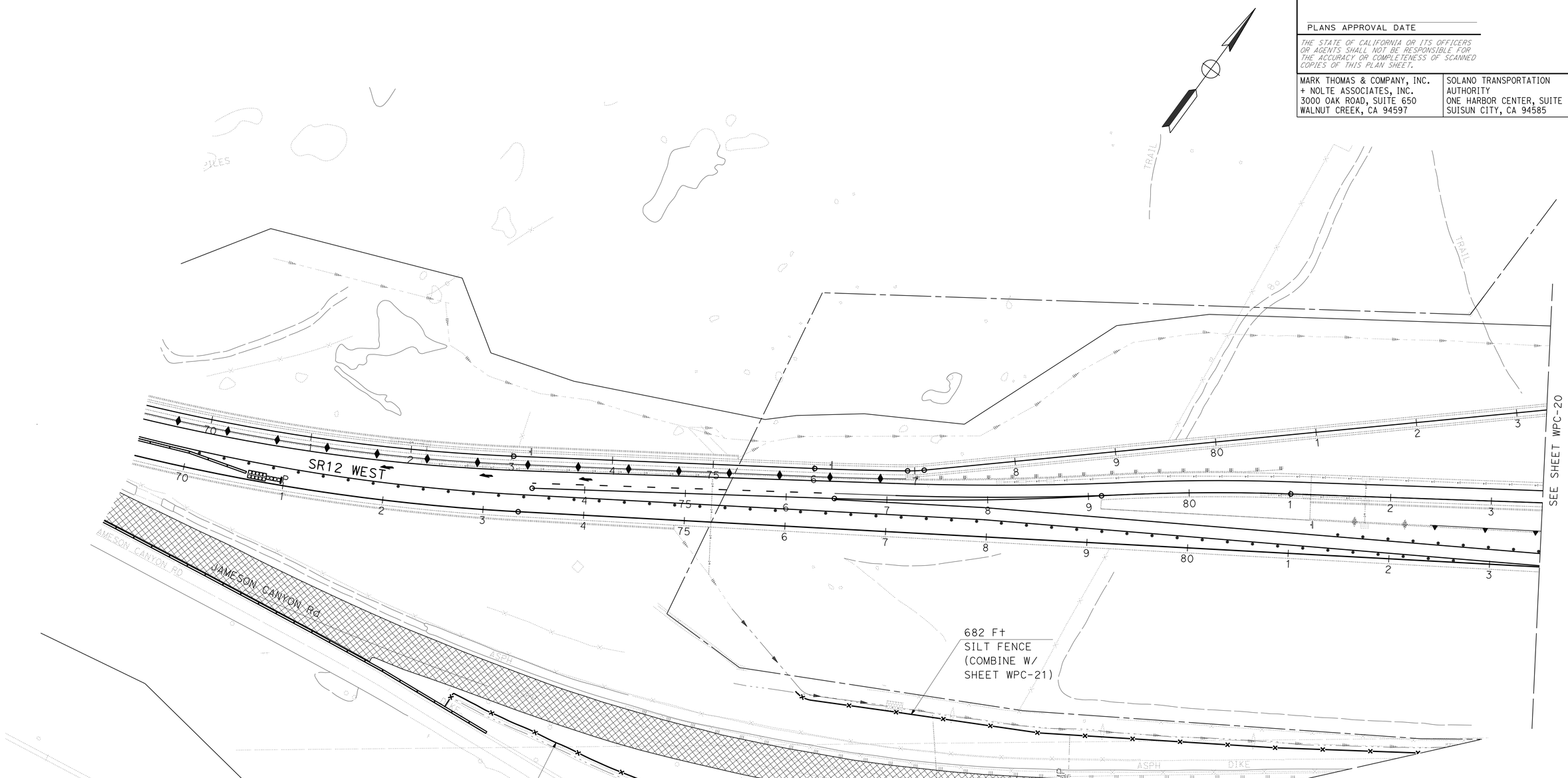

WATER POLLUTION CONTROL PLAN

STAGE 5

SCALE: 1" = 50'

WPC-23

FOR NOTES AND LEGEND SEE SHEET WPC-1

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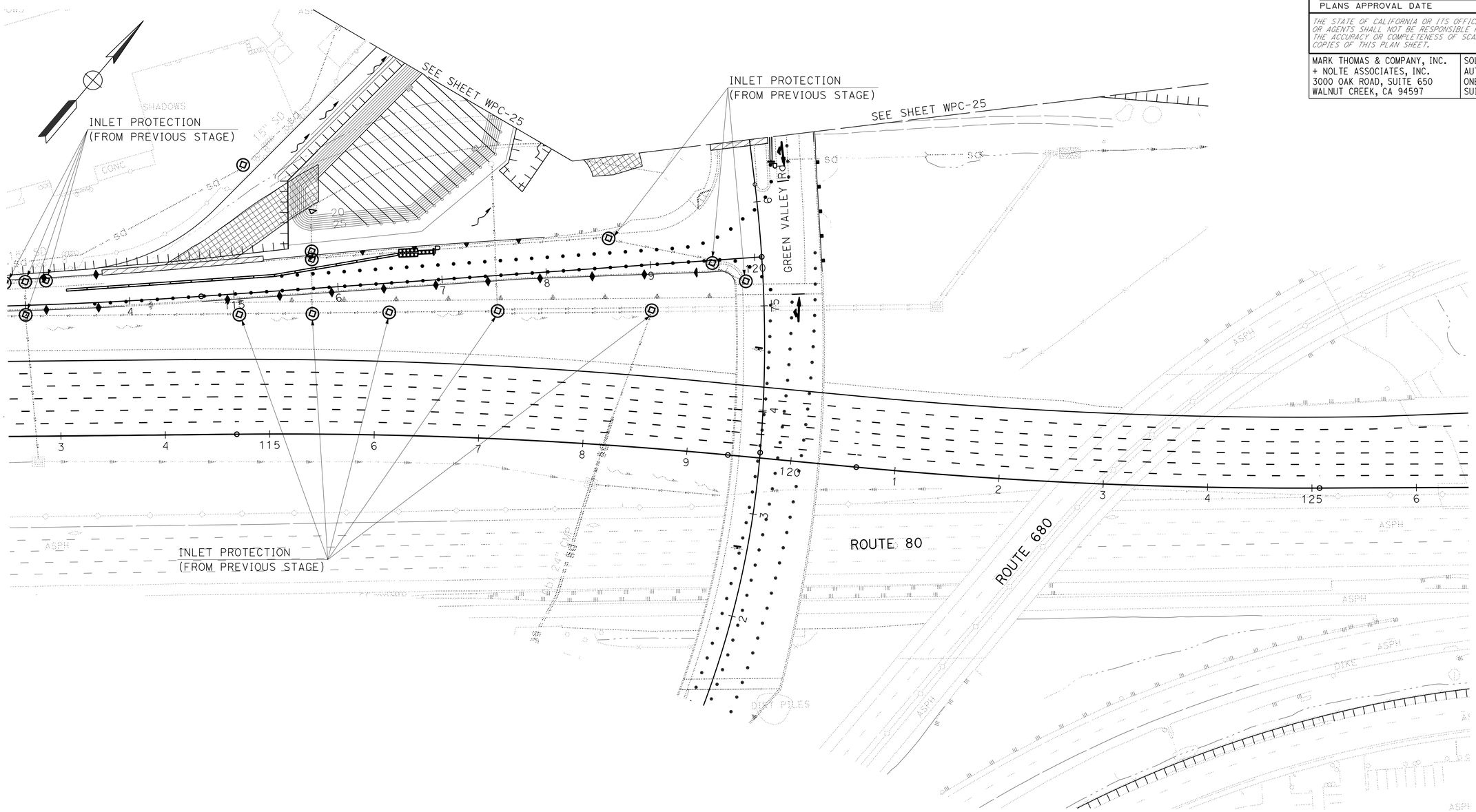

WATER POLLUTION CONTROL PLAN

STAGE 6A

SCALE: 1" = 50'

WPC-24

FOR NOTES AND LEGEND SEE SHEET WPC-1

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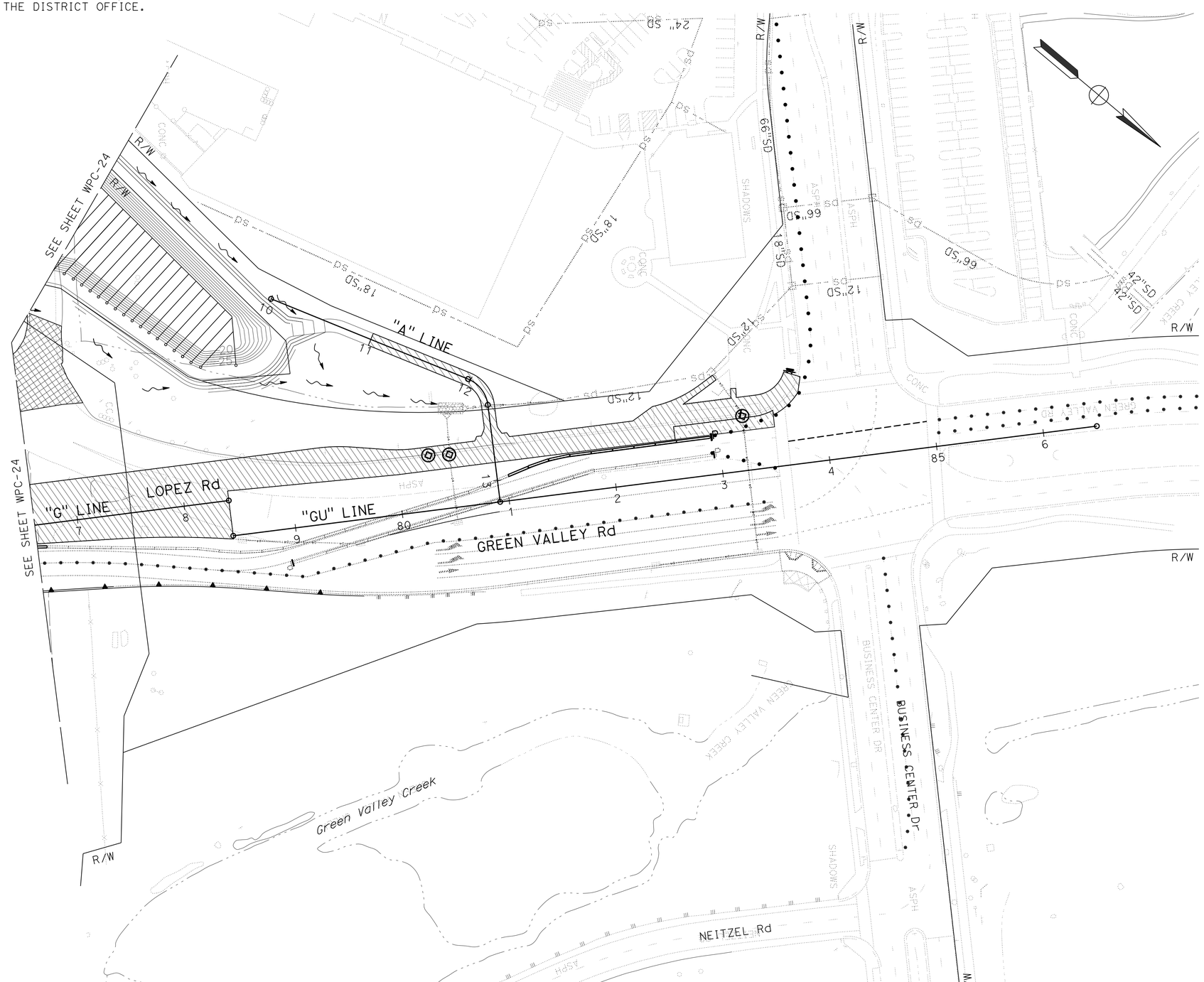

FOR NOTES AND LEGEND SEE SHEET WPC-1

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WATER POLLUTION CONTROL PLAN

STAGE 6A

SCALE: 1" = 50'

WPC-25

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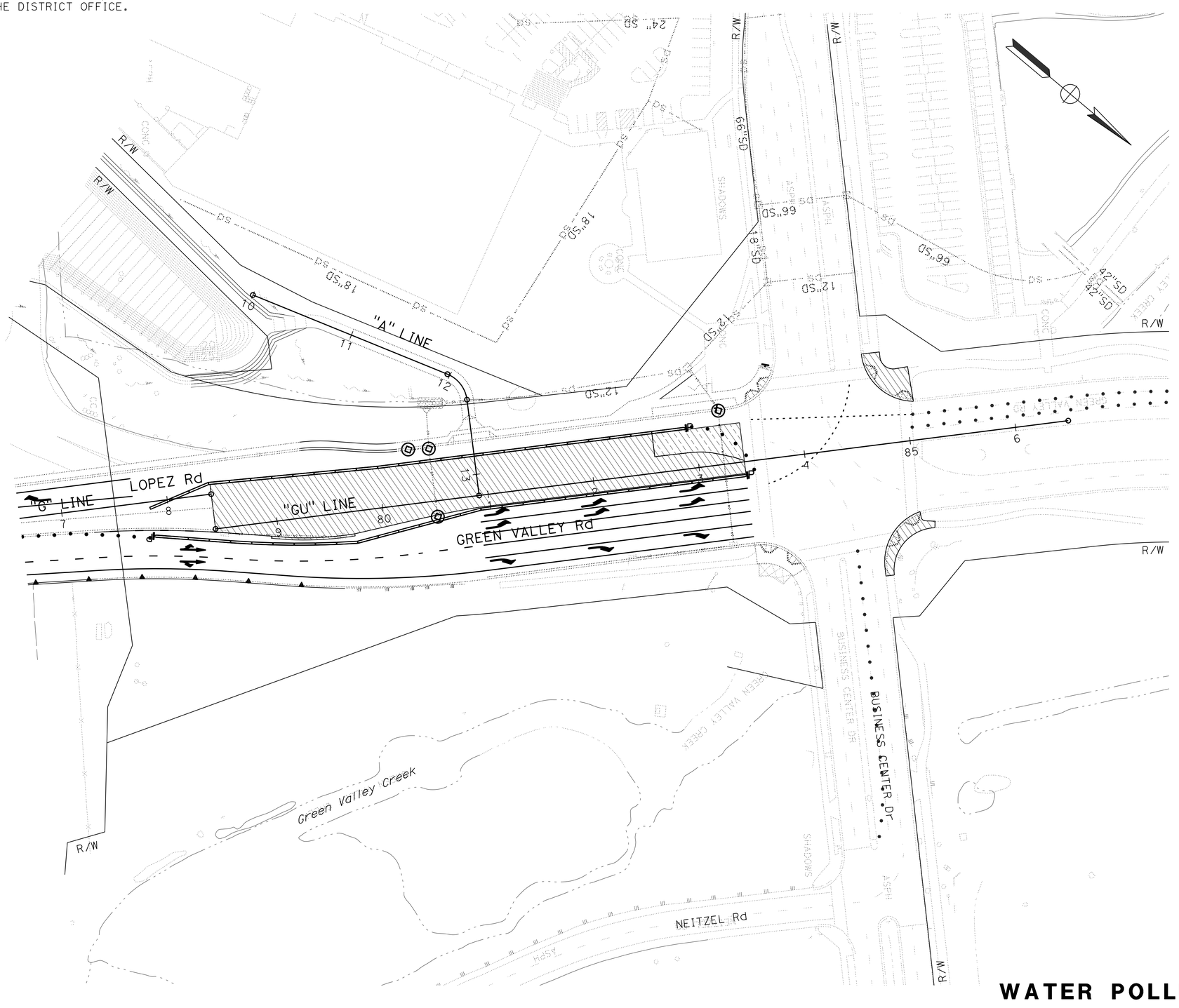

WATER POLLUTION CONTROL PLAN

STAGE 6B

SCALE: 1" = 50'

WPC-26

FOR NOTES AND LEGEND SEE SHEET WPC-1

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TEMPORARY WATER POLLUTION CONTROL QUANTITIES

STAGE No.	Temp DRAINAGE INLET PROTECTION	Temp Const ENTRANCE	Temp CONCRETE WASHOUT	Temp HYDRAULIC MULCH (BONDED FIBER MATRIX)	Temp FIBER ROLL	Temp SILT FENCE	MOVE IN/MOVE OUT (Temp EROSION CONTROL)
	EA		LS	SQYD	LF		EA
1A	1	1		801			1
1B	72	6	5	3112	2437	4078	3
2	5			398	650		1
3	3					908	1
4	5					682	1
5	14					1224	1
6A	4						1
6B	4						1
TOTAL	108	7	5	4311	3087	6892	10

TEMPORARY WATER POLLUTION CONTROL QUANTITIES

WPCQ-1

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NON-STORM WATER INFORMATION HANDOUT
CONTRACT NO. 0A5344

I-80 /I-680/SR 12 Interchange Project-Initial Construction Package
Solano County, California

California Department of Transportation
District 4, 111 Grand Avenue
Oakland, CA 94612

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I. PROJECT DESCRIPTION

2. CONSTRUCTION ACTIVITIES REQUIRING DEWATERING

3. TREATMENT SYSTEM COMPONENTS

4. DISPOSAL OF TREATED GROUNDWATER

5. INSPECTION, MONITORING, AND REPORTING

ATTACHMENTS

A. ESTIMATED GROUNWATER SEEPAGE RATES IN THE PROJECT AREA

B. DEWATERING LOCATION PLAN

C. SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD (RWQCB) GENERAL WASTE DISCHARGE REQUIREMENTS, ORDER NO. R2-2012-0012

D. PUBLICLY-OWNED TREATMENT WORKS (POTW) FACILITY INFORMATION

E. SITE INVESTIGATION REPORT

1. Project Description

The project is located in the vicinity of the City of Fairfield in Solano County at the interchanges between Interstate 80 (I-80), Interstate 680 (I-680), and State Route 12 (SR 12). The proposed improvement will construct braided ramps on westbound I-80 between GreenValley Road Overcrossing and SR 12 and replace the Green Valley Road Overcrossing to improve traffic flow, pedestrian access and safety on the overcrossing.

2. Construction Activities Requiring Dewatering

Ground water will be encountered in the structure excavations for bridge footings. Bent 3 of the WB 80 to WB12 and Bent 2 of the Green Valley Road OC. The groundwater level is about 2 feet above the bottom of the excavation. The dewatering locations are depicted on the Dewatering Location Plan in Attachment B.

3. Treatment System Components

Treatment systems must be designed to remove turbidity-producing suspended solids, petroleum hydrocarbon constituents found in the groundwater. Primary and secondary treatment may be required, or the design of the treatment system may require combined use of the various treatment components in series to achieve effective treatment. Ensure that the treatment system components are steam cleaned to remove any residual contaminants. Treatment system components may include:

1. Desilting basins
2. Weir tanks
3. Settling tanks
4. Sediment traps
5. Gravity bag filters
6. Sand media filters
7. Pressurized bag filters
8. Cartridge filters
9. In-line chemical coagulants and flocculants
10. Activated clay filters
11. Activated carbon filters
12. A combination of these systems to provide primary and secondary treatment

4. Disposal of Treated Groundwater

Use discharged treated water or uncontaminated ground or surface water for dust control in active work areas when possible, or discharge the water to an inactive area where the grade prevents sheet flow and the soil will allow percolation. The discharge point in the inactive area must include a velocity dissipater. The discharge volume must not exceed the area's capacity for percolation.

Do not discharge into a body of water where erosion, scour, or sedimentary deposits could occur that impact natural bedding or aquatic life. Monitor the water at the discharge point using water quality measurements and visual observation in conformance with the regulatory permit and the special provisions. Storm water must be diverted away from excavations that would require dewatering.

5. Inspection, Monitoring, and Reporting

If treated groundwater is discharged to the storm drain system, perform compliance monitoring in conformance with the Monitoring and Reporting Program (MRP) included in Attachment E of the Order No. R2-2012-0012. If a batch discharge permit is obtained from a POTW, comply with the provisions contained in the batch discharge permit including all monitoring and reporting requirements.

During periods when the dewatering and non-storm water discharge operations occur, document the results in a Daily Inspection Report (DIR). The DIR form must include the discharge volume records and water quality monitoring records. In developing the DIR, refer to the Department's Dewatering Guide. The DIR form must be approved by the Engineer before use. The DIR must be provided weekly or as directed to the Engineer.

All information and recorded data collected or submitted as part of the DIR must be certified as true and accurate and signed by those who gather the information. During each day of discharge, perform daily inspection of the effluent at the discharge site and include, in the DIR, observations of:

1. Date and Time.
2. Weather conditions,
3. Wind direction and velocity,
4. The presence or absence of water fowl or aquatic wildlife,
5. The color and clarity of the effluent discharge, and
6. Erosion or ponding downstream of the discharge site.

The DIR must include photographs of the discharge point and areas downstream of the discharge location. These photographs must be labeled with the time, date, and location.

A flow meter that has been approved by the Engineer for exclusive use in dewatering during construction must be used to measure all excavation discharges. All calibrations must be done in conformance with the manufacturer's instructions in the presence of the Engineer. Record the flow-meter totalizer readings and compute average daily volumes for every day that dewatering is conducted.

ATTACHMENT A

ESTIMATED GROUNWATER SEEPAGE RATES IN THE PROJECT AREA

PARIKH
Practicing in the Geosciences

Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

MEMORANDUM

To: **MARK THOMAS & CO., INC.**
7300 Folsom Blvd., Suite 203
Sacramento, CA 95826

February 5, 2013
Job No.: 2009-130-GDR

Attn.: Mr. Matt Brogan

From: Frank Y. Wang, G.E.

Sub: Estimation of Seepage Rate
I-80/680/12 ICP Project, Solano County, California

This memorandum is prepared to summarize the estimated groundwater seepage flow rate expected during the footing excavations for this project, including the following three bridge structures:

- Green Valley Road OC, Br. No. 23-0246
- Green Valley Road OC – Over SB 680 On-Ramp, Br. No. 23-0247
- WB 80 to WB 12 Separation – Over WB 80 On-Ramp, Bridge, Br. No. 23-0248

Based on the boring data, the groundwater was encountered at about 10 to 15 feet below existing grade. Based on the plans provided, the footings are generally above the groundwater. The seepage rate is considered relatively small. However, Bent 3 of the WB 80 to WB12 and Bent 2 of the Green Valley Road OC are quite close to the groundwater level and we have assumed groundwater table at 2 feet above the bottom of the excavation.

The flow of groundwater through porous media, such as soil, is dependent upon many variables. The most important parameters that control the flow of water in soil are the permeability of the soil and the head differential. The permeability of the soil can be determined from laboratory test results or a site pump test. In the absence of laboratory tests or pump test data, an estimate of the permeability can be made based on standard correlations published in geotechnical literature. Head differential can be determined based on the elevation of the measured phreatic surface and the anticipated drawdown needed to keep the ground surface dry and workable.

The permeability of soil is generally very difficult to estimate accurately from laboratory tests and correlations. This is because the permeability of the soil is dependent on numerous factors such as the soil density, the void ratio, the presence of sand or silt lenses, the soil saturation, sample disturbance, etc. It is virtually impossible to account for all these factors accurately in the laboratory or when correlating with published values. Consequently, permeability based on laboratory tests and/or correlations can be off by orders of magnitude. For this project, we estimated the seepage using soil description and published soil data correlations in literature.

At the planned location of Bent 3 of WB 80 to WB 12 Separation structure, the site is underlain by predominantly clayey materials. At the planned location of Bent 2 of Green Valley Road OC,

the site is underlain by about 10 feet of lean clay overlying a layer of clayey sand. We have assumed a typical permeability of 10^{-6} cm/s for the clayey materials and 10^{-4} cm/s for the clayey sand.

We have used the computer program SEEP/W (by Geoslope) for estimating the seepage rate. The seepage rate is estimated on the order of 0.003 gallon-per-minute (gpm) for Bent 3 of WB 80 to WB 12 and 0.05 gpm for Bent 2 of Green Valley Road OC.

Please be advised that we are performing a professional service and that our conclusions and professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

ATTACHMENT B

DEWATERING LOCATION PLAN

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Sol	12,80	2.1/2.8, 12.0/13.1	1	544

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY

IN SOLANO COUNTY
IN AND NEAR FAIRFIELD

FROM ROUTE 12/80 SEPARATION TO 0.7 MILES WEST ON ROUTE 12
ON ROUTE 80 FROM ROUTE 12/80 SEPARATION
TO ROUTE 80/680 SEPARATION

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2010

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368-416	LIGHTING AND SIGN ILLUMINATION, TOS, ELECTRICAL

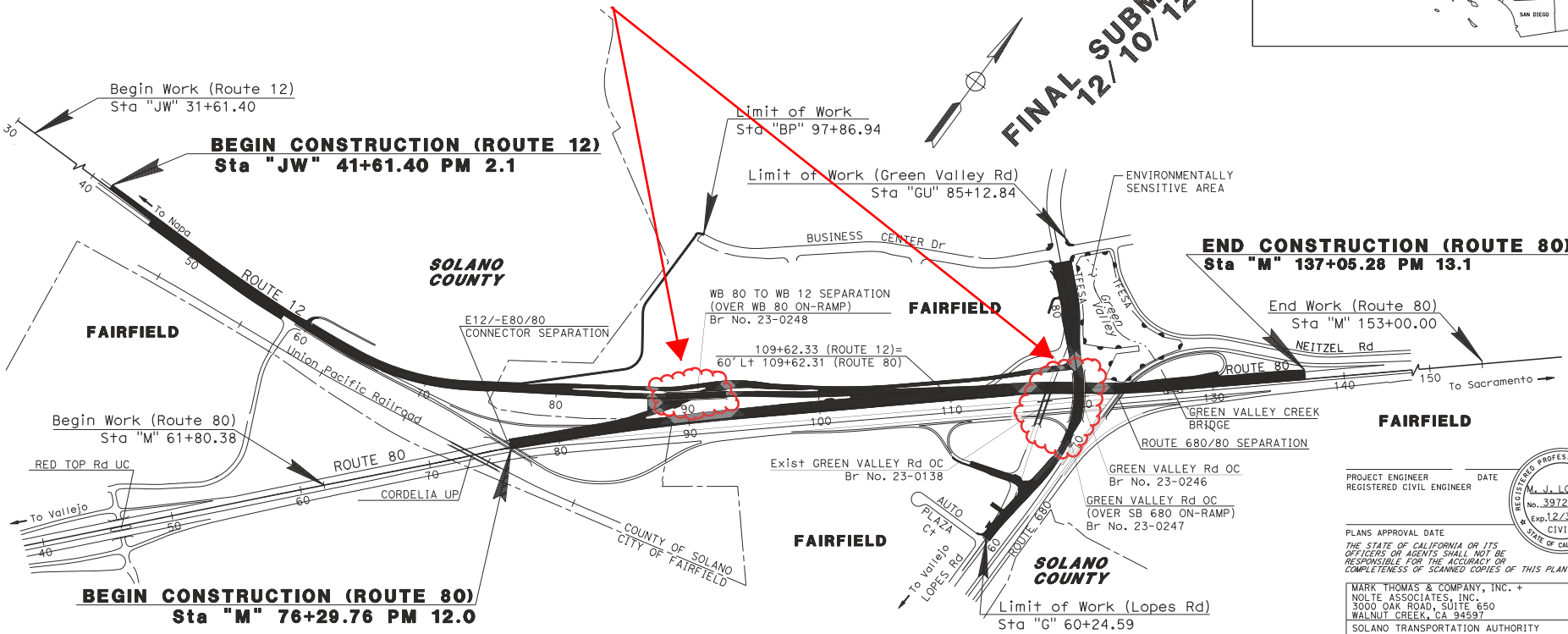
STRUCTURES PLANS

417-468	RETAINING WALL PLANS
469-544	STRUCTURE PLANS

Groundwater may be encountered in the structure excavations for bridge footing

FINAL SUBMITTAL 12/10/12

LOCATION MAP



THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO BIDDERS."

