

**Meeting Date:** 9/23/2014

**Report Type:** Consent

**Report ID:** 2014-00480

**Title: Contract: Well Rehabilitation Phase 2A (Reviewed 09/16/2014)**

**Location:** Citywide

**Recommendation:** Pass a Resolution 1) approving the contract plans and specifications for the Well Rehabilitation Phase 2A project, and awarding the contract to McGuire and Hester, Inc., in an amount not-to-exceed \$3,462,095; and 2) authorizing the City Manager or his designee to transfer \$250,000 from the Groundwater Well Fluoride Systems Project.

**Contact:** Bill Busath, Interim Director, (916) 808-1434; Dan Sherry, Supervising Engineer, (916) 808-1419, Department of Utilities

**Presenter:** None

**Department:** Department Of Utilities

**Division:** Engineering & Water Resources

**Dept ID:** 14001311

**Attachments:**

- 1-Description/Analysis
- 2-Background
- 3-Resolution
- 4-Specifications
- 5-Plans

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**City Attorney Review**

Approved as to Form  
Joe Robinson  
9/17/2014 1:39:00 PM

**Approvals/Acknowledgements**

Department Director or Designee: Bill Busath - 9/12/2014 4:28:50 PM

## Description/Analysis

**Issue Detail:** The Utilities Department performed a condition assessment on their highest priority groundwater wells that were showing signs of poor performance due to mechanical and electrical failure or water quality concerns in 2011. Staff prepared plans and specifications to rehabilitate eight of these wells and the project was formally advertised to solicit public bids. The lowest bid was determined to be non-responsive because the bid did not meet the minimum 5% Local Business Enterprise (LBE) participation requirement. Staff is recommending award of the contract to the second lowest bidder, as the lowest responsive and responsible bidder.

**Policy Considerations:** The requested action is in conformance with City Code Section 3.60, Articles I and III, which provide for the award of competitively bid contracts to the lowest responsible and responsive bidder. Staff has verified or will verify prior to the Notice to Proceed, that the bonds and insurance required for this project are valid.

**Economic Impacts:** This project is expected to create 13.85 total jobs (7.96 direct jobs and 5.89 jobs through indirect and induced activities) and create \$2,137,618 in total economic output (\$1,347,357 of direct output and another \$790,261 of output through indirect and induced activities).

The indicated economic impacts are estimates calculated using a calculation tool developed by the Center for Strategic Economic Research (CSER). CSER utilized the IMPLAN input-output model (2009 coefficients) to quantify the economic impacts of a hypothetical \$1 million of spending in various construction categories within the City of Sacramento in an average one-year period. Actual impacts could differ significantly from the estimates and neither the City of Sacramento nor CSER shall be held responsible for consequences resulting from such differences.

**Environmental Considerations:** The Community Development Department, Environmental Planning Services Manager has reviewed the project and has determined that the project is exempt from the California Environmental Quality Act (CEQA) per CEQA Guidelines sections 15301 (b&d) and 15302.

**15301(b and d) Existing Facilities** - The project consists of operation and maintenance of existing utilities (City drinking water wells) involving negligible or no expansion of use beyond that at the time of the City's determination; and the rehabilitation of deteriorated facilities or mechanical equipment to meet current standards of public health and safety. **15302 Replacement or Reconstruction** – the project also consists of the replacement of existing structures and facilities (fencing, fluoride systems, and electrical systems) on the same site with the same purpose as the facilities being replaced.

**Sustainability:** The City is committed to developing an efficient and dependable groundwater supply that will increase the City's water supply reliability and support a surface water/ groundwater conjunctive use program. This report's recommendation is consistent with the City's Strategic Plan Goals of achieving sustainability, livability, and expanding economic development throughout the City.

**Commission/Committee Action:** None

**Rationale for Recommendation:** The project was formally advertised to solicit public bids, and opened by the City Clerk on May 21, 2014. Two firms bid on the project, as follows:

- |                            |                         |
|----------------------------|-------------------------|
| 1) Clyde G. Steagall Inc.  | Bid Amount: \$3,242,109 |
| 2) McGuire and Hester Inc. | Bid Amount: \$3,462,095 |

The engineer's estimate was \$2,400,000. The lowest responsive and responsible bidder is approximately 41% higher than the engineer's estimate. The engineer's estimate was based on a similar well rehabilitation project that was bid approximately 2 years ago. Drought conditions have significantly increased the demand for groundwater well rehabilitation projects throughout the Central Valley, limiting the number of contractors bidding on projects and driving up costs. The drought condition, along with an improved economy, accounts for the variance in the engineer's estimate and the lowest responsive and responsible bid. This project is critical to the City's strategy of relying on groundwater to offset possible reductions in surface water due to the ongoing drought and therefore, staff recommends moving forward with awarding the contract.

The low bid submitted by Clyde Steagall listed several firms to meet the contract's minimum 5% LBE participation requirement, including Mason Painting. The bid analysis performed by Engineering Services staff found that Mason Painting's business address is located in Rancho Cordova. To be counted for purposes of LBE participation, an LBE firm must have a valid business address located in the City of Sacramento or within the unincorporated area of Sacramento County at the time bids are opened. Because Mason Painting's business address is not located in the unincorporated area of the County, Clyde Steagall's bid cannot be credited with any LBE participation by Mason Painting. Without this LBE participation credit for Mason Painting, Clyde Steagall's bid demonstrates 4.78% LBE participation, which is below the minimum 5% LBE participation requirement. City Code section 3.60.270, and the LBE requirements included in the bid specifications, state that a bidder is not considered responsive unless its bid meets or exceeds the minimum LBE participation level. For this reason, Clyde Steagall's bid is non-responsive, and staff recommends award to the second low bidder, McGuire and Hester, as the lowest responsive and responsible bidder.

**Financial Considerations:** The total estimated project cost including design, project management, inspection, and contingency is estimated to be \$4,550,000. The Well Rehabilitation Phase 2A project (Z14110104) budget is currently \$4,314,400. To complete the project \$250,000 will be transferred, pending City Council authorization as requested in the attached resolution, from the Groundwater Well Fluoride Systems project (Z14130604, Fund 6205) to the Well Rehabilitation Phase 2A project.

**Local Business Enterprise (LBE):** This project included a minimum participation requirement of 5% for LBEs. The bid submitted by McGuire and Hester exceeded this requirement, with an LBE participation level of 6%.

## **Background**

The City currently operates 27 wells in the City, a majority of which have been in service for over 40 years. In order to pursue a conjunctive use strategy for water production, which reduces reliance on surface water during periods of low water supply, Utilities evaluated the City's well system to identify future needs for system reliability and efficient groundwater production.

Ten wells were chosen for assessment due to evidence of poor performance and for their importance in providing adequate supply to the water distribution system. Results from the assessment have provided information to determine if each well can be rehabilitated, and the scope of the rehabilitation for each eligible well.

Staff prepared plans and specifications for the rehabilitation of eight wells (83, 131, 137, 143, 144, 153A, 155, 164) and the project was solicited for public bids. Two bids were received and opened by the City Clerk on May 21, 2014.

## **RESOLUTION NO. 2014-**

### **Adopted by the Sacramento City Council**

**September 23, 2014**

#### **AWARD CONTRACT FOR WELL REHABILITATION PHASE 2A PROJECT (Z14110104) AND AUTHORIZING BUDGET TRANSFER**

##### **BACKGROUND**

- A.** The City currently operates 27 wells in the City, a majority of which have been in service for over 40 years. In order to pursue a conjunctive use strategy for water production, to reduce reliance on surface water during periods of low water supply, the Department of Utilities evaluated the City's well system to identify future needs for system reliability and efficient groundwater production.
- B.** Staff prepared plans and specifications for the rehabilitation of eight wells (83, 131, 137, 143, 144, 153A, 155, 164) and the project was solicited for public bids. Two bids were received and opened by the City Clerk on May 21, 2014.
- C.** Two firms bid on the project, Clyde G. Steagall, Inc., and McGuire and Hester, Inc.. The bid from Clyde G. Steagall, Inc. did not meet the minimum 5% LBE participation requirement and was non-responsive. McGuire and Hester, Inc., was the lowest responsive and responsible bidder, with a bid amount of \$3,462,095.
- D.** \$250,000 will be transferred from the Groundwater Well Fluoride Systems Project (Z14130604, Fund 6205) to the Well Rehabilitation Phase 2A Project (Z14110104) to complete the project.

##### **BASED ON THE FACTS SET FORTH IN THE BACKGROUND, THE CITY COUNCIL RESOLVES AS FOLLOWS:**

- Section 1. The plans and specifications for the Well Rehabilitation Phase 2A contract (Z14110104) are approved, and the contract is awarded to McGuire and Hester for an amount not to exceed \$3,462,095.
- Section 2. The City Manager or his designee is authorized to transfer \$250,000 from the Groundwater Well Fluoride Systems Project (Z14130604, Fund 6205) to the Well Rehabilitation Phase 2A Project (Z14110104).

**SPECIFICATIONS**  
**FOR**  
**WELL REHABILITATION**  
**PHASE 2A**  
**PN Z14110104**

**APRIL 2014**

**CITY OF SACRAMENTO**  
**DEPARTMENT OF UTILITIES**

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**END OF SECTION**

**SECTION 1 – GENERAL REQUIREMENTS****1.1 Project Description**

The City of Sacramento seeks bids from qualified Contractors to rehabilitate Wells 83, 131, 137, 143, 144, 153A, 155, and 164. The project consists of two major components, well casing rehabilitation, and installation and construction of new site improvements. Site improvements include but are not limited to new fencing, pumping, electrical, and chemical systems, paving, switchgear enclosures, piping fabrication, and wellhead demolition and construction. Contractors are to provide all labor, materials, and equipment necessary to successfully complete the project. All work shall be performed in accordance with the requirements presented in these Special Provisions, the City of Sacramento Standard Specification adopted June 2007 (CSSS), and the contract documents. The Special Provisions contained herein are intended to be consistent with the California Department of Public Health Waterworks Standards, ANSI/AWWA Standard A100-06 and NSF/ANSI Standards 60 and 61. No exceptions to the project requirements shall be made unless a written request is made by the Contractor and written approval is provided by the Engineer before the work is performed.

Well casing rehabilitation shall include the following work performed by the Contractor:

1. Pre-mobilization site video
2. Mobilization, site setup, demobilization and site cleanup
3. Pre-cleaning test pumping
4. Pre-cleaning spinner logging
5. Traffic control
6. Brushing and sediment removal
7. Pre and post-brushing video survey
8. Additional sediment removal and brushing
9. Additional post-brushing video survey
10. Screen and casing repair
11. Agitating the near-well environment
12. Mechanical cleaning
13. Chemical cleaning
14. Post-cleaning video survey
15. Additional mechanical and chemical cleaning
16. Additional post-cleaning video survey
17. Post-cleaning spinner logging
18. Deviation survey
19. Post-cleaning test pumping
20. Well disinfection
21. Wastewater treatment and disposal
22. Waste solids disposal
23. Pump removal and installation

Additional work related to the project to be performed by the City includes:

1. Wastewater sampling as required in the wastewater discharge permit. A copy has been provided in Attachment A.
2. Water quality testing during test pumping (at the end of each step in the step-discharge test).

Site improvement work shall include but not be limited to the following work performed by the Contractor:

1. Wellhead demolition and construction
2. MCC installation(City provided)
3. MCC enclosure construction
4. Fencing demolition, disposal, installation
5. Wellhead pipe fabrication and installation
6. Wellhead baseplate fabrication and installation
7. Flouride system installation(City provided)
8. Asphalt paving
9. Sign fabrication and installation
10. Conduit and conductor installation
11. Water level detection system construction and installation
12. Lighting installation
13. Well column, flow meter, and pump installation
14. Electrical and chemical systems testing

Any work to be performed by the Contractor and City shall be coordinated by the Engineer.

### **1.2. Site Walk**

The project site walk shall begin approximately one week after bid posting at 9 a.m. at Well 83.

### **1.3. Project Duration**

It is anticipated that the project shall be completed within 180 calendar days of the Contractor receiving notice to proceed from the City. The Contractor shall perform well casing rehabilitation work on two wells simultaneously. Site security at all sites must be maintained at all times.

### **1.4 Well Facility Locations and Descriptions**

#### **Well 83**

Site Location: 6562 Wyndham, Sacramento, CA  
Assessor's Parcel Number: 117-0170-052-0000

Well Construction: Year constructed: 1963  
Depth: 240 feet  
Borehole diameter: 28 inches  
Casing diameter: 14 inches  
Casing material: Steel  
Screen Type: Factory Perforated

Screen Interval: 108 to 131, 151 to 191 and 215 to 230 feet bgs

Static Well

Volume: Approximately 2,260 gallons

Well Condition: Out of service. Perforations are heavily encrusted. Several casing joints appear slightly misaligned.

Pumping system: Removed from site

Static water level: Approximately 45 feet bgs

Well site: Fenced with a locking gate. Site dimensions are approximately 25 by 75 feet. Well is not enclosed in a building.

Perimeter: Well site is within an apartment complex parking lot.

Water source: On-site hose bib (3/4-inch)

**Well 131**

Site Location: 1707 North Avenue, Sacramento, CA  
Parcel Number: 252-0012-024-0000

Well Construction: Year constructed: 1946  
Depth: Approximately 270 feet  
Borehole diameter: 28 inches  
Casing diameter: 12 inches  
Casing material: Steel  
Screen type: Unknown  
Screen interval: Approximately 150 to 270 feet bgs

Standing Well

Volume: Approximately 2,200 gallons

Well Condition: Out of service

Pumping system: Vertical Turbine

Static water level: Unknown (assumed 45 feet bgs)

Well site: Well is not enclosed in a building. Site is paved. Hydropneumatic tank and chemical shed on site. Well site perimeter available for equipment storage.

Perimeter: Fenced with a locking gate

Water source: On-site hose bib (3/4-inch)

**Well 137**

Site Location: 1941 Los Robles Blvd., Sacramento, CA  
Parcel Number: Unknown

Well Construction: Year constructed: 1965  
Depth: 250 feet  
Borehole diameter: 28 inches  
Casing diameter: 14 inches  
Casing material: Steel  
Screen type: Factory milled slots  
Screen interval: 80 to 245 feet bgs

Static Well  
Volume: Approximately 1,900 gallons

Well Condition: In service. Heavy encrustation. Possible hole in casing at 88 feet bgs. Sediment accumulated in well to 242 feet bgs.

Pumping system: Vertical turbine

Static water level: Approximately 86 feet bgs

Well site: Well is not enclosed in a building. Hydropneumatic tank and chemical feed shed on site. Well site perimeter available for equipment storage. Sewer manhole located 20' north of well site.

Perimeter: Fenced with a locking gate

Water source: On-site hose bib (3/4-inch)

**Well 143**

Site Location: 3001 Rio Linda Blvd., Sacramento, CA  
Parcel Number: 265-0071-008-0000

Well Construction: Year constructed: 1965  
Depth: 330 feet  
Borehole diameter: 28 inches  
Casing diameter: 14 inches  
Casing material: Steel  
Screen Type: Factory sawed  
Screen Interval: 140 to 330 feet bgs

Static Well  
Volume: Approximately 3,130 gallons

Well Condition: Heavy encrustation. Approximately 30 feet of oil floating on water.

Pumping system: Vertical turbine

Static water level: Approximately 60 feet bgs

Well site: Well is not enclosed in a building. Chemical feed shed and hydropneumatic tank on site.

Perimeter: Fenced with a locking gate, vacant lot on west side of well site is City owned.

Water source: On-site hose bib (3/4-inch)

**Well 144**

Site Location: 1715 Eldridge Avenue, Sacramento, CA  
Parcel Number: 265-0371-012

Well Construction: Year constructed: 1965  
Depth: 396 feet  
Borehole diameter: 26 inches  
Casing diameter: 14 inches  
Casing material: Steel  
Screen Type: Louver  
Screen Interval: 144 to 396 feet bgs

Static Well Volume: Approximately 3,500 gallons

Well Condition: In service. Heavy encrustation present.

Pumping system: Submersible

Static water level: Approximately 76 feet bgs

Well site: Site dimensions are 75 feet by 75 feet. Well is not enclosed in a building. Chemical feed building and hydropneumatic tank onsite.

Perimeter: Fenced with a locking gate, vacant property on east side is City owned.

Water source: On-site hose bib (3/4-inch)

**Well 153A**

Site Location: 201 Main Avenue, Sacramento, CA  
Parcel Number: 237-0040-047

Well Construction: Year constructed: 1993  
Depth: 626 feet  
Borehole diameter: 28 inches  
Casing diameter: 16 inches  
Casing material: Steel  
Screen type: 0.050-inch wire-wrapped

Screen intervals: 260 to 300, 345 to 362, 430 to 458 and 500 to 616 feet bgs

Static Well

Volume: Approximately 7,630 gallons

Well Condition: In service. Encrustation present. Floating oil layer thickness of 8.5 feet.

Pumping system: Vertical Turbine

Static water level: Approximately 68 feet bgs

Well site: Well not housed in a building. Chemical feed building and tanks are present. Vacant parcel to the west is City owned.

Perimeter: Fenced with a locking gate

Water source: On-site hose bib (3/4-inch)

**Well 155**

Site Location: 2320 Roanoke Ave, Sacramento, CA  
Parcel Number: 252-0202-019

Well Construction: Year constructed: 1968  
Depth: 430 feet  
Borehole diameter: 28  
Casing diameter: 14 inches  
Casing material: Steel  
Screen type: Louvered  
Intervals: 175 to 427 feet bgs

Static Well

Volume: Approximately 4,011 gallons

Well Condition: Out of service. Heavy encrustation present. Holes in casing present from 160' to 168'.

Pumping system: Vertical turbine

Static water level: Approximately 84 feet

Well site: Well not housed in a building. Site is paved. Hydropneumatic tank and chemical shed on site. Sewer manhole adjacent to site in Roanoke Ave.

Perimeter: Fenced with a locking gate

Water source: On-site hose bib (3/4-inch)

**Well 164**

Site Location: 0 Kelton Way, Sacramento, CA  
Assessor's Parcel Number: 226-0050-036-0000

Well Construction: Year constructed: 1993  
Depth: 635 feet  
Borehole diameter: 28 inches  
Casing diameter: 16 inches  
Casing material: Steel  
Screen Type: 0.035-inch wire-wrapped  
Screen Interval: 222 to 260, 286 to 346, 446 to 486, 510 to 578 and 605 to 625 feet bgs

Static Well  
Volume: Approximately 7,630 gallons

Well Condition: Out of service. Encrustation present. Sediment accumulated to 621 feet bgs. Cable present to 607 feet bgs.

