FOR CONTRACT NO. 07-4S8404
PROJECT NO. 0700001000

INFORMATION HANDOUT

Geotechnical Design Recommendations for Retaining Wall

Control System Narrative

Route 105 Dewatering System Transition Plan Garfield Treatment Facility

ROUTE: 07-LA-105-R14.3

FOR CONTRACT NO. 07-4S8404
PROJECT NO. 0700001000

INFORMATION HANDOUT

Geotechnical Design Recommendations
for
Retaining Wall

OUTE: 07-LA-105 R14.3

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Shafiqul Islam
District 7 Maintenance

Date: May 13, 2010

Attn.: Cynthia Chang/ Dana Hendrix

File: 07-LA-105 PM 14.3
EA 4S8401
I-105 Groundwater Treatment
System Modification

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 1

Subject: Geotechnical Design Recommendations for Retaining Wall

Introduction

This memorandum presents the geotechnical design recommendations for the proposed retaining wall between Vessel E-2 and Vessel E-3 at the East Water Treatment Plan at above-mentioned location.

The recommendations provided herein are based on:

- Site visit on March 29, 2010
- Discussion with the District Maintenance Engineers
- Review of Foundation Recommendations and Log of Test Boring (LOTB) by Caltrans for the Garfield Pumping Plant project
- Review of available part of CCO #7 As-Built Plan for EA 07-195004 provided by the District Maintenance
- Review of proposed site plan provided by the District Maintenance

No additional subsurface exploration has been conducted at the site for the proposed retaining wall.

Project Description

According to the proposed site plan, the proposed retaining wall would be approximately 55 feet long with height of approximately 14 feet, and the angle of the slope behind the proposed wall would be approximately 20 degrees.

The existing material at the proposed retaining wall is fill material, considering two buried pipes (10-inch and 14-inch) exist at the area of the proposed retaining wall. However, there is no record available to confirm that it is structural back fill.

According to the District Maintenance, the existing retaining wall for Vessel E-03 thru E-06 at East Water Treatment System is Caltrans Standard Type 1 retaining wall.

Geotechnical Recommendations

Based on the observations during site visits and the information provide by the District, the geotechnical recommendations are made as follows:

- Caltrans Standard Type 1 Retaining Wall with Spread Footing can be used under the following conditions:
    - Caltrans Standard Plans (May 2006) shall be used.
    - The spread footing shall be horizontal.
    - 3 feet over-excavation below the bottom of spread footing is required, and the over-excavation backfill shall be structure fill compacted to a relative compaction of 95 percent according to Standard Specifications (May 2006)
    - A minimum cover of 1.5 feet of fill is required over the top of footing.

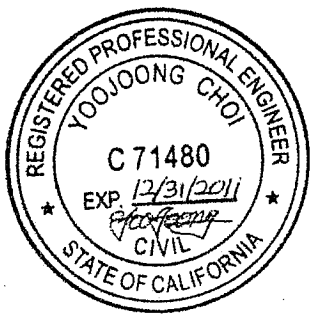
- Due to lack of corrosion tests on the project site materials, the project site should be conservatively considered as corrosive, and the thickness of the concrete cover should be increased accordingly.

Construction Considerations

- Temporary shoring system should be used during construction of the proposed retaining wall.
- The Log of Test Boring (LOTB) by Caltrans for the Garfield Pumping Plant indicates that groundwater was encountered at elevation of 39.2 feet at the time of boring (July 7, 1987). Based on this information, groundwater should not be a major concern during the construction. However, it should be noted that groundwater can fluctuate due to seasonal and climate variations.
- We assume that the existence of two buried pipes (10-inch and 14-inch) will not affect construction of the proposed retaining wall.

If you have any questions, please contact me at 916-227-5241 or Thang Le at 916-227-5390.

Prepared by Date: 5/13/2010



YOOJOONG CHOI, Ph.D., P.E.
Transportation Engineer - Civil
Branch A

cc: District Project Manager
GS Corporate
District Construction R.E Pending File
District Materials Engineer

1 GENERAL

The California Department of Transportation (CalTrans) is upgrading the groundwater dewatering and treatment facility located in Paramount, Ca, just east of the intersection of the I-710 and I-105 freeways. This document describes the Programmable Logic Controller (PLC) based control system that will be implemented at the Garfield Pump House (Pump House) to monitor and control both the East Treatment System and ten dedicated Well Heads.

1.1 System Description

The I-105 Groundwater Dewatering and Treatment System (I-105 System) is designed to extract groundwater from 13 dewatering wells (ID-01 through ID-13). Currently, three of the dewatering wells (ID-01, ID-02, and ID-13) are not being used to control groundwater levels. Extracted groundwater is treated either at the West (ID-01 through ID-04) or the East (ID-05 through ID-13) Treatment Systems using granular activated carbon (GAC) filters prior to being discharged to the Los Angeles (LA) River. Upgrades to the I-105 System generally include redirecting all extracted groundwater to the East Treatment System, installation of two bag filters at the East Treatment System, and upgrading the monitoring and control system. The I-105 System's central point is the Pump House, located along the north side of I-105. The purpose of the groundwater dewatering system is to keep the groundwater level at least 3.5 feet below the roadway surface.

1.1.1 Garfield Pump House

The Garfield Pump House will contain the system's PLC based Main Control Panel (MCP) and Human Machine Interface (HMI) computer, and is collocated with the East Treatment System. The upgraded I-105 System will pump groundwater from the Well Heads to the East Treatment System where it will pass through two Bag Filters (BF-01/BF-02) and six Carbon Vessel Filters (E-01 – E-06) before being discharged.

The East Treatment System portion of the control system is passive as it only monitors, records, trends and alarms based on system flows and pressures.