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER M. J. LOHMAN No. 39727 Exp. 12/31/13 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

MARK THOMAS & COMPANY, INC. +
NOLTE ASSOCIATES, INC.
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CA 94597

SOLANO TRANSPORTATION AUTHORITY
ONE HARBOR CENTER, SUITE 130
SUISUN CITY, CA 94585

CONTRACT No.	04-0A5344
PROJECT ID	0400021131

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
MICHAEL J. LOHMAN	RONI BOUKHALIL	50744	9/30/13	

LAST REVISION 12-10-12 DATE PLOTTED => 07-DEC-2012 TIME PLOTTED => 14:54

Dewatering Location Map

ATTACHMENT C

SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD (RWQCB) GENERAL WASTE DISCHARGE REQUIREMENTS, ORDER NO. R2-2012-0012

Matthew Rodriquez
Secretary for Environmen Protection

California Regional Water Quality Control Board
San Francisco Bay Region

1515 Clay Street, Suite 1400, Oakland, California 94612
(510) 622-2300 • FAX (510) 622-2460
http://www.waterboards.ca.gov/sanfranciscobay

Edmund G. Brown Jr.
Governor

ORDER NO. R2-2012-0012
NPDES NO. CAG912002

GENERAL WASTE DISCHARGE REQUIREMENTS FOR:
Discharge or Reuse of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Volatile Organic Compounds (VOC), Fuel Leaks and Other Related Wastes (VOC and Fuel General Permit)

Table 1. Administrative Information

This Order was adopted by the Regional Water Quality Control Board on:	**February 8, 2012**
This Order shall become effective on:	**March 15, 2012**
This Order shall expire on:	**March 15, 2017**
CIWQS Regulatory Measure Number:	**383087**
The U.S. Environmental Protection Agency (USEPA) and the Regional Water Quality Control Board have classified the discharges under this General National Pollutant Discharge Elimination System (NPDES) Permit as minor discharges based on the discharges' impacts to receiving water bodies.	
To obtain coverage under this General Permit, dischargers must submit a Notice of Intent (NOI) Form as described in Attachment B and a filing fee equivalent to the first year's annual fee. If the NOI is complete, Authorization to Discharge will be issued by the Regional Water Quality Control Board Executive Officer.	
Authorized dischargers who need to continue discharging after the expiration date of this Order shall file a completed NOI form no later than 180 days in advance of this Order's expiration date. Such dischargers for whom coverage is extended will become subject to the new Order upon authorization by the Executive Officer.	

I, Bruce H. Wolfe, Executive Officer, do hereby certify that this Order with all attachments is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on the date indicated above.

_____

Bruce H. Wolfe, Executive Officer

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Attachment A – Definitions
Attachment B – Notice of Intent Application Form and Instructions
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Attachment E – Monitoring and Reporting Program
Attachment F – Fact Sheet

I. SCOPE OF GENERAL PERMIT

Facilities that may be covered under this Order are groundwater treatment facilities located at active or closed sites, such as service stations or construction sites. These groundwater treatment facilities are in operation to extract and treat groundwater polluted by volatile organic compounds (VOC), fuel, and fuel additives. This Order covers discharges from these facilities to all surface waters such as creeks, streams, rivers including flood control channels, lakes, or San Francisco Bay. Such discharges may occur directly to surface waters or through constructed storm drain systems.

II. FINDINGS

The California Regional Water Quality Control Board, San Francisco Bay Region (hereinafter, the Regional Water Board), finds:

A. Background. There are 20 permittees authorized (as of November 2011) to discharge pursuant to Order No. R2-2006-0075, NPDES Permit No. CAG912002 (General Waste Discharge Requirements for Discharge or Reuse of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Fuel Leaks and Other Related Waste at Service Stations and Similar Sites). Of this group, 18 submitted Notices of Intent (NOI) applications and applied for an NPDES permit to continue their discharge of treated wastewater from their groundwater extraction and treatment facilities (hereinafter Facility or Facilities).

In addition, there are 56 permittees currently authorized to discharge pursuant to Order No. R2-2009-0059, NPDES Permit No. CAG912003 (General Waste Discharge for Discharge or Reuse of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by VOC). Order No. R2-2009-0059 will not be reissued upon expiration on September 30, 2014, and permittees with a continued need to discharge shall seek coverage under this General Permit.

For the purposes of this Order, references to the "Discharger" or "permittee" in applicable federal and State laws, regulations, plans, or policy are held to be equivalent to references to the Discharger(s) herein. A discharger who is authorized under this Order is hereinafter a Discharger.

B. Facility Description. Dischargers typically use aeration and/or granular activated carbon (GAC) systems to treat their groundwater prior to discharge. Facilities that use other types of treatment systems that are effective at removal of VOC or fuel pollutants may be covered by this Order subject to the approval of the Executive Officer. Treated wastewaters are typically discharged through storm drain systems, rivers, and/or creeks to San Francisco Bay. To obtain coverage under this Order, a discharger must include a complete description of the treatment system installed at its facility in the Notice of Intent (NOI) application form (Attachment B).

C. Regional Water Board Preference for Reuse or Discharge to POTW: The Regional Water Board adopted Resolution No. 88-160 on October 19, 1988. The Resolution urges dischargers of extracted groundwater from site cleanup projects to reuse their treated groundwater. When reuse is not technically and/or economically feasible, to discharge to a publicly owned treatment works (POTW). Only if neither reuse nor discharge to a POTW is technically or economically feasible, and if beneficial uses of the receiving water are not adversely affected, the Regional Water

Board may authorize the discharge of treated extracted groundwater in accordance with the requirements of this Order.

D. Legal Authorities. This Order is issued pursuant to Clean Water Act (CWA) section 402 and implementing regulations adopted by the U.S. Environmental Protection Agency (USEPA) and chapter 5.5, division 7 of the California Water Code (CWC) (commencing with section 13370). It shall serve as an NPDES permit for point source discharges from each Facility, regulated under this Order, to surface waters. This Order also serves as General Waste Discharge Requirements (GWDRs) pursuant to CWC article 4, chapter 4, division 7 (commencing with section 13260).

States may request authority to issue general NPDES permits pursuant to title 40 of the Code of Federal Regulations (40 CFR) section 122.28. On June 8, 1989, the State Water Resources Control Board (State Water Board) submitted an application to USEPA requesting revisions to its NPDES Program in accordance with 40 CFR 122.28, 123.62, and 403.10. The application included a request to add general permit authority to its approved NPDES Program. On September 22, 1989, USEPA Region 9 approved the State Water Board's request and granted authorization for the State to issue general NPDES permits.

E. Background and Rationale for Requirements. The Regional Water Board developed the requirements in this Order based on information submitted as part of NOIs, through monitoring and reporting programs, and other available environmental information. The Fact Sheet (Attachment F), which contains background information and rationale for Order requirements, is hereby incorporated into this Order and constitutes part of the Findings for this Order. Attachments A through F are also incorporated into this Order.

F. California Environmental Quality Act (CEQA). Under CWC section 13389, this action to adopt an NPDES permit is exempt from Chapter 3 of CEQA.

G. Technology-based Effluent Limitations. CWA section 301(b) and NPDES regulations at 40 CFR 122.44 require that permits include conditions meeting applicable technology-based requirements, at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. Discharges authorized by this Order must meet technology-based effluent limitations based on Best Professional Judgment (BPJ) in accordance with 40 CFR 125.3. A detailed discussion of the technology-based effluent limitations development and BPJ is included in the Fact Sheet (Attachment F).

H. Water Quality-Based Effluent Limitations. CWA section 301(b) and NPDES regulations at 40 CFR 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards. NPDES regulations at 40 CFR122.44(d)(1)(i) mandate that permits include effluent limitations for all pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard. Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELs must be established using: (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) on an indicator parameter for the pollutant of concern; or (3)

using a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in 40 CFR 122.44(d)(1)(vi).

I. Water Quality Control Plans. The *Water Quality Control Plan for the San Francisco Bay Basin* (Basin Plan) is the Regional Water Board's master water quality control planning document. It designates beneficial uses and water quality objectives (WQOs) for waters of the State, including surface waters and groundwater. It also includes programs of implementation to achieve WQOs. The Basin Plan was duly adopted by the Regional Water Board and approved by the State Water Board, Office of Administrative Law, and USEPA.

The Basin Plan states that the beneficial uses of any specifically identified water body generally apply to its tributary streams. The Basin Plan may not specifically identify beneficial uses for every receiving water regulated under this permit, but may identify present and potential uses for the downstream water body, to which the receiving water, via an intermediate water body, is tributary. These potential and existing beneficial uses are municipal and domestic supply, fish migration and fish spawning, industrial service supply, navigation, industrial process supply, marine habitat, agricultural supply, estuarine habitat, groundwater recharge, shellfish harvesting, water contact and non-contact recreation, ocean, commercial, and sport fishing, wildlife habitat, areas of special biological significance, cold freshwater and warm freshwater habitat, and preservation of rare and endangered species for surface waters and municipal and domestic supply, industrial service supply, industrial process supply, agricultural supply, and freshwater replenishment for groundwaters. In addition, the Basin Plan implements State Water Board Resolution No. 88-63, which established State policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply. Requirements of this Order implement the Basin Plan.

On September 18, 1975, the State Water Board adopted the *Water Quality Control Plan for Control of Temperature in the Coastal Interstate Waters and Enclosed Bays and Estuaries of California* (hereinafter the Thermal Plan). The Thermal Plan contains objectives governing cooling water discharges, providing different and specific numeric and narrative water quality objectives for new and existing discharges.

The State Water Board's *Water Quality Control Plan for Enclosed Bays and Estuaries—Part 1, Sediment Quality* became effective on August 25, 2009. This plan supersedes other narrative sediment quality objectives and establishes new sediment quality objectives and related implementation provisions for specifically defined sediments in most bays and estuaries.

J. National Toxics Rule (NTR) and California Toxics Rule (CTR). USEPA adopted the NTR on December 22, 1992, and later amended it on May 4, 1995, and November 9, 1999. About 40 criteria in the NTR apply in California. On May 18, 2000, USEPA adopted the CTR. The CTR promulgated new toxics criteria for California and, in addition, incorporated the previously adopted NTR criteria that were applicable in the State. The CTR was amended on February 13, 2001. These rules contain water quality criteria (WQC) for priority pollutants.

K. State Implementation Policy. On March 2, 2000, the State Water Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of*

California (State Implementation Policy or SIP). The SIP became effective on April 28, 2000, with respect to the priority pollutant criteria promulgated for California by USEPA through the NTR and to the priority pollutant objectives established by the Regional Water Board in the Basin Plan. The SIP became effective on May 18, 2000, with respect to the priority pollutant criteria promulgated by USEPA through the CTR. The State Water Board adopted amendments to the SIP on February 24, 2005, that became effective on July 13, 2005. The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control. Requirements of this Order implement the SIP.

L. Recycled Water Policy. The State Water Board adopted Resolution No. 2009-0011 (*Policy for Water Quality Control for Recycled Water*) on February 3, 2009. The policy is intended to promote sustainable local water supplies by increasing the acceptance and promoting the use of recycled water. It sets a goal of increasing recycled water use statewide by at least one million acre feet per year by 2030. The policy also requires Regional Water Boards to exercise their authority to the fullest extent possible to encourage recycled water use and to develop watershed-based salt and nutrient management plans to ensure that groundwater resources are not degraded by recycled water use.

M. Alaska Rule. On March 30, 2000, USEPA revised its regulation that specifies when new and revised state and tribal water quality standards (WQS) become effective for CWA purposes. [40 CFR 131.21; 65 Fed. Reg. 24641 (April 27, 2000)] Under the revised regulation (also known as the Alaska rule), new and revised standards submitted to USEPA after May 30, 2000, must be approved by USEPA before being used for CWA purposes. The final rule also provides that standards already in effect and submitted to USEPA by May 30, 2000, may be used for CWA purposes, whether or not approved by USEPA.

N. Stringency of Requirements for Individual Pollutants. This Order contains both technology-based and water quality-based effluent limitations (WQBELs) for individual pollutants. Derivation of these limitations is discussed in the Fact Sheet (Attachment F.) This Order's technology-based pollutant restrictions on benzene, carbon tetrachloride, chloroform, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, ethylbenzene, methylene chloride, tetrachloroethylene, toluene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, trichloroethylene, vinyl chloride, total xylenes, methyl tertiary butyl ether, total petroleum hydrocarbons, and trichlorotrifluoroethane implement the minimum applicable federal technology-based requirements and meet requirements of the Basin Plan.

WQBELs have been derived to implement WQOs that protect beneficial uses. Both the beneficial uses and the WQOs have been approved pursuant to federal law and are the applicable federal water quality standards. To the extent that toxic pollutant WQBELs were derived from the CTR, the CTR is the applicable standard pursuant to 40 CFR 131.38. The procedure for calculating individual WQBELs for priority pollutants is based on the SIP. Most beneficial uses and WQOs contained in the Basin Plan were approved under State law and submitted to and approved by USEPA. Any WQOs and beneficial uses submitted to USEPA prior to May 30, 2000, but not approved by USEPA before that date, are nonetheless "applicable water quality standards for the purposes of the CWA" pursuant to 40 CFR 131.21(c)(1).

O. Antidegradation Policy. NPDES regulations at 40 CFR 131.12 require that state water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16, which incorporates the federal antidegradation policy where the federal policy applies under federal law and requires that existing quality of waters be maintained unless degradation is justified based on specific findings. The Basin Plan implements, and incorporates by reference, both the State and federal antidegradation policies.

P. Anti-Backsliding Requirements. CWA sections 402(o)(2) and 303(d)(4) and 40 CFR 122.44(l) prohibit backsliding in NPDES permits. These anti-backsliding provisions require that effluent limitations in a reissued permit be as stringent as those in the previous permit, with some exceptions where limitations may be relaxed. This Order retains effluent limitations no less stringent than those established by previous orders.

Q. Endangered Species Act. This Order does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code sections 2050 to 2097) or the federal Endangered Species Act (16 U.S.C.A. sections 1531 to 1544). This Order requires compliance with effluent limits, receiving water limits, and other requirements to protect the beneficial uses of waters of the State. Dischargers are responsible for meeting all requirements of applicable State and federal law pertaining to threatened and endangered species.

R. Monitoring and Reporting. NPDES regulations at 40 CFR 122.48 require that all NPDES permits specify requirements for recording and reporting monitoring results. CWC sections 13267 and 13383 authorize the Regional Water Board to require technical and monitoring reports. The Monitoring and Reporting Program establishes monitoring and reporting requirements to implement federal and State requirements. This Monitoring and Reporting Program is provided in Attachment E.

S. Standard and Special Provisions. Standard Provisions, which apply to all NPDES permits in accordance with 40 CFR section 122.41, and additional conditions applicable to specified categories of permits in accordance with 40 CFR 122.42 and as modified for this General Permit, are provided in Attachment D. Dischargers must comply with all standard provisions and with those additional conditions that are applicable under 40 CFR 122.42. The Regional Water Board has also included in this Order special provisions applicable to the Dischargers. The attached Fact Sheet (Attachment F) provides rationale for the special provisions contained in this Order.

T. Provisions and Requirements Implementing State Law. The provisions/requirements in subsections IV.B (Reclamation Specifications) and V.B (Groundwater Limitations) of this Order are included to implement State law only. These provisions/requirements are not required or authorized under the federal CWA; consequently, violations of these provisions/requirements are not subject to the enforcement remedies that are available for NPDES violations.

U. Notification of Interested Parties. The Regional Water Board notified the Dischargers and interested agencies and persons of its intent to prescribe GWDRs for the discharge and has

provided them with an opportunity to submit their written comments and recommendations. The Fact Sheet (Attachment F) provides details of the notification.

V. Consideration of Public Comment. The Regional Water Board, in a public meeting, heard and considered all comments pertaining to the discharge. The Fact Sheet (Attachment F) provides details of the public hearing.

IT IS HEREBY ORDERED, that this Order supersedes Order No. R2-2006-0075 and, effective September 30, 2014, Order No. R2-2009-0059, except for enforcement purposes, and in order to meet the provisions contained in CWC Division 7 (commencing with section 13000) and regulations adopted thereunder, and the provisions of the federal CWA and regulations and guidelines adopted thereunder, the Discharger shall comply with the following requirements in this Order.

III. DISCHARGE PROHIBITIONS

A. The discharge of extracted and treated groundwater polluted by fuel, fuel components, VOC, and related wastes to surface waters from service stations, construction sites, and similar sites, is prohibited unless an NOI application for proposed discharge has been submitted, and the Executive Officer has provided the Discharger with an Authorization to Discharge.

B. Discharges other than the following are prohibited: extracted groundwater treated only with treatment chemicals approved by the Executive Officer and added in a manner consistent with the proper operation and maintenance of the treatment facility.

C. The discharge of extracted and treated groundwater from a specific site in excess of the flow rate specified by the Executive Officer in the Authorization to Discharge is prohibited.

D. Discharges to a storm drain shall not cause scouring or erosion at the point where the storm drain discharges into the receiving water and shall not cause or contribute to scouring of banks, excessive sedimentation, or flooding of the storm drain system or receiving water downstream of the point of discharge.

E. Neither the treatment nor the discharge of pollutants shall create a pollution, contamination, or nuisance, as defined by CWC section 13050.

F. Bypass or overflow of untreated or partially treated groundwater polluted by fuel, fuel components, VOC, or other related wastes to waters of the State either at the treatment system or from any of the collection or transport systems or pump stations tributary to the treatment system is prohibited, except as provided for in the conditions stated in section I.G.2 and I.G.4 of Attachment D.

IV. EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

A. Effluent Limitations (For Dischargers to Surface Water Only)

1. **Toxic Pollutants:** The discharge of treated groundwater shall maintain compliance with the following effluent limitations at Monitoring Location EFF-001 as specified in the Authorization to Discharge:

Table 2. Effluent Limitations for Toxic Pollutants

No.	Compound	CAS Number	Column A: Discharge to Drinking Water Areas[1]		Column B: Discharge to Other Surface Water Areas	
			Average Monthly Effluent Limitation (µg/L)	Maximum Daily Effluent Limitation (µg/L)	Average Monthly Effluent Limitation (µg/L)	Maximum Daily Effluent Limitation (µg/L)
1	Benzene	71432	---	1	---	5
2	Carbon Tetrachloride	56235	0.25[2]	0.50	4.4	5
3	Chloroform	67663	---	5	---	5
4	1,1-Dichloroethane	75343	---	5	---	5
5	1,2-Dichloroethane	107062	0.38[2]	0.5	---	5
6	1,1-Dichloroethylene	75354	0.057[2]	0.11[2]	3.2	5
7	Ethylbenzene	100414	---	5	---	5
8	Methylene Chloride	75092	4.7	5	---	5
9	Tetrachloroethylene (PCE)	127184	0.8	1.6	---	5
10	Toluene	108883	---	5	---	5
11	Cis 1,2-Dichloroethylene	156592	---	5	---	5
12	Trans 1,2-Dichloroethylene	156605	---	5	---	5
13	1,1,1-Trichloroethane	71556	---	5	---	5
14	1,1,2-Trichloroethane	79005	0.6	1.2	---	5
15	Trichloroethylene (TCE)	79016	2.7	5	---	5
16	Vinyl Chloride	75014	---	0.5	---	1
17	Total Xylenes	1330207	---	5	---	5
18	Methyl Tertiary Butyl Ether (MTBE)	1634044	---	5	---	5
19	Total Petroleum Hydrocarbons[TPHs (as gasoline or as diesel)]	---	---	50	---	50

No.	Compound	CAS Number	Column A: Discharge to Drinking Water Areas[1]		Column B: Discharge to Other Surface Water Areas	
			Average Monthly Effluent Limitation (µg/L)	Maximum Daily Effluent Limitation (µg/L)	Average Monthly Effluent Limitation (µg/L)	Maximum Daily Effluent Limitation (µg/L)
20	Ethylene Dibromide (1,2-Dibromoethane)	106934	---	0.05[2]	---	5
21	Trichloro-trifluoroethane	76131	---	5	---	5
22	Total Chlorine Residual	---	---	0.0[3]	---	0.0[3]

Table Notes:
[1] Drinking water areas are defined as surface waters with the existing or potential beneficial uses of "Municipal and Domestic Supply" and "Groundwater Recharge" (the latter includes recharge areas to maintain salt balance or to halt salt water intrusion into fresh water aquifers).
[2] If reported detection level is greater than effluent limit, then a non-detect result using a 0.5 µg/L detection level will not be deemed to be out of compliance.
[3] There shall be no detectable levels of residual chlorine in the effluent (a non-detect result using a detection level equal or less than 0.08 milligram per liter (mg/L) will not be deemed to be out of compliance). This limit only applies to Dischargers that chlorinate their extracted groundwater.

2. **pH:** The pH of the discharge shall not exceed 8.5 nor be less than 6.5.

3. **Acute Toxicity:**

   a. Representative samples of the discharge, with compliance measured at Monitoring Location EFF-001 as described in the Authorization to Discharge, shall meet the following limits for acute toxicity. Bioassays shall be conducted in compliance with Section V.A of the Monitoring and Reporting Program (Attachment E).

   The survival of test fish in 96-hour static renewal bioassays with the discharge shall be not less than a three sample moving median of 90% survival and a single test value of not less than 70% survival.

   b. These acute toxicity limitations are further defined as follows:

   (1) 3-sample median. A bioassay test showing survival of less than 90 percent represents a violation of this limitation, if one or more of the past two or less bioassay tests show less than 90 percent survival.

   (2) Single sample. A bioassay test showing survival of less than 70 percent represents a violation of this limitation.

   c. Bioassays shall be performed using the most up-to-date USEPA protocol. Bioassays shall be conducted using rainbow trout as the test species in compliance with *Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms*, currently 5th Edition (EPA-821-R-02-012), with exceptions granted

to the Discharger by the Executive Officer and the Environmental Laboratory Accreditation Program (ELAP) upon the Discharger's request with justification.

B. Groundwater Reuse Specifications (For Dischargers that Reuse All or a Portion of Treated Groundwater)

1. **Reuse Policy:** As noted in the findings, the Regional Water Board adopted Resolution No. 88-160 on October 19, 1988. The Resolution urges dischargers of extracted groundwater from site cleanup projects to reuse their effluent and that when reuse is not technically and/or economically feasible, to discharge to a POTW.

2. **Reuse Allowed:** This Order permits reuse of extracted treated groundwater in conjunction with the discharge to surface water. Reuse of extracted treated groundwater can take many forms, such as irrigation of landscaping or agriculture, dust control or soil compaction on construction sites, and industrial water supply.

3. **Water Reuse Specifications (Water Reuse Only)**

   a. Water for beneficial reuse shall meet the requirements in Section IV.A - Effluent Limitations.

   b. Water reuse activities shall be described in the Discharger's NOI, including the method of any additional treatment and the location and type of water reuse.

   c. The reuse of treated groundwater shall not impair the quality of waters of the State, nor shall it create a nuisance as defined by CWC section 13050(m).

   d. Adequate measures shall be taken to minimize public contact with the reused groundwater and to prevent the breeding of flies, mosquitoes, and other vectors of public health significance during or after the process of reuse.

   e. Appropriate public warnings must be posted to advise the public that the water is not suitable for drinking. Signs must be posted in the area, and all reused water valves and outlets appropriately labeled.

   f. There shall be no cross-connection between the potable water supply and piping containing treated groundwater intended for reuse.

   g. Water reuse consisting of recharge or reinjection is not authorized under this Order. Any reinjection must be performed in accordance with a cleanup order approved by the Regional Water Board, or another lead oversight agency.

V. RECEIVING WATER LIMITATIONS

A. Surface Water Limitations

Discharges shall not cause the following in surface receiving waters:

1. The discharge of waste shall not cause the following conditions to exist in waters of the State at any place:

a. Floating, suspended, or deposited macroscopic particulate matter or foam;

b. Bottom deposits or aquatic growths to the extent that such deposits or growths cause nuisance or adversely affect beneficial uses;

c. Alteration of temperature, turbidity, or apparent color beyond present natural background levels;

d. Visible, floating, suspended, or deposited oil or other products of petroleum origin; and

e. Toxic or other deleterious substances to be present in concentrations or quantities that will cause deleterious effects on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentration.