Pumping system: Removed from site

Static water level: Approximately 77 feet bgs

Well site: Well is not enclosed in a building. Fenced with a locking gate. Site dimensions are 82 feet by 43 feet by 107 feet by 85 feet.

Perimeter: Additional equipment storage is available on the east side of the well site. Sewer and drainage manholes are nearby in Kelton Avenue.

Water source: On-site hose bib (3/4-inch)

**1.5 Time of Award**

Time of Award for this contract shall be made within Sixty (60) calendar days after opening of the proposals to the lowest responsible bidder, per Section 3-2 of the CSSS.

**1.6 Providing Bonds and Surety**

The Contractor shall provide a signed Agreement and surety bonds within ten (10) calendar days after receipt of notice to award by the City and prior to award by the City Council. The Contractor shall be reimbursed for all surety bond costs should the City Council not award a contract.

## **1.7 Interpretation of Contract Documents**

Questions from bidder's concerning the interpretation of any portion of the contract documents may be directed to Mark Elliott of the City of Sacramento, Department of Utilities, 1395 35<sup>th</sup> Ave, Sacramento, California, 95822, phone (916) 808-8894. Interpretation, where necessary, shall be made by the City in the form of an addendum to the contract documents and, when issued, shall be sent as promptly as is practicable to all parties to whom the bid documents have been issued. All such addenda shall become part of the contract.

It shall also be the bidder's responsibility to call to the attention of the Engineer any missing pages or drawings in the contract documents including the addenda. These items shall be brought to the attention of the Engineer at least 7 calendar days prior to the bid opening date.

## **1.8 Proof of Compliance with Contract**

In order that the Engineer may determine whether the Contractor has complied with the requirements of the contract documents not readily determinable through inspection and tests of plant, equipment, work, or materials, the Contractor shall at any time when requested, at the Contractor's expense, submit to the Engineer properly authenticated documents or other satisfactory proofs as to his compliance with such requirements.

## **1.9 Submittals(Well Casing Rehabilitation)**

In accordance with Section 5-7 of the CSSS, Contractor shall prepare and submit for review 4 copies of the following submittals:

1. Project schedule
2. Material and equipment storage
3. Well aggregate(if required)
4. Test pumping/spinner logging/video survey/deviation survey results and updated Project Task Completion Form (upon completion of work)
5. Traffic control plan(s)
6. Wastewater storage and disposal plan
7. Solid waste disposal plan
8. Health and safety plan with employee safety training certifications
9. Hydraulic/compressive or acoustic energy methods (see Technical Specifications, Section 2.11)
10. Public notification
11. Chemical use and storage plans
12. Daily field logs (daily)
13. Any other City requested items

Contractor is advised that at the Engineer's discretion, the above list may be expanded to include additional items to which Section 5-7 of the CSSS shall apply. Contractor shall keep one copy of the approved Traffic Control Plan and the local sanitary district wastewater discharge permit at each site at all times while work is being performed.

### 1.10 Project Signs

Prior to beginning any onsite work the Contractor shall install one project sign at each well site. The signs shall be supplied by the City and are approximately 30-inches by 54-inches. Location and height of sign installation shall be as directed by the Engineer. In general, the signs shall be installed a minimum of seven (7) feet and maximum of ten (10) feet above surrounding grade. If acceptable to the Engineer an existing sign post may be used, otherwise, the Contractor shall be required to install a new post. Each sign and post installed by the Contractor shall be removed at the end of the project and the sign returned to the City.

### 1.11 Manufacturer's Instructions

Contractor shall comply with manufacturer's installation instructions and procedures in accordance with Section 5-16 of the City CSSS.

### 1.12 Project Scheduling

The Contractor shall submit a detailed schedule showing all items of work prior to initiating work. **Well casing rehabilitation shall be performed on two wells at a time in order to move the project toward completion in a timely manner. To minimize impact to the distribution system, the Contractor must perform work on only one group of four wells at a time. Group 1 shall include Wells 83, 144, 155, and 164. The Contractor shall begin Group 1 casing rehabilitation work on Wells 164 and 155 first. Group 2 shall include Wells 131, 137, 143, and 153A. The Contractor shall begin Group 2 casing rehabilitation work on Wells 143 and 131 first.** Upon written approval by the Engineer, site improvement work may occur at additional Group 1 or 2 well sites provided that no more than 2 active wells are off line at any time during construction. The schedule shall include the proposed sequencing of well rehabilitation activities. The schedule shall be submitted, reviewed and updated in accordance with Section 7-2 of the CSSS. No progress payments shall be made for work completed prior to acceptance of the schedule.

Weekend, night, and holiday work shall be done in accordance with Section 7-4 of the CSSS.

### 1.13 Administrative Penalty Ordinance

The Contractor shall become familiar with Chapter 12.20 of the City Code which contains minimum requirements and restrictions relating to construction activities within the City right of way and establishes administrative penalties for non-compliance of these requirements. The Contractor may be assessed the administrative penalty for each violation of any provision addressed by the ordinance, unless modified herein, and amounts can be deducted from the Contract. The ordinance includes the following general categories:

- Working hours for the City's "Primary Streets"
- Traffic control plan requirements
- Access to private property
- Maintenance of construction areas
- Maintenance of traffic, public safety and convenience

- Care of existing known facilities
- Protection of existing improvements
- Public notification
- Noise levels

Copies of the ordinance are available from the City Clerk's Office, 915 I Street, Sacramento, CA. 95814, and at [www.cityofsacramento.org](http://www.cityofsacramento.org).

#### **1.14 Water Quality Control**

The Contractor shall be responsible for the requirements consisting of regulations contained in the National Pollution Discharge Elimination System (NPDES) Stormwater Permit issued to the City and in accordance with Section 16 of the CSSS.

The City reserves the right to take corrective action and withhold the City's costs for corrective action from progress payments or final payment in accordance with Section 7, "Retention of Sums Charged against the Contractor", of the Agreement, contained herein. Any fines, including third-party claims, levied against the City as a result of the Contractor's non-compliance are the Contractor's sole responsibility and shall be withheld from progress payments or final payment in accordance with Section 7 of the Agreement.

#### **1.15 Communication with City Engineer**

The Engineer for the project shall be a member of City staff. A consulting hydrogeologist from The Source Group, Inc. shall support the Engineer on the project. The Engineer shall not be on-site during all portions of the project work and the Contractor shall be required to communicate by cell phone and email during performance of the work. A communication schedule shall be developed with the successful bidder. Copies of daily field logs shall be delivered to the Engineer during the project on a daily basis. An example daily field log is provided as Attachment C. A complete set of all daily field logs shall also be provided to the Engineer upon completion of the project. The Contractor shall also submit updated versions of the Project Task Completion Form (Attachment B) as project tasks are completed.

#### **1.16 Health and Safety Requirements**

The Contractor is warned that existing sewers and appurtenances have been exposed to sewage and industrial wastes. These facilities shall therefore be considered contaminated with disease-causing organisms. Personnel in contact with contaminated facilities, debris, wastewater, or similar items shall be advised by the Contractor of the necessary precautions that must be taken to avoid becoming diseased. It is the Contractor's responsibility to urge his personnel to observe a strict regime of proper hygienic precautions, including any inoculations recommended by the local public health officer.

Because of the danger of solvents, gasoline, and other hazardous material in the existing sewers, these areas shall be considered hazardous to open flame, sparks, or unventilated occupancy. The Contractor shall be aware of these dangers and shall take the necessary measures to assure his personnel observe proper safety precautions when working in these areas.

The Contractor shall not allow any wastewater to discharge from sewage collection systems onto adjacent lands or waters. In case of accidental discharge, the Contractor shall be responsible for containment, immediate cleanup and disposal at his own expense to the full satisfaction of the Engineer. Where containment is not possible, adequate disinfection shall be provided by the Contractor at his expense as directed by the Engineer or agency with jurisdiction. If, in the opinion of the Engineer, the Contractor fails to adequately follow the above guidelines, he shall make arrangements to have the work done by others, and have the cost charged to the Contractor.

A project-specific health and safety plan shall be prepared by the Contractor and submitted to the Engineer before mobilization to the site. Maintenance of an exclusion zone is required for all tasks conducted by the Contractor on the well site regardless of whether specifically mentioned in individual task descriptions in the Technical Specifications. All staff who shall be on-site during the handling of chemicals must be HAZWOPER trained (40-hour and 8-hour annual refresher) consistent with CFR 291910.120. The Contractor shall provide evidence of appropriate training before chemicals are handled on-site.

### **1.17 Wastewater Discharge and Solids Disposal**

All wastewater shall be contained in tanks until discharged. Well site space restrictions may make on-site storage not possible and other approaches may be required. All tanks used to store wastewater shall be thoroughly cleaned prior to arrival on site. Tanks that arrive on site will be inspected by the Engineer prior to use to ensure no chemical odors, residues, or solids are present from previous usage. Any tank deemed not sufficiently clean by the Engineer will not be permitted for use. Wastewater discharge shall be to the local sanitary district at specified discharge locations and rates. The Contractor must comply with the discharge requirements set by the sanitary district (i.e., pH, TSS, dissolved constituent concentrations, etc.). A copy of the wastewater discharge permit that has been issued to the City by the Sacramento Regional County Sanitation District (Attachment A) provides information regarding the discharge requirements and locations. The City shall periodically verify Contractor compliance with the discharge requirements by collecting samples and conducting chemical analysis on site and at its laboratory. The Contractor shall not be responsible for sample collection and analysis, but shall be responsible for meeting all other permit requirements. There may be delays before discharge is allowed while the chemical analyses are performed. Additional compensation shall not be provided to the Contractor should a delay occur that is related to sample analysis and the results that are produced.

The Contractor shall monitor water levels in the sewer system at each discharge location. Should any evidence of surcharging be apparent at the discharge site, the Contractor shall immediately cease the discharge until surcharging is no longer evident. Any overflows shall be immediately contained and remediated by the Contractor. Cleanup costs or penalties resulting from an overflow attributable to the discharge shall be paid by the Contractor.

All solid waste generated during the project shall be removed by the Contractor so that the site is returned to its pre-project state. Wastes including trash, unused chemicals and solids removed from the well shall be disposed of properly. Documentation of

proper waste disposal must be provided to the Engineer before the task is considered complete.

### **1.18 Compliance with Permit, License, and Regulatory Requirements**

The Contractor is responsible for compliance with all permit, license and regulatory requirements (i.e., OSHA, Department of Transportation, local encroachment, air quality) for performing the work. The Contractor is responsible for acquisition and payment of any necessary encroachment permits from the City, and any permits required by the Sacramento County Environmental Management Department.

For the well rehabilitation work the Contractor shall hold a valid C-57 Water Well Contractor's license throughout the duration of the project.

### **1.19 Materials and Equipment**

The Contractor is responsible for the care and protection of all materials and equipment until the completion and final acceptance of the work, in accordance with Sections 5-15, 5-16, 5-17, 5-18, 5-21, and 5-22 of the CSSS and these Special Provisions.

### **1.20 Public Right of Way and Easements**

All water, sewer & drainage pipe and appurtenances used as part of this project are to be placed within public street rights-of-way and easements. The Contractor shall confine his or her operations within the limits of existing street right-of-way or easements as much as practicable.

In the event the Contract requirements necessitate the Contractor to encroach onto adjoining private property the Contractor shall make all necessary arrangements with the owner of the property for such encroachment. A copy of any written agreements entered into between the Contractor and the property owner concerning encroachment onto private property shall be provided to the Engineer prior to beginning any work on the property described in the agreement.

### **1.21 Existing Facilities**

Protection and maintenance of existing utilities shall meet the applicable requirements of Section 13 of the CSSS and these Special Provisions.

Connection to City water supply requires backflow protection to be approved by the Engineer.

The location, alignment, and depth of existing underground utilities are taken from public records and no responsibility is assumed for the accuracy thereof. Attention is directed to the provisions in Section 6-19 of the CSSS. The Contractor shall insure that utility services to customers in the project area are maintained.

The cost of relocating existing overhead and/or underground utilities not specified on these Special Provisions to be relocated, but are relocated or cut and reconnected at the Contractor's choice, shall be borne by the Contractor.

## **1.22 Maintaining Water, Sewer & Drainage Flows**

The Contractor shall be responsible maintaining water, sewer, and drainage flows including in accordance with Section 13-2 of the CSSS until the final completion of the project.

No additional compensation shall be paid to the Contractor for maintenance of existing facilities; the cost of this work shall be included in the various contract items of work.

## **1.23 Work Performed by City Crews**

The Contractor is advised that the City retains the option of performing with City crews all or a portion of any work involved in relocating, repairing, or otherwise restoring existing sewer, water, and drainage systems and services to developed properties within the limits of the project that may be in conflict with the proposed project improvements. Any such work performed by City forces shall be at the discretion and convenience of the City. All work performed and materials provided by the City shall be paid for by the Contractor or removed from this contract at no additional cost to the City.

## **1.24 Existing Site Conditions**

Bidders are directed to Section 2-4 of the CSSS which require Bidders to examine the project sites.

## **1.25 Handling and Removal of Hazardous or Contaminated Materials**

In the event hazardous or contaminated materials are encountered at the site for which separate handling or removal provisions have not been made in these Special Provisions, the Contractor shall stop work on that item, contact the Engineer and schedule his operations to work elsewhere on the site, if possible. The City shall be responsible for handling and removal of hazardous material or may request that the Contractor be made available, through contract change order, to provide additional services as needed for the completion of the work. Additional services may consist of retaining a Subcontractor who possesses a California license for hazardous substance removal and remedial actions.

Hazardous or contaminated materials may only be removed and disposed of from the project site in accordance with the following provisions:

1. All work is to be completed in accordance with the following regulations and requirements:
  - a. Chapter 6.5, Division 20, California Health and Safety Code.
  - b. California Administration Code, Title 22, relating to Handling, Storage, and Treatment of Hazardous Materials.
  - c. City of Sacramento Building Code and the Uniform Building Code , 1994 edition.
2. Coordination shall be made with the County of Sacramento Environmental Management Department, Hazardous Materials Division, and the necessary applications shall be filed.

3. All hazardous materials shall be disposed of at an approved disposal site and shall only be hauled by a current California registered hazardous waste hauler using correct manifesting procedures and vehicles displaying a current Certificate of Compliance. The Contractor shall identify by name and address the site where toxic substances shall be disposed of. No payment for removal and disposal services shall be made without a valid certificate from the approved disposal site that the material was delivered.

None of the aforementioned provisions shall be construed to relieve the Contractor from the Contractor's responsibility for the health and safety of all persons (including employees) and from the protection of property during the performance of the work. This requirement shall be applied continuously and not be limited to normal working hours.

### **1.26 Public Notification of Work**

The Contractor shall notify property owners and/or tenants adjacent to the project limits in writing two (2) working days in advance of beginning work. The notice shall be approved by the Engineer and shall describe the work to be performed, the anticipated duration of construction and the name and telephone number of the Contractor's representative that can be reached 24 hours a day, seven (7) days a week. A sample notification letter is provided in Attachment D.

### **1.27 Maintenance of Traffic, Public Safety, and Convenience**

The Contractor's attention is directed to Sections 6-6 through 6-11, 7-4, and 16-3 of the CSSS.

Spillage resulting from hauling operations along or across any public traveled way shall be removed immediately by the Contractor at his expense. Water or dust palliative shall be applied if ordered by the Engineer for the alleviation or prevention of dust nuisance.

The Contractor shall ensure that utility services to customers in the project are maintained.

The Contractor shall be required to establish traffic scheduling and control measures acceptable to the Engineer prior to starting any work. The Contractor shall submit to the Engineer for review and approval a plan showing proposed traffic control measures and/or detours for vehicles and pedestrians affected by the work. This plan shall be submitted a minimum of ten (10) working days prior to the scheduled commencement of any work by the Contractor. **The Contractor shall not be allowed to begin work until an approved plan is on file with the Engineer.** In addition, the approved plan shall be kept on hand at the project site at all times while work is in progress. **All advance warning and traffic delineation shall conform to the provisions of Section 6-10 of the CSSS.**

The Contractor's traffic control plan shall include location of proposed work area, locations of areas where the public right of way shall be closed or obstructed, any proposed phases of traffic control and the time period of when traffic control shall be in effect. The traffic control plan shall also include name and business address of Contractor and a statement that the Contractor shall comply with City's noise ordinance.

The Contractor shall be solely and completely responsible for furnishing, installing, and maintaining all warning signs and devices necessary to safeguard the general public and the work, and to provide for the safe and proper routing of all vehicular and pedestrian traffic during the performance of the work. The requirement shall apply continuously and shall not be limited to normal working hours.

The Contractor shall perform the following requirements included in the City ordinance Chapter 12.20, with this contract:

1. The Contractor shall not cause public rights-of-way, public property or public easement to be covered with construction related trash, debris, garbage, waste material or soil. Areas affected by the construction, must be cleaned to the satisfaction of the Engineer prior to re-opening to the public.
2. Trench plates shall not be utilized for more than three (3) calendar days in one location and temporary surfacing shall not be utilized for more than five (5) calendar days in one location without prior written approval of the Engineer.
3. The Contractor shall provide access to all existing driveways at all times except when excavation is in progress, when forms are in place, when concrete or asphalt is being placed or unless other arrangements are made with the property owner. The Contractor shall take precautions so as not to entrap vehicles on private property during the progress of the work. Driveways may be closed only during normal working hours and only after giving property owners a minimum of twenty-four (24) hours notice in advance of the closure. Access for emergency vehicles shall be available on all streets within the construction area at all times.
4. Rear access to buildings and existing parking areas behind buildings shall be maintained. If arrangements have been made with property owners, the Contractor may close such access for a limited time. Contractor shall give property owners forty-eight (48) hours notice in advance of the closure.
5. Provide for pedestrian traffic at all times except where closures are approved in advance by the Engineer.
6. At least one (1) lane of traffic shall be maintained at all times in the street. All work within public streets and/or roadway right-of-way shall be done in an expeditious manner so as to cause as little inconvenience to the traveling public as possible. Skid - resistant steel plates or other approved methods shall be used to cover all open excavations in the roadway during non-working hours for the entire project.
7. For work done before 7:00 A.M. or after 6:00 P.M., or during all daylight hours between 6:00 P.M. Friday to 7:00 A.M. Monday, the street or alley may be closed provided proper detours are provided and only if arrangements have been made with the property owners in advance and approved by the Engineer. A minimum of five (5) working days notice shall be given to property owners in advance of closure.

8. At night and at other times when work is not in progress, the entire roadway and alley shall be open to the public for pedestrian and vehicular traffic.