1.1.2 Well Heads

There are thirteen well heads dedicated to the Pump House. Well Heads ID-01 through ID-04 are located west of the Pump House and ID-05 through ID-13 are located east of the Pump House. At this time, and for this project, only ten (10) Well Heads will be integrated into the system. Well Heads ID-01, ID-02 and ID-13 are not operational and do not form part of the project scope.

A 'Well Head' consists of a Control Well and a Dewatering Well. At each Well Head, an intelligent Variable Frequency Drive (VFD) will power a 25 horsepower submersible pump located in the dewatering well. Control and Dewatering well levels, pump head pressure and pump outlet flow are monitored locally by the intelligent VFD and the information is sent to the MCP PLC located in the Pump House over the communication network.

Local Control (at each Well Head) and Remote Control (from the MCP/HMI) shall both be provided for each of the 10 active Well Heads.

2 CONTROL SYSTEM

The upgrade incorporates electrical and control upgrades for East Treatment System lighting, sump pumps, and PLC based control system. The objectives of the PLC based control system are to monitor the East Treatment System, provide local and remote control of the Well Heads and to provide HMI functionality for the system with alarming, logging, trending and operator interface.

Coordination for a broadband internet service is required by the bidding contractor in cooperation with Caltrans. The HMI interface must be accessible via the broadband connection for offsite monitoring of system status.

2.1 Control System Operation

A new PLC based control system and computer based HMI will be installed in the Pump House. The PLC will monitor flow and pressure in the East Treatment System and will provide remote control and monitoring of the 10 active Well Heads. In addition to monitoring and control, the control system will trend system variables, alarm when setpoints are exceeded and provide a central location for remote Well Head operation.

2.1.1 East Treatment Control 'Monitoring' System

The project includes water flow and pressure monitoring, recording and trending of the East Treatment System as described below:

- East Treatment Water Flow
  The control system monitors the following parameters.
  - West Influent Flow (FIQT-4401) and West Influent Pressure (PT-4401) monitor water being pumped from ID-03 and ID-04 located west of the Pump House.
  - East Influent Flow (FIQT-4601) and East Influent Pressure (PT-4602) monitor water being pumped from ID-05 through ID-12 located east of the Pump House.
- Bag Filter Pressures
  The control system will compare these two values to provide a calculated differential pressure across each filter; thereby enabling proper changing of bag filters and alarming on high differential pressure conditions.

- Bag Filter 1 (BF-1) Infeed Pressure (PT-4501) and BF-1 Outfeed Pressure (PT-4502) monitor the water pressure associated with BF-1.
- Bag Filter 2 (BF-2) Infeed Pressure (PT-4511) and BF-2 Outfeed Pressure (PT-4512) monitor the water pressure associated with BF-2.

2.1.2 Well Heads

An intelligent VFD and dedicated Local User Interface (LUI), located at each Well Pump Control Station, receives process information from the local instrumentation and communicates it back to the MCP in the Pump House via the communication network. In addition, the VFD receives control signals (Off/On, Speed Reference) from the MCP in Remote Mode. Note that LUI and Human Interface Module (HIM) may be used interchangeably in the specifications and plans.

The LUI provides a local interface to the VFD and enables operators to place the VFD in Local Control Mode or Remote Control Mode, described in section 2.1.4.

The project includes replacing the Control Well and Dewatering Well level monitoring instruments, Dewatering Pump Flow instrument and Head Pressure instrument at each of the 10 active Well Head sites. Well Head ID-03 is described below, and Well Heads ID-04 through ID-12 are duplicates of ID-03, with their identification number being the only change:

- Well Water Levels
  - Control Well Water Level (LT-0301) and Dewatering Well Water Level (LT-0302) are submersible 'pressure' type transducers located in the wells that provide an analog signal corresponding to water level to the VFD that is communicated to the MCP.
- Dewatering Pump Pressure and Flow
  - Dewatering Pump Pressure (PT-0301) and Dewatering Pump Flow (FT-0301) provide analog signals to the VFD that are communicated to the MCP.
  - Dewatering Pump Flow Totalization Pulse (FQ-0301) is a discrete signal from the flow transmitter to the VFD, also relayed to the MCP.

2.1.3 Garfield Pump House

The Pump House will house the MCP and HMI, and serve as the interface point to the system for the broadband internet service. The new PLC based MCP will be installed in this location, along with the HMI Keyboard, Video monitor and Mouse. A 'KVM' bulkhead on the MCP provides the access point for the HMI operator interface devices.

In addition to the new control system, site lighting and two self-contained sump pumps will also be installed at the Pump House.

2.1.4 Modes of Operation

Three modes of operation will be implemented for the Well Heads: Local Manual, Remote 'SCADA' Manual and Remote Automatic; each is described below:

- Local Control - Manual

  An operator must place a Well Head in Local Control via the VFD's dedicated LUI. This mode of operation allows local control of a Well Head pump by an operator located at the Well Head. It can be used for testing and also be used if communication is lost to the MCP, during a power outage at Pump House or if the PLC fails. Note this is the current mode of operation at the Well Heads.

  In Local Control, the operator has manual control to start/stop the pump and adjust its speed via the LUI. A local display will provide feedback of the Control Well Level. When in Local Control, the VFD will send a signal to the MCP PLC indicating that it is in Local Control, its speed and when it is running or stopped. The HMI in the Pump House will display this information and warn operators viewing the HMI that a Well Head is in Local Control.

  Note that in Local Control, the MCP PLC does not have control of the Dewatering Well Pump; rather, the local LUI module is used to control operation. No process interlocks are active in Local Mode.

- Remote Control

  An operator must place a Well Head in Remote Control via the VFD's dedicated LUI Module. When in Remote Control, the VFD will send a signal to the MCP PLC indicating that it is in Remote Control, its speed, alarm/fault status and when it is running or stopped. The HMI in the Pump House will display this information.