2. The discharge of waste shall not cause the following limits to be exceeded in waters of the State in any place within one foot of the water surface:

a. Dissolved oxygen:

<u>For all tidal waters</u>:

In the Bay downstream of Carquinez Bridge - 5.0 mg/L minimum

Upstream of Carquinez Bridge - 7.0 mg/L minimum

<u>For nontidal waters</u>:

Waters designated as cold water habitat - 7.0 mg/L minimum

Waters designated as warm water habitat - 5.0 mg/L minimum

<u>For all inland surface waters</u>:

The median dissolved oxygen concentration for any three consecutive months shall not be less than 80% of the dissolved oxygen content at saturation. When natural factors cause concentrations less than that specified above, the discharge shall not cause further reduction in ambient dissolved oxygen concentrations.

b. Dissolved Sulfide

Natural background levels

c. pH:	The pH shall not be depressed below 6.5 nor raised above 8.5, nor caused to vary from normal ambient pH by more than 0.5 pH units.
d. Un-ionized Ammonia	0.025 mg/L as an annual median; 0.16 mg/L as a maximum for Central Bay and upstream; 0.4 mg/L as a maximum for Lower Bay.
e. Nutrients	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

3. Discharges shall not cause or contribute to a violation of any applicable water quality standard for receiving waters adopted by the Regional Water Board or the State Water Board as required by the CWA and regulations adopted there under. If more stringent applicable water quality standards are promulgated or approved pursuant to CWA section 303, or amendments thereto, the Regional Water Board will revise and modify this Order in accordance with such more stringent standards.

B. Groundwater Limitations – No discharges to groundwater authorized by this Order

VI. PROVISIONS

A. Standard Provisions

Dischargers shall comply with federal Standard Provisions included in Attachment D of this Order.

B. Monitoring and Reporting Program Requirements

1. Dischargers shall comply with the Monitoring and Reporting Program (Attachment E), and future revisions thereto, including applicable sampling and reporting requirements in the standard provisions listed in VI.A, above.

2. Dischargers authorized under this Order, especially those Dischargers with flow rates exceeding 10 gallons per minute, may be required to comply with additional monitoring requirements. The Executive Officer will specify such additional monitoring requirements in the Authorization to Discharge letter. Examples of additional monitoring that may be required are listed below:

a. Monitoring in response to a complaint received about a facility authorized to discharge under this permit,
b. Storm water monitoring,
c. Dioxins and furans monitoring,
d. Regional Monitoring Program (RMP) monitoring,
e. Additional discharge observations, and
f. Additional effluent and ambient priority pollutant scans.

C. Special Provisions

1. Reopener Provisions

The Regional Water Board may modify or reopen this Order prior to its expiration date in any of the following circumstances as allowed by law:

a. If present or future investigations demonstrate that the discharges governed by this Order have or will have a reasonable potential to cause or contribute to, or will cease to have, adverse impacts on water quality or beneficial uses of the receiving waters.

b. If new or revised WQOs or total maximum daily loads (TMDLs) come into effect for the San Francisco Bay Estuary and contiguous water bodies (whether statewide, regional, or site-specific). In such cases, effluent limitations in this Order will be modified as necessary to reflect updated WQOs and waste load allocations in TMDLs. Adoption of effluent limitations contained in this Order is not intended to restrict in any way future modifications based on legally adopted WQOs or TMDLs, or as otherwise permitted under federal regulations governing NPDES permit modifications.

c. If State Water Board precedential decisions, new policies, new laws, or new regulations on chronic toxicity or total chlorine residual become available.

d. If an administrative or judicial decision on a separate NPDES permit or WDRs addresses requirements similar to this discharge.

e. The Discharger may request permit modification based on any of the circumstances described above. In any such request, the Discharger shall include an antidegradation and anti-backsliding analysis.

f. The California Department of Public Health established a notification level for 1, 4-dioxane in November 2010 and has determined that it is reasonably anticipated to be a human carcinogen. Although this Order does not provide an effluent limit for 1,4-dioxane, the Regional Water Board may reopen this Order prior to its expiration to revise permit provisions pertaining to 1,4-dioxane.

g. Or as otherwise authorized by law.

2. **NOI or Modified NOI Application.** The NOI or Modified NOI application for each point of proposed discharge to a storm drain system shall contain the information required in the NOI Application as explained in Attachment B of this Order and as may be amended by the Executive Officer.

3. **NOI Review.** Upon receipt of a complete NOI application package for proposed discharge, the Executive Officer will review the application to determine whether the proposed Discharger is eligible to discharge waste under this Order. The application package shall document that:

a. The proposed discharge results from the cleanup of groundwater polluted by fuel leaks,

VOC leaks, and other related wastes;

b. The proposed Discharger has met the provisions of Regional Water Board Resolution No. 88-160 (*Regional Water Board Position on the Disposal of Extracted Groundwater from Groundwater Cleanup Projects*); and

c. The proposed treatment system and associated operation, maintenance, and monitoring plans are capable of ensuring that the discharge will meet the provisions, prohibitions, effluent limitations, and receiving water limitations of this Order.

4. **Discharge Authorization.** If the Regional Water Board Executive Officer determines that the proposed Discharger is eligible to discharge waste under this Order, the Executive Officer will issue an Authorization to Discharge. This Authorization to Discharge may be terminated by the Executive Officer at any time.

5. **Non-Compliance Is A Violation.** Upon receipt of the Regional Water Board Executive Officer's Authorization to Discharge, the Discharger shall comply with all applicable conditions and limitations of this Order and its Attachments. Any noncompliance (violations of requirements in this Order or Monitoring Program) constitutes a violation of the CWA and the CWC and is grounds for enforcement action and/or termination or modification of authorization to discharge.

6. **Triggers.** The following triggers are not effluent limitations and must not be construed as such. Instead, the triggers are levels above which additional investigation is required to determine further action. If any constituent in the discharge exceeds the corresponding trigger as listed in Table 3, below, the Discharger shall take monthly influent and effluent samples for three consecutive months for each exceeded constituent and conduct activities as required in Provisions VI.C.7 or VI.C.8. If additional monitoring has already been completed, the Discharger shall summarize the results including a description of plans underway to address the previous exceedance, such as details of source elimination, changes in operation of existing treatment units, or the re-design of any treatment unit.

Table 3. Trigger Pollutants

Pollutant	Chemical Abstract Service (CAS) Number	Trigger (µg/L)[1],[2]
Antimony	7440360	6
Arsenic	7440382	10
Beryllium	7440417	4
Cadmium	7440439	1.1
Chromium (VI)	18540299	11[3]
Copper[4]	7440508	5.9
Copper[5]	7440508	3.4
Copper[6]	7440508	4.7
Lead	7439921	3.2
Mercury	7439976	0.025
Nickel[4]	7440020	30
Nickel[5]	7440020	13
Nickel[6]	7440020	19
Selenium	7782492	5
Silver	7440224	2.2
Thallium	7440280	1.7
Zinc	7440666	86
Cyanide	57125	2.9

Pollutant	Chemical Abstract Service (CAS) Number	Trigger (µg/L)[1],[2]
Acrylonitrile	107131	0.059
Bromoform	75252	4.3
Chlorodibromomethane	124481	0.401
Dichlorobromomethane	75274	0.56
1,2-Dichloropropane	78875	0.52
1,3-Dichloropropylene	542756	0.5
1,1,2,2-Tetrachloroethane	79345	0.17
Pentachlorophenol	87865	0.28
2,4,6-Trichlorophenol	88062	2.1
Benzidine	92875	0.00012
Benzo(a)anthracene	56553	0.0044
Benzo(a)pyrene	50328	0.0044
Benzo(b)fluoranthene	205992	0.0044
Benzo(k)fluoranthene	207089	0.0044
Bis(2-chloroethyl)ether	111444	0.031
Bis(2-ethylhexyl)phthalate	117817	1.8
Chrysene	218019	0.044
Dibenzo(a,h)anthracene	53703	0.0044
3,3'-Dichlorobenzidine	91941	0.04
2,4-Dinitrotoluene	121142	0.11
1,2-Diphenylhydrazine	122667	0.040
Hexachlorobenzene	118741	0.00075
Hexachlorobutadiene	87683	0.44
Hexachloroethane	67721	1.9
Indeno(1,2,3-c,d)pyrene	193395	0.0044
N-nitrosodimethylamine	62759	0.00069
N-nitrosodi-n-propylamine	621647	0.005
Aldrin	309002	0.00013
alpha-BHC	319846	0.0039
beta-BHC	319857	0.014
gamma-BHC	58899	0.019
Chlordane	57749	0.00057
4,4-DDT	50393	0.00059
4,4-DDE	72559	0.00059
4,4-DDD	72548	0.00083
Dieldrin	60571	0.00014
alpha-Endosulfan	959988	0.0087
beta-Endosulfan	33213659	0.0087
Endrin	72208	0.0023
Endrin aldehyde	7421934	0.76
Heptachlor	76448	0.00021
Heptachlor epoxide	1024573	0.00010
PCBs, sum	1336363	0.00017
Toxaphene	8001352	0.0002
1,4-dioxane	123911	3
Turbidity (NTU)	---	5
Odor-Threshold (Units)	---	3
Oxygenates Other than MTBE	---	5
TPHs (other than gasoline and diesel)	---	50[7]
Sulfate	---	250,000
Foaming agents	---	500
Color (Units)	-	15

Table Notes:

[1] Units are in µg/L unless noted otherwise right after the name of pollutant

[2] If a discharger is reporting non-detect monitoring data with a reporting level higher than the trigger, the reason for the higher detection level shall be consistent with Appendix 4 of the SIP (Minimum Levels) and must be explained within the monitoring report. Please refer to the Regional Water Board web site for the latest version of SIP.

[3] If total chromium concentration exceeds 11 µg/L, then analysis for chromium (VI) shall also be conducted.

[4] Applicable to Suisun Bay and San Pablo Bay segments of San Francisco Bay.

[5] Applicable to Central Bay and Lower Bay segments of San Francisco Bay

[6] Applicable to South San Francisco Bay, south of Hayward Shoals.

[7] If a discharger is reporting monitoring data with a detection level higher than 50 µg/L, the reason for the higher

Pollutant	Chemical Abstract Service (CAS) Number	Trigger (µg/L)[1],[2]
detection level shall be explained within the monitoring report. In case of Bunker C Fuel, any non-detect result with reporting levels not exceeding 100 µg/L will not be deemed to be out of compliance with the 50 ug/L trigger level.		

7. **Trigger Case 1:** If the results of all three additional discharge samples **do not** exceed the triggers, the Discharger shall report the results in the next Monitoring Report and shall return to the schedule of sampling and analysis in the attached Monitoring and Reporting Program (Attachment E).

8. **Trigger Case 2:** If the results of **at least one of the three** additional discharge samples show exceedance of the same trigger, the Discharger shall investigate the source (e.g., comparing influent and discharge sample results) and investigate source control and/or treatment options for each triggered pollutant. The Discharger shall document its progress on these efforts in the Annual Self-Monitoring Report required by section IX.B of the Monitoring and Reporting Program (Attachment E). Until the Executive Officer determines that the "triggered pollutants" investigation is complete, the Discharger must implement the following monitoring schedule for the triggered pollutants:

   a. In case of a triggered inorganic pollutant, the Discharger shall accelerate monitoring of the discharge to quarterly and provide information, updated annually, confirming that pollutant source is background and explain the reasons why treatment of that pollutant is not feasible. Specifically, the annual monitoring reports shall include site-specific background groundwater concentrations, types of treatment available, and costs of treatment systems for each triggered inorganic pollutant, and

   b. In case of a triggered organic pollutant, the Discharger shall accelerate monitoring of the discharge to every two weeks and provide information, updated annually, confirming the reason(s) why that pollutant could not be treated to the level not exceeding the trigger for that pollutant.

9. The Executive Officer may require the Discharger to perform additional investigations or take additional actions if the Discharger: (1) exceeds a trigger value for the same pollutant and confirms (Trigger Case 2 above) the exceedance greater than two times in one calendar year; and (2) is not pursuing resolution of trigger exceedances in a timely fashion in the judgment of the Executive Officer. These two trigger exceedances do not include the data collected to verify the trigger (i.e., effluent data collected to confirm the trigger exceedance). These conditions are also grounds for termination of the Authorization to Discharge.

10. **Individual NPDES Permit May Be Required.** The USEPA Administrator may request the Regional Water Board Executive Officer to require any Discharger authorized to discharge waste by the General Permit to apply for and obtain an individual NPDES permit. The Executive Officer may require any Discharger authorized to discharge waste by the General Permit to apply for and obtain an individual NPDES permit. Cases where an individual NPDES permit may be required include the following:

a. The Discharger is not in compliance with the conditions of this Order or as authorized by the Executive Officer;

b. A change has occurred in the availability of demonstrated technology or practices for the control or abatement of pollutants applicable to the point source;

c. Effluent limitation guidelines are promulgated for point sources covered by the General NPDES Permit; or

d. A water quality control plan containing requirements applicable to such point sources is approved.

11. Treatment Reliability. Dischargers shall, at all times, retain a professional engineer certified in the State of California to oversee the design and operation and maintenance of the treatment system to properly operate and maintain all facilities that are used by the Dischargers to achieve compliance with this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. All of these procedures shall be described in an Operation and Maintenance (O&M) Manual. The Discharger shall keep in a state of readiness all systems necessary to achieve compliance with the conditions of this Order. All systems, both those in service and reserve, shall be inspected and maintained on a regular basis. Records shall be kept of the tests (e.g., analytical or treatment system tests) and made available to the Regional Water Board for at least five years. Additional requirements for compliance with this provision are explained in Attachments B and C of the Order.

12. No Preemption. This Order permits the discharge of treated groundwater to waters of the State subject to the prohibitions, effluent limitations, and provisions of this Order. It does not preempt or supersede the authority of municipalities, flood control agencies, or other local agencies to prohibit, restrict, or control discharges of waste to storm drain systems or other watercourses subject to their jurisdiction. For example, this Order provides no water or groundwater rights and does not preempt the authority of any local or State agency as relates to water rights.

VII. COMPLIANCE DETERMINATION

Compliance with the effluent limitations contained in Section IV of this Order will be determined as specified below:

A. General

Compliance with effluent limitations for priority pollutants shall be determined using sample reporting protocols defined in the Monitoring and Reporting Program and Attachment A of this Order. For purposes of reporting and administrative enforcement by the Regional and State Water Boards, the Discharger shall be deemed out of compliance with effluent limitations if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reporting level (RL).

B. Multiple Sample Data

When determining compliance with an Average Monthly Effluent Limitation (AMEL) **or** Maximum Daily Effluent Limitation (MDEL) for priority pollutants and more than one sample result is available, the Discharger shall compute the arithmetic mean unless the data set contains one or more reported determinations of "Detected, but Not Quantified" (DNQ) or "Not Detected" (ND). In those cases, the Discharger shall compute the median in place of the arithmetic mean in accordance with the following procedure:

1. The data set shall be ranked from low to high, ranking the reported ND determinations lowest, DNQ determinations next, followed by quantified values (if any). The order of the individual ND or DNQ determinations is unimportant.

2. The median value of the data set shall be determined. If the data set has an odd number of data points, then the median is the middle value. If the data set has an even number of data points, then the median is the average of the two values around the middle unless one or both of the points are ND or DNQ, in which case the median value shall be the lower of the two data points where DNQ is lower than a value and ND is lower than DNQ.

ATTACHMENT A – ACRONYMS AND DEFINITIONS

Acronyms

CIWQS	California Integrated Water Quality System
AMEL	Average Monthly Effluent Limitation
Basin Plan	Water Quality Control Plan for the San Francisco Bay Basin
BPJ	Best Professional Judgment
CFR	Code of Federal Regulations
CTR	California Toxics Rule
CV	Coefficient of Variation
CWA	Federal Clean Water Act
DNQ	Detected, but Not Quantified
DO	Dissolved oxygen
ECA	Effluent Concentration Allowance
EFF	Effluent
MDEL	Maximum Daily Effluent Limitation
MDL	Method Detection Limit
ML	Minimum Level
MTBE	Methyl Tertiary Butyl Ether
ND	Not Detected
NTR	National Toxics Rule
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
PCE	Tetrachloroethylene
POTW	Publicly Owned Treatment Work
RL	Reporting Level
RPA	Reasonable Potential Analysis
SIP	State Implementation Policy
SSTs	Site-Specific Translators
TCE	Trichloroethylene
TPHG	Total Petroleum Hydrocarbons as Gasoline
TPHD	Total Petroleum Hydrocarbons as Diesel
µg/L	Microgram per Liter
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compounds

Definitions

Arithmetic Mean (µ), also called the average, is the sum of measured values divided by the number of samples. For ambient water concentrations, the arithmetic mean is calculated as follows:

Arithmetic mean = $\mu = \Sigma x / n$ where: Σx is the sum of the measured ambient water concentrations, and n is the number of samples.

Average Monthly Effluent Limitation (AMEL) is the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Bioaccumulative pollutants are those substances taken up by an organism from its surrounding medium through gill membranes, epithelial tissue, or from food and subsequently concentrated and retained in the body of the organism.

Carcinogenic pollutants are substances that are known to cause cancer in living organisms.

Coefficient of Variation (CV) is a measure of the data variability and is calculated as the estimated standard deviation divided by the arithmetic mean of the observed values.

Detected, but Not Quantified (DNQ) are those sample results less than the RL, but greater than or equal to the laboratory's MDL.

Dilution Credit is the amount of dilution granted to a discharge in the calculation of a water quality-based effluent limitation, based on the allowance of a specified mixing zone. It is calculated from the dilution ratio or determined through conducting a mixing zone study or modeling of the discharge and receiving water.

Duly Authorized Representative is one whose:

a. Authorization is made in writing by a principal executive officer or ranking elected official;

b. Authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as general partner in a partnership, sole proprietor in a sole proprietorship, the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company (A duly authorized representative may thus be either a named individual or any individual occupying a named position).

Effluent Concentration Allowance (ECA) is a value derived from the water quality criterion/objective, dilution credit, and ambient background concentration that is used, in conjunction with the coefficient of variation for the effluent monitoring data, to calculate a long-term average (LTA) discharge concentration. The ECA has the same meaning as waste load allocation (WLA) as used in USEPA guidance (Technical Support Document For Water Quality-based Toxics Control, March 1991, second printing, EPA/505/2-90-001).

Estimated Chemical Concentration is the estimated chemical concentration that results from the confirmed detection of the substance by the analytical method below the ML value.

Field Blank is defined as an individual sample demonstrated to be free from the contaminants of interest and other potentially interfering substances, and treated as a sample in all respects, including exposure to grab-sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the field blank is to determine if the field or sample transporting procedures and

environments have contaminated the sample.

Flow Sample is defined as the accurate measurement of the average daily flow volume using a properly calibrated and maintained flow-measuring device.

Grab Sample is defined as an individual sample collected in a short period of time not exceeding 15 minutes. Grab samples shall be collected during normal peak loading conditions for the parameter of interest, which may or may not be during hydraulic peaks. It is used primarily in determining compliance with maximum daily limits and average monthly limits. Grab samples represent only the condition that exists at the time the wastewater is collected.

Instantaneous Maximum Effluent Limitation is the highest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous maximum limitation).

Instantaneous Minimum Effluent Limitation is the lowest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous minimum limitation).

Maximum Daily Effluent Limitation (MDEL) means the highest allowable daily discharge of a pollutant, over a calendar day (or 24-hour period). For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the arithmetic mean measurement of the pollutant over the day.

Median is the middle measurement in a set of data. The median of a set of data is found by first arranging the measurements in order of magnitude (either increasing or decreasing order). If the number of measurements (n) is odd, then the median = $X_{(n+1)/2}$. If n is even, then the median = $(X_{n/2} + X_{(n/2)+1})/2$ (i.e., the midpoint between the n/2 and n/2+1).

Method Detection Limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, as defined in title 40 of the Code of Federal Regulations, Part 136, Attachment B, revised as of July 3, 1999.

Minimum Level (ML) is the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes, and processing steps have been followed.

Not Detected (ND) are those sample results less than the laboratory's MDL.

Ocean Waters are the territorial marine waters of the State as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons. Discharges to ocean waters are regulated in accordance with the State Water Board's California Ocean Plan.

Quality Assurance Officer is a qualified individual who was not otherwise involved in sample collection, transport, or analysis (please refer to the following web site for a more detailed description: http://www.waterboards.ca.gov/swamp/docs/swampqapp_template032404.doc) to investigate the cause of data error.

Persistent Pollutants are substances for which degradation or decomposition in the environment is nonexistent or very slow.

Reporting Level (RL) is the ML (and its associated analytical method) chosen by the Discharger for reporting and compliance determination from the MLs included in this Order. The MLs included in this Order correspond to approved analytical methods for reporting a sample result that are selected by the Regional Water Board either from Appendix 4 of the SIP in accordance with section 2.4.2 of the SIP or established in accordance with section 2.4.3 of the SIP. The ML is based on the proper application of method-based analytical procedures for sample preparation and the absence of any matrix interferences. Other factors may be applied to the ML depending on the specific sample preparation steps employed. For example, the treatment typically applied in cases where there are matrix-effects is to dilute the sample or sample aliquot by a factor of ten. In such cases, this additional factor must be applied to the ML in the computation of the RL.

Source of Drinking Water is any water designated as municipal or domestic supply (MUN) in a Regional Water Board Basin Plan.

Standard Deviation (σ) is a measure of variability that is calculated as follows:

$$\sigma = (\sum[(x - \mu)^2]/(n - 1))^{0.5}$$

where:

x is the observed value;

μ is the arithmetic mean of the observed values; and

n is the number of samples.

Toxicity Reduction Evaluation (TRE) is a study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices, and best management practices. A Toxicity Identification Evaluation (TIE) may be required as part of the TRE, if appropriate. (A TIE is a set of procedures to identify the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests.)

ATTACHMENT B – NOTICE OF INTENT (NOI) APPLICATION FORM AND INSTRUCTIONS

Complete and submit this NOI to apply for Authorization or Reauthorization to Discharge and/or reuse extracted and treated groundwater resulting from the cleanup of groundwater polluted by volatile organic compounds (VOC), fuel leaks, and other related waste under the requirements of NPDES Permit No. CAG912002
(VOC and Fuel General Permit)

I certify under penalty of law that this document and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the design engineer whose signature and engineering license number is documented in this notice, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of a fine and imprisonment.

_____ _____
Name (print) Signature and Date

_____ _____
Title/Organization Address of Responsible Official

This Application is for the Groundwater Treatment Facility located at (provide street address):

_____

This NOI form and all required attachment shall be uploaded to Geo-Tracker, http://www.waterboards.ca.gov/ust/electronic_submittal/index.shtml (contact Lourdes Gonzales at (510) 622-2365 or lgonzales@waterboards.ca.gov if you have any questions). If electronic submittal is not possible, applicants may submit the NOI package to the following address: California Regional Water Quality Control Board, San Francisco Bay Region, 1515 Clay Street, Suite 1400, Oakland, California 94612. Please include a check for $11,195 (as of December 2011), or the most current fee amount, payable to the State Water Resources Control Board.

Table B-1. Mark only one as applicable

1	**This is a new discharge.**	
2	**This discharge is currently authorized under Order No. R2-2009-0059 (VOC General Permit)**, which requires authorized dischargers, who need to continue discharging after September 30, 2014, to file a completed NOI form no later than April 3, 2014.	
3	**This discharge is currently authorized under this Order (VOC and Fuel General Permit)**, which requires authorized dischargers who **need to continue** discharging after January 11, 2017, to file a completed NOI form no later than July 15, 2016.	
4	**This discharge is currently authorized under this Order (VOC and Fuel General Permit)** and this Form is submitted for **modification** of the current Authorization to Discharge.	

Table B-2. Mark or provide information as applicable

1	I have contacted the local sanitary sewer agency serving the above address and determined that discharging to the local sanitary sewer system is not a feasible option.	
2	I have contacted the local agencies having jurisdiction over the use of the storm drain system or watercourse and inform them about this proposed discharge.	
3	Approximately, what percentage of the total effluent is reused or will be reused?	%

Table B-3. Facility and Professional Engineer(s) information

1	Facility Name Discharger Name Discharger's Contact Person Name, Mail Address, Phone number, and Email Address	
2	Authorized Person to Sign & Submit Reports	
3	Billing Information Contact Person Name, Mail Address, Phone number, and Email Address	
4	Design Professional Engineer's Name, California License Number, Mail Address, Phone Number, and Email Address	
5	Operation and Maintenance Professional Engineer's Name, California License Number, Mail Address, Phone Number, and Email Address	
6	Groundwater treatment system design capacity as certified by Professional Engineer in gallons per minute (gpm).	_____ gpm
7	Attach design capacity certification report including flow schematics showing every components of the treatment system to this application. The Professional Engineer shall affix his/her stamp including signature and engineering license number to the certification report.	
8	Type of Site or Project. For example: active service station, closed service station, solvent spills/leaks active or closed groundwater cleanup sites, short term dewatering project, long term dewatering Project, or other (please explain if "other")	

9	Watershed. To determine the watershed, refer to the State of California Watershed Browser located online at www.conservation.ca.gov/dlrp/watershedportal/Watershed Browser/Pages/WatershedBrowser.aspx or the Guide to San Francisco Bay Area Creeks located online at http://museumca.org/creeks/index.html.	
10	Discharge path to Receiving Water. Please list the complete path of the discharge and attach an aerial map [e.g., the discharge would travel about a quarter of a mile inside a storm drain system before reaching a river (provide the name of the river), and then would travel two miles in the river before reaching the bay].	
11	Project Brief Description and Tentative Completion Date	

Table B-4. Treatment System Description

	Unit	**Number**	**Size or capacity (e.g. pounds of GAC) and Further Description (If Applicable)**
1	Total number of extraction well(s) on site		
2	Extraction Wells with Dedicated Treatment Unit(s)		
3	Wellhead Treatment Unit(s)		
4	Settling Tank(s) in series		
5	Settling Tank(s) in parallel		
6	Oil/Water Separator(s)		
7	Filter(s) for particulates in groundwater		
8	Air Strippers with Air Filters		
9	Air Strippers without Air Filters		
10	Other Treatment Unit(s) (e.g. units installed for removing 1,4-dioxane)		
11	Granular Activated Carbon (GAC) Vessel(s) in Series		
12	GAC Vessel(s) in Parallel		
13	Chemical Additives		
14	Effluent Reuse Tank(s)		

Table B-5. Discharge location information

Discharge Point Location	Discharge Point Latitude	Discharge Point Longitude	Receiving Water
Storm Drain Location where discharge enters:	_____° _____' _____"	_____° _____' _____"	Not applicable (complete the row below)
Location where discharge enters receiving water either directly or via storm drain system:	_____° _____' _____"	_____° _____' _____"	

Table B-6. List of pollutants (For new and existing discharges. For existing discharges, complete one table for influent and one for effluent)

Monitoring data since effective date of the initial discharge authorization letter, or estimated from groundwater monitoring data for new discharges	Pollutant 1	Pollutant 2	Pollutant 3	Add Columns and/or tables as needed (all detected pollutants with effluent limitations and all triggered pollutants exceeding the triggers shall be listed in this table)
Number of Samples				
Maximum Concentration				
Average Concentration (average of detected pollutants only)				
Number of times the effluent limitation was exceeded				
Median Concentration				
Minimum Concentration				
Number of Non-Detects				
Lowest Reporting Limit				
Highest Reporting Limit				
Number of Samples with Lowest Reporting Limit				
Most recent sample Date, Method Number				

Note: The Regional Water Board may modify this form at any time to reflect any new fees and other needed improvements as applicable.