All signs and street marking damage caused by or related to the project shall be replaced in kind by the Contractor. In the case of partial damage to lane stripes and traffic lettering the whole stripe or marking in its entirety shall be replaced. Temporary markings and striping shall be installed within 72 hours (three working days) of damage.

Prior to commencing work and/or closing the street or alley, Contractor shall contact the following City Divisions and agencies:

1. Police Communication Center one (1) working day prior to closure by calling 277-1750, or fax at 277-1772.
2. Fire Department Communications Center one (1) working day prior to closure by calling 228-3035 or fax at 228-3082.
3. City Traffic Engineering Services five (5) working days prior to closure by calling 808-5307.
4. City Solid Waste Division five (5) working days prior to closure by calling 808-4952 or fax at 808-4999. The Contractor shall also coordinate with the property owners all relocations of trash receptacles necessary to maintain garbage collection.
4. Street Parking five (5) working days prior to closure by calling 808-5579 or fax at 808-7501.
5. Regional Transit five (5) working days prior to closure by calling Lynn Cain at 321-5375 or fax at 557-4541.

At a minimum, the information faxed shall include:

Project name and number  
Contractor's name and a 24-hour phone number  
City of Sacramento's project manager's name  
City Inspector name and phone number  
Limits of street closure, with street names  
Duration of street closure

### **1.28 Removal of Street Parking**

In locations where the Contractor's operations require removal of on-street parking, such removal shall be in accordance with Section 6-18 of the CSSS. Failure to comply with this section shall not prevent the City from towing vehicles parked in the proposed work area.

### **1.29 Project Closeout**

When the project is completed in accordance with these Special Provisions, the Contractor shall notify the Engineer of the completion of the project at which time the

City shall prepare a list of deficient work items, or punch list, and after all punch list items have been completed to the satisfaction of the Engineer, a completion report shall be prepared in accordance with Section 8-4 of the CSSS.

### **1.30 Payment**

Full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all work involved in performing and complying with these General Requirements shall be considered as included in the prices paid for in the various contract bid items the Contractor deems appropriate and no additional compensation shall be allowed.

**End of Section**

**SECTION 2A: TECHNICAL SPECIFICATIONS - Well Casing Rehabilitation****2.1 Pre-Mobilization Site Video**

The Contractor shall document above ground site conditions before mobilizing to each site in accordance with Section 11 of the CSSS. The documentation shall be comprehensive and include but not be limited to pavement, landscaping, fencing, buildings, piping, other structures, and pumping system controls. A DVD containing the site video shall be provided to the Engineer no less than 48 hours before mobilization to the site.

**2.2 Mobilization, Site Setup, Demobilization and Site Cleanup**

The Contractor shall deliver to and remove from the site all workmen, materials and equipment required to successfully complete the project. The Contractor shall also prepare the site for performance of the project work. Site preparations may include, but are not necessarily limited to, addition of work area fencing, removal and replacement of building roofs, protection of existing facilities and equipment, construction of wastewater discharge piping, and placement of equipment.

The Contractor is responsible for site security and safety from the project start date until site cleanup and restoration is completed. A portable toilet and sanitary facilities for project workers shall be provided by the Contractor. This task includes per diem and other costs that may not be shown as line items on the bid schedule.

All solid waste generated and site alterations performed by the Contractor during the project shall be addressed by the Contractor so that the site is returned to its pre-project state. Wastes, including trash, unused chemicals and solids removed from the well, shall be disposed of properly. Documentation of proper waste disposal must be provided to the Engineer and the City before this task is considered complete.

**2.3 Pre-Cleaning Test Pumping**

Test pumping may not be allowed during or immediately after rain events. The Contractor shall seek written approval from the Engineer prior to the commencement of any test pumping.

Test pumping shall be performed to establish the hydraulic performance of the well and provide data for additional analysis by the Engineer. The Contractor shall provide a test pump appropriate for determining the maximum sustainable pumping rate for the well. The pump intake shall be set approximately 10 feet above the top of the shallowest screened interval. All water level data recorded during the testing shall be provided to the Engineer within 48 hours of test completion. The following procedure shall be performed:

Step 1: The pumping rate shall be adjusted until a rate is found that stresses the well near its maximum sustainable rate. During the adjustment process, the pumping rates and resulting water levels shall be monitored and recorded. Once the pump has been adjusted to near the maximum sustainable pumping rate, the well shall be pumped for one to two hours with the pumping water level monitored and recorded every five minutes. The pumping water level shall not be allowed to fall so low that the pump cavitates. If pump cavitation occurs, the pumping rate shall be reduced to eliminate

cavitation. The well shall be pumped at the adjusted rate for a minimum of one hour with the pumping water level monitored and recorded every five minutes.

Step 2: A step-discharge test shall be performed on the well. The test shall not begin until the non-pumping water level in the well has stabilized near the level observed before Step 1 was performed. The well shall be pumped in four steps at successively higher rates. The rates shall be approved by the Engineer before the test begins. The range of these pumping rates may vary from 50% to 100% of the estimated maximum sustainable pumping rate of the well determined in Step 1. The pumping water level shall be monitored and recorded frequently during the test. The recording intervals shall be approved by the Engineer before the test begins. Each step shall continue until 1) a straight line water level trend with time is established and 2) the Engineer agrees that it is appropriate to progress to the next discharge rate. It is anticipated that each step shall not last more than two hours.

#### **2.4 Pre-Cleaning Spinner Logging**

A spinner log shall be conducted in the presence of the Engineer to establish flow contribution along the screened interval(s). A test pump shall be used. The target pumping rate shall be based upon the results of the pre-cleaning test pumping. Unless a change is approved by the Engineer, both the pump intake and the bottom of any conduit used to guide the spinner log tool past the pump shall be located at least 100 feet below the static water level and no deeper than ten feet above the top of the shallowest screened interval. If these two depth criteria conflict, the Engineer shall be consulted in order to determine the depth setting. The well shall be pumped for at least 30 minutes before the spinner logging is performed. The depth to water in the well shall be measured no less frequently than every 1) five minutes during this initial 30 minute period and 2) 15 minutes during the spinner logging. A Rossum sand tester shall be used to establish the sand content of the discharge. A report on the spinner logging and the sand testing results shall be provided to the Engineer within 48 hours of performing the work.

#### **2.5 Traffic Control**

See General Requirements, Section 1.27.

#### **2.6 Brushing and Sediment Removal**

The removal of material in the well shall be accomplished by brushing and pumping (or airlifting). Any oil floating on the water surface shall be removed before the work begins. The brushing and sediment removal shall be performed in a single trip down the well. The following procedure shall be performed:

Step 1: The well screen and casing shall be brushed to remove encrusting and biological material attached to the inside of the well. The brushing shall be performed in a manner that achieves maximum contact with the louvers and perforations; however, care shall be taken not to damage the aging screen and casing. **Nylon, instead of wire brushes shall be used on all wire-wrapped screens(Wells 153a and 164).** Simultaneous with the brushing, water shall be removed by pumping or airlifting. The rate of brushing shall not exceed 40 feet per hour below the static water level, and brushing shall progress from the shallowest to deepest portions of the well. The rate of pumping or airlifting shall be no less than 200 gallons per minute.

Step 2: Once the brushing is complete, sediment accumulated in the bottom of the well shall be removed by pumping or airlifting. The sediment removal process shall continue

until the discharge is visibly clear. The discharge from Steps 1 and 2 shall be contained in a tank until released as wastewater in accordance with these specifications (General Requirements, Section 1.17). These same general requirements apply to solids generated during the work.

### **2.7 Well Casing Video Surveys**

Detailed video surveys shall be performed in the presence of the Engineer. Videos shall be taken after brushing (Section 2.6) and after chemical cleaning (Section 2.12), or as requested by the Engineer. (A video survey of Well 131 shall also be conducted upon mobilization to that site before any equipment is placed in the well.) The video logging shall be in color, include down-hole viewing and side-scan viewing (with 360 degree capability), and extend to the total well depth. Potable water shall be added to the well at a slow rate (approximately 5 gallons per minute) for at least 8 hours before the video logging in order to reduce suspended sediment and improve viewing conditions. The log shall methodically inspect the casing and screened interval(s) in order to assess the current well condition and identify any damage. A downhole view shall be maintained while descending through the well with use of sidescan views as necessary to inspect areas for potential casing or screen damage until the bottom of the well is reached. A sidescan view with slow continuous rotation shall be maintained while ascending **at a rate no greater than 0.1 feet per second** through the well with stops as necessary to inspect areas for potential casing or screen damage until the top of the well is reached (video to continue above the water level). The Contractor shall provide two copies of the video log on DVD to the Engineer within 48 hours of completing the video and before subsequent tasks are performed.

### **2.8 Additional Brushing and Sediment Removal**

Based upon the results of the video logging performed after the brushing and sediment removal, additional brushing and sediment removal may be required. The need for and extent of this additional work shall be determined through consultation with the Engineer.

### **2.9 Screen and Casing Repair**

Based upon the video logging results and as necessary and appropriate, the Contractor shall repair damage discovered during the video survey. This work shall be performed by the Contractor after consultation with the Engineer; however, it is anticipated that the work shall entail swaging into place a mild steel liner with a rubber sleeve and video confirmation of the work. Subsequent tasks shall not be performed until a decision is made as to whether well repair is required.

### **2.10 Agitating the Near-Well Environment**

The near-well environment shall be agitated to improve the efficiency of subsequent mechanical and chemical treatment steps. The following procedure shall be performed:

Step 1: Encrusting and biological material present outside the well in the gravel pack and aquifer material located close to the well shall be loosened by use of hydraulic/compressive or acoustic energy tools. **No explosives shall be used in this work.** The work shall be performed along the screened interval(s). The number of locations along the screened interval(s) at which the work is performed may depend upon the method used. The plans for this work shall be finalized in consultation with the Engineer.

Step 2: Once the agitation is complete, sediment accumulated in the bottom of the well shall be removed by pumping or airlifting. The sediment removal process shall continue until the discharge is visibly clear. The discharge shall be contained in a tank until released as wastewater in accordance with these specifications (General Requirements, Section 1.17). These same general requirements apply to solids generated during the work.

**2.11 Mechanical Cleaning**

Mechanical cleaning of each screened interval shall be accomplished by injecting, swabbing and pumping (or airlifting). The swabbing tool (double surge block) shall be sized to allow approximately one inch of clearance between the tool (surge block circumference) and the screen. (Note that mechanical cleaning may be performed after chemical cleaning depending upon the condition of the well screen as determined from the post-brushing video survey. This potential change in the order of tasks shall be requested by the Engineer as necessary.)

The following procedure shall be performed:

Step 1: An NSF-approved surfactant and biodispersant shall be injected during the swabbing to enhance mobilization of materials clogging the well screen and near well environment. The chemical solution shall be at a concentration consistent with manufacturer specifications and of a volume generally equal to 1.5 times the standing well volume. For situations where the screened length is a relatively short portion of the well depth, the solution volume shall be reduced. Volumes to be used are specified below for each well.

<b>Well</b>	<b>Chemical Volume (G)</b>
83	3,400
131	3,300
137	2,800
143	4,700
144	5,200
153a	11,400
155	6,000
164	11,400

Only potable water shall be used to prepare the chemical solution. This process shall be performed on the deepest part of the screened interval first and then progress to the shallowest portion of the screened interval in 10-foot sections. Each 10-foot section shall be swabbed for approximately 20 minutes at a slow rate that shall not damage the well.

Step 2: Once chemical addition is complete, water shall be removed by pumping or airlifting at a rate of no less than 200 gallons per minute simultaneous with swabbing. The swabbing shall begin slowly and progress to a faster action only when doing so shall not damage the well. The swabbing shall progress in 10-foot sections from the shallowest to deepest portions of the well. The amount of settleable solids in the

discharge shall be evaluated as the swabbing progresses. The process shall continue for at least 60 minutes per 10-foot section. The process shall continue for each screened interval until the discharge is visibly clear and contains less than 10 parts per million settleable solids as estimated using an Imhoff cone (one tenth of the 0.1 milliliter division on the cone as per California Groundwater Association Article 230).

Step 3: Once the swabbing is complete, sediment accumulated in the bottom of the well shall be removed by pumping or airlifting. The sediment removal process shall continue until the discharge is visibly clear.

Step 4: The discharge from all mechanical cleaning work shall be contained in a tank until released as wastewater in accordance with these Technical Specifications (General Requirements, Section 1.17). These same general requirements apply to solids generated during the work.

## 2.12 Chemical Cleaning

Chemical cleaning of each screened interval shall be accomplished by injecting, swabbing and pumping (or airlifting). The treatment solution shall consist of 5 percent hydrochloric acid with an inhibitor and a biodispersant. Any on-site preparation of chemical solutions shall be conducted such that no vapors migrate off-site. Due to the close proximity of the public at each site an exclusion zone to be implemented in the field for each site shall be identified in the health and safety plan submitted by the Contractor.

Only potable water shall be used to prepare the treatment solution. The Contractor may choose methods for obtaining water at a higher rate than available on-site. Prior to water being transported to the site the Contractor must provide certification to the Engineer that the tanks used have been thoroughly cleaned prior to use or have only previously been used to transport potable water. All chemicals used shall be NSF-approved. The following procedure shall be performed:

Step 1: A chemical solution with a volume equal to 1.5 times the standing well volume shall be added to the well. For situations where the screened length is a relatively short portion of the well depth, the solution volume shall be reduced. Volumes to be used are specified in the previous table shown in Section 2.11. The addition shall be accomplished by injecting through a double surge block and swabbing the chemical solution into the well screen. **Because a significant amount of calcium carbonate is present in each well, the acid solution shall be injected slowly in order to avoid a violent chemical reaction.** This process shall be performed on the deepest part of the screened interval first and then progress to the shallowest portion of the screened interval in 10-foot sections. Each 10-foot screen section shall be swabbed for at least 20 minutes at a slow rate that shall not damage the well.

Step 2: Once the chemical addition is complete, the pH shall be 1) measured and compared to the pH before the acid was injected and 2) monitored hourly until the pH stabilizes. If the pH rises above 3.0 at any point in the pH monitoring process, an additional volume of chemical solution shall be added using the above-described process and the pH monitoring begun again. Once the pH has stabilized at or below 3.0, the well shall be left to stand until the next morning.

Step 3: After the well has been allowed to stand overnight, swabbing and pumping shall be performed for each screened interval as described above (Section 2.12, Step 2). The amount of settleable solids and pH in the discharge shall be evaluated as the swabbing progresses. The process shall continue for at least 60 minutes per 10-foot section. The process shall continue for each screened interval until the discharge is visibly clear, contains less than 10 parts per million settleable solids as estimated using an Imhoff cone (one tenth of the 0.1 milliliter division on the cone as per California Groundwater Association Article 230) and the pH has returned to the pretreatment level.

Step 4: Once the cleaning is complete, sediment accumulated in the bottom of the well shall be removed by pumping or airlifting. The sediment removal process shall continue until the discharge is visibly clear.

Step 5: The discharge from all chemical cleaning work shall be contained in a tank until released as wastewater in accordance with these technical specifications (General Requirements, Section 1.17). These same general requirements apply to solids generated during the work.

### **2.13 Additional Mechanical and Chemical Cleaning**

Based upon the results of the post-cleaning spinner logging, additional mechanical and chemical cleaning may be required. The need and extent of this additional work shall be determined through consultation with the Engineer.

### **2.14 Post-Cleaning Spinner Logging**

A spinner log shall be conducted in the presence of the Engineer to establish flow contribution along the screened interval(s) after mechanical and chemical cleanings are performed. A test pump shall be used. The target pumping rate shall match that used for the pre-cleaning spinner logging to within 10 gallons per minute. Unless a change is approved by the Engineer, both the pump intake and the bottom of any conduit used to guide the spinner log tool past the pump shall be located at least 100 feet below the static water level and no deeper than ten feet above the top of the shallowest screened interval. If these two depth criteria conflict, the Engineer shall be consulted in order to determine the depth setting. The well shall be pumped for at least 30 minutes before the spinner logging is performed. The depth to water in the well shall be measured no less frequently than every 1) five minutes during this initial 30 minute period and 2) 15 minutes during the spinner logging. A Rossum sand tester shall be used to establish the sand content of the discharge. A report on the spinner logging and the sand testing results shall be provided to the Engineer within 48 hours of performing the work and before subsequent tasks are performed.

### **2.15 Deviation Survey**

A deviation survey shall be performed to evaluate the extent to which the well may be out of plumb. A report on the well drift and alignment shall be provided to the Engineer within 48 hours of performing the survey.

### **2.16 Post-Cleaning Test Pumping**

Test pumping may not be allowed during or immediately after rain events. The Contractor shall seek written approval from the Engineer prior to the commencement of any test pumping.

Test pumping shall be performed to establish the hydraulic performance of the well and provide data for additional analysis by the Engineer. The Contractor shall provide a test pump appropriate for determining the maximum sustainable pumping rate for the well. The pump intake shall be set approximately 10 feet above the top of the shallowest screened interval. All water level data recorded during the testing shall be provided to the Engineer within 48 hours of test completion. The following procedure shall be performed:

Step 1: The pumping rate shall be adjusted until a rate is found that stresses the well near its maximum sustainable rate. During the adjustment process, the pumping rates and resulting water levels shall be monitored and recorded. Once the pump has been adjusted to near the maximum sustainable pumping rate, the well shall be pumped for one to two hours with the pumping water level monitored and recorded every five minutes. The pumping water level shall not be allowed to fall so low that the pump cavitates. If pump cavitation occurs, the pumping rate shall be reduced to eliminate cavitation. The well shall be pumped at the adjusted rate for a minimum of one hour with the pumping water level monitored and recorded every five minutes.

Step 2: A step-discharge test shall be performed on the well. The test shall not begin until the non-pumping water level in the well has stabilized near the level observed before Step 1 was performed. The well shall be pumped in four steps at successively higher rates. The rates shall be approved by the Engineer before the test begins. The range of these pumping rates may vary from 50% to 100% of the estimated maximum sustainable pumping rate of the well determined in Step 1. The pumping water level shall be monitored and recorded frequently during the test. The recording intervals shall be approved by the Engineer before the test begins. Each step shall continue until 1) a straight line water level trend with time is established and 2) the Engineer agrees that it is appropriate to progress to the next discharge rate. It is anticipated that each step shall not last more than two hours.