  Once in Remote Control, the operator can select either Remote Control Manual Mode or Remote Control Automatic Mode from the HMI. Both are described below:

  - Remote Control - Manual

    This mode of operation allows remote control of a Well Head pump by an operator located at the Garfield Pump House HMI. Often referred to as SCADA manual, the mode allows an operator to start/stop the pump and adjust its speed via the HMI computer.

    Note that in Remote Control Manual Mode, the PLC level control loop is disabled; however, the Dewatering Well Level permissive/interlocks are active.

  - Remote Control - Automatic

    This is the recommended mode of operation of a Well Head as it adapts to changing conditions and protects the pump with the Dewatering Well Level permissive interlocks. In Remote Automatic, the MCP PLC uses Control Well Water Level as a permissive and to adjust the speed of the VFD.

- Dewatering Well Water Level Transmitter (LT-0351) provides an interlock to operate the Dewatering Pump. Dewatering Well Water Level must be above an operator settable water level setpoint below road surface or the pump will not be allowed to operate.
- Control Well Water Level Transmitter (LT-0301) provides the process variable that controls the speed of the Dewatering Pump. The PLC will adjust the pump speed to maintain the Control Well Water Level at setpoint, using a PI control loop.
    - Pump operation is limited to between 50% of rated Hz to 100%.
    - Pump operation is suspended when the water level in the Control Well is sufficiently below the setpoint that operation at 50% speed is not warranted.
    - Pump operation is resumed when the water level in the Control Well rises and operation at or above 50% speed is warranted.

2.2 Control System Signals

Control signals originate from system instrumentation and are communicated to the MCP. East Treatment System signals are monitored directly by the MCP PLC. Well Head signals are received at an intelligent VFD and communicated to the MCP PLC. In addition, the Well Head VFD receives control commands from the MCP PLC when in remote mode. Below is a summary of the external signals associated with the control system.

2.2.1 East Treatment System

- West Influent Flow (FIQT-4401) – water flow from ID-03 and ID-04
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as flow dependent upon pump operation and speed
- West Influent Pressure (PT-4401) – water pressure from ID-03 and ID-0-4
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as pressure dependent upon pump operation and speed
- East Influent Flow (FIQT-4601) – water flow from ID-05 through ID-12
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as flow dependent upon pump operation and speed
- East Influent Pressure (PT-4602) – water pressure from ID-05 through ID-12
    - Displayed on the HMI system screen, recorded and trended
    - No alarms, as pressure dependent upon pump operation and speed
- BF- 1 Infeed Pressure (PT-4501) and BF- 1 Outfeed Pressure (PT-4502)
    - Displayed on the HMI system screen, recorded and trended
    - Used in calculation of differential pressure across BF- 1

- Calculated BF- 1 Differential Pressure (DPI-4500)
  - Displayed on the HMI system screen, recorded and trended
  - Differential Pressure Alarm High (DPAH-4500) setpoint via the HMI, annunciated and logged
- BF- 2 Infeed Pressure (PT-4511) and BF- 2 Outfeed Pressure (PT-4512)
  - Displayed on the HMI system screen, recorded and trended
  - Used in calculation of differential pressure across BF- 2
- Calculated BF- 2 Differential Pressure (DPI-4510)
  - Displayed on the HMI system screen, recorded and trended
  - Differential Pressure Alarm High (DPAH-4510) setpoint via the HMI, annunciated and logged
- West Influent Flow Totalization Pulse (FQT-4401)
  - Discrete signal from flow meter
  - Totalized in Main Control Panel PLC
  - Total Well Head Flow displayed on HMI system screen
- East Influent Flow Totalization Pulse (FQT-4601)
  - Discrete signal from flow meter
  - Totalized in Main Control Panel PLC
  - Total Well Head Flow displayed on HMI system screen

2.2.2 Well Heads

The PLC in the MCP communicates to the ten active Well Head Intelligent VFDs via DeviceNET or equivalent communication protocol, in a trunk-and-tap configuration starting at ID--03 and extending to ID--12. Due to the total length of the network trunk, a bus expander is required at ID--08. Refer to the network communication drawing for more detail on the communication network.

Signals received from the Well Head (Where XX is 03 through 12 for each Well Head)

- Control Well Water Level (LT-XX01)
  - Displayed on the HMI Well Head screen, recorded and trends
  - Displayed on local Well Head display for local control
  - Out of Range Alarm, Level High Alarm and Level High-High Alarms
  - Used as Process Variable for VFD speed control loop in Remote Automatic
- Dewatering Well Water Level (LT-XX51)
  - Displayed on the HMI Well Head screen, recorded and trends
  - Out of Range Alarm and Low Level Alarm
  - Used as permissive interlock to VFD operation in both Remote Modes
  - Interlock setpoint can be adjusted from the HMI

- Well Head Pump Head Pressure (PT-XX01)
  - Displayed on HMI Well Head screen, recorded and trends
  - Out of Range Alarm
  - Low Pressure Alarm
    - Active only when pump operating
    - Setpoint initial value (10 psi) adjustable from HMI
- Well Head Pump Flow Rate (FT-XX01)
  - Displayed on HMI Well Head screen, recorded and trends
  - Out of Range Alarm only
  - Low Flow Alarm
    - Active only when pump operating
    - Setpoint initial value (10 gpm) adjustable from HMI
- Well Head Pump Flow Totalization Pulse (FQ-XX01)
  - Discrete signal from flow meter
  - Totalized in Main Control Panel PLC
  - Total Well Head Flow displayed on HMI Well Head screen
- Well Head Control Mode (HS-XX01)
  - Displayed on both HMI System and Well Head screens
  - Controlled via VFD LUI module, discrete signal
- Well Head Pump Running Status (YS-XX01)
  - Displayed on both HMI System and Well Head screens
- Well Head Pump Speed Feedback (ST-XX01)
  - Displayed on both HMI System and Well Head screens
  - Displayed on Well Head LUI for local control
- Well Head VFD Alarm Status (YA-XX01)
  - Displayed on both HMI System and Well Head screens
  - Annunciated and logged