ATTACHMENT C – NOTICE OF TERMINATION

Complete and Submit to Request Termination of Coverage Under Requirements of General Waste Discharge Requirements for Discharge or Reuse of Extracted and Treated Groundwater resulting from the Cleanup of Groundwater Polluted by Volatile Organic Compounds (VOC), Fuel Leaks, and Other Related Wastes NPDES Permit No. CAG912002 (VOC and Fuel General Permit)

For the Groundwater Treatment Facility located at:

_____ _____

Facility Street Address, City, Zip Code CIWQS Place Identification Number

A PDF electronic copy of this form shall be uploaded on GeoTracker and a confirmation email shall be sent to the responsible staff member at this office, currently Lourdes Gonzales, at lgonzales@waterboards.ca.gov.

Table C-1. Mark only one as applicable

1	Temporary groundwater dewatering project, e.g., during a construction project, has been completed.	
2	Groundwater cleanup work has been completed.	
3	Method of groundwater cleanup has been changed with no need to discharge treated groundwater.	
4	Extract and treat method of groundwater cleanup will be stopped for a while and only monitoring of groundwater will occur at this site. Please attach documentation that the agency overseeing cleanup has no objection to cessation of groundwater extraction and treatment.	
5	Other reason. Please specify below (e.g., discharge to POTW has been granted):	

Table C-2. Agency Approval (applicable if Table C-1 row 2, 3, or 4 marked)

	Name, address, email, and phone number of the agency and agency staff overseeing the cleanup work	Have you provided a copy of this termination notice to this staff? (Yes/No. If No, please explain the reason)
1		

I, the Discharger, certify under penalty of law that this notice is prepared under my direction or supervision and last/final date of this discharge was _____. I am aware that discharging without a discharge authorization is in violation of California Water Code.

_____

Name (print) Signature and Date

_____

Title/Organization (Discharger's Organization) Address, email, and phone number

Note: The Regional Water Board may modify this form at any time to reflect new requirements and other needed improvements.

ATTACHMENT D –STANDARD PROVISIONS

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ATTACHMENT D –STANDARD PROVISIONS

I. STANDARD PROVISIONS – PERMIT COMPLIANCE

A. Duty to Comply

1. The Discharger must comply with all of the conditions of this Order. Any noncompliance constitutes a violation of the Clean Water Act (CWA) and the California Water Code and is grounds for enforcement action, for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application. (40 CFR § 122.41(a).)

2. The Discharger shall comply with effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this Order has not yet been modified to incorporate the requirement. (40 CFR § 122.41(a)(1).)

B. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a Discharger in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Order. (40 CFR § 122.41(c).)

C. Duty to Mitigate

The Discharger shall take all reasonable steps to minimize or prevent any discharge in violation of this Order that has a reasonable likelihood of adversely affecting human health or the environment. (40 CFR § 122.41(d).)

D. Proper Operation and Maintenance

The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Discharger to achieve compliance with the conditions of this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by a Discharger only when necessary to achieve compliance with the conditions of this Order. (40 CFR § 122.41(e).)

E. Property Rights

1. This Order does not convey any property rights of any sort or any exclusive privileges. (40 CFR § 122.41(g).)

2. The issuance of this Order does not authorize any injury to persons or property or invasion of other private rights, or any infringement of state or local law or regulations (40 CFR § 122.5(c)).

F. Inspection and Entry

The Discharger shall allow the Regional Water Board, State Water Board, United States Environmental Protection Agency (USEPA), and/or their authorized representatives (including an authorized contractor acting as their representative), upon the presentation of credentials and other documents, as may be required by law, to (40 CFR § 122.41(i); Wat. Code, § 13383):

1. Enter upon the Discharger's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order (40 CFR § 122.41(i)(1));

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order (40 CFR § 122.41(i)(2));

3. Inspect and photograph, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order (40 CFR § 122.41(i)(3)); and

4. Sample or monitor, at reasonable times, for the purposes of assuring Order compliance or as otherwise authorized by the CWA or the Water Code, any substances or parameters at any location. (40 CFR § 122.41(i)(4).)

G. Bypass

1. Definitions

   a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility. (40 CFR § 122.41(m)(1)(i).)

   b. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities, which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production. (40 CFR § 122.41(m)(1)(ii).)

2. Bypass of extracted groundwater. During a dewatering project, the Discharger may allow any bypass of uncontaminated extracted groundwater to occur which originates from uncontaminated extraction well(s). The Discharger shall monitor the water quality of these extractions wells to confirm that the extracted water remains uncontaminated. The Discharger may also allow any bypass to occur which does not cause exceedances of effluent limitation, but only if it is for essential maintenance to assure efficient operation. In this case, weekly monitoring results of pollutants of concern shall be reported in the quarterly monitoring reports.

3. Prohibition of bypass. Bypass is prohibited, and the Regional Water Board may take enforcement action against a Discharger for bypass, unless (40 CFR § 122.41(m)(4)(i)):

a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage (40 CFR § 122.41(m)(4)(i)(A));

b. There were no feasible alternatives to the bypass, such as turning off the extraction wells pump(s), discharge to a POTW, retention of untreated wastes, maintenance during normal periods of equipment downtime, or the use of auxiliary treatment facilities. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance (40 CFR § 122.41(m)(4)(i)(B)); and

c. The Discharger submitted notice to the Regional Water Board as required under Standard Provisions – Permit Compliance I.G.5 below. (40 CFR § 122.41(m)(4)(i)(C).)

4. The Regional Water Board may not take enforcement action against a Discharger for bypass, if the Regional Water Board determines that the three conditions listed in Standard Provisions – Permit Compliance I.G.3 above have been met. (40 CFR § 122.41(m)(4)(ii).)

5. Notice

a. Anticipated bypass of uncontaminated extracted groundwater. If the Discharger knows in advance of the need for a bypass of uncontaminated extracted groundwater, it shall submit the necessary information in the initial or modified Notice of Intent, if possible at least 45 days before the date of the bypass. The necessary information includes but not limited to the name and number of extraction wells, flow rates for each well, the distance to other contaminated wells, and monitoring data such as turbidity, color, conductivity, pH, temperature, metals, TPH, VOC, SVOC, PAHs, Oxygenates.

b. Unanticipated bypass. The Discharger shall submit notice of an unanticipated bypass as required in Standard Provisions - Reporting V.E below (24-hour notice). (40 CFR § 122.41(m)(3)(ii).)

H. Upset

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the Discharger. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. (40 CFR § 122.41(n)(1).)

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of Standard Provisions – Permit Compliance I.H.2 below are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review. (40 CFR § 122.41(n)(2)).

2. Conditions necessary for a demonstration of upset. A Discharger who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that (40 CFR § 122.41(n)(3)):

   a. An upset occurred and that the Discharger can identify the cause(s) of the upset (40 CFR § 122.41(n)(3)(i));

   b. The permitted facility was, at the time, being properly operated (40 CFR § 122.41(n)(3)(ii));

   c. The Discharger submitted notice of the upset as required in Standard Provisions – Reporting V.E.2.b below (24-hour notice) (40 CFR § 122.41(n)(3)(iii)); and

   d. The Discharger complied with any remedial measures required under Standard Provisions – Permit Compliance I.C above. (40 CFR § 122.41(n)(3)(iv).)

3. Burden of proof. In any enforcement proceeding, the Discharger seeking to establish the occurrence of an upset has the burden of proof. (40 CFR § 122.41(n)(4).)

II. STANDARD PROVISIONS – PERMIT ACTION

A. General

This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Discharger for modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any Order condition. (40 CFR § 122.41(f).)

B. Duty to Reapply

If the Discharger wishes to continue an activity regulated by this Order after the expiration date of this Order, the Discharger must submit a completed Notice of Intent form (see Attachment B), 180 days in advance of the Order expiration date, **to** obtain a new permit. (40 CFR § 122.41(b).)

C. Transfers

Any authorization to discharge issued under this Order is not transferable to any person except after filing a modified Notice of Intent with the Regional Water Board. If the new Discharger has a different professional engineer, the modified Notice of Intent shall be revised accordingly.\

III. STANDARD PROVISIONS – MONITORING

A. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. (40 CFR § 122.41(j)(1).)

B. Monitoring results must be conducted according to test procedures under 40 CFR Part 136 or other test procedures specified in this Order. (40 CFR § 122.41(j)(4); § 122.44(i)(1)(iv).)

IV. STANDARD PROVISIONS – RECORDS

A. The Discharger shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Order, and records of all data used to complete the application for this Order, for a period of at least three (3) years from the date of the sample, measurement, report or application. This period may be extended by request of the Regional Water Board Executive Officer at any time (40 CFR § 122.41(j)(2).)

B. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements (40 CFR § 122.41(j)(3)(i));
2. The individual(s) who performed the sampling or measurements (40 CFR § 122.41(j)(3)(ii));
3. The date(s) analyses were performed (40 CFR § 122.41(j)(3)(iii));
4. The individual(s) who performed the analyses (40 CFR § 122.41(j)(3)(iv));
5. The analytical techniques or methods used (40 CFR § 122.41(j)(3)(v)); and
6. The results of such analyses. (40 CFR § 122.41(j)(3)(vi).)

C. Claims of confidentiality for the following information will be denied (40 CFR § 122.7(b)):

1. The name and address of any permit applicant or Discharger (40 CFR § 122.7(b)(1)); and
2. Permit applications and attachments, permits and effluent data. (40 CFR § 122.7(b)(2).)

V. STANDARD PROVISIONS – REPORTING

A. Duty to Provide Information

The Discharger shall furnish to the Regional Water Board, State Water Board, or USEPA within a reasonable time, any information which the Regional Water Board, State Water Board, or USEPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order or to determine compliance with this Order. Upon request, the Discharger shall also furnish to the Regional Water Board, State Water Board, or USEPA copies of records required to be kept by this Order. (40 CFR § 122.41(h); California Water Code (CWC), § 13267.)

B. Signatory and Certification Requirements

1. All applications, reports, or information submitted to the Regional Water Board, State Water Board, and/or USEPA shall be signed and certified in accordance with Standard Provisions – Reporting V.B.2, V.B.3, V.B.4, and V.B.5 below. (40 CFR § 122.41(k).)
2. All permit applications shall be signed by a responsible person as explained below:
   a. **For a corporation.** All permit applications shall be signed by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means: (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a

principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. (40 CFR § 122.22(a)(1).)

b. **For a partnership or sole proprietorship.** All permit applications shall be signed by a general partner or the proprietor, respectively. (40 CFR § 122.22(a)(2).)

c. **For a municipality, State, federal, or other public agency.** All permit applications shall be signed by either a principal executive officer or ranking elected official. For purposes of this provision, a principal executive officer of a federal agency includes: (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of USEPA). (40 CFR § 122.22(a)(3).).

3. All reports required by this Order and other information requested by the Regional Water Board, State Water Board, or USEPA shall be signed by a person described in Standard Provisions – Reporting V.B.2 above, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described in Standard Provisions – Reporting V.B.2 above (40 CFR § 122.22(b)(1));

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) (40 CFR § 122.22(b)(2)); and

   c. The written authorization is submitted to the Regional Water Board. (40 CFR § 122.22(b)(3).)

4. If an authorization under Standard Provisions – Reporting V.B.3 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Standard Provisions – Reporting V.B.3 above must be submitted to the Regional Water Board and State Water Board prior to or together with any reports, information, or applications, to be signed by an authorized representative. (40 CFR § 122.22(c).)

5. Any person signing a document under Standard Provisions – Reporting V.B.2 or V.B.3 above shall make the following certification:

   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." (40 CFR § 122.22(d).)

C. Monitoring Reports

1. Monitoring results shall be reported at the intervals specified in the Monitoring and Reporting Program (Attachment E) in this Order. (40 CFR § 122.22(l)(4).)

2. Monitoring results must be reported on a Discharge Monitoring Report (DMR) form (40 CFR § 122.41(l)(4)(i).) or paper or electronic forms provided or specified by the Regional Water Board or State Water Board.

3. If the Discharger monitors any pollutant more frequently than required by this Order using test procedures approved under Part 136 or as specified in this Order, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or other reporting form specified by the Regional Water Board. (40 CFR § 122.41(l)(4)(ii).)

4. Calculations for all limitations, which require averaging of measurements, shall utilize an arithmetic mean unless otherwise specified in this Order. (40 CFR § 122.41(l)(4)(iii).)

D. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Order, shall be submitted no later than 14 days following each schedule date. (40 CFR § 122.41(l)(5).)

E. Twenty-Four Hour Reporting

1. The Discharger shall report any noncompliance that may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the Discharger becomes aware of the circumstances. A written submission shall also be uploaded on GeoTracker (**http://www.waterboards.ca.gov/ust/electronic_submittal/index.shtml)** within five (5) days of the time the Discharger becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to

reduce, eliminate, and prevent reoccurrence of the noncompliance. (40 CFR § 122.41(l)(6)(i).)

2. The following shall be included as information that must be reported within 24 hours under this paragraph (40 CFR § 122.41(l)(6)(ii)):

   a. Any unanticipated bypass that exceeds any effluent limitation in this Order. (40 CFR § 122.41(l)(6)(ii)(A).)

   b. Any upset that exceeds any effluent limitation in this Order. (40 CFR § 122.41(l)(6)(ii)(B).)

3. The Regional Water Board may waive the above-required written report under this provision on a case-by-case basis if an oral report has been received within 24 hours. (40 CFR § 122.41(l)(6)(iii).)

F. Planned Changes

The discharger shall file with the Executive Officer an amended Notice of Intent at least 60 days before making any material change in the character, location, or volume of the discharge. In case of proposing any change of treatment system or operation and maintenance procedures, a professional engineer certified in State of California shall certify the adequacy of the design and/or the procedures. A modified Notice of Intent is required under this provision only when (40 CFR § 122.41(l)(1)) the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged (pollutants regulated or not regulated by this Order). Three examples of significant changes are a change in discharge location, a change of the engineer responsible for the design and/or operation and maintenance of the treatment system, and an increase in discharge flow rates.

G. Anticipated Noncompliance

The Discharger shall give advance notice to the Regional Water Board or State Water Board of any planned changes in the permitted facility or activity that may result in noncompliance with the requirements in this Order. (40 CFR § 122.41(l)(2).)

H. Other Noncompliance

The Discharger shall report all instances of noncompliance not reported under Standard Provisions – Reporting V.C, V.D, and V.E above at the time monitoring reports are submitted. The reports shall contain the information listed in Standard Provision – Reporting V.E above. (40 CFR § 122.41(l)(7).)

I. Other Information

When the Discharger becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Regional Water Board, State Water Board, or USEPA, the Discharger shall promptly submit such facts or information. (40 CFR § 122.41(l)(8).)

VI. STANDARD PROVISIONS – ENFORCEMENT

The Regional Water Board is authorized to enforce the terms of this permit under several provisions of the Water Code, including, but not limited to, sections 13385, 13386, and 13387.

VII. ADDITIONAL PROVISIONS – NOTIFICATION LEVELS

A. Non-Municipal Facilities

Existing manufacturing, commercial, mining, and silvicultural Dischargers shall notify the Regional Water Board as soon as they know or have reason to believe (40 C.F.R. § 122.42(a)):

1. That any activity has occurred or will occur that would result in the discharge, on a routine or frequent basis, of any toxic pollutant that is not limited in this Order, if that discharge will exceed the highest of the following "notification levels" (40 C.F.R. § 122.42(a)(1)):

    a. 100 micrograms per liter (µg/L) (40 C.F.R. § 122.42(a)(1)(i));

    b. 200 µg/L for acrolein and acrylonitrile; 500 µg/L for 2,4-dinitrophenol and 2-methyl-4,6-dinitrophenol; and 1 milligram per liter (mg/L) for antimony (40 C.F.R. § 122.42(a)(1)(ii));

    c. Five (5) times the maximum concentration value reported for that pollutant in the Report of Waste Discharge (40 C.F.R. § 122.42(a)(1)(iii)); or

    d. The level established by the Regional Water Board in accordance with section 122.44(f). (40 C.F.R. § 122.42(a)(1)(iv).)

2. That any activity has occurred or will occur that would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant that is not limited in this Order, if that discharge will exceed the highest of the following “notification levels" (40 C.F.R. § 122.42(a)(2)):

    a. 500 micrograms per liter (µg/L) (40 C.F.R. § 122.42(a)(2)(i));

    b. 1 milligram per liter (mg/L) for antimony (40 C.F.R. § 122.42(a)(2)(ii));

    c. Ten (10) times the maximum concentration value reported for that pollutant in the Report of Waste Discharge (40 C.F.R. § 122.42(a)(2)(iii)); or

    d. The level established by the Regional Water Board in accordance with section 122.44(f). (40 C.F.R. § 122.42(a)(2)(iv).)

ATTACHMENT E – MONITORING AND REPORTING PROGRAM

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ATTACHMENT E – MONITORING AND REPORTING PROGRAM

National Pollutant Discharge Elimination System (NPDES) regulations at 40 CFR 122.48 require that all NPDES permits specify monitoring and reporting requirements. California Water Code (CWC) Sections 13267 and 13383 also authorize the Regional Water Quality Control Board (Regional Water Board) to require technical and monitoring reports. This Monitoring and Reporting Program establishes monitoring and reporting requirements that implement the federal and State regulations.

I. GENERAL MONITORING PROVISIONS

A. The Discharger shall comply with this Monitoring and Reporting Program. The Executive Officer may amend this Monitoring and Reporting Program pursuant to 40 CFR 122.62, 122.63, and 124.5.

B. The Discharger shall conduct all monitoring in accordance with Attachment D, section III, and all tests must be performed by laboratories certified for the analyses in accordance with the California Water Code Section 13176. Equivalent test methods must be more sensitive than those specified in 40 CFR 136 and must be specified in the permit or in the related discharge authorization letter.

C. Monthly discharge flow volume, total quarterly flow, and annual flow shall be recorded.

D. The number and frequency of bypasses and accidental spills shall be recorded.

E. A copy of this Order, a complete copy of the Notice of Intent (NOI) filed, documentation of the Authorization to Initiate Discharge received from the Regional Water Board, a full copy of the Operation and Maintenance (O&M) Manual, and any other documents relevant to the operation and maintenance of the treatment facility shall be stored at or near the treatment facility, and made available to Regional Water Board staff, USEPA staff, or their contractors upon request. The Discharger shall inspect its facility as frequently as required by the O&M Manual.

II. MONITORING LOCATIONS

The Discharger shall establish the following monitoring locations to demonstrate compliance with the effluent limitations, discharge specifications, and other requirements in this Order:

Table E-1. Monitoring Station Locations

Discharge Point Name (if applicable)	Monitoring Location Name	Monitoring Location Description (include Latitude and Longitude when available)
---	INF-001	At a point in the extraction system immediately prior to inflow to the treatment unit.
001	EFF-001	At a point in the discharge line immediately following treatment and before it joins or is diluted by any other waste stream, body of water, or substance.
---	RSW-001U	At a point 50 feet upstream from the point of discharge into the receiving water, or if access is limited, at the first point upstream which is accessible.
---	RSW-001D	At a point 50 feet downstream from the point of discharge into the receiving water, or if access is limited, at the first point downstream which is accessible.

Discharge Point Name (if applicable)	Monitoring Location Name	Monitoring Location Description (include Latitude and Longitude when available)
---	REU-001	At a point immediately prior to reuse location. Not applicable if effluent is not reused or reclaimed.

III. INFLUENT MONITORING REQUIREMENTS

The Discharger shall monitor influent to the facility at Monitoring Location INF-001 in accordance with the schedule shown on Column 1 of Table E.2.

IV. EFFLUENT MONITORING REQUIREMENTS

Dischargers shall monitor discharges of treated wastewater from the facility at Monitoring Location EFF-001, in accordance with the schedule shown on Column 2 of Table E.2. Effluent sampling shall occur concurrently (within 30 minutes) with influent sampling.

A. Monitoring during bypass. When any type of bypass occurs, grab samples shall be collected on a daily basis for all constituents at all affected discharge points that have effluent limits for the duration of the bypass.

B. Required Actions After Any Effluent Violation. If the analytical results show violation of any effluent limitation, the Discharger shall take a confirmation effluent sample, together with receiving water samples (see Column 3 of Table E-2) within 24 hours of becoming aware of the violation of effluent limit. The Discharger must have the confirmation sample analyzed by expedited methods and obtain results within 24 hours of sample collection. If the analytical results are also in violation of the effluent limit, the Discharger shall terminate the discharge until it has corrected the cause of violation. In this case, both the initial and confirmed results are violations. However, if the confirmation effluent sampling shows compliance, the Regional Water Board will consider only the initial exceedance as a violation.

V. WHOLE EFFLUENT ACUTE TOXICITY TESTING REQUIREMENTS

The Discharger shall monitor acute toxicity at EFF-001 as follows:

A. Compliance with the acute toxicity effluent limitations of this Order shall be evaluated by measuring survival if test organisms to 96-hour static renewal bioassays at Monitoring Location EFF-001.

B. Test organisms shall be rainbow trout unless the Executive Officer specifies otherwise in writing.

C. All bioassays shall be performed according to the most up-to-date protocols in 40 CFR 136m currently in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms*, 5th Edition.

D. If specific identifiable substances in the discharge can be demonstrated by the Discharger as being rapidly rendered harmless upon discharge to the receiving water, compliance with the acute toxicity limitation may be determined after the test samples are adjusted to remove the influence of those substances. Written approval from the Executive Officer must be obtained to authorize such an adjustment.

E. The sample may be taken from effluent prior to chlorination. Monitoring of the bioassay water shall include, on a daily basis, the following parameters: pH, dissolved oxygen, ammonia, (if toxicity is observed), temperature, hardness, and alkalinity. These results shall be reported. If a violation of acute toxicity requirements occurs, the bioassay test shall be repeated with new fish as soon as practical and shall be repeated until a test fish survival rate of 90 percent or greater is observed. If the control fish survival rate is less than 90 percent, the bioassay test shall be restarted with new fish and shall continue as soon as practical until an acceptable test is completed (i.e., control fish survival rate is 90 percent or greater).

VI. RECLAMATION MONITORING REQUIREMENTS

The Discharger shall monitor reuse effluent at Monitoring Location REU-001 as shown on Column 2 of Table E.2.

VII. RECEIVING WATER MONITORING REQUIREMENTS – SURFACE WATER AND GROUNDWATER

The Discharger shall monitor receiving water at Monitoring Locations RSW-001U and RSW-001D as shown on Column 3 of Table E.2.

A. Receiving water sampling shall occur concurrently with effluent sampling.

B. Receiving water samples shall be collected at each station on each sampling day during the period within 1 hour following low slack water, if relevant. Where sampling at lower slack water period is not practical, sampling shall be performed during higher slack water period. Samples shall be collected within the discharge plume and 50 feet down current of the discharge point so as to be representative, unless otherwise stipulated.

C. Samples should be collected within one foot below the surface of the receiving water body. Explanation shall be provided in the monitoring report if this specification could not be met.