Step 3: A constant rate test shall be performed on the well. If the test is performed immediately after the step-discharge test, the pump shall remain running upon completion of the step-discharge test. If the test is performed after step-discharge test pumping has been discontinued, the test pumping shall not begin until the following two conditions have been met: 1) at least 12 hours have passed since step-discharge test pumping ceased and 2) the non-pumping water level in the well has stabilized near the level observed before Step 2. The Contractor shall discuss with the Engineer any necessary adjustments to the pumping rate at the beginning of the test. The test shall be run for 24 hours, and the pumping water level shall be monitored and recorded frequently during the test. The recording intervals shall be approved by the Engineer before the test begins. After 24 hours, pumping shall stop and the water level in the well shall be monitored and recorded for a maximum of 24 hours. The recording intervals shall be approved by the Engineer before the pumping stops. The water level monitoring shall not stop without approval of the Engineer.

## **2.17 Disinfect Well**

The well screen and casing shall be disinfected. Barring any uncontrollable delays (weather, supplier delay, equipment failure) installation of each new submersible pump shall commence within 48 hours of completion of well disinfection at each well.

The following procedure shall be performed:

Step 1: A pH-adjusted, slightly acidic (i.e., pH 6.0 to 7.0) chlorine solution of 100 mg/l, with a volume equal to four times the standing well volume, shall be used. For situations where the screened length is a relatively short portion of the well depth, the solution volume shall be reduced. Any on-site preparation of chemical solutions shall be conducted such that no vapors migrate off-site. Only potable water shall be used to prepare the treatment solution. The Contractor may consider methods for obtaining water at a higher rate than available on-site. The solution shall be added to the well by injecting through a tremie pipe or equivalent approach. This process shall start at the bottom of the well and progress to the standing water level. Each 10-foot section of screen shall be swabbed for at least 20 minutes at a slow rate that shall not damage the well. The chlorine solution shall be allowed to remain in the well for at least 12 hours. Volumes to be used are specified in the table below.

Well	Chlorine Solution Volume (G)
83	9,000
131	8,800
137	7,600
143	12,500
144	14,000
153a	15,300
155	16,800
164	15,300

Step 2: After the well has been allowed to stand the required amount of time, water shall be removed by pumping or airlifting at a rate of no less than 200 gallons per minute. Within the screened interval(s), the pumping shall be performed simultaneous with swabbing starting at the standing water level and progressing to the bottom of the well. The swabbing shall be performed at a rate that shall not damage the well and progress in 10-foot sections of the screened interval(s). Each section shall be pumped for at least 60 minutes. At least 5 times the chlorine solution volume used in Step 1 shall be removed from the well. The chlorine content in the discharge shall be evaluated as the pumping progresses, and the pumping shall continue until the discharge contains no chlorine.

Step 3: The discharge shall be contained in a tank until released as wastewater in accordance with these technical specifications (General Requirements, Section 1.17). These same general requirements apply to solids generated during the work.

**2.18 Wastewater Treatment and Disposal**

All wastewater shall be contained in tanks until discharged. The Contractor shall employ approaches necessary to work within site space restrictions and wastewater discharge requirements. The Contractor shall comply with the discharge requirements set by the sanitary district in the wastewater discharge permit for the project (included in General Requirements, Section 1.17 and Attachment A of these specifications). In

general, wastewater discharge flow rates shall not exceed the following: 100 gpm for 6" diameter sewer pipe, 200 gpm for 8" diameter sewer pipe, 300 gpm for 10" diameter sewer pipe. The City shall verify Contractor compliance with the discharge requirements by collecting samples and conducting chemical analysis at its laboratory. The Contractor shall accommodate delays before discharge is allowed while the chemical analyses are performed.

**2.19 Waste Solids Disposal**

See General Requirements, Section 1.17 and Technical Specifications, Section 2.2.

**End of Section**

## **SECTION 2B: TECHNICAL SPECIFICATIONS - SITE IMPROVEMENTS**

### **SECTION 01330**

#### **SUBMITTALS**

##### **PART 1 - GENERAL**

##### **1.01 STANDARD COMPLIANCE**

- A. When materials or equipment must conform to the standards of organizations such as, but not limited to, the American National Standards Institute (ANSI), American Society for Testing and Materials (ASTM), National Sanitation Foundation(NSF), National Electrical Manufacturers Association (NEMA) and Underwriter's Laboratories (UL) documents showing, or proving, conformance shall be submitted.
  
- B. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified in the individual Sections. In lieu of the label or listing, the Contractor shall submit a certificate from an independent testing organization, which is competent to perform acceptable tests, and is approved by the City. The certificate shall state that the item has been tested in accordance with the specified organization's standard. For materials and equipment whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate of compliance from the manufacturer shall be submitted for approval. The certificate shall identify the manufacturer, the product, and the referenced standard and shall state that the manufacturer certifies that the product conforms to all requirements of the project Specification and of the referenced standards listed.

##### **1.02 REVIEW OF CONTRACTOR'S INFORMATION**

- A. When review and checking for acceptance is required of any drawing or information regarding materials and equipment, the Contractor shall prepare or secure, and submit for review, five (5) copies. The Engineer, after taking appropriate action, will return two (2) marked copies to the Contractor.

Within a reasonable time after receipt of said submittal copies, the Engineer will return the marked copies indicating one of the following four (4) actions:

1. If review and checking indicates no exceptions, copies will be returned marked "NO EXCEPTIONS TAKEN" and work may begin immediately on incorporating the material and equipment covered by the submittal into the work.

2. If review and checking indicates limited corrections are required, copies will be returned marked "MAKE CORRECTIONS NOTED". Work may begin immediately on incorporating into the work the material and equipment covered by the corrected submittal.
  3. If review and checking indicates insufficient, or incorrect data, has been submitted, copies will be returned marked "REVISE AND RESUBMIT". No work may begin on incorporating the material and equipment covered by this submittal into the work until the submittal is revised, resubmitted, and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".
  4. If review and checking indicates the material and equipment submittal is unacceptable, copies will be returned marked "REJECTED". No work may begin on incorporating the material and equipment covered by this submittal into the work until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".
- B. Approval of the submittal by the Engineer shall not relieve the Contractor from responsibility for any errors or omissions in such submittals nor from responsibility for complying with the requirements of this Contract.
- C. If Shop Drawings show variations from Contract requirements, Contractor shall describe such variations in writing, separate from the drawings, at time of submission. All such variations must be approved by the Engineer.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURER'S DATA**

- A. Submittals for each manufactured item shall be comprised of manufacturer's descriptive literature, drawings, diagrams, performance and characteristic curves, and catalog cuts. Manufacturer's name, trade name, model or catalog number, nameplate data, size, layout dimensions, capacity, project specification references, and any other additional information necessary to establish contract compliance shall be clearly indicated for each item submitted. Contractor shall identify items submitted for approval using an arrow or yellow highlighter. All submittals that fail to properly identify items will be returned to the Contractor.

### **2.02 SHOP DRAWINGS**

- A. Shop Drawings shall show types, sizes, accessories, elevations, floor plans, sectional views, installation details, elementary control diagrams, and wiring diagrams. Wiring diagrams shall identify circuit terminals and shall indicate the internal wiring for each item of equipment. Drawings shall also indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If any equipment is disapproved, the drawings shall be revised to show acceptable equipment and be resubmitted. **Contractor shall provide a hard copy of all shop drawings.**

## 2.03 OPERATION AND MAINTENANCE MANUAL

- A. Submit an operation and maintenance manual covering the stipulated systems and equipment. Three (3) approved copies of the manual, bound in Avery D - Ring binder model number AVY79-799 or approved equal, shall be furnished to the City. **One (1) of the three copies of the operation and maintenance manual shall contain original documentation/manuals and not photocopies.** Each binder shall be no more than 75% full. Prior to system and equipment tests, one (1) complete, bound copy of the manual shall be submitted for approval. Three (3) approved copies of the manual each for this project, with all applicable test forms completed, shall be furnished to the City before completion of the Contract. The following identification shall be inscribed on the cover and spine of the binders:

Operation and Maintenance Manual :  
Project: Well Rehabilitation Phase 2A Project  
Contractor: \_\_\_\_\_  
Contract No.: \_\_\_\_\_  
Date: \_\_\_\_\_

**The Contractor shall also provide the City with an electronic copy of each O&M manual. The electronic copies shall be in Adobe format (Portable Document Format) and shall be provided on a CD. Contractor shall use the latest version of Adobe.**

- B. Provide a table of contents and tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood with large sheets and drawings folded in. Use manufacturer's original pre-printed instructions when available, do not copy these pre-printed instructions. Cross out all material which does not apply to the equipment furnished on this job.
- C. The operating and maintenance instruction shall include, as a minimum, the following data for each item of mechanical and electrical equipment:
1. Name and location of the manufacturer, the manufacturer's local representative, the nearest supplier and spare parts warehouse.
  2. Approved submittals applicable to operation and maintenance.
  3. Recommended installation, adjustment, start-up, calibration, and troubleshooting procedures.
  4. A control sequence describing start-up, operation, and shutdown.
  5. Detailed description of the function of each principal component of the systems.
  6. Recommended lubrication and an estimate of yearly quantity needed.

7. Recommended step-by-step procedures for all modes of operation.
  8. Complete internal and connection wiring diagrams.
  9. Complete printed circuit board schematic and assembly drawings.
  10. Recommended preventive maintenance procedures and schedule.
  11. Complete parts lists, by generic title and identification number, with exploded views of each assembly.
  12. Recommended spare parts.
  13. Disassembly, overhaul, and reassembly instructions.
  14. All completed test forms.
  15. Provide ISA (International Society for Measurement and Control) S-20 forms for all instrumentation devices.
  16. As-built single line drawings of the entire electrical system including motor control drawings of each motor. AutoCAD files of both single line and motor control drawings on a CD.
- D. Contractor is not required to provide manuals for equipment supplied by the City. However, any manuals provided to the Contractor by the City shall be returned in a condition acceptable to the Engineer, or replaced at no cost to the City.

## **2.04 PROJECT RECORD DRAWINGS**

- A. The Contractor shall maintain a neatly and accurately marked set of record drawings showing the elementary control diagrams, wiring diagrams, and final locations and layout of all mechanical, electrical, and instrumentation equipment; piping and conduit; structures; and other facilities. Drawings shall be kept current weekly, with all work instructions and change orders; mechanical, electrical, and instrumentation equipment accommodations; and construction adjustment. Drawings shall be subject to the inspection of the Engineer at all times, and progress payments, or portions thereof, may be withheld if drawings are not accurate and current. Prior to acceptance of the work, the Contractor shall deliver to the Engineer two (2) sets of neatly marked record drawings, accurately showing all the information required above.

## **PART 3 - EXECUTION**

### **3.01 SUBMITTAL PROCEDURE**

- A. At least thirty (30) days prior to the Contractors need for approval, Contractor shall forward to the Engineer all submittals required by the individual Sections of the Specifications.

- B. Identify all submittals by submittal number on letter of transmittal. Specification number shall be identified on the letter of transmittal. Submittals shall be numbered consecutively and resubmittals shall have a letter suffix. For example:
1. 1st submittal: 2
  2. 1st resubmittal: 2A
  3. 2nd resubmittal: 2B, etc.

### **3.02 INFORMATION TO BE SUBMITTED FOR REVIEW**

- A. Information on items to be submitted for review are specified in the individual Sections of these Specifications. Submittals for each Section shall be bound together in one book. Book shall have numbered tab dividers for each item. Submittals that are related to, or affect, each other shall be forwarded simultaneously as a package to facilitate coordinated review. Uncoordinated submittals will be rejected. Do not combine unrelated materials in the same submittal. Submittals shall be arranged in the same order as they appear in the Specification Section. Items shall be highlighted and clearly marked with the same identification number as indicated on the drawings. The Contractor shall include submittal time appropriate within each item of work on the Construction Schedule. The City will receive submittals at the preconstruction meeting as specified in Section 01105, General Information and Requirements.

**END OF SECTION**

## SECTION 01410

### QUALITY CONTROL

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

###### A. Work Included:

1. Cooperate with the Engineer's selected testing agency and all others responsible for testing and inspecting the work as described herein.
2. Provide such other testing and inspecting as are specified to be furnished by the Contractor in this section and/or elsewhere in the contract documents

###### B. Related Work

1. Requirements for testing may be described in various sections of these specifications and applicable codes.
2. Where no testing requirements are described but the Engineer decides that testing is required, the Engineer may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described in this section.

###### C. Work Not Included:

1. Selection of testing laboratory: The City will select a pre-qualified independent testing laboratory.
2. Payment for specified initial testing: The City will only pay for **initial** material strength testing of items described in Part 1.02 TESTING DESCRIPTION, subparagraph A.1, herein. Contractor shall be responsible to pay for all other testing.

##### 1.02 TESTING DESCRIPTION

###### A. Material Strength:

1. The City will only pay for initial testing services for concrete strength and slump, soil compaction, and grout strength.
2. When initial tests indicate non-compliance with the Contract Documents, the costs of any additional tests required for determining compliance will be deducted by the City from the Contract Sum as reflected in the progress payments due the Contractor.

###### B. Operational Testing: All operational tests shall be paid for by the Contractor.

C. Contractor's Convenience Testing:

1. Inspecting and testing performed exclusively for the Contractor's convenience, such as determining grain size or index properties of material proposed for use as import, shall be the sole responsibility of the Contractor.
2. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
3. The City will provide initial testing for trench/structure backfill and embankment compaction.

**1.03 REFERENCES**

ANSI/ASTM D3740	Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
ANSI/ASTM E329	Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

**1.04 LIMITS ON TESTING LABORATORY AUTHORITY**

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor.
- D. Laboratory has no authority to stop Work.

**1.06 CONTRACTOR RESPONSIBILITIES**

- A. Deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing, together with proposed mix designs.
- B. Cooperate with laboratory personnel, and provide access to Work and to manufacturer's facilities.
- C. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.
- C. Notify laboratory twenty-four (24) hours prior to expected time for operations requiring inspection and testing services.

## **PART 2 - PRODUCTS**

NOT USED

## **PART 3 - EXECUTION**

### **3.01 COOPERATION WITH TESTING LABORATORY**

- A. Representatives of the testing laboratory shall have access to the work at all times and at all locations where the work is in progress. Provide facilities for such access to enable the laboratory to perform its functions properly.

### **3.02 TAKING SAMPLES**

- B. All specimens and samples for testing, unless otherwise provided in the Contract Documents, shall be taken by the testing personnel. All sampling equipment and personnel will be provided by the testing laboratory. All deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

### **3.03 SCHEDULES FOR TESTING**

- A. Establishing Schedule:
  - 1. By advance discussion with the testing laboratory selected by the City, determine the time required for the laboratory to perform its tests and to issue each of its findings.
  - 2. Provide all required time within the construction schedule.
- B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate all such changes with the testing laboratory as required.

**END OF SECTION**

## SECTION 01500

### CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

A. Requirements Included:

1. Electrical
2. Water
3. Sanitary Facilities
4. Construction Aids
5. Cleaning During Construction
6. Project Identification
7. Security
8. Safety
9. Noise Control

B. Related Requirements:

1. Section 01770: Contract Closeout: Final Cleaning.

##### 1.02 WATER

A single outdoor hose bib is available for use at each well site. Use of this water source by the Contractor shall be allowed provided it does not interfere with necessary City use. Contractor shall make additional provisions for water if necessary for construction operations and for testing. The Contractor shall be responsible for all associated costs.

##### 1.03 SANITARY FACILITIES

Sanitary Facilities: The Contractor shall make arrangements for the maintenance of adequate toilet facilities at or near the work site and shall pay the costs thereof.

##### 1.05 CONSTRUCTION AIDS

Provide and operate drainage and pumping equipment as required to maintain excavations and site free of standing water.

##### 1.06 CLEANING DURING CONSTRUCTION

- A. Control accumulation of waste materials and rubbish; periodically dispose of off-site in a location approved by the Engineer.
- B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

## 1.07 TEMPORARY ELECTRICITY

Contractor shall provide temporary power to the worksite as required. Temporary power shall not be provided by the City or from existing facilities. All requests for exceptions to this policy shall be submitted in writing to and approved in writing by the Engineer.

## H. REMOVAL

- A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of two (2) feet, grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

## PART 2 - PRODUCTS

NOT USED

## PART 3 - EXECUTION

### 3.01 CONTRACTOR'S PLANT AND EQUIPMENT

- A. Security: The Contractor shall be responsible for the security of his plant and equipment at all times. The City will not take responsibility for missing or damaged equipment, tools or personal belongings.
- B. Workshop and Storage Facilities: The Contractor shall provide storage facilities for the protection from weather materials and supplies and shall keep the facilities clean and in proper order at all times.
- C. Parking Facilities: Parking areas at the project location for the vehicles used by the Contractor's construction employees and his own vehicles shall be as approved by the Engineer.

### 3.02 GENERAL AND TRENCH SAFETY

- A. The Contractor shall execute and maintain his work so as to avoid injury or damage to any person or property. All work shall be done in conformance with the State of California Division of Industrial Safety and OSHA Standards. Safety precautions, as applicable, shall include, but not be limited to, adequate fume protection; adequate illumination for underground and night operations; instructions in accident prevention for all employees; such machinery guards, walkways, scaffolds, ladders, bridges, and other safety devices, equipment and wearing apparel as are necessary or lawfully required to prevent accidents or injuries, and the proper inspection and maintenance of all safety measures. Contractor shall have emergency phone numbers and addresses posted on the job site.

- B. Trench safety shall conform to the provisions of Section 6705 of the Labor Code of the State of California.
- C. Excavation for any trench five (5) feet or more in depth shall not begin until the City has received the Contractor's detailed plan for worker protection from the hazards of caving ground during the excavation of such trench. Such plan shall be submitted at least five (5) days before the Contractor intends to begin excavation for the trench and shall show the details of the design of shoring, bracing, sloping or other provisions to be made for worker protection during such excavation. No such plan shall allow the use of shoring, sloping or a protective system less effective than that required by the Construction Safety Orders of the Division of Industrial Safety, and if such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared and signed by an Engineer who is registered as a Civil or Structural Engineer in the State of California.
- D. Contractor shall obtain, pay for, and comply with all provisions of the permit required by Section 6500 of the California Occupational Safety and Health Act of 1973.

### **3.03 NOISE CONTROL**

- A. Conform to City of Sacramento's Noise Ordinance. Section 66.203 of the ordinance exempts construction noise from the quantitative limits if the construction occurs between 7:00 am and 6:00 pm, Monday through Saturday, and/or between 9:00 am and 6:00 pm Sunday; Operation of internal combustion engines is not exempt pursuant to this subsection if engines are not equipped with suitable exhaust and intake silencers.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION (NOT USED)**

## SECTION 01511

### TEMPORARY ELECTRICITY

#### PART 1 - GENERAL

##### 1.01 REQUIREMENTS INCLUDED

- A. Power: Contractor shall provide and make arrangements for temporary electric service for all purposes of power and lighting as required for construction, and shall maintain such service until completion of the contract.