<u>Signals sent to the Well Head (Remote Mode Only)</u>

- Pump Call To Run Command (YC-XX01)
  - Internal signal sent to Well Head VFD
  - Active in Remote Manual when called to run
  - Active in Remote Automatic when level control loop calls pump to run
- Pump Enabled Status (Text Display)
  - Displayed on both HMI System and Well Head screens
  - Active when pump is in Remote Automatic Mode
- Pump Speed Reference (SC-XX01)
  - Internal signal sent to Well Head VFD

- Controlled by operator in Remote Manual Mode
- Controlled by level control loop in Remote Automatic Mode
- Displayed on Well Head screen in Remote Automatic Mode

Signals displayed locally in either mode (Hardwired signals):
An array of three indicator lights (White, Green, & Amber) is mounted on top of each Well Head's MCC. Contractor is required to implement the following VFD discrete output control of these lights and install/correct/replace failed or missing lights:

- Local Power On Light (JIL-XX01)
  - Local Power On indicator light (white) is hardwired through a relay output on the VFD that is closed when the VFD has control power available. It is illuminated when control power is present.
  - It provides operators an external means of determining if a site is powered without opening the enclosures.
- Local Pump Running Light (YIL-XX01)
  - Local Pump Running indicator light (Green), is hardwired through a relay output contact on the VFD that is closed when the VFD's motor is operating and not illuminated when the VFD's motor is not operating.
  - It provides operator an external means of determining if a site's pump is running.
- Local VFD Fault/Alarm Light (YAL-XX01)
  - Local VFD Fault indicator light (Amber), is hardwired through a relay output contact on the VFD that is closed when the VFD is faulted or in alarm condition and is not illuminated when the VFD is not faulted or in an alarm condition.
  - It provides operators an external means of determining if a site's VFD has faulted.

3 HUMAN MACHINE INTERFACE (HMI)

Please refer to the Supervisory Control and Data Acquisition (SCADA) AND PLC Specification for more detailed information on the specific hardware and software associated with the HMI PC. This section provides information on the functionality of the HMI.

Monitoring and control is provided from the HMI located in the Pump House. Remote monitoring will be provided via internet access with user name/password protection to enable remote monitoring of the system; however, no control is to be provided via remote internet access to the Pump House MCP at this time. The capability for future remote control integration must be accounted for in the design and implementation of the system, at Caltrans discretion.

3.1 HMI Screens

As a minimum, the following screens will be provided to enable operators to monitor and control the I-105 Dewatering System. Navigation must be easy and intuitive for system operators. See Appendix A for screen examples.

3.1.1 System Screen

A system overview screen showing the East Treatment System, a summary of Well Head status and a starting point for system navigation. The screen should provide the following information and functionality:

- Status
  - East Treatment System Influent Flow Rates
  - East Treatment System Influent Flow Pressure
  - Bag Filter Pressure
  - Calculated Bag Filter Differential Pressure
    - Bag Filter Differential Pressure Alarm High
  - Well Head Array
    - Control Mode (Local / Remote)
    - VFD Status (Faulted / not faulted)
    - Pump Status (Running / Stopped)
    - Pump Speed (Hz or %)
    - Control Well Level (feet below road surface)
- Control
  - Ability to adjust Calculated Differential Pressure Alarm Setpoints
    - Bag Filter Differential Pressure Alarm High Setpoint

3.1.2 Well Head Screen

An indirect addressed screen for each of the 10 active sites. The screen should provide the following information and functionality:

- Status
  - Control Mode Status (Local, Remote Manual, Remote Automatic)
  - Pump operating status (Running, Stopped, Enabled)
  - Pump operating speed (Hz or %)
  - VFD Alarm / Fault status
  - Display analog parameters: Dewatering Well Level, Control Well Water Level, Pump Head Pressure, Pump Flow Rate
  - Display totalized Well Head Flow (from totalizer pulse signal)
- Control (using individual pump control popup screens)
  - Ability to switch between Remote Manual and Remote Automatic
  - Remote Manual Controls:
    - Ability to start / stop pump
    - Ability to adjust speed in Remote Manual (50% to 100%)
  - Remote Automatic Controls:
    - Ability to Enable pump operation – level control loop
    - Ability to adjust level control loop setpoint (feet below road surface)
  - Ability to monitor Pump speed and controlling water level on each control popup

3.1.3 Historical Trend Screen

The HMI Trend screen should provide the capability to monitor all analogs monitored by the system PLC, including all flows, pressures, levels, and other system variables. The trend screen must utilize ActiveX trend objects that communicate with the site historical database and logging software. The screen should provide the following functionality:

- Trend Control
  - Add/Remove analog variables during runtime, each with distinct pen colors
  - Modify trend time scale, and vertical engineering unit scale
  - Add commonly used variables for each remote well site and the primary treatment site with the click of a single button
  - Provide realtime/historic trend status with the click of a single button, where realtime trends continually update to the most recent data, and historic trends maintain the chosen time period.
  - Ability to save commonly used trend configurations to the local hard drive for later use.

3.1.4 Alarm Screen

The HMI Alarm screen should provide the capability to monitor all current and historical alarm information. All alarms are to be logged to a database on the HMI computer for historical retrieval and off site queries. The screen should provide the following functionality:

- Ability to switch between real time active alarms (Current alarms) and a historical alarm display with a single button.