Table E-2. Schedule for Sampling, Measurements, and Analysis

Required Analytical Test Method Number, Technique, Standard Methods (SM), USEPA Method Number (EPA), 40 CFR Part (or equivalent)/Sampling Station	Column 1 Minimum Sampling Frequency for Influent INF-001	Column 2 Minimum Sampling Frequency for Effluent EFF-001 or Effluent for Reuse REU-001	Column 3 Minimum Sampling Frequency for Receiving Surface Water RSW-001U and RSW-001D
Unit is "µg/L" and Type of Sample is "Grab" unless noted otherwise	**Grab**	**Grab**	**Grab**
Discharge Flow (gpm & gpd)	-	Continuous	-
Reclamation Flow Rate (gpm & gpd or gallons reclaimed during the calendar quarter if reclamation is not continuous)	-	Continuous	-
Fish Toxicity, 96-hr (% survival), EPA-821-R-02-012 Test, Method 2019.0	-	Q/Y	-
All Applicable Standard Observations (No Unit)	D/M	D/M	V
Volatile Organic Compounds, EPA 8260b for discharges from sites contaminated with fuel leaks and other related wastes	Y	Y	V
Volatile Organic Compounds, EPA 8260b for dischargers from sites contaminated with VOC	2/Y	D/M	V
1,4-Dioxane (See Note 3), EPA 8270c	-	2/Y	-

Required Analytical Test Method Number, Technique, Standard Methods (SM), USEPA Method Number (EPA), 40 CFR Part (or equivalent)/Sampling Station	**Column 1 Minimum Sampling Frequency for Influent INF-001**	**Column 2 Minimum Sampling Frequency for Effluent EFF-001 or Effluent for Reuse REU-001**	**Column 3 Minimum Sampling Frequency for Receiving Surface Water RSW-001U and RSW-001D**
Unit is "µg/L" and Type of Sample is "Grab" unless noted otherwise	**Grab**	**Grab**	**Grab**
Semi Volatile Organic Compounds except PAHs (See Note 1), EPA 8270c	D/Q	D/M	-
Turbidity	-	D/Q/Y	-
pH	D/M/Q/Y	D/M/Q/Y	V
Dissolved Oxygen (mg/L)	-	-	V
Total Dissolved Solids (mg/L) (construction and dewatering projects)	-	D/M	-
Temperature (ºC)	-	D/M/Q/Y	-
Electrical Conductivity	-	D/M/Q/Y	-
Hardness (mg/L as $CaCO_3$)	-	-	T
Salinity (parts per thousand)	-	-	T
Ethylene Dibromide (EDB) (See Note 1), 504	D/Q	D/M	V
Benzene, Toluene, Ethylbenzene, and/or Total Xylenes (See Note 1), EPA 8020	D/Q	D/M	V
Methyl Tertiary Butyl Ether (MTBE) (See Note 1), EPA 8020	D/Q	D/M	V
Total Petroleum Hydrocarbons as Gasoline (See Note 1), EPA 8015 Modified	D/Q	D/M	V
Total Petroleum Hydrocarbons as Diesel (See Note 1), EPA 8015 Modified	D/Q	D/M	V
Total Petroleum Hydrocarbons other than Gasoline and Diesel (required if Petroleum Hydrocarbons other than Gasoline and Diesel present in the soil and groundwater) (See Note 1), EPA 8015 Modified	D/Q	D/M	V
Polynuclear Aromatic Hydrocarbons (PAHs) (See Note 1), 8310	D/Q	D/M	V
Tertiary Amyl Methyl Ether (TAME), DiIsopropyl Ether (DIPE), Ethyl Tertiary Butyl Ether (ETBE), Tertiary Butyl Alcohol (TBA), Ethanol, and/or Methanol (See Note 1)	D/Y	D/Y	-
Total Chlorine Residual (See Note 1), (Field Kit, EPA 330 or SM 4500-Cl)	D/Q	D/M	V
Antimony (EPA 204.2), Arsenic (EPA 206.3), Beryllium (GFAA or ICPMS), Cadmium (GFAA or ICPMS), Hexavalent and Total Chromium (SM 3500), Copper (EPA 200.9), Cyanide (SM 4500-CN C or I), Lead (EPA 200.9), Mercury (EPA 1631), Nickel (EPA 249.2), Selenium (SM 3114B OR C), Silver (EPA 272.2), Thallium (EPA 279.2), and Zinc (EPA 200.8) (See Note 2) for dischargers from sites contaminated with VOC		3Y	
Antimony (EPA 204.2), Arsenic (EPA 206.3), Beryllium (GFAA or ICPMS), Cadmium (GFAA or ICPMS), Hexavalent and Total Chromium (SM 3500), Copper (EPA 200.9), Cyanide (SM 4500-CN C or I), Lead (EPA 200.9), Mercury (EPA 1631), Nickel (EPA 249.2), Selenium (SM 3114B OR C), Silver (EPA 272.2), Thallium (EPA 279.2), and Zinc (EPA 200.8) (See Note 2) for discharges from sites contaminated with fuel leaks and other related wastes	-	D/Y	-
Other pollutants such as non VOC-related odor, sulfate and foaming agents (See Note 1), SM	D/Q/Q/Y	D/M/Q/Y	V

Notes:
Note 1: if known to be present in the influent.
Note 2: Inorganic compounds samples shall be analyzed for total (unfiltered) constituents with the reporting levels not exceeding the following: 0.002 ug/L for Mercury; 0.25 ug/L for Cadmium and Silver; 1 ug/L for Nickel, Thallium, and Zinc; 2.0 ug/L for Arsenic and Selenium; 1 ug/L for Cyanide; and 0.5 ug/L for Antimony, Beryllium, Total Chromium, Copper, and Lead (SIP Appendix 4 Minimum Levels

http://www.waterboards.ca.gov/iswp/docs/final.pdf). If the Discharger cannot attain the reporting levels for Zinc, Arsenic, or Total Chromium, the reason(s) along with any supporting documentation shall be documented in the monitoring reports. Water Board staff shall make a compliance determination based on data provided. If the Discharger exceeds the trigger for mercury of 0.025, the Discharger may consider re-sampling and re-analyzing another sample using ultra-clean techniques as described in USEPA methods 1669 and 1631 to eliminate the possibility of artifactual contamination of the sample. For pollutants not listed in Appendix 4 of the SIP, the Discharger shall provide the reason for the higher detection level along with any supporting documentation in the monitoring reports. Water Board staff shall make a compliance determination based on data provided. Note 3: Use techniques such as selective ion mode or isotope dilution to achieve reporting levels not exceeding 1 ug/l.
Definitions: ug/L = microgram per liter or parts per billion (ppb); g/day = grams per day; gpm = gallons per minute; mg/L = milligram per liter or parts per million (ppm); gpd = gallons per day; MFL = million fibers per liter GC = Gas Chromatography; GCMS = Gas Chromatography/Mass Spectrometry; FAA = Flame Atomic Absorption; GFAA = Graphite Furnace Atomic Absorption; Hydride = Gaseous Hydride Atomic Absorption; ICP = Inductively Coupled Plasma; and ICPMS = Inductively Coupled Plasma/Mass Spectrometry.
Legends: D/M Once during the first and fifth day of startup; monthly thereafter. For VOC, if a discharger has no VOC detected in the influent or the effluent other than Total Petroleum Hydrocarbons, Benzene, Toluene, Ethylbenzene, Xylenes, Tertiary Amyl Methyl Ether (TAME), DiIsopropyl Ether (DIPE), Ethyl Tertiary Butyl Ether (ETBE), Tertiary Butyl Alcohol (TBA), Ethanol, or Methanol then frequency of VOC monitoring may be reduced to once a year. D/Q Once during the first and fifth day of startup; quarterly thereafter. Y Once during the first week of startup; annually thereafter. 3Y Once during the first week of startup; every three years thereafter. 2/Y Once during the first week of startup; twice per year thereafter. D/Y Once during the first and fifth day of startup; annually thereafter. Q/Y Quarterly for first year of operation, annually thereafter. D/Q/Y Once during the first and fifth day of startup; quarterly for first year of operation, annually thereafter. D/M/Q/Y Once during the first and fifth day of startup; monthly for first year of operation, quarterly for the second year, and annually thereafter. In case of pH analysis, this monitoring requirement is only for facilities with a treatment process that would cause no pH variances in the effluent. If any chemical used in the treatment process may cause pH variances in the effluent, the frequency of pH monitoring in the effluent shall be increased to twice per week for the first month of operation and weekly thereafter if pH monitoring data for the first month of operation demonstrate compliance with pH effluent limits. V Receiving Waters sampling must be performed together (on the same calendar day) with the required effluent confirmation sampling that is required when a violation of an effluent limit is known, and the sample analyzed for that specific violated parameter and the Dissolved Oxygen level. In no case, should a Discharger continue discharging in known violation of effluent limits just to comply with this receiving water sampling requirement. T Sampling shall be performed when Cadmium, Chromium (total), Copper, Lead, Nickel, Silver, or Zinc triggers are exceeded.

VIII. OTHER MONITORING REQUIREMENTS

A. Startup Phase Monitoring. During the original startup for the treatment system, sampling of the effluent must occur on the first day and fifth day of operation (weekend days may be excluded).

1. On the first day of the original startup, the system shall be allowed to run until at least three to five well volumes are removed and until three consecutive readings for pH, conductivity, and temperature are within five percent of each other; then, the influent and effluent shall be sampled and submitted for analyses. Prior to receipt of the results of the initial samples, all effluent shall be discharged into a holding tank (that is contained, not discharged to the receiving water) or discharged to the sanitary sewer until the results of the analyses show the discharge to be within the effluent limits established in this Order and/or as authorized by the Executive Officer. The treatment system may be shut down after the first day's sampling to await the analyses results and thereby reduce the amount of storage needed. If the treatment system is shut down more than 120 hours during the original startup (awaiting analyses results, etc.), the original startup procedures and sampling must be repeated. For the stored effluent, if the results of the analyses show the discharge to be in violation, the effluent shall: (1) be retreated until the retreated effluent is in compliance, or (2) be disposed of in accordance with the applicable provisions of California Code of Regulations.

2. If the first day's sampling shows compliance, the treatment system shall be operated for a total of five days with the discharge to the storm sewer or other conveyance system leading to the receiving water, and be sampled again during the fifth day. While the fifth day's

samples are being analyzed, the effluent may be discharged to the receiving water as long as the analyses are received within 120 hours of sampling, and then, continue to be discharged to the receiving water if the analyses show compliance. Otherwise, the original startup procedures and sampling must be repeated. In case of a temporary shutdown, if the facility reported effluent limit violation(s) during the previous three years, then any re-startup shall follow the original startup procedures.

B. Chemical Additives Monitoring: If applicable, monitoring related to chemical usage shall be conducted by the Discharger as required in its treatment system design specification and Operation and Maintenance Manual.

C. Standard Observations for Receiving Water

1. Floating and suspended materials (e.g., oil, grease, algae, and other macroscopic particulate matter): presence or absence, source, and size of affected area.

2. Discoloration and turbidity: description of color, source, and size of affected area.

3. Odor: presence or absence, characterization, source, distance of travel, and wind direction.

4. Beneficial water use: presence of water-associated waterfowl or wildlife, fisherperson, and other recreational activities in the vicinity of each sampling station.

5. Hydrographic condition, if relevant:

    a. Time and height of corrected high and low tides (corrected to nearest National Oceanic and Atmospheric Administration location for the sampling date and time of sample and collection).

    b. Depth of water columns and sampling depths.

6. Weather condition:

    a. Air temperature.

    b. Wind direction and estimated velocity.

    c. Total precipitation during the five days prior to observation.

D. Standard Observations for Onsite Usage of Reclaimed Water

1. Floating and suspended materials of waste origin (to include oil, grease, algae, and other macroscopic particulate matter): presence or absence, source, and size of affected area.

2. Discoloration and turbidity: description of color, source, and size of affected area.

3. Odor: presence or absence, characterization, source, distance of travel, and wind direction.

4. Weather condition:

a. Air temperature.

b. Wind direction and estimated velocity.

c. Total precipitation during the previous five days and on the day of observation.

5. Deposits, discolorations, and/or plugging in the conveyance system that could adversely affect the system reliability and performance.

6. Operation of the valves, outlets, sprinkler heads, and/or pressure shutoff valves in conveyance system.

E. Standard Observations for Groundwater Treatment System

1. Odor: presence or absence, characterization, source, distance of travel, and wind direction.

2. Weather condition: wind direction and estimated velocity.

3. Deposits, discolorations, and/or plugging in the treatment system (stripping tower, carbon filters, etc.) that could adversely affect the system reliability and performance.

4. Operation of the float and/or pressure shutoff valves installed to prevent system overflow or bypass.

IX. REPORTING REQUIREMENTS

A. General Monitoring and Reporting Requirements

The Discharger shall comply with all Standard Provisions (Attachment D) and in this document related to monitoring, reporting, non-compliance reporting, and record keeping.

B. Self Monitoring Reports (SMRs)

1. **SMR Format.** At any time during the term of this Order, the State or Regional Water Board may notify the Discharger to electronically submit SMRs using the State Water Board's California Integrated Water Quality System (CIWQS) Program Web site (http://www.waterboards.ca.gov/ciwqs/index.html). The CIWQS website will provide additional directions for SMR submittal. In the interim, Dischargers shall submit SMRs using the submittal method specified in the Authorization to Discharge letter.

2. **SMR Due Dates and Contents.** The Discharger shall submit SMRs by the due dates, and with the contents, specified below:

   a. The Discharger shall submit quarterly SMRs no later than 45 days after the end of each calendar quarter, including the results of all required monitoring.

   b. The Discharger shall submit annual reports by February 15 of each year, covering the previous calendar year. The annual report shall contain all data required for the fourth quarter in addition to summary data required for annual reporting. This report may be submitted in lieu of the report for the fourth quarter of a calendar year.

c. The Discharger shall report in the SMR the results for all monitoring specified in this Monitoring and Reporting Program under sections III through VIII. If there has been no discharge during the entire reporting period, quarterly and annual reports must still be submitted to report that has been the case.

d. The Discharger shall attach a cover letter to the monitoring reports. The information contained in the cover letter shall clearly identify number of permit violations; discuss corrective actions taken or planned; and the proposed time schedule for corrective actions. Identified violations must include a description of the requirement that was violated and a description of the violation. In the cover letter, the Discharger shall also document the volume of the effluent reused during that reporting period.

e. The Discharger shall arrange all reported data in a tabular format. The data shall be summarized to clearly illustrate whether the facility is operating in compliance with the effluent limitations. The Discharger shall not include laboratory reports unless requested.

f. Monitoring reports must be submitted to the Regional Water Board signed, certified, and using the submittal method specified by the Authorization to Discharge letter.

g. The monitoring reports shall also include a description of operation and maintenance (O&M) of the groundwater extraction and treatment system consistent with the O&M manual, which shall be available to all personnel who are responsible for operation and maintenance activities.

h. The monitoring reports shall include the results of analyses and observations as follows:

(1) Calculations for all limitations that require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

(2) A table identifying by method number the analytical procedures used for analyses. Any special methods shall be identified and should have prior approval of the Regional Water Board's Executive Officer.

(3) Laboratory results shall be summarized in tabular form but actual laboratory reports do not need to be included in the report. A summary of quality assurance/quality control activities data such as field, travel, and laboratory blanks shall be reported for each analyzed constituent or group of constituents.

(4) A summary of the monitoring data to include information such as source of the sample (influent, effluent, or receiving water); the constituents; the methods of analysis used; the laboratory reporting limits in µg/L; the sample results (µg/L); the date sampled; and the date sample was analyzed.

(5) Flow (in gpm) and mass removal data (in kilograms).

(6) Summary of treatment system status during the reporting period (e.g., in operation/on standby) and reason(s) for non-routine treatment system shut down.

(7) The annual reports shall contain tabular summary of the monitoring data obtained during the previous year. In addition, the annual reports shall contain a comprehensive discussion of the compliance record and the corrective actions taken or planned which may be needed to bring the Discharger into full compliance with the waste discharge requirements including any trigger study required by Special Provision VI.C.6 and the progress in satisfaction of Special Provisions VI.C.7 and VI.C.8 of this Order. The annual report shall document that the annual fee has been paid.

(8) If, during any calendar quarter, a Discharger becomes aware that any monitoring data obtained for compliance with this Order may be invalid, the Discharger shall submit a claim of invalid monitoring data, as uploaded on GeoTracker, with a confirmation email to the Regional Water Board staff in charge of this permit, within 45 days after end of that calendar quarter. The Discharger shall include with this claim, the name, phone number, and email of its assigned staff to investigate the cause(s) of errors and the corrective actions taken, or date when actions will be completed to eliminate or reduce future data errors. The Discharger shall also provide, in this claim, a date that the O&M manual will be updated to include errors prevention measures. These preventive measures shall include but not be limited to accelerated monitoring (e.g., twice a month monitoring for at least one month) to provide valid monitoring data indicating the effectiveness of the proposed preventive measures.

i. Additional Specifications for Submitting SMRs to CIWQS — If the Discharger submits SMRs to CIWQS, it shall submit analytical results and other information using one of the following methods:

Table E-3. SMR Reporting for CIWQS

Parameter	Method of Reporting	
	EDF/CDF data upload or manual entry	**Attached File**
All parameters identified in influent, effluent, and receiving water monitoring tables (except Dissolved Oxygen and Temperature)	Required for All Results	
Dissolved Oxygen Temperature	Required for Monthly Maximum and Minimum Results Only (1)	Discharger may use this method for all results or keep records
Cyanide Arsenic Cadmium Chromium Copper Lead Mercury Nickel Selenium Silver Zinc Dioxins and Furans (by U.S. EPA Method 1613)	Required for All Results (2)	

Antimony Beryllium Thallium Pollutants by U.S. EPA Methods 601, 602, 608, 610, 614, 624, and 625	Not Required (unless identified in influent, effluent, or receiving water monitoring tables), But Encouraged (1)	Discharger may use this method and submit results with application for permit reissuance, unless data submitted by CDF/EDF upload
Analytical Method	Not Required (Discharger may select "data unavailable") (1)	
Collection Time Analysis Time	Not Required (Discharger may select "0:00") (1)	

Notes for Table E-3:

[1] The Discharger shall continue to monitor at the minimum frequency specified in the monitoring tables, keep records of the measurements, and make the records available upon request.

[2] These parameters require EDF/CDF data upload or manual entry regardless of whether monitoring is required by this Monitoring and Reporting Program or other provisions of this Order (except for biosolids, sludge, or ash provisions).

3. Monitoring periods and reporting for all required monitoring shall be completed according to the following schedule:

Table E-4. Monitoring Periods and Reporting Schedule

Sampling Frequency	Monitoring Period Begins On…	Monitoring Period
Continuous	Effective startup date	All
Daily	Effective startup date	(Midnight through 11:59 PM) or any 24-hour period that reasonably represents a calendar day for purposes of sampling.
Weekly	Effective startup date	Effective startup day through one week after Effective startup date
Monthly	First day of calendar month following the last day of the startup date	1st day of calendar month through last day of calendar month
Quarterly	Closest of January 1, April 1, July 1, or October 1 following (or on) the last day of the startup date	January 1 through March 31 April 1 through June 30 July 1 through September 30 October 1 through December 31
Semiannually	Closest of January 1 or July 1 following (or on) the last day of the startup date	January 1 through June 30 July 1 through December 31
Annually	January 1 following (or on) the last day of the start -up date	January 1 through December 31

4. The Discharger shall report with each sample result the applicable Reporting Level (RL) and the current Method Detection Limit (MDL), as determined by the procedure in 40 CFR Part 136. The Discharger shall report the results of analytical determinations for the presence of chemical constituents in a sample using the following reporting protocols:

   a. Sample results greater than or equal to the RL shall be reported as measured by the laboratory (i.e., the measured chemical concentration in the sample).

   b. Sample results less than the RL, but greater than or equal to the laboratory's MDL, shall

be reported as "Detected, but Not Quantified," or DNQ. The estimated chemical concentration of the sample shall also be reported. For the purposes of data collection, the laboratory shall write the estimated chemical concentration next to DNQ as well as the words "Estimated Concentration" (may be shortened to "Est. Conc."). The laboratory may, if such information is available, include numerical estimates of the data quality for the reported result. Numerical estimates of data quality may be percent accuracy (± a percentage of the reported value), numerical ranges (low to high), or any other means considered appropriate by the laboratory.

c. Sample results less than the laboratory's MDL shall be reported as "Not Detected," or ND.

d. Dischargers are to instruct laboratories to establish calibration standards so that the Minimum Level (ML) value (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the Discharger to use analytical data derived from *extrapolation* beyond the lowest point of the calibration curve.

C. Discharge Monitoring Reports (DMRs) - Not Applicable

D. Other Reports

1. Startup Report: A report on the startup phase shall be included in the first quarterly monitoring report. This report shall include a certification that a professional engineer certified in the State of California oversees the treatment system operation and maintenance activities including the startup work.

2. Spill Reports: If any hazardous substance is discharged in or on any waters of the state, or discharged and deposited where it is, or probably will be discharged in or on any waters of the state, the Discharger shall report such a discharge to this Regional Water Board, at (510) 622-2369, and to the California Emergency Management Agency, at (800) 852-7550, within 24 hours of becoming aware of the spill. A written report shall be uploaded on GeoTracker, with an confirmation email to staff, within five working days and shall contain information relative to:

a. Nature of waste or pollutant,

b. Quantity involved,

c. Duration of incident,

d. Cause of spilling,

e. Spill Prevention, Control, and Countermeasure Plan (SPCC) in effect, if any,

f. Estimated size of affected area,

g. Nature of effects (i.e., fish kill, discoloration of receiving water, etc.),

h. Corrective measures that have been taken or planned, and a schedule of these activities, and

i. Persons/agencies notified.

3. Reports of Treatment Unit Bypass and Permit Violation: In the event the Discharger violates or threatens to violate the conditions of the waste discharge requirements and prohibitions or intends to permit a treatment unit bypass, the Discharger shall notify the Regional Water Board within 24 hours of when the Discharger or Discharger's agent has knowledge of the incident and confirm this notification in writing and uploaded on GeoTracker with a confirmation email to Regional Water Board staff, within 5 working days of the initial notification. The written report shall include time, date, duration and estimated volume of waste bypassed, method used in estimating volume and person notified of the incident. The report shall include pertinent information explaining reasons for the noncompliance and shall indicate what steps were taken to prevent the problem from recurring.

A treatment unit bypass may occur due to:

a. Maintenance work, power failures, or breakdown of waste treatment equipment,

b. Accidents caused by human error or negligence,

c. The self-monitoring program results exceeding effluent limitations,

d. Any activity that would result in a frequent or routine discharge of any toxic pollutant not limited by this Order, or

e. Other causes, such as acts of nature.

4. Additional Reporting: If a violation of the effluent limitations should occur, the Discharger shall direct the effluent to a holding tank and contained, or the extraction and treatment system shall be shut down. The confirmation sampling shall be conducted when the discharge is directed to a holding tank and contained or right before the extraction and treatment system is shut down. The content of the holding tank shall be retreated until the retreated effluent is in compliance, be discharged to a publicly owned treatment works (POTW), or be disposed in accord with the provisions of applicable California Code of Regulations. The Discharger shall obtain permission from the POTW for any temporary or permanent discharges to the sanitary sewer. All confirmation sampling results shall be reported.

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ATTACHMENT F – FACT SHEET

As described in Section II of this Order, this Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of this Order. This Order has been prepared under a standardized format to accommodate a broad range of discharge requirements for dischargers in California. Except where identified as "not applicable", all sections or subsections are applicable to the discharges regulated under this Order.

This Order is intended to cover discharges of extracted and treated groundwater resulting from the cleanup of groundwater polluted by volatile organic compounds (VOC), fuel leaks, and other related wastes. This Order combines two previously issued Regional Water Board orders:

a. R2-2006-0075, NPDES General Permit for the discharge of extracted and treated groundwater resulting from the cleanup of groundwater polluted by fuel leaks and other related wastes at service stations and similar sites (**Fuel General Permit**), and

b. R2-2009-0059, NPDES General Permit for the discharge of extracted and treated groundwater resulting from the cleanup of groundwater polluted by volatile organic compounds (**VOC General Permit**). The VOC General Permit remains in effect and the dischargers authorized under this permit will need to seek coverage under this Order no later than April 3, 2014.

I. PERMIT INFORMATION

From 1980 to date, approximately 11,000 sites with underground fuel or VOC storage tanks in the San Francisco Bay Region are known to be leaking or to have leaked. Historically, a number of these sites were cleaned-up by extracting and treating contaminated groundwater and discharging treated groundwater to surface water. Because the number of such applications exceeded the capacity of available Regional Water Board staff to develop and bring individual waste discharge requirements to the Regional Water Board for adoption, in the early 1990s, the Regional Water Board issued National Pollutant Discharge Elimination System (NPDES) General Permits to cover such discharges.

In 1991, the Regional Water Board issued the Fuel General Permit. This permit was reissued in 1996, 2001, and 2006. The 2006 permit (Regional Water Board Order No. R2-2006-0075) expired on January 12, 2012. There are 20 current Dischargers covered under this permit. In 2011, 18 Dischargers submitted Notice of Intent (NOI) applications to either continue discharging or initiate the discharge of treated groundwater to surface water under the Fuel General Permit after it expires.

In 1994, the Regional Water Board issued the VOC General Permit. This permit was reissued in 1999, 2004, and 2009. The current VOC General Permit (Regional Water Board Order No. R2-2009-0059) was adopted on August 12, 2009, became effective October 1, 2009, and expires September 30, 2014. There are 56 current Dischargers covered under this permit.

The Fuel General Permit needs to be reissued because 18 Dischargers have submitted NOI applications to either continue discharging or initiate the discharge of treated groundwater to surface water. In addition, within the next five years, it is anticipated that a number of fuel-contaminated sites will be conducting cleanup by extracting contaminated groundwater, treating, and discharging

treated groundwater. Some Publicly Owned Treatment Works (POTWs) do not accept new discharges from groundwater clean-up, and, therefore, a number of sites conducting groundwater cleanup will require waste discharge requirements from the Regional Water Board for discharge to surface water. The number of cleanups anticipated exceeds the capacity of available Regional Water Board staff to develop and bring individual waste discharge requirements to the Regional Water Board for adoption. These circumstances create the need for an expedited system to process the anticipated requests. The reissuance of the Fuel General Permit will expedite the processing of requirements, enable the Regional Water Board to better utilize limited staff resources, and permit cleanups to begin promptly.

What is New in this Permit Reissuance - Because the nature and treatment of pollutants present in fuel-contaminated groundwater and VOC-contaminated groundwater is similar, the Regional Water Board expects to cover both types of discharges under this General Permit. It is also anticipated that the total number of VOC and fuel-contaminated sites that will be conducting cleanup by extracting contaminated groundwater, and treating and discharging treated groundwater to surface water will decline. This decline is the result of several factors:

(i) Fewer open cases as the Regional Water Board closes cases but finds not as many new cases to take their place,
(ii) Significant shift in groundwater cleanup technology away from "pump and treat" and towards in-situ methods, due to the latter's greater effectiveness, and
(iii) Wider use of the Regional Water Board low-threat closure tool for both fuel and VOC cleanup sites.