##### 1.02 RELATED REQUIREMENTS

- A. Section 01500: Construction Facilities & Temporary Controls
- B. Section 16010: Electrical Work
- C. Section 16530: Lighting

##### 1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with National Electric Code.
- B. Comply with Federal, State and local codes and regulations and with utility company requirements.

##### 1.04 SERVICE REQUIREMENTS

- A. Provide power centers, as required, for miscellaneous tools and equipment used in the work.
  - 1. Weatherproof distribution box with minimum of four (4) 20 amp, 120 volt grounded outlets.
  - 2. Locate so that power is available at any point of use with not more than 100 foot (30m) power cords.
  - 3. Minimum: One (1) on each floor of each building.
  - 4. Circuit breaker protection for each outlet.
- B. Capacity of Service:
  - 1. Provide electrical service for construction use by trades during the construction period; minimum 120/240 volts, 1 phase, 60 hertz.
  - 2. Notify SMUD when unusually heavy loads, such as for welding and other equipment with special power requirements, will be connected.

3. Any trade requiring service of capacity or characteristics other than that specified shall provide and pay for the additional service.
4. Make arrangements to obtain temporary power from the local utility, or use portable generators.

### **1.05 LIGHTING REQUIREMENTS**

- A. Provide temporary artificial lighting in enclosed areas and for all areas when natural light does not meet minimum requirements for:
  1. Construction work areas: Uniform illumination of 20 foot candles.
  2. Security.
  3. Temporary offices, storage, shop and other construction buildings.

### **1.06 COSTS OF INSTALLATION AND OPERATION**

- A. Pay fees and any permit charges for temporary power from SMUD.
- B. Pay costs of installation, maintenance and removal of temporary services, and restoration of any permanent facilities used.
- C. Cost of power used will be paid by the Contractor.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. General:
  1. Comply with applicable requirements specified in sections of Division 16 - Electrical.
  2. Materials may be new or used, but must be adequate for required usage, and must not violate requirements of applicable codes and standards.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Comply with applicable requirements specified in sections of Division 16 - Electrical.
- B. Maintain system to provide continuous service.
- C. Modify and extend service as work progress requires.

### **3.02 INSTALLATION**

- A. Locate fixtures to provide full illumination of required areas.
- B. Make connections for temporary heating, cooling and ventilating equipment.
  - 1. Wire all safety devices specified for final operation of equipment.
  - 2. Verify proper operation of safety devices.

### **3.03 REMOVAL**

- A. Completely remove temporary materials and equipment:
  - 1. When construction needs can be met by use of the permanent installation.
  - 2. And/or at project completion.
- B. Restore existing and/or permanent facilities used for temporary services to original or better condition.

**\*\* END OF SECTION \*\***

## SECTION 01600

### MATERIAL AND EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

A. Requirements Included:

1. Products.
2. Transportation and Handling.
3. Storage and Protection.
4. Substitutions and Product Options.

B. Related Requirements:

1. Section 01330: Submittals: Submittal of Manufacturers' Certificates.

##### 1.02 QUALITY ASSURANCE

- A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

##### 1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Manufacturer's Recommendations:

1. Except as otherwise approved by the Engineer, determine and comply with manufacturer's recommendations on product handling, storage and protection.
  - a. Maintain packaged materials with seals unbroken and labels intact until time of use.
  - b. Promptly remove damaged materials and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the City.
2. The Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality, and other pertinent information.
3. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

## 1.04 JOB CONDITIONS

### A. Storage and Protection:

1. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
2. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
3. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
4. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.
5. After installation, provide coverings to protect products from damage from traffic and construction operations, remove when no longer needed.
6. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

### B. Repairs and Replacements:

1. In event of damage, promptly make replacements and repairs to the approval of the Engineer and at no additional cost to the City.
2. Additional time required to secure replacements and to make repairs will not be considered to justify an extension in the Contract Time of Completion.

## 1.05 ALTERNATIVES

A. Within ten (10) days after date of Contract, submit complete list of major products proposed, with name of manufacturer, trade name, and model.

### B. Options:

1. Products Specified by Reference Standards or by Description Only: Any product meeting those standards.
2. Products Specified by Naming One (1) or More Manufacturers with a Substitute Paragraph: Submit a request for substitution for any manufacturer not specifically named.
3. Products Specified by Naming Several Manufacturers: Products of named

manufacturers meeting specifications; no options, no substitutions allowed.

4. Products Specified by Naming Only One (1) Manufacturer: No options, no substitutions allowed.

B. Substitutions:

1. Within ten (10) calendar days after date of Contract, Contractor shall submit requests to the Engineer for consideration of substitutions.
2. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
3. Request constitutes a representation that Contractor:
  4. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
  5. Will provide the same warranty for substitution as for specified product.

Will coordinate installation and make other changes that may be required for Work to be complete in all respects.

6. Waives claims for additional costs that may subsequently become apparent.
7. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.
8. Engineer will determine acceptability of proposed substitution, and will notify Contractor of acceptance or rejection in writing within a reasonable time.
9. The Engineer can, at his option, require as a condition of acceptance of a substitution that the Contractor provide a credit to the City for the difference in cost of product(s) or components, or systems proposed as a substitution.
10. If, upon Engineer's review of a substitution, it is determined by the Engineer that the substitution is not acceptable, for whatever reason, the Contractor shall supply the specified product or products.

**PART 2 – PRODUCTS(NOT USED)**

**PART 3 - EXECUTION**

### 3.01 SHIPPING AND PROTECTION OF EQUIPMENT

- A. Definition: For the purpose of this article, "equipment" means all mechanical devices, all electrical devices, all electronic devices, and all items with one or more moving parts.
- B. Packing and Marking: All equipment shall be adequately and effectively protected against damage from moisture, dust, handling or other cause during transport from manufacturer's or supplier's premises to site. Each item or package shall be clearly marked with a fitting or distinguishing mark that shall be shown on the packing lists. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or sub-assembled units where possible.
- C. Identification of Equipment: Each item of equipment shall have firmly affixed to it a nameplate, label or tag with its equipment number or other discrete identifying mark.
- D. Storage of Equipment: Contractor shall provide storage for equipment; for the entire interval between receiving and installation, and for the entire interval between being removed and reinstalled. Equipment shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions as required to ensure against equipment deterioration. Storage container shall be heated above dew point temperature.
- E. After installation, all equipment shall be protected as required. During construction, including finishing, all equipment that may be affected must be completely covered.
- F. Delivery of Equipment: City personnel will not accept materials or equipment deliveries for the Contractor.
- G. Security: Security of equipment stored by the Contractor is the sole responsibility of the Contractor. All losses or damage shall be replaced or repaired at the Contractor's expense.

**\*\* END OF SECTION \*\***

## SECTION 02220

### DEMOLITION AND SALVAGE OF MATERIALS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

- A. Scope of Work: The work includes demolition, removal, and salvage where specified of all items indicated on the drawings, or specified herein.
- B. All materials resulting from demolition work, except as otherwise indicated on the drawings or specified herein for re-use by the Contractor or re-use by the City shall become the property of the Contractor.

##### 1.02 AVAILABILITY OF WORK AREAS

- A. Subject to all related Contract stipulations, the contract area will be released to the Contractor, at one time, upon issuance of the Notice-to-Proceed. Unless otherwise directed, the Contractor shall maintain access to and shall not begin demolition of the existing well electrical and mechanical facilities until authorized in writing by the Engineer.

##### 1.03 SUBMITTALS

- A. The procedures proposed for the accomplishment of demolition and storage of salvaged materials shall be submitted for approval. The procedures shall provide for safe performance of work, careful removal and disposition of materials specified to be stored, protection of property which is to remain undisturbed, and coordination with other work in progress. The procedures shall include a detailed description of the methods and equipment to be reused for each operation, and the sequence of operations.
- B. Submit schedule for demolition activities.

##### 1.04 SAFETY PROCEDURES AND WORKER PROTECTION

- A. Take all precautions and measures required to protect employees, related trade employees, City employees, residents, and the general public from exposure to energized parts.
  - 1. All personnel authorized for entry into work areas shall be instructed in the proper procedures for high voltage work. In instances where off-line equipment may require removal from high voltage installations, personnel will be instructed and properly supervised for working in the vicinity of high-voltage equipment.

2. All electrical equipment upon which activities are to be performed shall be de-energized and permanently disconnected from any power source prior to commencing any work.
- B. Erect barriers, fences, guard rails, enclosures, chutes, and shoring to protect personnel, structures, and utilities remaining intact. Protect trees and plants from damage.

## **PART 2 - PRODUCTS(NOT USED)**

## **PART 3 - EXECUTION**

### **3.01 INSPECTION**

- A. Verify that areas to be demolished are unoccupied and no longer are in use.
- B. Do not commence work until conditions are acceptable to the City.

### **3.02 PREPARATION**

- A. Contractor shall hold a field meeting at the existing well site prior to beginning demolition work. Meeting shall cover the Contractors procedures for removal and transportation of salvaged items. Attendees shall include as a minimum: Tim Giffin (916) 808-7997, Vernon Fields (916) 808-5542, and Amy Kral (916) 808-5651 of the Department of Utilities, Plant Services Division. Contractor shall give attendees forty-eight (48) hours of notice in advance of said field meeting.
- B. Remove items scheduled to be salvaged for City, and place in designated storage area or as otherwise directed by the Engineer.

### **3.03 DEMOLITION**

- A. Salvage existing equipment as directed by City.
- B. Protect fencing, landscaping, and other improvements on adjacent private properties that are exposed by demolition work.
- C. Make neat saw cuts a minimum of one inch (1") in depth, around perimeter of Portland cement concrete or asphaltic concrete to be removed, where remaining concrete surface is to be incorporated into new work. Where new asphalt paving is to match existing asphalt paving, sawcut existing pavement to a neat straight line and apply a tack coat of asphaltic emulsion to the surface of the existing pavement prior to placing new asphalt paving.
- D. Remove existing exposed conduit and electrical wiring and conduit to be abandoned to structural surface, cut flush, and finish to match existing surfaces.

### **3.04 SALVAGE**

- A. The Contractor shall deliver any item to be salvaged to the City's Combined Sewage Treatment Plant, located at 1391 35th Avenue between the hours of 8:00AM and 2:00 PM. The Contractor shall contact Tim Giffin at (916) 808-7997 or Vernon Fields at (916) 808-5542 to coordinate delivery of these items. All removed conduit and conductors shall become property of the Contractor, unless otherwise directed by the Engineer.

**3.05 CLEAN-UP**

- A. Debris and Rubbish: Debris and rubbish shall be removed from the limits of work daily to a location approved in advance by the Engineer. Do not allow to accumulate on-site.
- B. Debris Control: Debris shall be removed and transported in a manner as to prevent spillage on streets or adjacent areas. Local regulations regarding hauling and disposal apply.

**\*\* END OF SECTION \*\***

## SECTION 02740

### PAVING AND GRAVEL SURFACING

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

###### A. Scope of Work

Contractor shall furnish all labor, materials, equipment, and incidentals necessary to construct all paving and gravel surfacing shown on the drawings, and/or specified herein. The work shall include, but not necessarily be limited to preparing the subgrade, placing and compacting aggregate base, saw cutting existing pavement, applying paint binder, placing and compacting asphalt concrete, applying seal coats, and all related work.

Areas to receive gravel surfacing shall be prepared, then aggregate base material placed and compacted as specified herein for paving, except that no paint binder or paving shall be placed.

###### B. Related Work Specified In Other Sections

1. Section 01410 - Quality Control
2. Section 02315 - Earthwork

##### 1.02 SUBMITTALS

###### A. The following information shall be submitted for approval in accordance with the General Conditions and Section 01330, SUBMITTALS.

1. Manufacturer's Data:
  - a. Aggregate base
  - b. Paint binder
  - c. Asphalt concrete mix design and copies of delivery tickets.
- B. A certificate of compliance, signed by the manufacturer, shall be furnished prior to the use of any project site asphalt materials. The certificate shall state that the furnished materials will comply with the requirements of these Specifications.
- C. A delivery ticket that clearly identifies the product and quantity of each lot of material shall accompany each load delivered to the site. Unless requested earlier by the Engineer, retain the delivery tickets until the end of the job.

**1.03 REFERENCE PUBLICATIONS**

<b>Caltrans (State of California, Department of Transportation):</b>	
--	Standard Specifications (July 1992)
--	Standard Plans (July 1992)
<b>American Society for Testing and Materials (ASTM):</b>	
D 1557	Test Methods for Moisture-Density Relations of Soil and Soil-Aggregate Mixtures
D 2041	Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
D 2922	Density of Soil and Soil Aggregate In-Place by Nuclear Methods
D 3017	Moisture Content of Soil and Soil Aggregate In-Place by Nuclear Methods

**PART 2 – PRODUCTS**

**2.01 AGGREGATE BASE**

Aggregate base shall be as specified in Section 02315 of these Specifications

**2.02 PAINT BINDER**

Paint binder (tack coat) shall meet all the requirements of Caltrans Specification Section 94

**2.03 ASPHALT CONCRETE**

- A. Asphalt concrete shall be commercially available material that meets the performance and grading requirements for Type A Asphalt Concrete (½ inch maximum, medium grading) as specified in Caltrans Standard Specification Section 39-2. Unless otherwise approved, the bitumen content shall be between 4.8 and 7.0 percent. A job mix formula will not be required provided that the material conforms to the requirements herein, **and** the mix design to be used has been approved by the City, County of Sacramento, or Caltrans, for placement on any project constructed within the last three years in Sacramento County.
- B. Asphalt shall conform to the requirements of Caltrans Standard Specification Section 92-1.02 for viscosity grade AR 4000 steam-refined paving asphalt.

**2.04 HEADER BOARD**

- A. Header board, where installation is required, shall consist of continuous pressure treated douglas fir 2 x 4 attached to 18-inch pressure treated douglas fir 2 x 4 stakes at 4 feet on center.

## **2.05 SLURRY SEAL**

- A. Slurry seal shall conform to CSSS Section 23-9.

## **PART 3 – EXECUTION**

### **3.01 SUBGRADE PREPARATION**

- A. The uppermost 0.50 feet of all existing subgrade that will underlie aggregate base placed this contract, shall be cleared and stripped, and then scarified to a depth of at least six (6) inches, moisture conditioned as required, and compacted to a relative compaction of not less than ninety-five percent (95%) in accordance with Section 02315.
- B. Wherever engineered fill material is to be placed under paved or gravel surfaced areas, it shall be placed and compacted to a relative compaction of not less than ninety percent (90%) to within the top six (6) inches and ninety-five percent (95%) for the top six (6) inches in accordance with Section 02315.

### **3.02 CLASS 2 AGGREGATE BASE**

- A. Class 2 aggregate base shall be placed to a depth as shown on the Plans and in these Specifications. Placement, moisturizing, spreading, and compaction of Class 2 aggregate base shall meet all requirements of Caltrans Standard Specification Sections 26-1.03 through 26-1.05, CSSS Specification Section 17-1, and the details on the drawings. Class 2 aggregate base shall be compacted to not less than ninety –five percent (95%) of maximum dry density.

### **3.03 PRIME COAT AND PAINT BINDER (TACK COAT)**

- A. After the sub-base and aggregate base are placed, compacted, and tested, to the satisfaction of the Engineer, the prime coat and tack coat shall be applied in accordance with Caltrans Standard Specification Section 39-4.02. Prime coat shall not be required atop aggregate base unless specifically called for on the plans.

### **3.04 ASPHALT CONCRETE**

- A. Place asphalt concrete where shown on the drawings, and to at least the minimum thicknesses indicated. Storing, proportioning, mixing, spreading, and compacting asphalt concrete shall conform to the requirements of Caltrans Standard Specification Sections 39-3 through 39-7, and CSSS Section 22.

### **3.05 SLURRY SEAL**

- A. Place slurry seal where shown on the drawings in accordance with CSSS Section 23.

### **3.06 HEADER BOARD**

- A. Header board shall not be required unless specifically called for on the drawings. Place header board at the limit of paving not abutting a concrete structure or saw cut line where it is specifically shown or called for on the drawings.

### **3.07 FINAL GRADING**

- A. The final grade of asphalt concrete and gravel surfacing shall vary not more than  $\pm 0.05$  foot from the elevations indicated on the drawings, and shall conform to the requirements of Caltrans Standard Specification Section 39-6. All areas shall be graded to drain.

### **3.08 TESTING**

- A. The City will perform the initial field testing for density, moisture, and compaction of asphalt and aggregate base. The Contractor shall pay for re-testing of locations failing to meet the specified compaction in the initial test.

**\*\* END OF SECTION \*\***

## SECTION 02741

### ASPHALT CONCRETE PAVING

#### PART 1 – GENERAL

##### 1.01 SUMMARY

- A. This specification describes furnishing, placing, installing, and compacting Aggregate Base and Asphalt Concrete Paving. Workmanship and materials specified herein that are required for project construction, shall be considered as part of the project, and no separate payment will be made therefore. Unless otherwise directed or approved by the Engineer, herbicide, prime coat, and slurry seal coatings are not required.

##### 1.02 REFERENCE STANDARDS

- A. Reference standards for the work herein shall be Sections 10, 17, and 22 of the Standard Specifications.
- B. In the event of a conflict, the requirements herein shall take precedence over those in the Standard Specifications.

##### 1.03 SUBMITTALS

- A. Submittals shall be made in conformance with Section 01300, and shall include:
  - 1. Certificate of compliance for the Aggregate Base.
  - 2. Asphalt Concrete Job-Mix formula.
  - 3. Certificate of Compliance for the Asphalt Concrete and the Striping Paint.

#### PART 2 – PRODUCTS

##### 2.01 AGGREGATE BASE

- A. Conform to Sections 10-7 and 17-1 of the Standard Specifications.

##### 2.02 ASPHALT CONCRETE

- A. Asphalt Concrete shall be Type A, ½” maximum, medium gradation, conforming to Sections 22-1 thru 22-8 of the Standard Specifications.
- B. Commercially available asphalt concrete approved within the last two years for City of Sacramento projects will be considered suitable for work on this project and will not require development of a new job mix formula, provided that the aggregate and asphalt gradations are as specified herein, and the resultant mix has between 4 and 7 percent voids and a stabilometer value of at least 37 when measured in accordance with California Test Method 366.