- Current Alarm status
  - Ability to acknowledge and provide operator comments to alarms appearing on the alarm display
  - Current unacknowledged alarms to be shown in red
  - Current acknowledged alarms to be shown in blue
  - Cleared, unacknowledged alarms to be shown in black
  - Cleared, acknowledged alarms not shown

- Historical Alarm status
  - Ability to show a chronological list of past alarm activity, including generation, acknowledgement, clearing, and any comments entered by operators.
  - Current unacknowledged alarms to be shown in red
  - Current acknowledged alarms to be shown in blue
  - Cleared, unacknowledged alarms to be shown in black
  - Cleared, acknowledged alarms to be shown in grey

3.2 Reporting

Reports should be generated using the supplied Report generation software, and automatically generate once a day, in the following formats:

- PDF files generated and stored in a local folder on the Industrial SCADA Server
- Web reports visible on a web server integrated into the Industrial SCADA Server.

Generation of a daily Dewatering System Status Report shall include minimum, maximum, average, monthly, and yearly data values for each pump station water levels, flow rates, as well as the flow rates and system pressures.

Appendix A: Example HMI Screens

Figure 1: System Screen

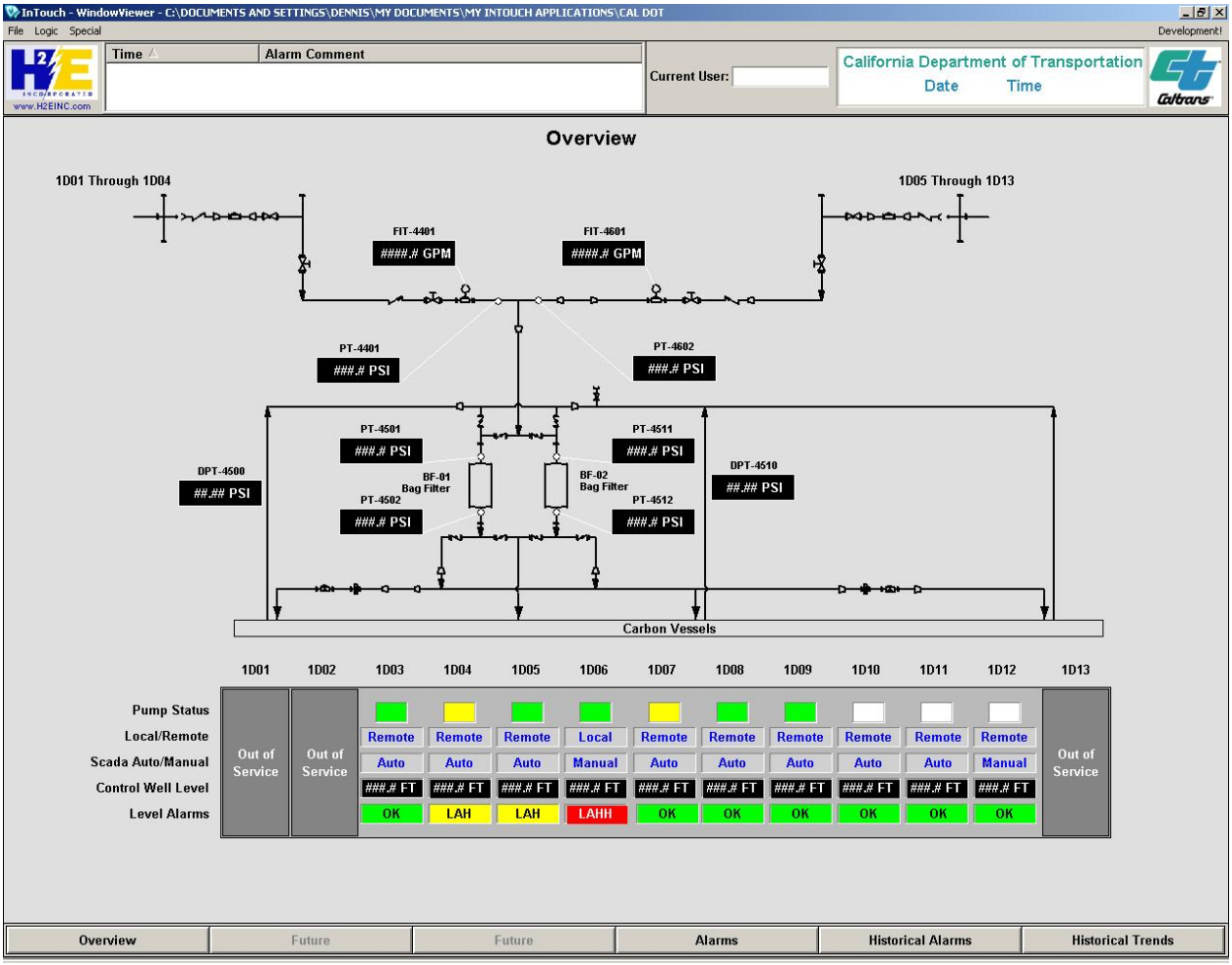


Figure 2: Well Head Screen

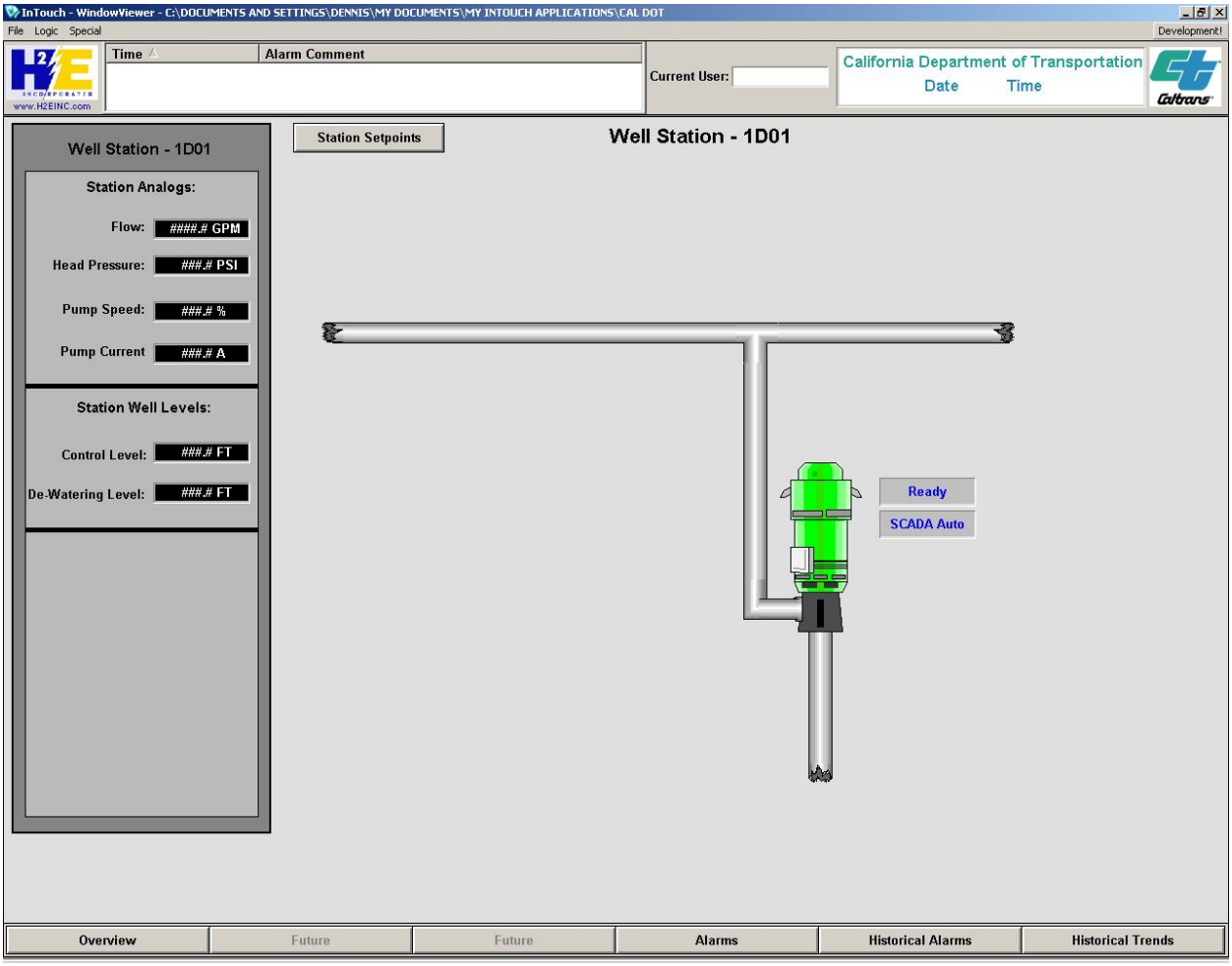
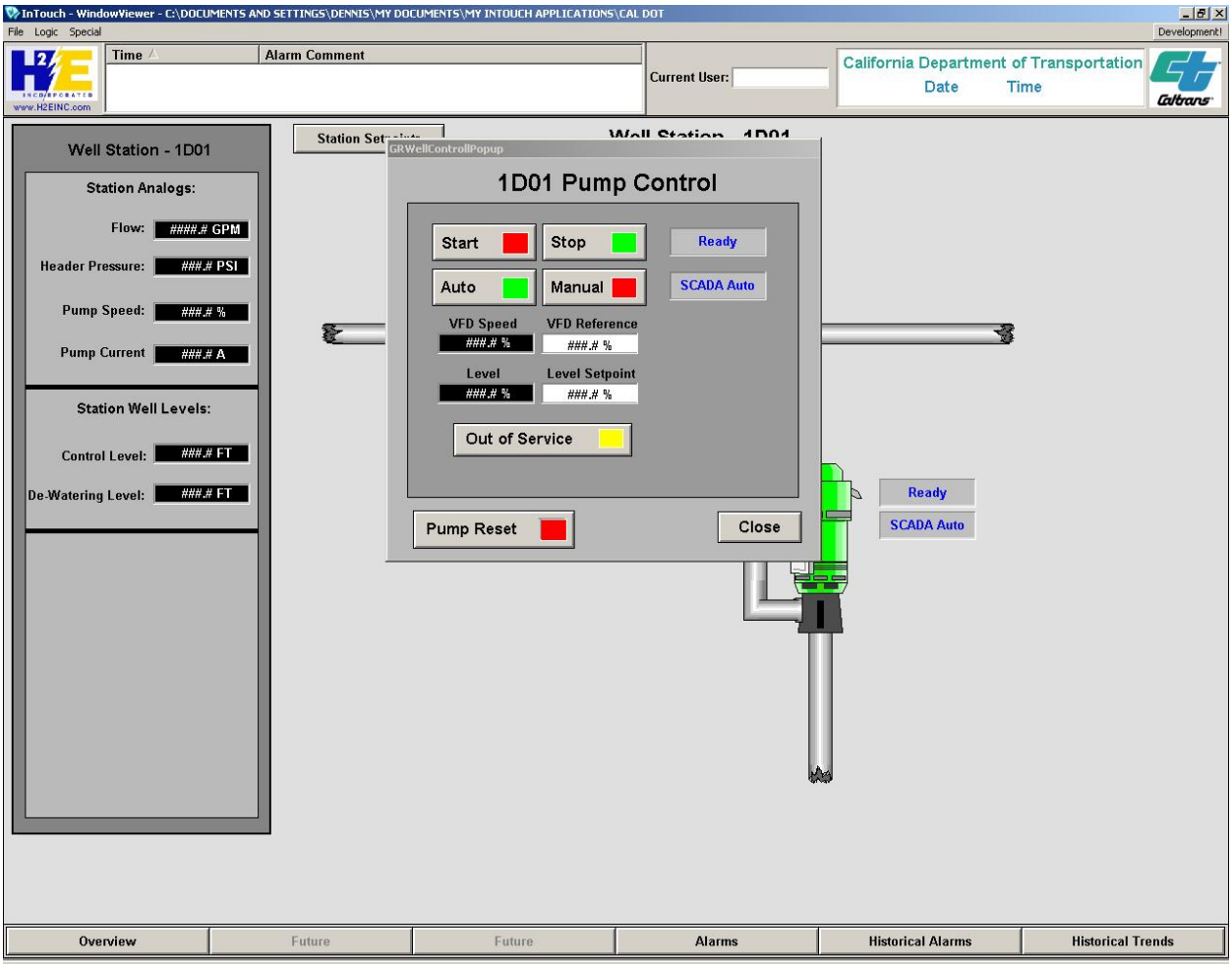