For the above reasons, two separate general NPDES permits will not be needed when the VOC General Permit expires in 2014. Those requiring continued permit coverage and new dischargers are expected to submit NOI applications for coverage under this Order.

The following VOC and fuel clean-up discharges are normally not eligible for coverage: discharges from cleanups involving significant contamination by metals, pesticides, or other conservative pollutants and discharges from sites with other NPDES discharges (e.g., process waste). Dischargers that combine extracted groundwater with stormwater before treatment are normally not eligible for coverage under this Order because the amount of rainwater varies and may exceed the treatment system capacity.

The following table (Table F-1) is a standard template primarily useful for individual permits. For this General Permit, it provides cross-references to the specific sections of the Notice of Intent (NOI) Form, in Attachment B, that each Discharger enrolled under this Order must initially complete and submit as part of the NOI.

Table F-1. Facility Information

California Integrated Water Quality System (CIWQS) Regulatory measure and Place ID	A CIWQS Place ID and Regulatory measure identification number will be assigned to a facility when the Executive Officer issues the Authorization to Initiate Discharge
Discharger	NOI Form in Attachment B
Name of Facility	
Facility Address	
Facility Contact, Title, Phone, and email address	
Consultant Name, Phone, and email address	
Authorized Person to Sign and Submit Reports	
Mailing Address and Contact Person Name, Phone, and email address	
Billing Address and Contact Person Name, Phone, and email address	
Type of Project	
Major or Minor Facility	Minor
Pretreatment Program	Not Applicable
Reclamation Requirements	Producer (See NOI in Attachment B)
Facility Permitted Flow	NOI Form in Attachment B
Facility Design Flow	
Watershed	
Receiving Water Type	

A. Site Owners or Operators who apply for an authorization to discharge under this Order and who are granted such authorization are hereinafter called Discharger(s). The groundwater treatment facility is considered the facility regulated under this Order (hereinafter Facility). For the purposes of this Order, references to the "Discharger(s)" or "permittee(s)" in applicable federal and State laws, regulations, plans, or policy are held to be equivalent to references to the Discharger(s) herein.

B. The Facilities regulated under the previously issued Fuel and VOC General NPDES permits discharge wastewater to multiple receiving waters of the State and/or the United States, mainly in Santa Clara County. The Fuel General Permit was adopted on November 13, 2006, became effective on January 12, 2007, and expired on January 12, 2012. The terms and conditions of Order No. R2-2006-0075 were automatically continued in effect until new Waste Discharge Requirements and NPDES permit are adopted pursuant to this Order. During the term of Order No. R2-2006-0075, 78 facilities were authorized to discharge treated groundwater to the receiving water documented in the NOI submitted for each discharge. Out of 78 facilities, 60 completed groundwater cleanup or changed to different cleanup methods that obviate the need to discharge any treated groundwater.

C. As of November 2011, 18 Dischargers had filed a report of waste discharge by submitting an NOI to continue their discharge authorization under this NPDES General Permit. In the process of reviewing and approving NOIs, supplemental information may be requested from a subset of these facilities. It may also be necessary to visit facilities for which an NOI has been submitted, to observe operations and collect additional data to determine the eligibility of authorizing those discharges

under this Order. This Order requires Dischargers to submit monitoring data according to the requirements contained in the Monitoring and Reporting Program (Attachment E). If monitoring data indicate significant contamination by metals, pesticides, or other conservative pollutants, Dischargers authorized under this Order may be required to apply for an individual NPDES permit.

II. FACILITY DESCRIPTION

The facilities that may be covered under this Order are groundwater treatment facilities located at active or closed sites with solvent and/or fuel leaks. These groundwater treatment facilities are in operation to extract and treat groundwater polluted mainly by VOC and/or fuel components. This Order covers discharges from these facilities to all surface waters such as creeks, streams, rivers including flood control channels, lakes, or San Francisco Bay. Such discharges may occur directly to surface waters or through constructed storm drain systems.

A. Description of Wastewater Treatment

Dischargers authorized under this Order typically use aeration and/or granular activated carbon (GAC) systems to treat their groundwater prior to discharge. Facilities that use other types of treatment systems that are effective at removal of VOC pollutants may be covered by this Order subject to the approval of the Executive Officer. The most common VOC pollutants contained in the influent of these treatment systems are tetrachloroethylene and trichloroethylene. The most common pollutants contained in groundwater influent that has been contaminated by fuel leaks are benzene, ethylbenzene, toluene, total xylenes, methyl tertiary butyl ether (MTBE), and other petroleum hydrocarbons collectively called total petroleum hydrocarbons (TPHs). Other volatile or semi-volatile organic compounds may also be present in the influent of a subset of facilities regulated under this permit. Less commonly, inorganic pollutants, such as metals, are present in the influent and effluent and may be naturally occurring.

Except for some inorganic compounds and some other organic compounds such as 1,4 dioxane, the concentrations of organic pollutants in the effluents of the discharges are usually below detectable levels. The Fuel and VOC Dischargers reported design flow rates ranging from 5 gpm to 840 gpm, and discharge flow rates ranging from 2.5 gpm to 605 gpm.

The reported detection limit for benzene, ethylbenzene, toluene, total xylenes, and most VOC is 0.5 microgram per liter (ug/L); for MTBE, the reported detection limit ranges from 0.5 to 5.0 ug/L; for TPH, the reported detection limit is mostly 50.0 ug/L; and the reported detection limits for semi volatile organic compounds are mostly 5.0 or 10.0 ug/L.

B. Discharge Points and Receiving Waters

The NOI Form (Attachment B) requires every Discharger to provide the discharge location and a map highlighting the discharge path to surface waters.

C. Summary of Existing Requirements

The effluent limitation contained in the previously issued Fuel (Order No. R2-2006-0075) and VOC (Order No. R2-2009-0059) General Permits is summarized in Table F-2. Except the residual chlorine effluent limit in the VOC General NPDES permit, the effluent limitations contained in the previously issued Fuel and VOC General Permits were the same.

Table F-2. Historic Effluent Limitations

No.	Compound	CAS Number	Column A: Discharge to Drinking Water Areas[2]		Column B: Discharge to Other Surface Water Areas	
			Average Monthly Effluent Limitation (µg/L)	Maximum Daily Effluent Limitation (µg/L)	Average Monthly Effluent Limitation (µg/L)	Maximum Daily Effluent Limitation (µg/L)
1	Benzene	71432		1		5
2	Carbon Tetrachloride	56235	0.25 [1]	0.50	4.4	5
3	Chloroform	67663		5		5
4	1,1-Dichloroethane	75343		5		5
5	1,2-Dichloroethane	107062	0.38 [1]	0.5		5
6	1,1-Dichloroethylene	75354	0.057 [1]	0.11[1]	3.2	5
7	Ethylbenzene	100414		5		5
8	Methylene Chloride (Dichloromethane)	75092	4.7	5		5
9	Tetrachloroethylene	127184	0.8	1.6		5
10	Toluene	108883		5		5
11	Cis 1,2-Dichloroethylene	156592		5		5
12	Trans 1,2-Dichloroethylene	156605		5		5
13	1,1,1-Trichloroethane	71556		5		5
14	1,1,2-Trichloroethane	79005	0.6	1.2		5
15	Trichloroethylene	79016	2.7	5		5
16	Vinyl Chloride	75014		0.5		1
17	Total Xylenes	1330207		5		5
18	Methyl Tertiary Butyl Ether (MTBE)	1634044		5		5
19	Total Petroleum Hydrocarbons (as Gasoline or as Diesel)			50		50
20	Ethylene Dibromide (1,2-Dibromoethane)	106934		0.05[1]		5
21	Trichloro-trifluoroethane	76131		5		5
22	Total Chlorine Residual	---	---	0.0[3]	---	0.0[3]

Notes for Table F-2:

[1] If reported detection level is greater than effluent limit, then a non-detect result using a 0.5 µg/L detection level will not be deemed to be out of compliance.

[2] Drinking water areas are defined as surface waters with the existing or potential beneficial uses of "municipal and domestic supply" and "groundwater recharge" (the latter includes recharge areas to maintain salt balance or to halt salt water intrusion into fresh water aquifers).

[3] There shall be no detectable levels of residual chlorine in the effluent (a non-detect result using a detection level equal or less than 0.08 milligram per liter (mg/L) will not be deemed to be out of compliance). This limit only applies to Dischargers that chlorinate their extracted groundwater.

D. Compliance Summary

Forty-four effluent limit and 17 late reporting violations (for a total of 61 violations) are reported in CIWQS during the term of the Fuel General Permit. On average, the Dischargers reported effluent limit compliance rates of about 99% for TPHd, TPHg, and on-time report submittal, and almost 100% for the remaining pollutants with effluent limits in Table F-2. Regional Water Board enforcement staff completed enforcement actions for 53 of these violations, and continues to review the remaining 8 violations. The VOC General Permit compliance summary is on page F-4 of Order No. R2-2009-0059.

E. Planned Changes

As required in Attachment D, a Discharger authorized under this Order shall submit a modified NOI before making any material change in the character, location, or volume of the discharge.

III. APPLICABLE PLANS, POLICIES, AND REGULATIONS

The requirements contained in the Order are based on the requirements and authorities described in this section.

A. Legal Authorities

This Order is issued pursuant to section 402 of the federal Clean Water Act (CWA) and implementing regulations adopted by the U.S. Environmental Protection Agency (USEPA) and chapter 5.5, division 7 of the California Water Code [(CWC), commencing with section 13370]. It shall serve as a NPDES permit for point source discharges from these facilities to surface waters. This Order also serves as General Waste Discharge Requirements (GWDRs) pursuant to CWC article 4, chapter 4, division 7 (commencing with section 13260). States may request authority to issue general NPDES permits pursuant to Code of Federal Regulations, Title 40, Chapter 1, Subchapter D, part 122.28 (40 CFR 122.28). 40 CFR 122.28 provides for the issuance of general permits to regulate discharges of waste which result from similar operations, are the same types of waste, require the same effluent limitations, require similar monitoring, and are more appropriately regulated under a general permit rather than individual permits. This general permit meets the requirements of 40 CFR 122.28 because the discharges and proposed discharges:

- result from similar operations (all involve extraction, treatment, and discharge of groundwater);
- are the same types of waste (all are groundwater containing VOC, fuel components, and other related wastes due to leaks and spills);
- require similar effluent limitations for the protection of the beneficial uses of surface waters in the San Francisco Bay Region (this general permit does not cover direct discharges to the Pacific Ocean);

- require similar monitoring; and
- are more appropriately regulated under a general permit rather than individual permits.

B. California Environmental Quality Act (CEQA)

Under CWC section 13389, this action to issue an NPDES permit is exempt from the provisions of CEQA.

C. State and Federal Regulations, Policies, and Plans

1. **Water Quality Control Plans.** *The Water Quality Control Plan for the San Francisco Bay Basin* (the Basin Plan) is the Regional Water Board's master water quality control planning document. It designates beneficial uses and water quality objectives (WQOs) for waters of the State, including surface and groundwater. It also includes implementation programs to achieve WQOs. The Basin Plan was duly adopted by the Regional Water Board and approved by the State Water Resources Control Board (State Water Board), the Office of Administrative Law, and USEPA. Requirements of this Order implement the Basin Plan.

   The Basin Plan designates beneficial uses, establishes water quality objectives, and contains implementation programs and policies to achieve those objectives for all waters addressed through the plan. The Basin Plan states that the beneficial uses of any specifically identified water body generally apply to its tributary streams. The Basin Plan may not specifically identify beneficial uses for every receiving water regulated under this permit, but identifies present and potential uses for the downstream water body, to which the receiving water, via an intermediate water body, is tributary. These potential and existing beneficial uses are: municipal and domestic supply, fish migration and fish spawning, industrial service supply, navigation, industrial process supply, marine habitat, agricultural supply, estuarine habitat, groundwater recharge, shellfish harvesting, water contact and non-contact recreation, ocean, commercial, and sport fishing, wildlife habitat, areas of special biological significance, cold freshwater and warm freshwater habitat, and preservation of rare and endangered species for surface waters and municipal and domestic supply, industrial service supply, industrial process supply, agricultural supply, and freshwater replenishment for groundwaters. In addition, the Basin Plan implements State Water Board Resolution No. 88-63, which established state policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply. Requirements of this Order implement the Basin Plan.

   On September 18, 1975, the State Water Board adopted the *Water Quality Control Plan for Control of Temperature in the Coastal Interstate Waters and Enclosed Bays and Estuaries of California* (hereinafter the Thermal Plan). The Thermal Plan contains objectives governing cooling water discharges, providing different and specific numeric and narrative water quality objectives for new and existing discharges.

   The State Water Board's *Water Quality Control Plan for Enclosed Bays and Estuaries—Part 1, Sediment Quality* became effective on August 25, 2009. This plan supersedes other narrative sediment quality objectives and establishes new sediment quality objectives and

related implementation provisions for specifically defined sediments in most bays and estuaries.

2. **National Toxics Rule (NTR) and California Toxics Rule (CTR).** USEPA adopted the NTR on December 22, 1992, and amended it on May 4, 1995, and November 9, 1999. About 40 criteria in the NTR and apply in California. On May 18, 2000, USEPA adopted the CTR. The CTR promulgated new toxics criteria for California and, in addition, incorporated the previously adopted NTR criteria that applied in the State. The CTR was amended on February 13, 2001. These rules contain water quality criteria (WQC) for priority toxic pollutants.

3. **State Implementation Policy.** On March 2, 2000, the State Water Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy or SIP). The SIP became effective on April 28, 2000, with respect to the priority pollutant criteria promulgated through the NTR and to the WQOs established in the Basin Plan. The SIP became effective on May 18, 2000, with respect to the priority pollutant criteria promulgated through the CTR. The State Water Board adopted amendments to the SIP on February 24, 2005, which became effective on July 13, 2005. The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control. Requirements of this Order implement the SIP.

4. **Alaska Rule.** On March 30, 2000, USEPA revised its regulation that specifies when new and revised state and tribal water quality standards (WQS) become effective for CWA purposes [65 Fed. Reg. 24641 (April 27, 2000), codified at 40 CFR 131.21]. Under the revised regulation (also known as the Alaska Rule), new and revised standards submitted to USEPA after May 30, 2000, must be approved by USEPA before being used for CWA purposes. The final rule also provides that standards already in effect and submitted to USEPA by May 30, 2000, may be used for CWA purposes, whether or not approved by USEPA.

5. **Antidegradation Policy.** 40 CFR 131.12 requires that state WQS include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution 68-16, which incorporates the federal antidegradation policy where the federal policy applies under federal law and requires that existing quality of waters be maintained unless degradation is justified based on specific findings. The Regional Water Board's Basin Plan implements, and incorporates by reference, both the State and federal antidegradation policies.

6. **Anti-Backsliding Requirements.** CWA Sections 402(o)(2) and 303(d)(4) and 40 CFR 122.44(l) prohibit backsliding in NPDES permits. These anti-backsliding provisions require that effluent limitations in a reissued permit must be as stringent as those in the previous permit, with some exceptions in which limitations may be relaxed. This Order retains effluent limitations no less stringent than those established by previous orders.

D. Impaired Water Bodies on CWA 303(d) List

In November 2006, USEPA approved a revised list of impaired water bodies prepared pursuant to CWA section 303(d), which requires identification of specific waterbodies where it is expected that water quality standards will not be met after implementation of technology-based effluent limitations on point sources. In November 2010, USEPA partially approved an updated 303(d) list. Where it has not already done so, the Regional Water Board plans to adopt Total Maximum Daily Loads (TMDLs) for pollutants on the 303(d) list. TMDLs establish wasteload allocations for point sources and load allocations for non-point source sand are established to achieve the water quality standards for the impaired waterbodies. The SIP requires final effluent limitations for all 303(d)-listed pollutants to be based on total maximum daily loads and associated waste load allocations.

IV. RATIONALE FOR EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. There are two principal bases for effluent limitations in 40CFR: Section 122.44(a) requires that permits include applicable technology-based limitations and standards; and Section 122.44(d) requires that permits include water quality-based effluent limitations to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water.

Several specific factors affecting the development of limitations and requirements in this Order are discussed as follows:

A. Discharge Prohibitions

1. **Prohibition III.A (Unauthorized discharges of extracted and treated groundwater are prohibited):** This discharge prohibition is retained from the previously issued Fuel and VOC General Permits and is based on CWC section 13260, which requires filing of a report of waste discharge (ROWD) before discharges can occur. Discharges which have not been described in a Discharger's NOI are prohibited.

2. **Prohibition III.B (Discharges of effluent other than extracted groundwater treated only with approved chemicals are prohibited):** This prohibition is retained from the previously issued Fuel and VOC General Permits and is based on the fact that the requirements in the Order were developed for discharges of treated groundwater from VOC or fuel-contaminated groundwater sites so only discharges associated with this type of activity can be permitted under this Order.

3. **Prohibition III.C (Discharges in excess of the authorized flow rate are prohibited):** This prohibition is retained from the previously issued Fuel and VOC General Permits. The basis for the prohibition is the same rationale documented for Prohibition III.A. Dischargers have submitted NOIs that included a description of treatment facility design and the maximum

design flow rate, certified by a professional engineer. Flows in excess of the design flow rate may result in lowering the reliability of achieving compliance with water quality requirements.

4. **Prohibition III.D (No scouring or erosion due to discharge of extracted and treated groundwater at the point where a storm drain discharges to a receiving water):** This prohibition is retained from the previously issued Fuel and VOC General Permits, with slight revisions for consistency with similar provisions of the Municipal Regional Stormwater NPDES Permit (Order No. R2-2009-0074), and is based on the sediment and erosion control goals of section 4.19 of the Basin Plan.

5. **Prohibition III.E (No pollution, contamination, or nuisance):** This prohibition is based on CWC section 13050, and has been retained from the previously issued Fuel and VOC General Permits.

6. **Prohibition III.F (No bypass or overflow of untreated or partially treated polluted groundwater**): This prohibition is retained from the previously issued Fuel and VOC General Permits and is based on 40 CFR 122.41(m).

B. Shallow Water Discharges and Basin Plan Discharge Prohibition 1

The Basin Plan (Chapter 4, Table 4-1, Discharge Prohibition 1) prohibits discharges not receiving a minimum 10:1 initial dilution or to dead end sloughs. In accordance with the Basin Plan, this Order continues to grant Dischargers an exception to the discharge prohibition for discharges to shallow waters. The exception is based on section 4.2 of the Basin Plan, which states that an exception to Prohibition 1 will be considered where:

- A discharge is approved as part of a reclamation project; or
- It can be demonstrated that net environmental benefits will be derived as a result of the discharge; or
- A discharge is approved as part of a groundwater cleanup project and, in accordance with Resolution No. 88-160 'Regional Board Position on the Disposal of Extracted Groundwater from Groundwater Clean-Up Projects', it has been demonstrated that neither reclamation nor discharge to a publicly owned treatment works is technically and economically feasible, and the discharger has provided certification of the adequacy and reliability of treatment facilities and a plan that describes procedures for proper operation and maintenance of all treatment facilities.

The Basin Plan further states:

> Significant factors to be considered by the Regional Water Board in reviewing requests for exceptions will be the reliability of the discharger's system in preventing inadequately treated wastewater from being discharged to the receiving water and the environmental consequences of such discharges.

To comply with the exception, this Order requires Dischargers to document in the NOI application that neither reclamation nor discharge to a POTW is technically and economically

feasible. In addition, to prevent inadequately treated wastewater from being discharged to receiving waters, Dischargers are required to document in the NOI that the discharge of inadequately treated waste will be reliably prevented.

C. Technology-Based Effluent Limitations

If any extracted and treated groundwater receives less than proper treatment, the pollutants listed in Table F-2 may be discharged at levels that have a reasonable potential to cause or contribute to an exceedance of any applicable criterion established by the USEPA pursuant to CWA section 303.

1. Scope and Authority

The CWA requires technology-based effluent limitations (TBELs) based on several levels of controls:

- Best practicable treatment control technology (BPT) represents the average of the best performance by plants within an industrial category or subcategory. BPT standards apply to toxic, conventional, and non-conventional pollutants.

- Best available technology economically achievable (BAT) represents the best existing performance of treatment technologies that are economically achievable within an industrial point source category. BAT standards apply to toxic and non-conventional pollutants.

- Best conventional pollutant control technology (BCT) represents the control from existing point sources of conventional pollutants including BOD, TSS, fecal coliform, pH, and oil and grease. The BCT standard is established after considering the "cost reasonableness" of the relationship between the cost of attaining a reduction in effluent discharge and the benefits that would result, and also the cost effectiveness of additional industrial treatment beyond BPT.

- New source performance standards (NSPS) represent the best available demonstrated control technology standards. The intent of NSPS guidelines is to set limitations that represent state-of-the-art treatment technology for new sources.

The CWA requires USEPA to develop effluent limitations, guidelines, and standards (ELGs) representing application of BPT, BAT, BCT, and NSPS. Section 402(a)(1) of the CWA and 40 CFR 125.3 authorize the use of Best Professional Judgment (BPJ) to derive TBELs on a case-by-case basis where ELGs are not available for certain industrial categories and/or pollutants of concern. Where BPJ is used, the permit writer must consider specific factors outlined in 40 CFR 125.3.

2. Applicable Technology-Based Effluent Limitations

Regional Water Board staff used BPJ in developing TBELs in this Order. BPJ is defined as the highest quality technical opinion developed by a permit writer after consideration of all reasonably available and pertinent data or information that forms the basis for the terms and conditions of a NPDES permit. The authority for BPJ is contained in CWA section 402(a)(1).

In the treatment systems regulated by this Order, organic compounds, including VOC and petroleum compounds, are removed from contaminated groundwater using such technologies as air stripping and activated carbon. Treated groundwater is then discharged to surface waters. When properly designed and operated, these treatment systems can lower the concentration of such pollutants to levels below analytical detection limits.

USEPA Region 9 issued a document titled *NPDES Permit Limitations for Discharge of Contaminated Groundwater: Guidance Document* (USEPA, 1986) in which USEPA concluded that the cost of reducing concentrations of most organic compounds commonly detected in contaminated groundwater to a non-detect concentration of 5 µg/L, and to a non-detect concentration for vinyl chloride of 1 µg/L, is considered economically achievable.

Based on an understanding that available treatment technologies can economically remove organic pollutants from contaminated groundwater, the Regional Water Board has established TBELs using BPJ at 5.0 µg/L for benzene, carbon tetrachloride, chloroform, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, ethylbenzene, methylene chloride, tetrachloroethylene, Toluene, Cis 1,2-Dichloroethylene, Trans 1,2-Dichloroethylene, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, Trichloroethylene, and total xylenes, and at 1.0 µg/L for vinyl chloride.

Petroleum-based compounds and fuel additives are commonly found at sites with fuel or fuel VOC commingled plumes. This Order therefore retains TBELs for TPHs, ethylene dibromide, and MTBE from the previous Fuel General Permit. Limitations for TPH are 50 µg/L and for ethylene dibromide and MTBE are 5 µg/L, which reflect a level of treated wastewater quality that is economically achievable by the treatment technologies contemplated by this Order.

Because a number of facilities covered under the Fuel General Permit are former semiconductor manufacturing operations, which used trichlorotrifluoroethane (Freon 113) in a manufacturing process and have detected concentrations of this compound in contaminated groundwater, this Order retains the effluent limitation from the previous Fuel General Permit for Freon. The effluent limitation of 5 µg/L reflects a level of treated wastewater quality that is economically achievable by the treatment technologies contemplated by this Order.

Table F-3, below, summarizes the TBELs established by this Order.

Table F-3. Summary of Technology-Based Effluent Limitations

No.	Compound	Limitations Established by BPJ	
		USEPA	RWB
1	Benzene	5	---
2	Carbon Tetrachloride	5	---
3	Chloroform	5	---
4	1,1-Dichloroethane	5	---
5	1,2-Dichloroethane	5	---
6	1,1-Dichloroethylene	5	---
7	Ethylbenzene	5	---

No.	Compound	Limitations Established by BPJ	
		USEPA	RWB
8	Methylene Chloride	5	---
9	Tetrachloroethylene	5	---
10	Toluene	5	---
11	Cis-1,2-Dichloroethylene	5	---
12	Trans-1,2-Dichloroethylene	5	---
13	1,1,1-Trichloroethane	5	---
14	1,1,2-Trichloroethane	5	---
15	Trichloroethylene	5	---
16	Vinyl Chloride	1	---
17	Total Xylenes	5	---
18	Methyl Tertiary Butyl Ether (MTBE)	5	5
19	Total Petroleum Hydrocarbons (TPH)	---	50
20	Ethylene Dibromide (1,2-Dibromoethane)	---	5
21	Trichlorotrifluoroethane	---	5

D. Water Quality-Based Effluent Limitations (WQBELs)

WQBELs have been derived to implement WQOs that protect beneficial uses. Both the beneficial uses and the WQOs have been approved pursuant to federal law. The procedures for calculating individual WQBELs are based on the SIP and the Basin Plan. Most Basin Plan beneficial uses and WQOs were approved under State law and submitted to and approved by USEPA prior to May 30, 2000. Any WQOs and beneficial uses submitted to USEPA prior to May 30, 2000, but not approved by USEPA before that date, are nonetheless "applicable water quality standards for purposes of the [Clean Water] Act" pursuant to 40 CFR 131.21(c)(1). Collectively, this Order's restrictions on individual pollutants are no more stringent than those required by CWA water quality standards.

1. Scope and Authority

a. 40 CFR 122.44(d)(1)(i) mandates that permits include effluent limitations for all pollutants that are or may be discharged at levels that have reasonable potential to cause or contribute to an excursion of a water quality standard, including numeric and narrative objectives within a standard. As specified in 40 CFR 122.44(d)(1)(i), permits are required to include WQBELs for all pollutants "which the Director determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard."