## **2.03 STRIPING PAINT**

- A. Striping paint shall be specifically formulated for use as a traffic lane marking paint to be applied on and compatible with asphalt concrete. Unless otherwise approved, comply with Federal Standard TT-P-115.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Conform to the aforementioned Standard Specification requirements for furnishing, placing, compacting, and finishing aggregate base and asphalt concrete. Skin patching shall not be used to obtain the specified finish surface tolerance.
- B. Installation of striping paint shall comply with the paint manufacturer's instructions.

**END OF SECTION**

**SECTION 02820  
CHAIN-LINK FENCES AND GATES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes:
  - 1. Fence, framework, fabric, signage, and accessories.
  - 2. Excavation for post bases and concrete foundation for posts.
  - 3. Gates and related hardware.
- B. Install new 8-foot tall industrial/commercial quality perimeter chain-link fence with three strands of barbed wire including any gates and necessary hardware at each site.

**1.02 REFERENCES**

- A. ASTM International (ASTM):
  - 1. A 121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
  - 2. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 3. A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 4. A 385 - Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
  - 5. A 392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
  - 6. A 702 - Standard Specification for Steel Fence Posts and Assemblies, Hot- Wrought.
  - 7. F 626 - Standard Specification for Fence Fittings.
  - 8. F 1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework.
  - 9. F 1184 - Standard Specification for Industrial and Commercial Horizontal Slide Gates.

**1.03 SUBMITTALS**

- A. Submit the following for approval, in accordance with CSSS Section 5-7:
  - 1. Catalog cuts for new fence materials.
  - 2. Certification reports that fence posts, hardware, and chain link fabric conform to the specifications herein.
  - 3. Layout drawing, hardware, and warranty info for review prior to manufacture

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. New Chain link fence and gates: One of the following, or equal:
  - 1. Allied Tube and Conduit.
  - 2. Master-Halco.
- B. Match existing fence materials where re-use is indicated.

**2.02 MATERIALS**

- A. 8-foot tall chain link fence:
  - 1. Fabric shall be Class 1 zinc-coated steel conforming to ASTM A 392 as follows:
    - a. Height: 96 inches.
    - b. Mesh: 2 inches.
    - c. Wire: 9 gauge, minimum 80,000 pounds per square inch tensile strength.
  - 2. Framework: In accordance with ASTM F 1043 Group 1A or 1C. Pipe shall be straight and conform to the following weights:

Pipe Size Outside Diameter	Group IA Weight	Group IC Weight
1-5/8	2.27	1.84
1-7/8	2.72	2.28
2-3/8	3.65	3.12
2-7/8	5.79	4.64
3-1/2	7.58	5.71
4	9.11	6.56

- a. Top rail: 1<sup>5</sup>/<sub>8</sub> inches outside diameter.
  - b. Tension wire: 7-gauge galvanized coil spring wire.
  - c. Line posts: 2<sup>5</sup>/<sub>8</sub> inches outside diameter.
  - d. Terminal, corner, and pull posts, including man gate hinge & strike posts:
    - 1) Size: 2<sup>7</sup>/<sub>8</sub>-inch outside diameter.
    - 2) Diagonal braces at terminal, corner and pull posts: 1 5/8-inch diameter.
    - 3) Truss rods: 3/8"-inch diameter, galvanized.
    - 4) Turnbuckles: Heavy duty, galvanized.
  - e. Coatings:
    - 1) Group IA: External coatings in accordance with ASTM F 1043, Type A; Internal coatings in accordance with ASTM F 1043, Type A.
    - 2) Group IC: External coatings in accordance with ASTM F 1043, Type B; Internal coatings in accordance with ASTM F 1043, Type D.
- 3. Accessories:
    - a. Fence fittings: In accordance with ASTM F 626.
      - 1) Post top fittings:
        - a) Provide post caps sized to post dimension that fit snugly over posts to exclude moisture. Except atop rolling gates

where barbed wire is vertical, provide hot dip galvanized steel combination style post caps with 45-deg barbed wire support arms. Provide dome style caps for vertical terminal posts adjacent to the rolling gate.

- b) Attach post caps with powder actuated Hilti stainless steel fasteners or comparable galvanized ¼-inch or longer self-tapping Tek-screws.
- 2) Rail and brace ends: Provide pressed steel or malleable castings that are cup shaped to receive rail and brace ends.
- b. Fabric accessories:
  - 1) Wire clips: Minimum 6 gauge hot-dip galvanized.
  - 2) Tension bars: 1/4 inch by 3/4 inch, galvanized.
  - 3) Steel bands: 11 gauge, 1 inch wide, hot-dip galvanized.
  - 4) Bolts and nuts: 3/8-inch diameter.
  - 5) Hog rings: 11 gauge.
- c. Barbed wire (Three strands, 1-foot vertical above top of fabric): Provide class 3 zinc coated 12.5 gage wire with four point round 14 gage barbs at 5-inch spacing in accordance with ASTM A121.

B. Chain Link Gates:

- 1. Frames shall be 1 7/8-inch outside diameter galvanized steel pipe in accordance with ASTM F 1043 Group IA or IC.
- 2. Corner fittings shall be Manufacturer's standard heavy pressed steel or malleable castings. Provide gates with diagonal tensioning rods and turnbuckles rigidly attached to gate frame.
  - a) Truss rods: 3/8 inch, galvanized.
  - b) Turnbuckles: Heavy duty, galvanized.
- 3. Chain link fence fabric: Attach to gate frame by use of tension bars and tie wires as specified for fence construction, with tension bars and associated band connectors spaced at approximately 16-inch vertical intervals.
- 4. Size gate frames to provide no more than a 4-inch clearance below the gate when closed.
- 5. Gates will be locked closed using padlocks with a minimum 5/16-inch diameter hasp.

C. Man gates:

- 1. Unless otherwise approved, frames shall be 4-feet wide, 6-feet 8-inches tall, with a 1-foot tall top and bottom rail framed chain-link covered transom above the gate.
- 2. Barbed wire shall run continuous across the man gate opening.
- 3. Provide a horizontal mid-height stiffener the same size as the perimeter frame.
- 4. Hardware:
  - a. Catch and locking attachment: Commercial grade combination steel or malleable iron catch and locking attachment of acceptable design for use with a padlock.

- b. Provide man gates with minimum 3 hinges designed to securely clamp to gatepost and permit gate to be swung open 180 degrees.
- D. Signage
  - 1. Provide 0.080 inch thick aluminum, nominal 16"x24" rectangular signs in general conformance with the layout drawing provided in the Plans. Signs shall be silk screened onto a reflective background for exterior use, and shall be coated with a UV resistant clear coat to inhibit graffiti. Provide stainless, galvanized, or cadmium coated steel hardware for attachment of the signs to the fencing. Manufacturer shall provide at least a 5 year warranty.
  - 2. Mount signs on the exterior of the perimeter chain link fence(31 signs are required for this project). Unless otherwise directed or approved, mount the top of signs 6" below the top of the chain link fence fabric. Install one sign on each man gate and each length of fencing exposed to public view. Maximum spacing between each sign shall not exceed 50 feet. Existing signage shall be reattached in its original position unless otherwise directed by the Engineer.

## 2.03 FABRICATION

- A. Gate Frames shall be welded and galvanized. Unless otherwise approved, shop weld by arc-gas shield method. Provide welds that are smooth and clean. No weld residue will be allowed.
- B. Shop finishing:
  - 1. Galvanizing: For items not fabricated of galvanized materials, hot-dip galvanize products after fabrication in accordance with following as applicable:
    - a. ASTM A123.
    - b. ASTM A153.
    - c. ASTM A385.
  - 2. Galvanize fabricated items complete, or in largest practicable sections.
  - 3. Provide galvanizing at rate of 2.0 ounces per square foot, minimum.
  - 4. Repair damaged galvanized surfaces and/or welds on pre-galvanized material with a cold applied 2.5 – 3.5 mil dried film thickness of galvanic zinc-rich coating containing 95% metallic zinc by weight in the dried film; such as ZRC Galvalite™ as manufactured by ZRC Worldwide, Marshfield, MA or approved equal. Coating shall conform to Federal Specification DOD-P-21035A for repair of hot-dip galvanizing, and shall be applied in accordance with the manufacturer's written instructions.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Surface preparation: Perform site grading ahead of post setting to permit grade of fence to remain constant over local elevations or depressions in ground line.

- B. Request City surveyor (7-day minimum advanced notice is required) to verify fence alignment to avoid private property encroachments.

### 3.02 INSTALLATION

- A. Chain link fences and gates:
  - 1. General:
    - a. Install chain link fence and gates as indicated on the Drawings and as specified herein. Fences shall be plumb, taut, true to line and grade, and complete in all details.
    - b. Install fencing to generally follow finish grade of ground and provide pull posts at points where required to conform to changes in grade.
    - d. Installed space between bottom of fence and finish grade shall not exceed 3 inches, and shall not exceed 4-inches below gates.
  - 2. Concrete foundations for fence posts:
    - a. Set fence posts centered in concrete foundations spaced not over 10 feet apart, that extend at least 3 feet into ground for line and 4 feet for terminal posts. Place additional posts at each abrupt change in line or change in grade, or as required for gate rail supports. Concrete shall be Class C per CSSS Section 10-5.1.
    - b. Provide concrete foundations having at least a minimum 12 inch diameter for line posts and 18 inch diameter for terminal posts.
    - c. Provide foundations that extend a minimum of 2-inches below bottom of posts, and a minimum of 1 inch above finish grade.
    - d. Finish trowel tops of footings, and slope to drain water away from the posts.
    - e. Set keepers, stops, sleeves, tracks, eye bolts, and other accessories into concrete as required.
    - f. Set rolling wheel tracks straight with the bottom of the rail flush with the adjacent finished concrete surface.
  - 3. Post bracing:
    - a. After posts are installed and concrete has set firmly, place top rail, braces, and bottom tension wire approximately 4 inches above grade.
    - b. End corner, pull, and gate posts: Brace with same material as top rail and trussed to line posts with rods and tighteners.
    - c. Bracing end, corner, slope, and gate posts:
      - 1) Brace to midpoint of nearest line post or posts with horizontal braces used as compression members.
      - 2) Then from such line posts truss from brace back to bottom of end, corner, slope, or gate post with 3/8-inch steel truss rods with turnbuckles or other suitable tightening devices used as tension members.
  - 4. Top rail:
    - a. Unless otherwise specified or indicated, install fence with top rail and bottom tension wire.
  - 5. Fabric:
    - a. Place fabric on gates and fence framework on outward side of the posts (away from the well site) and install so that top edge projects over top rail.

- b. Stretch fabric taut by means of mechanical fence stretchers to remove slack and securely fasten to posts, top rail, and bottom tension wire. Splice fabric lengths together by reweaving without breaking continuity of knuckled or twisted and barbed selvage.
  - c. Install tension wire parallel to line of fabric.
  - d. Fabric: Connect fabric to:
    - 1) Line posts with wire clips minimum every 14 inches.
    - 2) Terminal, corner, and gate posts with tension bars tied to posts minimum 14 inches on center and with steel bands and bolts and nuts.
    - 3) Tension wires with hog rings minimum 24 inches on center.
6. Barbed wire:
- a. Stretch strands to remove sag and anchor firmly to extension arms.
  - b. Incline extension arms on line posts away from the well site at approximately 45 degrees.
  - c. Transition to vertical post extensions adjacent to the rolling gate.

### 3.03 ADJUSTING

- A. All gates shall operate smoothly, with no more than 4-inches clearance below the gate when closed.
- B. Remove and replace un-plumb posts and fencing improperly located or not true to line and grade.
- C. Padlocks shall be accessible for keyed entry from the street side of the fence.

**\*\*END OF SECTION\*\***

**SECTION 03200**

**CONCRETE REINFORCEMENT**

**PART 1 - GENERAL**

**1.01 DESCRIPTION:** Provide reinforcing steel as shown on the Plans.

A. Related Work:

1. Section 01330 - Submittals
2. Section 03100 - Concrete Formwork.
3. Section 03150 - Concrete Accessories
4. Section 03300 - Cast-in-Place Concrete.

**1.02 REFERENCE PUBLICATIONS**

A. The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of publications at the time of bid shall govern.

B. American Concrete Institute (ACI) Standard

ACI 318	Building Code Requirements for Reinforced Concrete.
ACI SP-66	ACI Detailing Manual.

C. American Welding Society (AWS):

AWS D 12.1	Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction.
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D. City of Sacramento Standard Specifications (CSSS):

Section 10-25	Reinforcing Steel
Section 21	Placing Steel Reinforcement

E. Concrete Steel Reinforcing Institute (CRSI):

1MSP	Manual of Standard Practice(1997)
1SPLBK	Reinforcement Anchorages and Splices(1997)
1DET	Reinforcing Bar Detailing(2000)
1PLACE	Placing Reinforcing Bars(1997)

**1.03 SUBMITTALS**

A. Shop Drawings:

1. Reinforcing Steel: Before starting concrete work, submit shop drawings in accordance with Section 01330-SUBMITTALS. Comply with requirements of ACI 318, ACI SP-66, CRSI 1MSP, CRSI 1SPLBK, and CRSI 1DET. Show bar size, dimensions, bends, placing, and construction joint details. Submit drawing showing locations of any construction joints not shown on the plans. Maximum submittal drawing size shall be 22-inches by 34-inches. Submit type, size, and location of all slab and bar supports. Hooks, lap splices, bends and offsets shall be in accordance with the drawings. Obtain approval before shop fabrication.

B. Certificates of Compliance:

1. Submit Certificate of Compliance stating that reinforcement complies with specified requirements. Reinforcing steel shall be properly identified. Contractor shall bear costs for test of steel by an approved laboratory if the reinforcing steel is not properly identified.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. General: Conform to CSSS Section 10-23 except as modified herein. All materials covered by this Section shall be manufactured in the United States.
- B. Supports for reinforcing bars: Galvanized steel chairs and accessories or plastic coated units for work exposed to view, weather, or moisture so that finished surfaces will not be marred or stained; use precast concrete only (no metal), suitably sized for load distribution, in slabs-on-grade. Use no supports of wood or other cellulose material. Do not expose supports or accessories to view in architectural concrete.

## **PART 3 - EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Prior to installation of reinforcing steel work, Contractor shall inspect surfaces to receive work, and arrange for satisfactory correction of defects in workmanship and material that could have an adverse effect on reinforcing steel work.

### **3.02 FABRICATION AND DELIVERY**

- A. General: Conform to CSSS Section 21 except as modified herein.
- B. Bending and Forming: Fabricate indicated size bars into shapes and lengths shown on approved shop drawings by methods not injurious to materials. Do not heat reinforcement for bending. Bars with kinks or bends not in schedule will be rejected.
- C. Marking and shipping: Bundle reinforcement and tag with suitable identification

to facilitate sorting and placing, and transport and store at site so as not to damage material.

### 3.03 INSTALLATION

- A. General: Conform to CSSS Section 21, CRSI 1MSP, and CRSI 1PLACE except as modified herein.
- B. Reinforcement Welding: Where reinforcement welding is approved by the Engineer, perform welding by direct electric arc process, with trained and experienced certified operators. Conform to AWS D12.1. Use low-hydrogen electrodes. Do not tack weld reinforcing bars.
  - 1. Preparation: Clean surfaces to be welded of loose scale and all foreign material. Clean welds each time electrode is changed. Chip burned edges clean before welds are deposited.
  - 2. Characteristics of welds: When brushed with wire brushes, completed welds shall exhibit uniform section, smoothness of welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion with penetration into base metal. Cut out welds, or parts of welds found defective, and replace with proper welds.
- C. Concrete pours: At each location during concrete placing, inspect reinforcement and maintain bars in correct positions. Templates to maintain the correct position of reinforcing may be required. Contractor shall install templates, if required by the inspector, at no additional cost to the City.
- D. Contractor shall receive approval in writing from the Engineer of all reinforcing work prior to ordering concrete for placement.

**\*\*END OF SECTION\*\***

**SECTION 03300****CAST-IN-PLACE CONCRETE****PART 1 - GENERAL****1.01 DESCRIPTION:****A. Scope of Work:**

1. Unless otherwise directed, provide concrete as specified herein.

**B. Related Work:**

1. Section 01330 - Submittals
2. Section 03100 - Concrete Formwork.
3. Section 03200 - Concrete Reinforcement.

**1.02 REFERENCE PUBLICATIONS:**

- A. The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of publications in effect at the time of bid shall govern.
- B. American Concrete Institute (ACI) Standard:

ACI SP-15	Field Reference Manual: Standard Specifications for Structural Concrete with Selected ACI and ASTM references.
ACI 211	Recommended Practice for Selecting Proportions for Concrete.
ACI 301	Structural Concrete for Buildings.
ACI 302	Guide for Concrete Floor and Slab Construction.
ACI 304	Recommended Practice for Measuring, Mixing and Placing Concrete.
ACI 305	Hot Weather Concreting.
ACI 306	Cold Weather Concreting.
ACI 309	Consolidation of Concrete.
ACI 318	Building Code Requirement for Reinforced Concrete, with Commentary.

C. American Society for Testing and Materials (ASTM) Standards:

ASTM C 31	Method of Making and Curing Concrete Test Specimens.
ASTM C 33	Concrete Aggregates.
ASTM C 39	Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 94	Ready Mixed Concrete.
ASTM C 143	Slump of Portland Cement Concrete.
ASTM C 150	Portland Cement.
ASTM C 171	Sheet Materials for Curing Concrete.
ASTM C 172	Method of Sampling Freshly Mixed Concrete.
ASTM C 192	Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C 227	Test for Potential Alkali Reactivity of Cement-Aggregate Combinations.
ASTM C 231	Air Content of Freshly Mixed Concrete by the Pressure Method.
ASTM C 260	Air Entraining Admixture for Concrete.
ASTM C 289	Test of Potential Reactivity of Aggregates.
ASTM C 295	Petrographic Examination of Aggregates.
ASTM C 309	Liquid Membrane Forming Compounds for Curing Concrete.
ASTM D 98	Calcium Chloride.
ASTM D 1785	Poly (Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80 and 120.

D. City of Sacramento Standard Specification (CSSS):

Section 10	Construction Materials
Section 20	Concrete in Structures

**1.03 CONDITIONS**

- A. Notes: Notes pertaining to concrete on the Plan sheets are a part of these Specifications.
- B. Testing: Comply with the General and Special Conditions.