Figure 3: Pump Control Popup Screen



ROUTE 105
DEWATERING SYSTEM
TRANSITION PLAN
GARFIELD TREATMENT FACILITY

Contract Number 43A0236, Task Order No. 11

Prepared for:

California Department of Transportation

Division of Engineering Services

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February 9, 2011

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1.0 INTRODUCTION

Planned modifications to the I-105 Garfield Pumphouse groundwater dewatering and treatment systems have been prepared by AMEC Geomatrix, Inc. (AMEC) on behalf of the California Department of Transportation (Caltrans). Groundwater is continually pumped from below the I-105 Freeway using thirteen groundwater extraction wells to depress the groundwater table and prevent water from collecting on the surface of the highway. The existing treatment system treats the extracted groundwater using granular activated carbon (GAC) prior to discharge to the Los Angeles River. Design elements for the system modification include process flow piping modifications; new bag filter units; new concrete pad and retaining wall; and instrumentation and controls modifications. Because these modifications may result in a temporary shutdown of the treatment system(s), it is necessary to phase the work to minimize shutdown periods and prevent groundwater from surfacing on the I-105 Freeway. Currently the extraction wells are operated to maintain the groundwater 3.5 feet below profile grade of the freeway. The Contractor will be required to maintain the groundwater below this elevation during the construction process. This document describes one potential solution for sequencing work that limits the need for temporary treatment systems and maintain water levels at the required elevations below the freeway. Contractors are not required to follow this example, but are responsible for completing the modifications in a way that maintains groundwater levels at the required elevations below the surface of I-105. Details of the proposed system modifications can be found in the project construction plans and specifications.

2.0 BACKGROUND

A dewatering system is maintained along a low-lying section of the I-105 Freeway to maintain groundwater levels below the surface of the road. There are thirteen dewatering wells (1D-1 through 1D-13) associated with the Garfield Pumphouse groundwater extraction and treatment systems, ten of which are currently active (ID-3 through ID-12). Initially thirteen well were installed in 1998; but since that time, three wells have been abandoned. The wells are located immediately adjacent to the Route 105 Freeway between Garfield Avenue and Paramount Blvd.

The shallow aquifer in the area of the dewatering wells is impacted by volatile organic compounds (VOCs) from upgradient sources. The primary VOCs impacting groundwater include trichloroethene (TCE); dichloroethene (DCE); and tetrachloroethene (PCE). Other organic compounds have been detected at various times over the past 10 years including trichloroethane (TCA); 1,4-dioxane; and 1,2,3-trichloropropane (TCP). Formaldehyde and elevated levels of manganese were also present during a 2005 study of the groundwater. Thus, operation of the dewatering systems typically requires treatment of the water prior to discharge under a state National Pollutant Discharge Elimination System (NPDES) Permit. Extracted groundwater is treated using liquid-phase GAC. The Garfield Pumphouse treatment system consists of two separate treatment systems, designated as the West System and the East System. The West System includes eight vessels (W-01 thru W-08), each containing 5,000 lbs of GAC. This system services extracted groundwater from wells ID-3 and ID-4. The West System vessels are arranged as four sets of two vessels each, with each set of two in a lead/lag configuration. The four sets of vessels are piped in parallel, giving operators the capability of directing flow simultaneously to each set via a manifold header.

The East System consists of six treatment vessels (E-01 through E-06), each containing 20,000 lbs of GAC. The East System provides treatment for groundwater extracted from wells ID-5 through ID-12. These six vessels are operated in parallel, with flow directed to any number of

individual vessels simultaneously based on operator discretion. These vessels are not in lead-lag configuration.

Submersible pumps (20 - 25 HP) in each well are rated at approximately 500 gallons per minute (gpm) at 80 feet of head. Each pump motor is controlled with a variable frequency drive (VFD) that allows the operator to select a desired flow rate. Table 1 provides a summary of the facility equipment that is currently operational.