The process for determining "reasonable potential" and calculating WQBELs when necessary is intended to protect the designated beneficial uses of the receiving water as

specified in the Basin Plan, and achieve applicable WQOs contained in other state plans and policies, and applicable WQC contained in the CTR and NTR.

b. NPDES regulations and the SIP provide the basis to establish Maximum Daily Effluent Limitations (MDELs).

(1) NPDES regulations at 40 CFR 122.45(d) state, "For continuous discharges all permit effluent limitations, standards, and prohibitions, including those necessary to achieve water quality standards, shall *unless impracticable* be stated as maximum daily and average monthly discharge limitations for all discharges other than publicly owned treatment works."

(2) SIP section 1.4 requires WQBELs to be expressed as MDELs and average monthly effluent limitations (AMELs).

c. MDELs are used in this Order to protect against acute water quality effects. MDELs are necessary for preventing fish kills or mortality to aquatic organisms.

2. Applicable Beneficial Uses and Water Quality Criteria and Objectives

The WQOs applicable to the receiving waters for these discharges are from the Basin Plan; the CTR, established by USEPA at 40 CFR 131.38; and the NTR, established by USEPA at 40 CFR 131.36. Some pollutants have WQOs established by more than one of these three sources.

a. Basin Plan. The Basin Plan specifies numeric WQOs for 10 priority toxic pollutants, as well as narrative WQOs for toxicity and bioaccumulation in order to protect beneficial uses. The pollutants for which the Basin Plan specifies numeric objectives are arsenic, cadmium, chromium (VI), copper in fresh and marine water, lead, mercury, nickel, silver, zinc, and cyanide. The narrative toxicity objective states, "All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms." The bioaccumulation objective states, "Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered." Effluent limitations and provisions contained in this Order are designed to implement these objectives, based on available information.

The Basin Plan also contains a narrative objective for surface waters designated for use as a domestic or municipal supply (MUN) which states that these surface waters shall not contain concentrations of constituents in excess of the maximum contaminant levels (MCLs) or secondary MCLs specified in Title 22 of the California Code of Regulations. Effluent limitations and provisions contained in this Order are designed to implement these objectives, based on available information.

b. CTR. The CTR specifies numeric aquatic life criteria for 23 priority toxic pollutants and numeric human health criteria for 57 priority toxic pollutants. These criteria apply to all

inland surface waters and enclosed bays and estuaries of the San Francisco Bay Region, although Tables 3-3 and 3-4 of the Basin Plan include numeric objectives for certain of these priority toxic pollutants, which supersede criteria of the CTR (except in the South Bay south of the Dumbarton Bridge).

Human health criteria are further identified as "water and organisms" and "organisms only." The CTR criteria applicable to "water and organisms" are applied in the Reasonable Potential Analysis (RPA) for discharges to receiving waters with a MUN designation, and criteria applicable to "organisms only" were used in the RPA for discharges to receiving waters that are not MUN-designated.

c. NTR. The NTR establishes numeric aquatic life criteria for selenium and numeric "organisms only" human health criteria for 33 toxic pollutants for waters of San Francisco Bay upstream to, and including Suisun Bay and the San Joaquin-Sacramento River Delta.

d. Sediment Quality Objectives. The *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1, Sediment Quality* contains a narrative WQO, "Pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California." This WQO is to be implemented by integrating three lines of evidence: sediment toxicity, benthic community condition, and sediment chemistry. The policy requires that is the Regional Water Board determines that a discharge has reasonable potential to cause or contribute to an exceedance of this WQO, it is to impose the WQO as a receiving water limit.

e. Basin Plan Receiving Water Salinity Policy. The Basin Plan (like the CTR and the NTR) states that the salinity characteristics (i.e., freshwater vs. saltwater) of the receiving water are to be considered in determining the applicable WQOs. Freshwater criteria apply to discharges to waters with salinities equal to or less than one part per thousand (ppt) at least 95 percent of the time. Saltwater criteria apply to discharges to waters with salinities equal to or greater than 10 ppt at least 95 percent of the time in a normal water year. For discharges to water with salinities between these two categories, or tidally influenced freshwaters that support estuarine beneficial uses, the WQOs are the lower of the salt or freshwater WQOs (the latter calculated based on ambient hardness) for each substance.

Receiving waters considered by for this permit are the San Francisco Bay and other estuarine and tidally influences waters, and inland freshwaters. The Basin Plan implements State Water Board Resolution No. 88-63, which establishes State policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply (MUN). Because of marine influence on all reaches of San Francisco Bay and other tidally influenced waters, total dissolved solids levels exceed 3,000 mg/L and thereby meet an exception to State Water Board Resolution No. 88-63. The RPA therefore separately considered criteria that were applicable to receiving waters with a MUN designation and to receiving waters that are not MUN-designated.

Aquatic life criteria were based on the most stringent of the fresh and salt water criteria, to be fully protective of all receiving waters.

f. **Receiving Water Hardness.** Ambient hardness values are used to calculate freshwater WQOs that are hardness dependent. In determining the WQOs for this Order, Regional Water Board staff used a hardness value of 100 mg/L as $CaCO_3$, which is a conservative value and generally protective of aquatic life in all circumstances contemplated by the General Permit.

g. **Site-Specific Translators (SSTs).** NPDES regulations at 40 CFR 122.45(c) require that effluent limitations for metals be expressed as total recoverable metal. Since applicable WQOs for metals are typically expressed as dissolved metal, translators must be used to convert metals concentrations from dissolved to total recoverable and vice versa. The CTR includes default translators; however, site-specific conditions, such as water temperature, pH, suspended solids, and organic carbon greatly affect the form of metal (dissolved, non-filterable, or otherwise) present in the water and therefore available to cause toxicity. In general, the dissolved form of the metal is more available and more toxic to aquatic life than non-filterable forms. Site-specific translators can be developed to account for site-specific conditions, thereby preventing exceedingly stringent or under protective WQOs.

Receiving waters for discharges from the facilities covered under the General Permit are varied, and, therefore, site specific conditions are varied. In determining the need for and calculating WQBELs for all metals except for copper and nickel, the Regional Water Board has used default translators established by the USEPA in the CTR at 40 CFR 131.38 (b) (2), Table 2 to be protective in all circumstances. Most discharges are anticipated to eventually enter San Francisco Bay, and, therefore, the site specific translators were applied in determining criteria for copper and nickel. For copper, the Regional Water Board applied the SSTs adopted by Regional Water Board Resolution No. R2-2007-0042 for North and Central San Francisco Bay, and the SST contained in the Basin Plan Table 7.2.1-1 for South San Francisco Bay. For nickel, the Regional Water Board applied the translators for North and Central San Francisco Bay based on the recommendation of the Clean Estuary Partnership's *North of Dumbarton Bridge Copper and Nickel Development and Selection of Final Translators* (2005), and applied the translators contained in Table 7.2.1-1 of the Basin Plan for South San Francisco Bay. These translators for copper and nickel are summarized below.

Table F-4. SSTs for Copper and Nickel for San Francisco Bay

	Copper		**Nickel**	
San Francisco Bay Segment	**AMEL Translator**	**MDEL Translator**	**AMEL Translator**	**MDEL Translator**
North	0.38	0.66	0.27	0.57
Central	0.73	0.87	0.65	0.85
South	0.53	0.53	0.44	0.44

3. Determining the Need for WQBELs

Assessing whether a pollutant has Reasonable Potential is the fundamental step in determining whether or not a WQBEL is required.

a. Reasonable Potential Methodology

For priority pollutants and most other toxic pollutants, the RPA identifies the observed maximum effluent concentration (MEC) for each pollutant based on effluent concentration data. There are three triggers in determining Reasonable Potential according to SIP Section 1.3.

(1) The first trigger (Trigger 1) is activated if the MEC is greater than or equal to the lowest applicable WQO (MEC $\geq$ WQO), which has been adjusted, if appropriate, for pH, hardness, and translator data. If the MEC is greater than or equal to the adjusted WQO, then that pollutant has Reasonable Potential, and a WQBEL is required.

(2) The second trigger (Trigger 2) is activated if the observed maximum ambient background concentration (B) is greater than the adjusted WQO (B > WQO), and the pollutant is detected in any of the effluent samples (MEC > ND).

(3) The third trigger (Trigger 3) is activated if a review of other information determines that a WQBEL is required to protect beneficial uses, even though both MEC and B are less than the WQO/WQC.

b. Effluent Data

Each Discharger currently covered under the Fuel General Permit was required to conduct effluent monitoring pursuant to the Self-Monitoring Program for Order No. R2-2006-0075. The Regional Water Board analyzed the Dischargers' priority pollutant data and the nature of the discharges to determine if discharges have Reasonable Potential. Effluent data used to conduct this RPA consisted of data submitted as part of each Fuel General Permit facility's NOI which was combined with data submitted by facilities as part of the NOI application for coverage under the VOC General Permit. The Regional Water Board analyzed effluent quality data collected from 2004 to 2011 for a total of 55 facilities (43 from the VOC General Permit and 12 from the Fuel General Permit) in the San Francisco Bay Region. Effluent monitoring data from three NOIs received after the July 15, 2011, due date were not included in this RPA.

From this analysis, it was concluded that the data for metals would be excluded for use in RPA pursuant to SIP 1.2. The reason is that the metals were detected only occasionally and at low levels likely from natural background in the groundwater.

c. Ambient Background Data

The SIP states that, for calculating WQBELs, ambient background concentrations are either the observed maximum ambient water column concentrations or, for objectives

intended to protect human health from carcinogenic effects, the arithmetic mean of observed ambient water concentrations. Ambient background concentrations are the observed maximum detected water column concentrations for aquatic life protection.

Because the receiving waters for discharges from the facilities covered under this Order are varied, receiving water background concentrations were not considered for this RPA.

d. Reasonable Potential Determination for Priority Pollutants

The MECs and the most stringent applicable WQC used in the RPA are presented in the following table, along with the RPA results (yes or no) for each pollutant. Reasonable Potential was not determined for all pollutants because there are not applicable WQC for all pollutants, or monitoring data are not available for others. Based on a review of the effluent data, the pollutants that demonstrate reasonable potential by Trigger 1 are benzene, bromoform, chlorodibromomethane, 1,2-dichloroethane, 1,1-dichloroethylene, methylene chloride, trichloroethylene, vinyl chloride, and bis(2-ethylhexyl)phthalate.

The Regional Water Board has also determined that Reasonable Potential exists to exceed water quality objectives, by Trigger 3, for the organic pollutants that have been identified as pollutants that are commonly present in VOC and fuel-contaminated groundwater (i.e., those pollutants for which TBELs have been established.) As these TBELs limitations are achievable dependent on the proper design and operation of treatment systems, there is Reasonable Potential for excursions above applicable water quality criteria for these pollutants if the system is not designed or operated correctly.

Total residual chlorine is also identified as a pollutant with Reasonable Potential to exceed the Basin Plan narrative toxicity objective, as determined by Trigger 3. The Regional Water Board has identified that chlorine may be used in conjunction with air stripping and/or activated carbon treatment systems to control biological growth, and therefore Reasonable Potential exists for total residual chlorine for those facilities that use it.

Table F-5. Summary of RPA Results

CTR #	Priority Pollutants	MEC or Minimum DL [1][2] (µg/L)	Governing Applicable Criteria (µg/L)				RPA Results [3]
			Aquatic Life	Human Health			
			(Most stringent of salt and fresh water)	CTR Water + Organisms	Basin Plan Title 22 MCLs	CTR Organisms Only	
1	Antimony	**21**	---	14	6	4300	Ud
2	Arsenic	**140**	36	---	10	---	Ud
3	Beryllium	0.00053	---	---	4	---	Ud
4	Cadmium	0.36	1.1	---	5	---	Ud
5a	Chromium (III)	NA	207	---	50	---	Ud
5b	Chromium (VI)	**14**	11	---	---	---	Ud
6	Copper	**24**	4.7[4]	---	1000	---	Ud

CTR #	Priority Pollutants	MEC or Minimum DL [1][2] (µg/L)	Governing Applicable Criteria (µg/L)				RPA Results [3]
			Aquatic Life	Human Health			
			(Most stringent of salt and fresh water)	CTR Water + Organisms	Basin Plan Title 22 MCLs	CTR Organisms Only	
	Copper	**24**	3.4[5]	---	1000	---	Ud
	Copper	**24**	5.9[6]	---	1000	---	Ud
7	Lead	0.048	3.2	---	---	---	Ud
8	Mercury (303d listed)	0.00082	0.025	0.050	2	0.051	Ud
9	Nickel	**49**	19[7]	610	100	4600	Ud
	Nickel	**49**	13[8]	610	100	4600	Ud
	Nickel	**49**	30[9]	610	100	4600	Ud
10	Selenium (303d listed)	**25**	5.0	---	---	---	Ud
11	Silver	<0.25	2.2	---	---	---	Ud
12	Thallium	**7.3**	---	1.7	2.0	6.3	Ud
13	Zinc	**150**	86	---	5000	---	Ud
14	Cyanide	**30**	2.9[10]	700	150	220,000	Ud
19	**Benzene**	**1.2**	---	1.2	1	71	**Yes**
20	**Bromoform**	**5.2**		4.3	---	360	**Yes**
23	**Chlorodibromomethane**	**2.8**	---	0.401	---	34	**Yes**
26	**Chloroform**	**7.1**	---	No Criteria			**Yes**
28	**1,1-Dichloroethane**	**4.1**	---	---	5	---	**Yes**
29	**1,2-Dichloroethane**	**0.6**	---	0.38	0.5	99	**Yes**
30	**1,1-Dichloroethylene**	**5.7**	---	0.057	6	3.2	**Yes**
33	**Ethylbenzene**	**<0.5**	---	3100	300	29,000	**Yes**
36	**Methylene Chloride**	**23**	---	4.7	5	1600	**Yes**
38	**Tetrachloroethylene**	**25**	---	0.8	5	8.85	**Yes**
39	**Toluene**	**3.07**	---	6800	150	200,000	**Yes**
---	**1,2-Cis-Dichloroethylene**	**20**	---	---	6	---	**Yes**
40	**1,2-Trans-Dichloroethylene**	**4.2**	---	700	10	140,000	**Yes**
41	**1,1,1-Trichloroethane**	**15**	---	---	200	---	**Yes**
42	**1,1,2-Trichloroethane**	**0.5**	---	0.60	5	42	**Yes**
43	**Trichloroethylene**	**460**	---	2.7	5	81	**Yes**
44	**Vinyl Chloride**	**2.1**	---	2	0.5	525	**Yes**
68	**Bis-2(ethylhexyl)phthalate**	100		1.8	4	5.9	**Yes**
70	Butylbenzyl Phthalate	22	---	3000	---	5200	No
---	**Total Xylenes**	**3**	---	---	1750	---	**Yes**
---	**Methyl Tertiary Butyl Ether (MTBE)**	**2.7**	---	---	13	---	**Yes**
---	Total Petroleum Hydrocarbons (TPH)	1600	No Criteria				Ud
---	**Ethylene Dibromide**	**<0.05**	---	---	0.05	---	**Yes**
---	**Trichlorotrifluoroethane**	**5.4**	---	---	1200	---	**Yes**
---	**Total Residual Chlorine[11]**	**NA**	---	---	---	---	**Yes**

Notes for Table F-5:

[1] The Maximum Effluent Concentration (MEC) and maximum background concentration are the actual detected concentrations unless preceded by a "<" sign, in which case the value shown is the minimum detection level (DL).

[2] The MEC or maximum background concentration is "Not Available" (NA) when there are no monitoring data for the constituent.

[3] RPA Results = Yes, if MEC > WQO/WQC, B > WQO/WQC and MEC is detected, or Trigger 3;
= No, if MEC and B are < WQO/WQC or all effluent data are undetected;
= Undetermined (Ud), if no criteria have been promulgated or there are insufficient data. For metals and cyanide, Ud was determined because as noted previously the reported discharge data were excluded for use in RPA pursuant to SIP 1.2. Though the detected levels are high as shown in the MECs above, these were in just a few samples. Metals and cyanide were detected only occasionally and generally at low levels likely from

natural background in the groundwater extracted for cleanup. Because this Order would exclude coverage for sites where there is persistent metals contamination, and the relative small load of background metals to the Bay from all the discharges, a finding of undetermined is appropriate.

[4] Criterion based on the Basin Plan marine SSO for copper, and the site-specific translators (0.53 acute and chronic) for the Lower and South Bay.

[5] Criterion based on the Basin Plan marine SSO for copper, and the site-specific translators (0.87 acute, 0.73 chronic) for the Central Bay.

[6] Criterion based on the Basin Plan marine SSO for copper, and the site-specific translators (0.66 acute, 0.38 chronic) for Suisun and San Pablo Bay.

[7] Criterion based on the Basin Plan marine SSO for nickel and the site-specific translators (0.44 acute and chronic) for the Lower and South Bay.

[8] Criterion based on the Basin Plan marine WQO for nickel, and the site-specific translators (0.85 acute, 0.65 chronic) for the Central Bay.

[9] Criterion based on the Basin Plan marine WQO for nickel, and the site-specific translators (0.57 acute, 0.27 chronic) for Suisun and San Pablo Bay.

[10] Criterion based on the Basin Plan marine SSO for cyanide.

[11] Total Residual Chlorine: The water quality objective applicable to total residual chlorine is the Basin Plan narrative objective for toxicity which states "[a]ll waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms."

e. Constituents with limited data

In some cases, Reasonable Potential cannot be determined because effluent data are limited, or ambient background concentrations are unavailable. When additional data become available, further RPA will be conducted to determine whether numeric effluent limitations are necessary.

f. Pollutants with No Reasonable Potential

WQBELs are not included in this Order for constituents that do not demonstrate Reasonable Potential; however, monitoring for those pollutants is still required. If concentrations of these constituents are found to have increased significantly, the Discharger will be required to investigate the sources of the increases. Remedial measures are required if the increases pose a threat to receiving water quality.

g. RPA Determination for Sediment Quality Objectives

To date there is no evidence directly linking compromised sediment conditions to the discharges subject to this Order; therefore the Regional Water Board cannot draw a conclusion about Reasonable Potential for the discharges to cause or contribute to exceedances of the sediment quality objectives. However, due to the relatively small discharge volumes and the type and level of treatment, it is unlikely that the discharges would contribute to exceedance of sediment objectives.

4. WQBEL Calculations

a. Pollutants with Reasonable Potential. WQBELs were developed for the toxic and priority pollutants that were determined to have Reasonable Potential to cause or contribute to exceedances of the WQOs or WQC. The WQBELs were calculated based on WQOs and the appropriate procedures specified in Section 1.4 of the SIP. The WQOs used for each pollutant with Reasonable Potential are discussed below.

b. Shallow/Deep Water Discharge. The Basin Plan defines a deep water discharge as a discharge through an outfall equipped with a diffuser that achieves a minimum initial dilution of 10:1. Because the General Permit authorizes discharges to many types of receiving waters, Dischargers covered under the General Permit are classified by the

Regional Water Board as shallow water discharges, so that the General Permit is protective under all circumstances.

c. **Dilution Credit.** The General Permit assumes minimal dilution is available for discharges that it authorizes, and therefore no dilution credit is granted in calculating WQBELs. No dilution credit is granted because almost all discharges of treated groundwater regulated under this Order are to storm drain systems that discharge to rivers, creeks, and streams. Many of these creeks and streams are dry during the summer months. Therefore, for a few months of the year, these discharges may represent all or nearly all of the flow in some portions of the receiving creeks or streams. These discharges therefore also have the potential to recharge groundwaterss protected as drinking waters.

d. **Development of WQBELs for Specific Pollutants.** To develop WQBELs for pollutants that demonstrate reasonable potential based on CTR human health criteria (benzene, bromoform, chlorodibromomethane, 1,2-dichloroethane, and bis(2-ethylhexyl)phthalate) , the average monthly effluent limitation (AMEL) is established as the most stringent WQC because the WQC are based on applicable human health criteria. To calculate the maximum daily effluent limitation (MDEL), the AMEL is multiplied by a MDEL/AMEL multiplier of 2.01, which assumes a coefficient of variation (CV) of effluent data of 0.60, because not enough data were available to calculate a CV.

For pollutants with criteria based on Title 22 MCLs (benzene, vinyl chloride), where the MUN designation is applicable to the receiving water, MDELs are set equal to the MCL, because the MCLs are levels that shall not be exceeded in the receiving water, and no credit for dilution is granted.

WQBELs for total residual chlorine are based in Table 4-2 of the Basin Plan.

For the CTR metals and cyanide, WQBELs are not being established at this time. Instead, trigger values will be set for these inorganic pollutants as a backstop to ensuring that sites with metals or cyanide contamination are appropriately identified and addressed. Exceedance of these trigger values in the discharge would trigger actions specified Provision VI.C.6, which if warranted may also lead to termination of discharge authorization under this Order.

Table F-6. Summary of WQBELs

No.	Compound	Discharge to Receiving Waters used as Drinking Water Source[1]		Discharge to Other Receiving Waters	
		AMEL (µg/L)	MDEL (µg/L)	AMEL (µg/L)	MDEL (µg/L)
1	Benzene	---	1	71	142
2	Carbon Tetrachloride	0.25	0.5	4.4	8.8
3	Chloroform	---	---	---	---
4	1,1-Dichloroethane	---	5	---	---

No.	Compound	Discharge to Receiving Waters used as Drinking Water Source[1]		Discharge to Other Receiving Waters	
		AMEL (µg/L)	MDEL (µg/L)	AMEL (µg/L)	MDEL (µg/L)
5	1,2-Dichloroethane	0.38	0.5	99	199
6	1,1-Dichloroethylene	0.057	0.11	3.2	6.4
7	Ethylbenzene	---	300	29,000	58,000
8	Methylene Chloride	4.7	9.4	1600	3200
9	Tetrachloroethylene	0.8	1.6	8.85	17.8
10	Toluene	---	150	200,000	400,000
11	Cis-1,2-Dichloroethylene	---	6	---	---
12	Trans-1,2-Dichloroethylene	---	10	140,000	280,000
13	1,1,1-Trichloroethane	---	200	---	---
14	1,1,2-Trichloroethane	0.60	1.2	42	84
15	Trichloroethylene	2.7	5.4	81	160
16	Vinyl Chloride	---	0.5	525	1060
17	Total Xylenes	---	1750	---	---
18	Methyl Tertiary Butyl Ether (MTBE)	---	13	---	---
19	Total Petroleum Hydrocarbons (TPH)	---	---	---	---
20	Ethylene Dibromide (1,2-Dibromoethane)	---	0.05	---	---
21	Trichlorotrifluoroethane	---	1200	---	---
22	Total Residual Chlorine[2]	---	0.0	---	0.0

Notes for Table F-6:

[1] Receiving waters which are sources of drinking water are surface waters with the existing or potential beneficial use of Municipal and Domestic Supply, and/or Groundwater Recharge.

[2] The total residual chlorine requirement is defined as below the limit of detection in standard test methods defined in the latest USEPA approved edition of *Standard Methods for the Examination of Waste and Wastewater*.

5. Whole Effluent Toxicity (WET)

The Basin Plan requires dischargers to either conduct flow-through effluent toxicity tests or perform static renewal bioassays (Chapter 4, Acute Toxicity) to measure the toxicity of wastewaters and to assess negative impacts upon water quality and beneficial uses caused by the aggregate toxic effect of the discharge of pollutants. This Order retains the effluent limitation for whole effluent acute toxicity. Compliance evaluation with these limitations is based on 96-hour static-renewal bioassays. All bioassays shall be performed according to the USEPA-approved method in 40 CFR Part 136, currently *"Methods for Measuring the Acute Toxicity of Effluents and Receiving Water, 5th Edition."*

6. Final Effluent Limitations

The following table presents a summary of final effluent limitations for toxic pollutants established by this Order. The most stringent of the TBELs and WQBELs are established by the Order as final effluent limitations. For pollutants where the WQBEL is more stringent than the

TBEL, average monthly and maximum daily effluent limitations have been established, which is consistent with the SIP. When the TBEL is limiting, only an MDEL is established. For pollutants where the analytical detection limit is higher than the effluent limitation, the Regional Water Board shall deem a discharge out of compliance if the sample result is greater than the detection limit.

In summary, the effluent limitations contained in the previously issued Fuel and VOC General Permits (Regional Water Board Order Nos. R2-2006-0075 and R2-2009-0059) were the same except the residual chlorine effluent limit in the VOC General NPDES permit, which has been continued into this Order as summarized in Table F-7.

Table F-7. Summary of Final Effluent Limitations

No.	Compound	Discharge to Receiving Waters used as Drinking Water Source[1]		Discharge to Other Receiving Waters	
		AMEL (µg/L)	MDEL (µg/L)	AMEL (µg/L)	MDEL (µg/L)
1	Benzene	---	1	---	5
2	Carbon Tetrachloride	0.25	0.5	4.4	5
3	Chloroform	---	5	---	5
4	1,1-Dichloroethane	---	5	---	5
5	1,2-Dichloroethane	0.38	0.5	---	5
6	1,1-Dichloroethylene	0.057	0.11	3.2	5
7	Ethylbenzene	---	5	---	5
8	Methylene Chloride	4.7	5	---	5
9	Tetrachloroethylene	0.8	1.6	---	5
10	Toluene	---	5	---	5
11	Cis-1,2-Dichloroethylene	---	5	---	5
12	Trans-1,2-Dichloroethylene	---	5	---	5
13	1,1,1-Trichloroethane	---	5	---	5
14	1,1,2-Trichloroethane	0.60	1.2	---	5
15	Trichloroethylene	2.7	5	---	5
16	Vinyl Chloride	---	0.5	---	1
17	Total Xylenes	---	5	---	5
18	Methyl Tertiary Butyl Ether (MTBE)	---	5	---	5
19	Total Petroleum Hydrocarbons (TPH)	---	50	---	50
20	Ethylene Dibromide (1,2-Dibromoethane)	---	0.05	---	5
21	Trichlorotrifluoroethane	---	5	---	5
22	Total Residual Chlorine[2]	---	0.0	---	0.0

Notes:
[1] Receiving waters which are sources of drinking water are surface waters with the existing or potential beneficial use of Municipal and Domestic Supply, and/or Groundwater Recharge.
[2] Limitation defined as below the limit of detection using standard test methods defined in the latest USEPA approved edition of *Standard Methods for the Examination of Waste and Wastewater*

7. Anti-backsliding and Antidegradation

Effluent limitations in this Order comply with anti-backsliding and antidegradation requirements because all effluent limitations are as least as stringent as the limitations contained in the previously issued Fuel and VOC General Permits.