**1.04 SUBMITTALS**

A. MANUFACTURER'S DATA

- 1. Proposed mix designs, including admixtures

2. Curing Material
- B. Certificates:
1. Submit Certificate of Compliance that concrete meets the specified requirements.
  2. Delivery tickets for all concrete delivered to the project site.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Portland cement: ASTM C150, Type II or Type III.
1. Concrete: Standard gray cement. Use same brand for surfaces not to be painted.
- B. Water: Clean and free of substances injurious to concrete.
- C. Aggregate:
1. Do not use aggregates that are alkali reactive when tested by ASTM C227, C289, or C295.
  2. Unless otherwise noted, maximum coarse aggregate size shall be 1½-inches for walls and slabs greater than or equal to 12-inches thick, and 1-inch for walls and slabs less than 12 inches thick.
  3. Provide hard, washed, fine and coarse aggregates conforming to ASTM C33, including requirements for sampling and testing, except that loss after 500 revolutions in Los Angeles machine shall not exceed 40%. Limit material finer than No. 200 sieve to a maximum of 3% of the fine aggregate.
- D. Non-shrink grout: Master Builders premixed "Embeco", Burke's "Metallic Grouting Compound"; Sonneborn-Desoto "Ferrolith-G", or approved equal.
- E. Curing materials:
1. Liquid curing compound: ASTM C309, Type 1 (Clear) containing a fugitive dye.
  2. Sheet material: Double-layered, reinforced, stain proof, waterproofed Kraft paper, ASTM C171, regular type.
- F. Admixtures:
1. General: Provide only as indicated below. Submit manufacturer's data for admixtures, and use only those approved by Engineer. Use shall be in accordance with the manufacturer's recommendations.
  2. Water reducing: "Plastocrete", Sika Chemical Corporation; "WRDA with Hycol", W.R. Grace, or approved equal. Conform to ASTM C49A, Type A.

Use in all mixes.

3. Retarding: "Plastiment", Sika Chemical Corporation, or approved equal. Use for hot weather concreting only.

G. Concrete overlay bonding materials: Burke Acrylic Bondcrete or equal.

## 2.02 DESIGN OF MIXES

- A. General: The Contractor shall be responsible to design concrete mixtures resulting in the required 28-day compressive strength and other required characteristics. An approved laboratory shall design all mixes. Comply with ACI 211 "Recommended Practice for Selecting Proportions for Concrete" and ACI 304 "Recommended Practice for Measuring, Mixing and Placing Concrete" to produce plastic, workable mixture suitable for concrete work indicated, which will develop required compressive strengths, as indicated.
- B. Mix for conduit encasement: Concrete mix shall be Class D and contain a minimum of 5 sacks (470 pounds) of Portland cement per cubic yard. The maximum water/cement ratio shall be 0.50. The Contractor shall add red oxide, in the amount of 5 lbs. per cubic yard, to all concrete used for conduit encasement.
- C. Mix for antenna foundations, generator pads, building foundations and housekeeping pads, retaining walls, and footings: Concrete mix shall be Class B and contain a minimum of 6 sacks (564 pounds) of Portland cement per cubic yard. The compressive strength at 28 days shall be 4,000 psi. The maximum water/cement ratio shall be 0.50.
- D. The maximum slump for concrete shall be 4 inches. A tolerance of one inch above the maximum slump will be allowed, provided that the average of all batches is less than the specified maximum slump. Batches of concrete with slumps in excess of those specified will be rejected if their frequency of occurrence is excessive or the Contractor fails to take corrective action to reduce their occurrence. No water shall be added to the approved mix after batching except as approved by the Engineer.
- E. Batching and mixing: Use transit-mixed concrete from approved batch plant. Batching, mixing, and transportation of concrete shall conform to ASTM C94.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Embedded items: Includes installation of work built into concrete such as waterstop sleeves, anchor bolts, wood nailers, reglets, frames and sleeves for piping, conduit and fittings specified under other divisions. Provide facilities and supervision required for installation of inserts specified under other Sections, and perform cutting and reinforcing of forms required to accommodate them. Do not place any concrete until all inserted items are installed in their proper locations, secured against displacement, cleaned, inspected and approved. Furnish ties

and supports necessary to keep embedded items in place when concrete is placed.

- B. Clean Up: Remove excess water from forms before concrete is deposited. Remove hardened concrete, debris, and foreign materials from interior of forms and from surfaces of mixing and conveying equipment.
- C. Wetting: Prior to placing concrete, wet wood forms sufficiently to tighten up cracks. Wet all other materials sufficiently to reduce suction and maintain concrete workability.
- D. Earth or Gravel Subgrade: Lightly dampen subgrade no more than 24 hours in advance of concrete placement, but do not muddy. Reroll where necessary for smoothness and remove loose earth material.
- E. Screeds (Flatwork): Set screeds at walls and at maximum of 8-foot horizontal distance between adjacent screeds.
- F. Weather: Do not place concrete during rainy weather unless approved measures are taken to prevent damage to concrete. Cure concrete placed during periods of dry winds, low humidity, high temperatures and other conditions causing rapid drying, initially with a fine fog spray of water applied immediately after finishing and maintained until final curing operations are begun. Comply with the following:
  - 1. Hot weather: ACI 305
  - 2. Cold weather: ACI 306
- G. Pumping concrete: Maintain close observation of ambient temperature both at pump location and at discharge end. Allow for wide variance of temperature change.

### 3.02 FLATNESS TOLERANCE FOR FLOOR SLABS

#### A. SLABS (FLATWORK) INTERIOR AND EXTERIOR:

- 1. Finish slabs monolithically. Uniformly slope floor slabs to provide positive draining of indicated areas. Special care shall be taken so that a smooth, even joint is obtained between successive pours.
- 2. Finished surfaces shall be true plane surfaces with no deviation in excess of 1/8 inch in 10 feet when tested with a straight edge.
- 3. Replace or repair any slab which fails to meet this standard. If slabs fail to drain as indicated, remove drains and faulty floor section and refinish topping so that it drains according to the Drawings. No deviations will be allowed.

### 3.03 PLACING

- A. Formed concrete: Place concrete after subgrade, forms, and reinforcement has

been approved. Limit free vertical drop in concrete walls or columns to three (3) feet. In other concrete, limit the drop to five (5) feet. Deposit concrete in horizontal layers not more than 18" deep and continue pouring until section is completed. Control rate of pouring and depth of layers so that each layer will be covered within one hour after it is poured. Pour columns to top and allow to settle two (2) hours before additional concrete is placed. Place concrete continuously between pour joints.

- B. Grouting: Grout mix shall be regular concrete mix with  $\frac{1}{2}$  the large aggregate omitted. Use to cover the following before additional concrete is placed:
1. Flat form surfaces next to congested steel.
  2. Construction joints.
  3. Top of column and wall footings.
  4. On surfaces where concrete has set.
- C. Vibration and tamping: As concrete is placed in forms, work concrete around reinforcing steel, built-in items and into corners and angles. Extra care shall be given to work architectural concrete around inserts, reveals, quirks, corners and plastic cones of ties to preclude rock pockets, air pockets, and other defects, and to produce sharp corners, edges and smooth surfaces. Provide mechanical vibrators operated by experienced employees for agitating concrete in forms. Vibrate thoroughly within five (5) minutes after layer is placed. Carry vibration well into previous layer. Vibrators shall not be used to transport concrete inside forms. Internal vibrators shall maintain a speed of not less than 7,000 impulses per minute when submerged in concrete. Supplement vibration by suitable methods to eliminate voids along forms for full depth of layer as directed. Do not allow vibrators to strike overlaid plywood surfaces. Do not use vibrators to work concrete along forms. Keep at least one spare vibrator on job at all times while concrete is being placed. Comply with ACI Committee 309 consolidation of Concrete, Committee Report.
- D. Stoppage: Upon completion of a pour and after concrete has partially hardened, wash scum or laitance off surface with stiff brush and stream of water. When work is resumed, brush clean with wire brushes or sandblast, then place fresh concrete.
- E. Pumped concrete: Do not place concrete by pumping without prior written approval of the Engineer.
1. General: Do not use aluminum or aluminum lined pipe. Prevent concrete from contacting aluminum fittings.
  2. Mix: Do not add more water to mix unless approved by the Engineer. Check that the mix design entered on delivery ticket complies with that ordered.
  3. Pumps: Use only piston type pumps. Insure they are reversible. Make a

standby pump available of no less capacity than that in use for operation at the job within one hour's notice.

### **3.04 CONSTRUCTION JOINTS**

- A. The location and design of joints not shown or specified are subject to approval of the Engineer prior to placement of concrete.
- B. Horizontal Joints: Where joints occur in exposed concrete, set smooth painted wood strips in form to provide a straight and level joint in which upper pour laps lower pour. Place concrete level with, but not above top of pour joint strip as shown on Drawings. Allow 24 hours before concrete is placed over horizontal joints. Remove loose material and laitance. Clean by sandblasting, or wire brushing. Allow enough time between placing of adjacent pour sections to provide for initial shrinkage. Horizontal joints will not be allowed in beams, girders and slabs unless otherwise indicated.
- C. Vertical joints: Vertical joints not shown on the Drawings shall be so made and located as to least impair the strength of the structure and shall be approved by the Engineer prior to placement of concrete.

### **3.05 REPAIRS AND PATCHING**

- A. General: Patch defective areas immediately following form removal. Remove honeycombed and other defective concrete to sound concrete, but not less than 1" deep. Make the walls of the cut area perpendicular to the surface. Do not feather out the edges. Dampen the patch area and the adjacent area six (6) inches around the patch area.
- B. Exposed concrete: For exposed concrete prepare a patching mortar of one part portland cement adjusted to match the color of the surrounding concrete and 2-1/2 parts sand with the least water required to produce a workable mass. Rework this mortar until it is the stiffest consistency that will permit placing. Brush the patch area with a bond of neat cement and water paste and apply patching mortar when the water sheen is off the bond. Strike off the mortar slightly higher than the surrounding surface, let set for one hour and finish flush with the surrounding surface. Tie holes shall be cleaned, dampened and filled solid with the above specified patching mortar.

### **3.06 FINISHING FORMED SURFACES**

- A. Finish formed surfaces by removing any and all fins. The tolerances of finished formed surfaces shall conform to ACI 301.

### **3.07 FLATWORK**

- A. General: Place floor slabs on grade in alternate strips. Place each unit against construction joint forms with formed control joints perpendicular to the poured strips. Pour slabs-on-grade against a moist subgrade. Wet the subgrade the day before placing concrete. Moisten subgrade just ahead of concrete as it is placed. Do not place concrete in standing water. Provide new, clean cut, sharp-

edged wood headers at construction joints of suspended slabs. Deposit concrete evenly, consolidated with mechanical vibrators, particularly at side forms, and screed to indicated elevations and contours. Maintain full indicated thickness of slab over all parts of cambered support. Concrete shall be compacted with a grid tamper to eliminate voids and pockets and to produce a uniformly dense slab. Where ground slabs are left to receive deferred finishes, provide protection against contamination from time of placing concrete until time of placing finish. Remove contamination mechanically leaving a clean surface.

- B. Joints: Location and detail shall be as indicated. Tooling is required at control and pour joints.
1. Control joints: After concrete surface is screeded, cut concrete with a cutting bar, or other approved tool, approximately 1/4" thick x 2" deep. Form straight clean lines. After slot is formed in stiff concrete, insert 1/8" thick x 1-1/2" strip of tempered hardboard or plastic joint form zip strip. Butt strips neatly to line and flush with concrete surface. Finish slab flush with top of hardboard strips without tooling.
  2. Construction joints: Form construction joints with 2" nominal dressed lumber, or approved steel forms. Provide enough stakes to prevent sagging and misalignment under construction loads. Leave forms in place as long as possible and remove without chipping the edge of the slab. Protect the slab edge until the adjacent slab is placed.
  3. Expansion joints: Provide sponge neoprene joint filler where shown on the Drawings. Place filler to provide space for sealant as indicated. Seal joints with specified sealant per manufacturer's printed instructions. Thickness of filler material is indicated.

C. SLAB FINISHING

1. Broom Finish: Contractor shall apply a medium broom finish just after final troweling to all flat slabs not specified to receive another finish.
2. Wood float: Where wood float finish is indicated, screed slabs to elevations indicated. Compact with motor driven disk type compactor float and bull float to smooth, even surface. Perform final finishing with wood hand floats to give finished surface uniform, slightly roughened texture.
3. Steel trowel: Where steel trowel finish is indicated, tamp fresh concrete with a grid tamper enough to raise a thin bed of mortar to surface. Before finishing, remove any excess water. Level and compact with motor drive disk type compactor float. Immediately after floating, the surface shall be further leveled and compacted with a motor driven rotary trowel with flat-pitched blades. Final troweling shall be done with steel hand trowel after surfaces have become hard enough to produce a hard, dense, smooth, burnished surface.

### 3.08 CURING AND PROTECTING

- A. General: Do not use any curing method which will be incompatible with the specified applied finishes.
- B. Initial curing: Begin initial curing with water immediately after the final finishing operation. Keep the concrete continuously wet at least overnight. Use one of the following curing methods:
- C. FINAL CURING:
  - 1. Water or paper curing, mandatory for bridge slabs: Where water curing is used, keep surfaces continuously wet for seven (7) days. Where paper curing is used, keep the paper in place without torn areas for at least ten (10) days. Seal all joints in paper with a suitable waterproof cement or tape.
  - 2. Mandatory hot/dry weather curing: Use water curing for the first 24 hours of the required curing period.
  - 3. Optional curing: Surfaces not specified to receive a mandatory curing method may be cured by water, membrane, or paper curing. Use clear curing compound for all membrane curing and paper curing. Water and paper curing to be as specified above.
- D. Formed surfaces: Wood forms left in place during the final curing period shall be kept tight, wetting if necessary. If forms are removed during the curing period, one of the specified curing methods, as approved by Inspector, shall be applied immediately and continued for the remainder of the curing period.

### 3.09 MISCELLANEOUS

- A. GROUTING AND DRYPACKING
  - 1. Grout: One (1) part cement, two (2) parts sand and sufficient water that the grout will just flow under its own weight. Water reducing and workable agent may be added at the Contractor's option.
  - 2. Drypack: One (1) part cement, 2 parts sand, with just enough water to bind the materials together.
  - 3. Installation: Dampen surfaces before grouting and slush with neat cement. Force grout into place and rod so as to fill all voids and provide uniform bearing under plates. Provide smooth finish on exposed surfaces and damp cure for at least three (3) days.
- B. Non-shrink grout: Mix and place under structural steel base plates in accordance with manufacturer's printed instructions.

- C. Concrete overlay bonding: The surface of the existing concrete is to be roughened by sandblasting to remove loose material, rust and oils. Sufficient cement matrix should be removed to expose surface aggregates and to form a roughened surface for bonding. Clean with a high pressure water jet and allow to surface dry. Immediately apply an acrylic bonding agent such as Burke Acrylic Bondcrete at the rate of 200 sq. ft. per gallon and follow with placement of the concrete overlay after a minimum of one hour and after the film is dry to the touch. Install bonding agent in strict accord with manufacturer's instructions.

**3.10 QUALITY CONTROL**

- A. The Engineer shall be responsible for the routine quality control testing of concrete mixes.
- B. Slump Test: Slump test shall be performed at the job site by the Engineer in accordance with ASTM Test Method C 143.
- C. Compressive Strength Tests: Each day concrete is poured, the Engineer shall mold four concrete test cylinders in accordance with ASTM C31. City shall pay for the service of an independent testing company to cure and test the concrete cylinders in accordance with ASTM C39 and C172 unless samples fail to meet requirements, in which case Contractor shall pay for retesting done to the same requirements. Cylinders shall be tested at 7 days, 14 days, 21 days, and 28 days.
- D. The Contractor shall assist the Engineer in obtaining samples of fresh concrete.
- E. Methods of sampling and testing concrete mixtures shall include but not be limited to the following:

Composite Samples:	ASTM C172.
Specimen Preparation:	ASTM C31.
Compressive Strength:	ASTM C39.
Air content:	ASTM C173 or C231.
Slump:	ASTM C143.
Unit Weight:	ASTM C138

- F. Evaluation and acceptance of concrete and concrete structures shall be in accordance with Chapters 17 and 18 of ACI 301.

**\*\*END OF SECTION\*\***

**SECTION 05080****MECHANICAL ZINC COATING****PART 1 - GENERAL****1.01 DESCRIPTION**

This section specifies mechanically applied zinc coating. This coating shall be used on steel fasteners including bolts, screws, nuts and washers. Electroplated corrosion protection is not an acceptable substitute for mechanical zinc coating.

**1.02 QUALITY ASSURANCE**

**ZINC COATING THICKNESS:** Coating thickness shall be Class 50 as specified in ASTM B695.

**1.03 REFERENCES**

This section contains references to the following documents. They are a part of this section as specified and modified. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

References	Title
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B695	Coatings of Zinc Mechanically Deposited on Iron and Steel

**1.04 SUBMITTAL**

Submittals shall be provided in accordance with Section 01330, and shall include the following information.

1. Describe materials and method of coating used.

**PART 2 - PRODUCTS****2.01 MATERIALS**

The coating material shall be as specified in ASTM A153.

## **PART 3 - EXECUTION**

### **3.01 REPAIR OF DEFECTIVE GALVANIZED COATING**

Where zinc coating has been damaged after installation, substrate surface shall be first cleaned and then repaired with zinc dust-zinc oxide coating in accordance with ASTM A780. Application shall be as recommended by the zinc dust-zinc oxide coating manufacturer. Coating shall consist of multiple coats to dry film thickness of 8 mils. Items not physically damaged, but which have insufficient or deteriorating zinc coatings, and items damaged in shipment or prior to installation, shall be removed from the project site for repair by the hot-dip zinc coating method.

**\*\*END OF SECTION\*\***

**SECTION 05090****WELDING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Scope of Work: unless otherwise approved or directed, perform all required project welding as specified herein.
- B. Related Work:
1. Section 01330: Submittals
  2. Section 05505: Miscellaneous Metal Work
- C. Definitions:
1. Definitions shall be in accordance with AWS A3.0.
  2. Symbols shall be in accordance with AWS A2.4 for welding and nondestructive testing, respectively, unless otherwise indicated.