TABLE 1. SUMMARY OF EQUIPMENT AND CAPACITIES

Area	No. Wells and Well ID	Maximum Flow per Well	Combined Maximum Flow	No. Carbon Vessels	Carbon Vessel Configuration	Treatment Capacity per Vessel	Total Treatment Capacity(1)
West	2 Wells ID-3 & ID-4	500 gpm	2,000 gpm	8	4 sets of 2 in parallel lead/lag	250 gpm	1,000 gpm
East	8 Wells ID-5 – ID-12	500 gpm	4,500 gpm	6	Parallel	750 gpm	4,500 gpm

1. The West system total capacity would be 2,000 gpm if all 8 vessels were operated in parallel.

The West and East Treatment Systems each have a separate effluent pipe that directs flow to a rectangular, below-grade, concrete wet well located at the Garfield Pumphouse. A culvert leading from the wet well drains accumulated water via gravity to a county storm water channel that discharges to the Los Angeles River. It should be noted that the Garfield Pumphouse also collects storm water from a section of the I-105 Freeway underdrain system through a separate system and pumps it into the wet well; thus the wet well also serves the Garfield Pumphouse discharge. This stormwater system only operates during precipitation events.

3.0 CURRENT PUMPING STRATEGY

The system is manually operated with an operator selecting the active pumping wells and flow rates each month based on the observed depth to water in each well. Based on discussions with the operator, even-numbered wells are generally pumped during even-numbered months (e.g. February, April, June, etc.) and odd-numbered wells are generally pumped during odd-numbered months (e.g. January, March, May, etc.), with the exception of well ID-4. Well ID-4 is pumped continuously throughout the year to maintain the groundwater level at least 3.5 feet below profile grade of the freeway. During maintenance activities on the well, well ID-4 can typically be shut down for up to two or three days before water levels approach the maximum allowable level (i.e. 3.5 foot depth to water below profile grade of freeway) and pumping of ID-4 must resume. Based on operations data (flow rates and water levels) recorded in 2009 and 2010, it appears that the remainder of the wells can be shut down for several weeks or more before water levels reach their maximum allowable levels. The operations data also indicates that well ID-3 is rarely operated and Wells ID-5, ID-9, ID-11, and ID-12 have consistently low water levels in them with only periodic pumping. Furthermore, wells ID-6, ID-7, and ID-8 appear to be operated only periodically during the winter months to maintain adequate water levels. Only wells I-D4 and I-D10 require consistent operation to maintain acceptable water levels.

Based on flow data available from 2009 and 2010, the maximum flow rate for the West Treatment System was observed in January of both years at 137 gallons per minute (gpm) and 80 gpm, respectively. The maximum flow rate for the East Treatment System was observed in January 2009 at 435 gpm and in March 2010 at 550 gpm. This indicates that the treatment systems are operating at a fraction of their maximum flow capacity.

4.0 CONSTRUCTION SEQUENCING

Based on the above information, in order to construct the planned modifications without affecting the I-105 Freeway, AMEC proposes sequencing construction events in a manner that requires limited treatment system operations throughout most of the construction duration. The following phases are proposed as an example of how construction may be sequenced to maintain required groundwater levels. The conceptual components of each phase are shown in Figure 1. Figure 1 is a conceptual drawing; the Project Plans and Specifications issued by Caltrans are the definitive design documents and take precedence over this Transition Plan when identifying design components and placement.

Phase 0:

- Pump all operational wells for 2 to 4 weeks prior to construction in order to draw down water levels.

Phase 1 (approximately two day duration):

- Shutdown wells ID-3 and ID-4 and the West Treatment System; continually monitor the depth to water to confirm that a minimum of 3.5feet below the profile grade of the freeway is maintained.
- Demolish and replace West Treatment System pipe header in accordance with the Project Plans.
- Install a tee and gate valve behind Garfield Pumphouse (see Figure 1) and install a temporary blind flange on eastern opening of tee.
- Once all connections are completed, return the West Treatment System to service and turn wells ID-3 and ID-4 on.

Phase 2:

- Shutdown wells ID-5 through ID-13.
- Take GAC Units E-01 through E-06 off-line.
- Demolish existing piping related to E-01 and E-02 and install new piping associated with these GAC units.
- Install discharge line from E-01 and E-02 to the Garfield Pumphouse (see Figure 1). A temporary fitting will be required at the 90 degree bend to the Garfield Pumphouse until the remaining subsurface piping is installed.
- Demolish remaining piping connected to E-03 through E-06.
- Connect temporary flexible piping/hose from existing influent pipe from ID-5 though ID-13 to the newly installed E-01 and E-02 manifold (see Figure 1).

Phase 3:

- Return ID-5 through ID-13 to service and operate through E-01 and E-02 as needed to maintain water levels.
- Excavate and construct retaining wall and remaining civil work, including the concrete pad, the drains and sumps, and the fencing and gates.
- Install remaining subsurface piping north of retaining wall, except for final connections.
- Install Bag Filters.
- Install piping to E-03 through E-06 and Bag Filters.
- Install electrical and controls.
- Shut down all wells and perform final connections. Remove temporary flexible piping/hose.

Phase 4:

- Return all wells to service. Take West Treatment vessels out of service.
- Commission East Treatment System.

In general, these phases allow for the continued operation of the West Treatment System, with the exception of a two-day shutdown for modifications. This shutdown duration is not expected to have adverse effects on water levels, though additional testing is recommended prior to construction as discussed above. Furthermore, two 20,000-pound GAC units (E-01 and E-02) will be operational in the East Treatment System for the majority of the construction. These two units will provide up to 1,500 gpm of treatment capacity, well below the maximum flow rate observed at the East Treatment System in 2009 and 2010 (550 gpm).

5.0 PUMP AND WATER LEVEL TESTING

The Contractor should perform a pumping and water level study prior to enacting any transition plan in order to ensure the pumping frequencies, flow rates, and groundwater recovery rates discussed above are accurate. This process may include the following steps:

- Shut down wells ID-3 and ID-4 and measure water levels in all wells daily to assess how long the West Treatment System can be turned off.
- Turn ID-3 and ID-4 back on. Turn off all remaining wells and repeat the monitoring of water levels.

This process will give an indication of the amount of time the wells can remain off for construction purposes without groundwater levels affecting the freeway.