E. Reclamation Specifications

Reclamation or Reuse Specifications are retained from the previously issued Fuel and VOC General Permits. Reclamation specifications are required because reuse of treated groundwater is a preferred method of disposal. The basis for these requirements is Resolution No. 88-160.

V. RATIONALE FOR RECEIVING WATER LIMITATIONS

A. Surface Water Limitations

Receiving water limitations V.A.1 and V.A.2 are based on narrative and numeric WQOs in Basin Plan Chapter 3.

Receiving water limitation V.A.3 is a more general requirement intended to protect receiving water quality based on water quality standards not expressly addressed in this Order and Fact Sheet. It is retained from the previously issued Fuel and VOC permits and requires compliance with all federal and State water quality standards established pursuant to the CWA.

B. Groundwater Limitations

Groundwater limitations are in section 3.4 of the Basin Plan.

VI. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

NPDES regulations at 40 CFR 122.48 require that all NPDES permits specify monitoring and reporting requirements. California Water Code (CWC) sections 13267 and 13383 also authorize the Regional Water Board to require technical and monitoring reports. This Monitoring and Reporting Program establishes monitoring and reporting requirements that implement federal and State regulations.

The principal purposes of a monitoring program are to:

- Document compliance with waste discharge requirements and prohibitions established by the Regional Water Board,
- Facilitate self-policing by the Discharger in the prevention and abatement of pollution arising from waste discharge,
- Develop or assist in the development of limitations, discharge prohibitions, national standards of performance, pretreatment and toxicity standards, and other standards, and

- Prepare water and wastewater quality inventories.

The Monitoring and Reporting Program is a standard requirement in almost all NPDES permits issued by the Regional Water Board, including this Order. It contains definitions of terms and sets out requirements for reporting of routine monitoring data in accordance with NPDES regulations, the CWC, and State and Regional Water Board policies. The Monitoring and Reporting Program also defines the sampling stations and frequency, the pollutants to be monitored, and additional reporting requirements. Pollutants to be monitored include all parameters for which effluent limitations are specified. Monitoring for additional constituents, for which no effluent limitations are established, is also required to provide data for future completion of RPAs.

The following provides the rationale for the monitoring and reporting requirements contained in the Monitoring and Reporting Program for this facility.

A. Influent Monitoring

The purpose of influent monitoring is to provide documentation that pollutant loadings are below the level that the treatment system was designed for and to provide a warning if one or more new pollutants are being extracted that the as-built treatment system was not designed to remove. All influent monitoring requirements are retained from the previous Fuel General Permit and the VOC General Permit. If there is a discrepancy in monitoring frequency between the two General Permits, the more frequent requirement was retained.

B. Effluent Monitoring

The purpose of effluent monitoring is to provide documentation that the treatment system adequately removed all pollutants of concern in compliance with the limitations contained in the Order. Effluent monitoring data can also indicate if one or more pollutants are detected at levels less than effluent limits, but greater than trigger levels, which may indicate poor maintenance or other unexpected problems. All effluent monitoring requirements are retained from the previous Fuel General Permit and the VOC General Permit. If there is a discrepancy in monitoring frequency between the two General Permits, the more frequent requirement was retained.

C. Whole Effluent Toxicity Testing Requirements

The selected test species and frequency of testing are the same as previously issued Fuel and VOC General Permits and appropriately cost effective for the Dischargers covered under this Order.

D. Receiving Water Monitoring

The purpose of receiving water monitoring is to provide documentation about the condition of the receiving water should any effluent limit violations occur that may harm the life in the receiving water. The receiving water monitoring frequency is the same as previously issued Fuel and VOC General Permits.

E. Other Monitoring Requirements

The purpose of additional monitoring requirements is to investigate complaints, identify the discharges that should be regulated by individual NPDES permits, coordinate stormwater monitoring with municipalities, and quantify potential impacts of extracted and treated groundwater discharge on the receiving water and the ambient conditions of the receiving waters.

F. Reporting Requirements

Reporting requirements are included in the Monitoring and Reporting Program. The reporting requirements establish requirements for report submittal format.

VII. RATIONALE FOR PROVISIONS

A. Standard Provisions (Provision VI.A)

Standard Provisions, which in accordance with 40 CFR 122.41and 122.42 apply to all NPDES discharges and must be included in every NPDES permit, are provided in Attachments D of this Order. 40 CFR 122.41(a)(1) and (b) through (n) establish conditions that apply to all state-issued NPDES permits. These conditions must be incorporated into the permits either expressly or by reference. 40 CFR 123.25(a)(12) allows the state to omit or modify conditions to impose more stringent requirements. In accordance with 40 CFR 123.25, this Order omits federal conditions that address enforcement authority specified in 40 CFR 122.41(j)(5) and (k)(2) because the CWC enforcement authority is more stringent. In lieu of these conditions, this Order incorporates by reference CWC section 13387(e).

B. Monitoring and Reporting Program Requirements (Provision VI.B)

The Discharger is required to monitor the permitted discharge in order to evaluate compliance with permit conditions. Monitoring requirements are contained in the Monitoring and Reporting Program (Attachment E), and Standard Provisions (Attachment D). This provision requires compliance with these documents and is authorized by 40 CFR 122.41(h) and (j), and CWC sections 13267 and 13383.

C. Special Provisions (Provision VI.C)

1. **Reopener Provisions.** These reopener provisions are based on 40 CFR 122.63 and allow modification of this Order and its effluent limitations as necessary in response to updated WQOs, regulations, or other new relevant information that may be established in the future and other circumstances allowed by law.

2. **Notice of Intent (NOI) Application.** Provision VI.C.2, Notice of Intent (NOI) Application, is based on 40 CFR 122.28(b).

3. **NOI Review.** Provision VI.C.3, NOI Review, is based on 40 CFR 122.28(b).

4. **Discharge Authorization.** Provision VI.C.4, Discharge Authorization, is based on 40 CFR 122.28(b).

5. **Non-Compliance is a Violation.** Provision VI.C.5, Non-Compliance is a Violation, is based on 40 CFR 122.41(a).

6. **Triggers.** Dischargers authorized under this Order are expected to use BAT and treat their fuel or VOC pollutants to non-detectable levels. Some compounds other than pollutants with

effluent limitations may be detected in the effluent of some of the treatment systems, however. These pollutants include both organic and inorganic compounds. The purpose of these provisions is to require Dischargers to do additional activities should any pollutants exceed the triggers in Table F-8. These triggers are not effluent limitations, and must not be construed as such. Instead, they are levels at which additional investigation is warranted to determine whether a numeric limit for a particular constituent is necessary. Unless explained in a note, the concentration-based triggers in Table F-8 are set at the minimum applicable criterion, as determined from State MCLs, federal MCLs, CTR criteria, or Basin Plan WQOs. The reason for this approach is explained in section IV of this Fact Sheet, and further explained below.

a. **Triggers for Inorganic Compounds.** Antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc (hereinafter called inorganic compounds) are present in fuel- or VOC-cleanup discharges, primarily due to background concentrations in the shallow groundwater being remediated. The discharge volume and concentrations of inorganic compounds concentrations in the effluent are relatively low. The Regional Water Board has concluded that Bay-wide inorganic compounds loading from fuel- or VOC-cleanup discharges represent a very small portion of total inorganic compounds loadings from sources within the Region (including municipal and industrial point source discharges and stormwater discharges), and, therefore, shall cause no impairment of beneficial uses or potential exceedances of inorganic compounds objectives in receiving waters.

   Facilities where inorganic compounds have adversely impacted groundwater are not eligible for coverage under this Order. Each Discharger shall submit, as part of the NOI application for proposed discharge, analytical results including inorganic compounds concentrations in the influent and effluent, if available, or maximum concentrations in any individual extraction wells, if not operating yet. Based on these data, the Discharger may receive a discharge authorization letter. In some cases after starting up an extraction and treatment system, the effluent concentration of some inorganic compounds may exceed the triggers listed in Table F-8. In this case, the Discharger shall take three additional samples and have them analyzed for the inorganic compound of concern and comply with the Provisions VI.C.7, VI.C.8, or VI.C.9.

   Triggers for copper and nickel have been updated in the General Permit from the previous Fuel General Permit to reflect the recently adopted SSOs and SSTs for copper throughout San Francisco Bay, and the SSOs and SSTs for nickel in the South Bay.

b. **Triggers for Organic Compounds.** Dischargers authorized under this Order are expected to use BAT and treat their VOC pollutants to non-detectable levels. Sites where pesticides or other conservative pollutants have adversely impacted groundwater are not eligible for coverage under this Order. Each Discharger shall submit, as part of the NOI application for proposed discharge, analytical results including volatile and semi-volatile organic compounds concentrations in the influent and effluent if available or maximum concentrations in any individual extraction wells, if not operating yet. In addition, each Discharger shall submit a report, to the satisfaction of Executive Officer, certifying the

adequacy of the proposed treatment system in removal of all organic pollutants of concern. Based on these data and information, the Discharger may receive a discharge authorization letter. However, some organic compounds, other than pollutants with effluent limitations, may be detected in the effluent of some of the treatment systems. This could be due to the movement of the contaminated groundwater from a neighboring site into the capture zone of the treatment facility authorized under this permit. Table F-8 contains concentration-based triggers for conducting additional activities for a list of pollutants reported by Dischargers or listed in the CTR. This provision would allow Dischargers to continue groundwater cleanup while investigating the ability to treat any detected volatile or semi-volatile organic compounds, in excess of Table F-8 triggers.

Table F-8. Basis for Table 3 Trigger Compounds

Pollutant	CAS Number	Minimum State/Federal MCL (µg/L)	Minimum Basin Plan Criteria[1] (µg/L)	Minimum CTR Criteria[1] (µg/L)	Trigger[1][7] (µg/L)
Antimony	7440360	6	---	14	6
Arsenic	7440382	10	36	36	10
Beryllium	7440417	4	---	---	4
Cadmium	7440439	5	1.1	2.5	1.1
Chromium (VI)	18540299	---	11	11	11[2]
Copper[3]	7440508	1000	5.9	---	5.9
Copper[4]	7440508	1000	3.4	---	3.4
Copper[5]	7440508	1000	4.7	---	4.7
Lead	7439921	15	3.2	3.2	3.2
Mercury	7439976	2	0.025	0.050	0.025
Nickel[3]	7440020	100	30	30	30
Nickel[4]	7440020	100	13	13	13
Nickel[5]	7440020	100	19	19	19
Selenium	7782492	50	---	5	5
Silver	7440224	100	2.2	2.2	2.2
Thallium	7440280	2	---	1.7	1.7
Zinc	7440666	5000	86	86	86
Cyanide	57125	150	2.9	5.2	2.9
2,3,7,8-TCDD	1746016	0.00003	---	1.3E-08	1.3E-08
Acrylonitrile	107131	---	---	0.059	0.059
Bromoform	75252	80	---	4.3	4.3
Chlorodibromomethane	124481	80	---	0.401	0.401
Dichlorobromomethane	75274	80	---	0.56	0.56
1,2-Dichloropropane	78875	5	---	0.52	0.52
1,3-Dichloropropylene	542756	0.5	---	10	0.5
1,1,2,2-Tetrachloroethane	79345	1	---	0.17	0.17
Pentachlorophenol	87865	1	---	0.28	0.28
2,4,6-Trichlorophenol	88062	---	---	2.1	2.1
Benzidine	92875	---	---	0.00012	0.00012
Benzo(a)anthracene	56553	---	---	0.0044	0.0044
Benzo(a)pyrene	50328	0.2	---	0.0044	0.0044
Benzo(b)fluoranthene	205992	---	---	0.0044	0.0044
Benzo(k)fluoranthene	207089	---	---	0.0044	0.0044
Bis(2-chloroethyl)ether	111444	---	---	0.031	0.031
Bis(2-ethylhexyl)phthalate	117817	---	---	1.8	1.8
Chrysene	218019	---	---	0.0044	0.044

Pollutant	CAS Number	Minimum State/Federal MCL (µg/L)	Minimum Basin Plan Criteria[1] (µg/L)	Minimum CTR Criteria[1] (µg/L)	Trigger[1][7] (µg/L)
Dibenzo(a,h)anthracene	53703	---	---	0.0044	0.0044
3,3'-Dichlorobenzidine	91941	---	---	0.04	0.04
2,4-Dinitrotoluene	121142	---	---	0.11	0.11
1,2-Diphenylhydrazine	122667	---	---	0.040	0.040
Hexachlorobenzene	118741	1	---	0.00075	0.00075
Hexachlorobutadiene	87683	---	---	0.44	0.44
Hexachloroethane	67721	---	---	1.9	1.9
Indeno(1,2,3-c,d)pyrene	193395	---	---	0.0044	0.0044
N-nitrosodimethylamine	62759	---	---	0.00069	0.00069
N-nitrosodi-n-propylamine	621647	---	---	0.005	0.005
Aldrin	309002	---	---	0.00013	0.00013
alpha-BHC	319846	---	---	0.0039	0.0039
beta-BHC	319857	---	---	0.014	0.014
gamma-BHC	58899	0.2	---	0.019	0.019
Chlordane	57749	0.1	---	0.00057	0.00057
4,4-DDT	50393	---	---	0.00059	0.00059
4,4-DDE	72559	---	---	0.00059	0.00059
4,4-DDD	72548	---	---	0.00083	0.00083
Dieldrin	60571	---	---	0.00014	0.00014
alpha-Endosulfan	959988	---	---	0.0087	0.0087
beta-Endosulfan	33213659	---	---	0.0087	0.0087
Endrin	72208	2	---	0.0023	0.0023
Endrin aldehyde	7421934	---	---	0.76	0.76
Heptachlor	76448	0.01	---	0.00021	0.00021
Heptachlor epoxide	1024573	0.01	---	0.00010	0.00010
PCBs, sum	1336363	0.5	---	0.00017	0.00017
Toxaphene	8001352	3	---	0.0002	0.0002
1,4-dioxane	123911	3	---	---	3
Turbidity (NTU)	---	5	---	---	5
Odor-Threshold (Units)	---	3	---	---	3
TPHs (other than gasoline and diesel)	---	---	---	---	50[6]
Sulfate	---	250,000	---	---	250,000
Foaming agents	---	500	---	---	500
Color (units)	---	15	---	---	15

Notes for Table F-8:
[1] Unit is µg/L unless noted otherwise right after the name of pollutant
[2] If total chromium concentration exceeds 11 µg/L, then analysis for chromium(VI) shall also be conducted
[3] Applicable to Suisun Bay and San Pablo Bay segments of San Francisco Bay.
[4] Applicable to Central Bay and Lower Bay segments of San Francisco Bay.
[5] Applicable to South San Francisco Bay, south of Hayward Shoals.
[6] Trigger value based on Regional Water Board staff BPJ. If a discharger is reporting monitoring data with a detection level higher than 50 µg/L, the reason for the higher detection level shall be fully explained within the monitoring report.
[7] If a discharger is reporting non-detect monitoring data with a reporting level higher than the trigger, the reason for the higher detection level shall be consistent with the SIP Appendix 4 required minimum levels (please refer to our web site for the latest version of SIP) and must be explained within the monitoring report.

8. **Individual NPDES Permit May Be Required.** Provision VI.C.11 is retained from the previously issued Fuel and VOC General Permits and is based on 40 CFR 122.28(b)(3).

9. **Treatment Reliability Requirement.** Provision VI.C.12, Treatment Reliability, is mostly based on 40 CFR 122.41. The basis for the requirement for a certified engineer to oversee the treatment and operation of the treatment system is to ensure that qualified professionals perform this work. Service stations operators are generally not qualified for this technical level of oversight.

VIII. PUBLIC PARTICIPATION

The Regional Water Board is considering the reissuance of general waste discharge requirements (GWDRs) that will serve as a General NPDES Permit. As a step in the GWDRs adoption process, the Regional Water Board has developed tentative GWDRs. The Regional Water Board encourages public participation in the GWDR adoption process.

A. Notification of Interested Parties

The Regional Water Board has notified the Dischargers and interested agencies and persons of its intent to prescribe GWDRs for the discharge and has provided them with an opportunity to submit their written comments and recommendations. Notification was provided through the Recorder on December 12, 2011.

B. Written Comments

Staff determinations are tentative. Interested persons are invited to submit written comments concerning this Order. Comments should be submitted either in person or by mail to the Executive Officer at the Regional Water Board at the address above on the cover page of this Order.

To be fully responded to by staff and considered by the Regional Water Board, written comments should be received at the Regional Water Board offices by 5:00 p.m. on January 12, 2012**.**

C. Public Hearing

The Regional Water Board will hold a public hearing on the tentative WDRs during its regular Board meeting on the following date and time and at the following location:

Date:	February 8, 2012
Time:	9:00 a.m.
Location:	Elihu Harris State Building (1st Floor auditorium) 1515 Clay Street (Walking distance from City Center 12th Street BART station) Oakland, CA 94612

Interested persons are invited to attend. At the public hearing, the Regional Water Board will hear testimony, if any, pertinent to the discharge, GWDRs, and permit. Oral testimony will be heard; however, for accuracy of the record, important testimony should be in writing.

Please be aware that dates and venues may change. Our web address is http://www.waterboards.ca.gov/sanfranciscobay where you can access the current agenda for changes in dates and locations.

D. Waste Discharge Requirements Petitions

Any aggrieved person may petition the State Water Resources Control Board to review the decision of the Regional Water Board regarding the final GWDRs. The petition must be submitted within 30 days of the Regional Water Board's action to the following address:

State Water Resources Control Board
Office of Chief Counsel
P.O. Box 100, 1001 I Street
Sacramento, CA 95812-0100

E. Information and Copying

Report of Waste Discharges, related documents, tentative effluent limitations and special provisions, comments received, and other information are on file and may be inspected at the address above during regular office hours, which are generally weekdays from 8:00 a.m. to 5:00 p.m., excluding 12:00 p.m. to 1:00 p.m. lunch hours and holidays. Copying of documents may be arranged through the Regional Water Board by calling (510) 622-2300.

F. Register of Interested Persons

Any person interested in being placed on the mailing list for information regarding the GWDRs and NPDES permit should contact the Regional Water Board, reference this facility, and provide a name, address, and phone number.

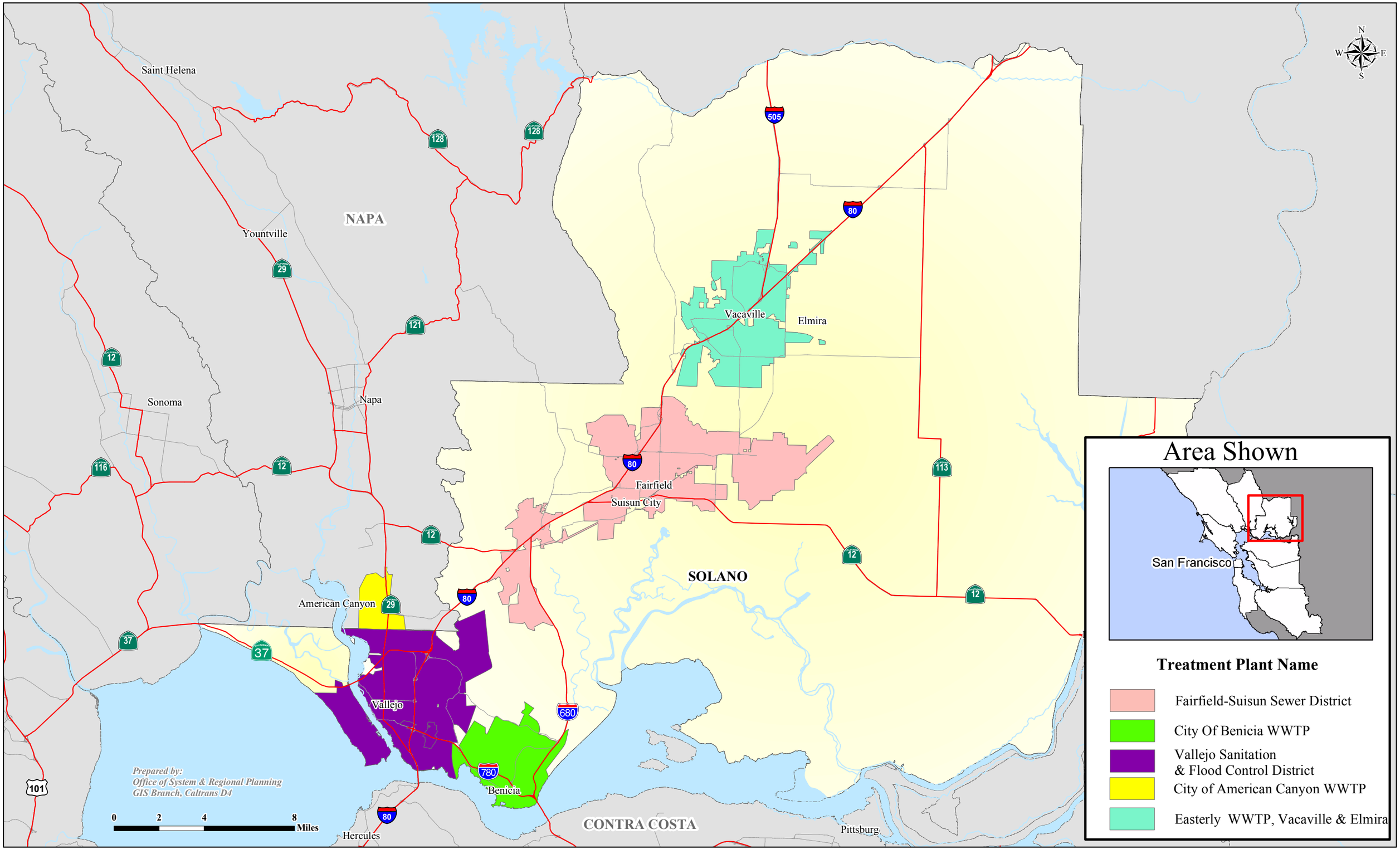
G. Additional Information

Requests for additional information or questions regarding this order should be directed to **Farhad Azimzadeh at (510) 622-2310 or by e-mail at fazimzadeh@waterboards.ca.gov.**

ATTACHMENT D

PUBLICLY-OWNED TREATMENT WORKS (POTW) FACILITY INFORMATION

Solano County - POTW Service Areas



	City Discharger	Treatment Plant Name	WDR Discharger Name	Discharger Contact Name	Contact Phone No.	Contact Email	Mail Address	Ct Contact for Groundwater & De-Watering Discharges	Service Area of the POTW
95	Fairfield-Suisun Sewer District Subregional WWTP	Fairfield-Suisun Sewer District Subregional WWTP	Fairfield-Suisun Sewer District Subregional WWTP	Larry Bahr	707-429-8930	lbahr@fssd.com		Contact either Donna Dessoir or Dennis Ariza @ 707-429-8930. One year permit for $100, and .05 per Gallon fee see 17 page fax of 6/28/04	Per Larry Bahr:"this is the treatment plant (with a few very minor exceptions) for the corporate limits of the cities of Fairfield and Suisun
96			City of Fairfield	James Prichard	707-428-7415	jpritchard@ci.fairfield.ca.us	James pritchard, Sewer Maintenance Manager, City of Fairfield, 420 Gregory St., Fairfield, CA 94533	Same as Fairfield-Suisun - see line # A - 95	Sends their WW to Fairfield-Suisun - see Line # A -95
97			City of Suisun City	Gary Cullen	707-421-7340	gcullen@suisun.com	Gary Cullen, City Engineer, City of Suisun City, 701 Civic Center Blvd., Suisun City, CA 94585	Same as Fairfield-Suisun - see line # 95	Sends their WW to Fairfield-Suisun - see Line # A -95
98	City of Benicia WWTP	City of Benicia WWTP	City of Benicia WWTP	John Bailey	707-746-4336	bailey@ci.benicia.ca.us	John Bailey, 614 East 5th Street, Benicia, CA 94510	Contact: John Bailey @ 707-746-4294 (or Vicki Shidell (4295) or Peter Fong. Per J.B.: "case-by-case, but DO allow, willing to accommodate. Permit, testing, and sampling are all required	The City of Benicia - "possibly some small unincorporated areas of Solano Co. - but all of our customers have Benicia addressses…"
99	Vallejo Sanitation & Flood Control District	Vallejo Sanitation & Flood Control District	Vallejo Sanitary & Flood Control District	Daniel Tafolla	707-644-8949 x261	dtafolla@vsfcd.com	Daniel Tafolla, Environmental Services Director, 450 Ryder St., Vallejo, CA 94590	Contact Doug Scott @ 707-644-8949 x 260 Has worked with Ct on 37/29 project - "if uncontaminated can go to the storm sewer" Has permit and testing process - every situation is special	City of Vallejo, Mare Island, Hiddenbrooke Golf Course and "a few other small pockets"
100	Mare Island	Mare Island	City of Vallejo	John Cerini; Mark Akaba	707-648-4302	akaba@ci.vallejo.ca.us., jcerini@ci.vallejo.ca.us	Mark Akaba, Utility Director, 555 Santa Clara St., Vallejo, CA 94590	Same as Vallejo Sanitary & Flood Control District - see Line # A - 99	Same as Vallejo Sanitary & Flood Control District - see Line # A - 99

ATTACHMENT E

SITE INVESTIGATION REPORT

Please refer to the "Site Investigation Report" in the Project Information Handout