**1.02 REFERENCES**

This section contains references to the following documents. They are a part of this section as specified and modified. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

AISC - 1999	LRFD Specification for Structural Steel for Buildings (with Commentary & Errata Incorporated as of September 4, 2001)
ANSI Z49.1-1973	Safety in Welding and Cutting
AWS A2.4-79	Symbols for Welding and Nondestructive Testing
AWS A3.0-80	Welding Terms and Definitions
AWS A5.18-69	Specifications for Carbon Steel Filler Metals for Gas Shielded Arc Welding
AWS D1.1-82	Structural Welding Code - Steel
MIL-W-8611A	Welding, Metal Arc and Gas, Steels and Corrosion and Heat Resistant Alloys
MIL-STD-1261A	Welding Procedures for Constructional Steels
MIL-STD-248C	Qualification Tests for Welders (Other than Aircraft Weldments)
MIL-STD-22D	Welded Joint Design

### 1.03 QUALITY ASSURANCE

#### A. Erector/Fabrication Qualification

1. Each welder and welding operator assigned to work on this contract shall be qualified in accordance with the applicable requirements of AWS D1.1, MIL-STD-248C and as specified herein. Welders and welding operators who make acceptable procedure qualifications test welds will be considered qualified for the welding procedure used.
2. Each welder or welding operator shall be assigned an identifying number, letter or symbol which shall be used to identify all welds made by him.
  - a. The Engineer may, at his discretion, require welders and welding operators assigned to the project to identify their completed weldments with their identifying number, letter or symbol.
  - b. For identification of welds, either written records indicating the location of welds made by each welder, welding operator or tacker shall be submitted or each welder, welding operator or tacker shall apply his symbol adjacent to the weld by means of a rubber stamp or felt-tipped marker and waterproof ink or other methods that do not result in an indentation in the metal.
  - c. In the case of seam welds, the identification mark shall be adjacent to the weld at three (3) foot intervals. Identification by the use of die stamps or electric etchers shall not be allowed.
3. Re-qualification of a welder or welding operator shall be required under any of the following conditions:
  - a. The welder or welding operator has not used the specific welding process for which he is qualified for a period exceeding six (6) months.
  - b. There is specific reason to question his ability to make welds that meet the requirements of these specifications.
  - c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract and a qualification test has not been taken within the preceding twelve (12) months.

#### B. Welding Operations:

1. This section covers structural welding and mechanical welding. Welding shall be performed where indicated on the contract drawings, on approved shop drawings, and in other sections of the specifications. Unless otherwise indicated on the drawings or in other sections of the

specifications, the design of welded connections shall conform to the applicable requirements of AISC Specification for the nondestructive Design, Fabrication and Erection of Structural Steel for Buildings.

2. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Welding shall be in accordance with the requirements are shown on the drawings or are specified in other sections.
3. Welding shall not be started until welding procedures, welders, welding operators have been qualified as specified herein. Qualification testing shall be performed at or near the work site. Each Contractor performing welding shall maintain records, readily available for examination by the Inspector, of the test results obtained in welding procedure, welder, welding operator performance qualifications.
4. Welding procedures, welders, welding operators previously qualified by test may, at the discretion of the Engineer, be accepted for this contract without re-qualification provided that all of the following conditions are fulfilled:
  - a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder and welding operator qualification test records are submitted and approved by the Engineer in accordance with the requirements for shop drawings.
  - b. Testing was performed by an approved testing laboratory, technical consultant, or the Engineer's approved quality control organization.
  - c. The qualified welding procedure conforms to the applicable requirements of this specification and is applicable to welding conditions encountered under this contract.
  - d. The welder and welding operator qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.
  - e. Renewal of Qualification, shall be met. Records showing period of employment, name of employer where welder or welding operator was last employed, and the process for which qualified shall be submitted as evidence of conformance.

C. Allowances Tolerances:

1. Dimensional tolerances for welded construction, details of welds, and quality of welds shall be in accordance with the applicable requirements of the AWS D1.1 and the contract drawings, and to the satisfaction of the Engineer.
2. Welding miscellaneous steel supports is structural welding and shall be subject to ten percent (10%) random inspection.

3. Structural welding shall be subject to twenty percent (20%) nondestructive inspection.

D. Source Quality Control:

1. The Contractor shall be responsible for the quality of all welding and joint preparation. Each person responsible for inspection and testing shall be qualified in accordance with this section as applicable and shall be knowledgeable of the specification requirements.
2. The services of a qualified commercial inspection or testing laboratory or technical consultant, approved by the Engineer shall be employed by the Contractor for the purpose of making twenty percent (20%) nondestructive inspection of all structural and mechanical welding, ten percent (10%) random inspection, of the structural welds on miscellaneous steel supports. Unacceptable welds shall be repaired by the Contractor at no additional expense to the Owner.
3. Prior to assigning any welder or welding operator tacker to work under this contract, the Contractor shall submit the names of the welders and welding operators to be employed on the work together with certification that each individual is qualified as specified herein. The certification shall state the type of welding and positions for which he is qualified, and the firm and individual certifying the qualification tests.

**1.04 SUBMITTALS**

A. Shop Drawings:

1. Submit shop drawings in an accordance with Section 01330: SUBMITTALS.
2. Submit a complete list of equipment and materials, including manufacturer's descriptive and technical literature, catalog cuts, and erection installation details.
3. Shop drawings shall show sizes, arrangement and methods of fabrication and installation.
4. Furnish equipment layout showing structural members and points of welding. Also furnish any other details required to demonstrate that the system has been coordinated and will properly function.

B. Welders Certificates:

1. Welders certificates shall be submitted in accordance with the General Conditions and Section 01330: SUBMITTALS.
2. Contractor shall submit a welding certificate for each welder of this job.

C. Manufacturer Data: Weld filler metal.

### **1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

A. Comply With Pertinent Parts of the General and Special Conditions:

1. Delivery of steel shall be made in accordance with ASTM A 700.
2. All equipment placed in storage shall be protected from the weather, humidity and temperature variations, dirt, dust, and other contaminants.
3. Items deformed so as to preclude satisfactory assembly shall not be used, and upon rejection, shall be removed for the site and replaced with acceptable items at the expense of the Contractor.

## **PART 2 - PRODUCTS**

### **2.01 WELDING MATERIALS**

All items of equipment for welding, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures. All welding materials shall comply with the applicable requirements of AWS D1.1.

### **2.02 WELD FILLER METAL**

A. Shall conform with AWS A5.18.

## **PART 3 - EXECUTION**

### **3.01 STRUCTURAL WELDING OPERATIONS**

- A. Workmanship and techniques for welded construction shall be in conformance with the applicable requirements of the AISC-1999 LRFD Specification for Structural Steel for Buildings, and of AWS D1.1. In case of conflict between AWS D1.1 and the AISC specification, the requirements of AWS D1.1 shall govern.
- B. Welds shall meet the following minimum requirements:
1. On members whose maximum dimension is two inches (2") or less, the weld must extend completely across the side or surface of largest dimensions.
  2. On members whose largest dimensions is greater than two inches (2") but less than twelve inches (12"), one weld of at least two inches (2") in length shall be provided.
  3. On members whose largest dimension is greater than twelve inches (12"), two or more welds, each not less than two inches (2") in length, are to be provided at uniform spacings across the surface of largest dimension.

The maximum spacing between successive welds must not exceed twelve inches (12").

4. At butt joints use complete penetration welds on all member whose thickness is maximum seven (7) gauge or less.
5. Fillet welds are to have an effective size equal to the thickness of the members or as specified in AISC Pub: Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

### **3.02 WELD QUALITY**

- A. Where not otherwise specified in this specification, welded joint design shall follow MIL-STD-22D.
- B. The general quality of weldments shall be such that no gaps, burnthroughs, holes, cracks, bubblers, wormholes, undercuts, inclusions or porosity shall be present.
- C. Fillet welds shall be as shown on the drawings. If not shown, the welds shall be the same dimension as thickness as the lesser width of the base metal being welded.
- D. All shield and conduit welds shall be continuous circumferential with no metal discontinuities allowed.

### **3.03 BONDING SURFACE PREPARATION**

- A. Mating surfaces shall be free of any foreign materials, e.g., dirt, filings, preservatives, etc., and non-conducting films such as paint, anodizing, and oxides and other metallic films.
- B. After cleaning, the bond shall be assembled or joined as soon as possible within thirty (30) minutes if practicable. When more than two (2) hours is required between cleaning and assembly of the bond, a temporary protective coating shall be applied. This coating shall be removed before completing the bond. The bond surface shall be kept free of moisture before assembly and the completed bond given a protective finish coat of paint as specified under Section 09970: METAL COATINGS.

### **3.04 INSPECTION AND TESTS**

- A. In addition to the inspection and tests performed by the Contractor for quality control, the Engineer will perform inspection and testing for acceptance to the extent determined by the Inspector.
- B. The Engineer reserves the right to perform supplemental nondestructive tests to determine compliance with this section.
- C. The welding shall be subject to inspection and tests in the mill, shop and field.

- D. Inspection and tests in the mill or shop will not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality.
- E. When materials or workmanship do not conform to the specification requirements in the opinion of the Engineer, the Engineer reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment.

### **3.05 CORRECTIONS AND REPAIR**

- A. When inspection or testing indicated defects in the weld joints, the welds shall be repaired by the Contractor using a qualified welder or welding operator as applicable.
- B. Repair shall be at no additional cost to the Owner.
- C. Corrections shall be in accordance with the applicable requirements of AWS D1.1 and as herein specified.
- D. Defects shall be repaired in accordance with the approved procedures.
- E. Defects discovered between passes shall be repaired before additional weld material is deposited. Wherever a defect is removed the surrounding surface shall be prepared accordingly so as to avoid sharp notches, crevices, or corners.
- F. After a defect is thought to have been removed, and prior to re-welding, the area shall be examined by the Inspector to insure that the defect has been eliminated.
- G. Repair welds shall meet the inspection requirements of the original welds.

**\*\* END OF SECTION \*\***

**SECTION 05100**  
**STRUCTURAL METALS**

**PART 1 - GENERAL****1.01 DESCRIPTION**

## A. Work Included:

1. This section specifies structural metals consisting of standard shapes, fasteners, rods and plates that are used in structural supports and connections.

## B. Related Work Specified in Other Sections

1. Section 01330: Submittals
2. Section 05090: Welding

**1.02 REFERENCE PUBLICATIONS**

- A. This section contains references to the following documents. They are a part of this section as specified and modified. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
AISC	American Institute of Steel Construction, Manual of Steel Construction, Load & Resistance Factor Design
ASTM A36/A36M	Structural Steel
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A283/A283M	Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars
ASTM A320/A320M	Alloy-Steel Bolting Materials for Low Temperature Service
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural

Reference	Title
	Tubing in Rounds and Shapes
ASTM B308	Aluminum-Alloy Standard Structural Shapes, Rolled or Extruded
AWS-B3.0	Welding Procedures and Performance Qualifications
AWS-DI.1	Structural Welding Code--Steel

**1.03 QUALITY ASSURANCE**

A. General

1. Structural assemblies and shop and field welding shall meet the requirements of the AISC Manual of Steel Construction.
2. The use of salvaged, reprocessed or scrap materials shall not be permitted.

**1.04 SUBMITTALS**

- A. Submittals shall be provided in accordance with Section 01330 SUBMITTALS.
- B. Detailed shop drawings of steel frame component parts of all structures. Submittals shall include the location, type and size of all bolts and welds. All welds shall be indicated by standard welding symbols of the AWS. The member cambers shall be indicated on the drawings.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

A. Steel

1. Materials for structural metals shall be as specified below.

Material	Specification
Standard rolled steel sections	ASTM A36
Pipe columns	ASTM A53, Grade B

Structural steel tubing	ASTM A500, Grade B
Structural bars, plates, and similar items	ASTM A36 or A283
Stainless steel	ASTM A666, Grade A, type 304 or Type 316
Stainless steel bolts, nuts, and washers	ASTM A320, type 316
Steel bolts	ASTM A307, Grade A

B. Aluminum

1. Unless otherwise specified, aluminum shall be extruded from 6061-T6 or 6063-T6 alloy, conforming to ASTM B308.

**2.02 FABRICATION**

Fabrication shall be in accordance with the AISC Manual of Steel Construction.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. General

1. Measurements shall be verified at the job.
2. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Whenever needed, because of the thickness of the metal, holes shall be subpunched and reamed or drilled. No drifting of bolts nor enlargement of holes will be allowed to correct misalignment. Mismatched holes shall be corrected with new material.
3. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. Aluminum in contact with concrete or grout shall be protected with a heavy coat of bituminous paint.
4. Metalwork to be embedded in concrete shall be as specified in Section 03300. Metalwork shall be placed accurately and held in correct position while the concrete is placed or, if specified, recesses or blockouts shall be formed in the concrete after design strength is attained, and the metalwork shall be grouted in place in accordance with Section 03300. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned.

5. Structural steel completely encased in concrete shall not be painted, and shall have a clean surface for bonding to concrete. Metalwork which is bent, broken or otherwise damaged shall be repaired or replaced by the Contractor.

B. Welding

1. Welding shall conform to Section 05090, Welding.
2. Unless otherwise specified, continuous welds shall be provided on all structural members that are exposed to weather or submerged in water or wastewater, and continuous seal welds shall be provided on both sides of all plates or structural shapes that are in contact with or submerged in water or wastewater.

C. Bolted Connections

1. Bolted connections shall conform to AISC Framed Beam Connections and shall be bearing type connections with threads excluded from shear planes.

### 3.02 CORROSION PROTECTION

- A. Unless otherwise specified, all structural metal and structural steel, including that used in the fabrication of process equipment, shall be coated in accordance with Section 09900. Surface preparation shall be as specified in Section 09900 and shall include the following operations:
1. Grind the exterior and interior edges of all flame-cut plates or members to a smooth surface.
  2. Grind all sharp edges off of sheared plates and punched holes.
  3. Grind uneven or rough welds with high beads to a smooth finish.

### 3.03 CLEANING

- A. After installation, damaged surfaces of shop primed metals shall be cleaned and touched up with the same material used for the shop coat. Damaged surfaces of galvanized metals shall be repaired as specified in Sections 5080 and 5910.

**\*\* END OF SECTION \*\***

**SECTION 05451****ANCHOR BOLTS****PART 1 - GENERAL****1.01 DESCRIPTION**

This section specifies anchor bolts complete with washers and nuts. Unless otherwise specified, anchor bolts shall be hot-dip galvanized or type 304 stainless steel and shall conform to the equipment manufacturer's recommendations.

**1.02 REFERENCES**

This section contains references to the following documents. They are a part of this section as specified and modified. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Reference	Title
ANSI A58.1	Minimum Design Loads for Buildings and Other Structures
ASTM A36/A36M	Structural Steel
ASTM A307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A320/A320M	Alloy-Steel Bolting Materials for Low Temperature Service
UBC-97	Uniform Building Code

**1.03 SUBMITTALS**

A. Submittals shall be provided in accordance with Section 01330 for all bolt systems not cast-in-place and shall include the following information:

1. Data indicating load capacities.
2. Chemical resistance.
3. Temperature limitations.

4. Installation instructions.
5. Evaluation Report for expansion and wedge type anchors as specified in paragraph 3.04.
6. Design calculations in accordance with Paragraph 2.03.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

- A. Anchor bolt holes in equipment support frames shall not exceed the bolt diameters by more than 25 percent, up to a limiting maximum oversizing of 1/4 inch. Unless otherwise specified, minimum anchor bolt diameter shall be 1/2 inch.
- B. Tapered washers shall be provided where mating surface is not square with the nut.
- C. Expansion, wedge, or adhesive anchors set in holes drilled in the concrete after the concrete is placed will not be permitted in substitution for anchor bolts except where otherwise specified. Upset threads shall not be acceptable.

**2.02 MATERIALS**

Anchor bolt materials shall be as specified below.

Material	Specification
Steel bolts	ASTM A307, Grade A
Fabricated steel bolts	ASTM A36
Stainless steel bolts, nuts, washers	ASTM A320, Type 304
Expansion anchors	HILTI-BOLT, McCulloch Industries, or equal
Adhesive anchors	Simpson, HILTI-HVA, PARABOND Capsule, or equal
Headed anchor stud	Nelson Stud or equal <sup>a</sup> Use Type 316 where specified.

## 2.03 DESIGN

Anchor bolts for equipment frames and foundations shall be designed in accordance with UBC for seismic zone 3,  $I = 1.5$ .

## PART 3 - EXECUTION

### 3.01 GENERAL

Fieldwork, including cutting and threading, shall not be permitted on galvanized items. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. Grouting of anchor bolts with nonshrink or epoxy grouts shall be in accordance with the bolt manufacturer's recommendations.

### 3.02 CAST-IN-PLACE ANCHOR BOLTS

- A. Anchor bolts to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed or, if specified, recesses or blockouts shall be formed in the concrete and the metalwork shall be grouted in place in accordance with Section 03300. The surfaces of metalwork in contact with concrete shall be thoroughly cleaned.
- B. After anchor bolts have been embedded, their threads shall be protected by grease and the nuts run on.

### 3.03 ADHESIVE ANCHOR BOLTS

Use of adhesive or capsule anchors shall be subject to the following conditions:

1. Approval from Engineer for specific application and from supplier of equipment to be anchored, if applicable.
2. Anchor diameter and grade of steel shall be per contract documents or per equipment supplier specifications. Anchor shall be threaded or deformed full length of embedment and shall be free of rust, scale, grease, and oils.
3. Adhesive capsules of different diameters may be used to obtain proper volume for the embedment, but no more than two capsules per anchor may be used. When installing different diameter capsules in the same hole, the larger diameter capsule shall be installed first. Any extension or protrusion of the capsule from the hole is prohibited.
4. All installation recommendations by the anchor system manufacturer shall be followed carefully, including maximum hole diameter.
5. Holes shall have rough surfaces, such as can be achieved using a rotary percussion drill.
6. Holes shall be blown clean with compressed air and be free of dust or standing water prior to installation.
7. Anchor shall be left undisturbed and unloaded for full adhesive curing period.

8. Concrete temperature (not air temperature) shall be compatible with curing requirements of adhesives per adhesive manufacturer. Anchors shall not be placed in concrete below 25 degrees F.

### **3.04 EXPANSION ANCHORS**

- A. Use of expansion or wedge type anchors shall be subject to subparagraph conditions 1, 2, 4, 5, and 6 as specified in Paragraph 3.03A hereinbefore.
- B. The Contractor shall supply the Engineer with the current evaluation report from the International Conference of Building Officials for the particular brand of expansion anchors to be used.

**\*\* END OF SECTION \*\***

## SECTION 05505

### MISCELLANEOUS METALS

#### PART 1 - GENERAL

##### 1.01 DESCRIPTION

A. Scope of Work:

1. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metals as shown on the drawings and specified herein.

B. Related Work:

1. Section 01330: Submittals
2. Section 05090: Welding
3. Section 05100: Structural Metals
4. Section 09900: Painting

##### 1.02 COORDINATION

A. The work of this section shall be completely coordinated with the work of other sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this section that are to be built into the work of other sections.

##### 1.03 SUBMITTALS

A. Manufacturer's certificate of compliance shall be submitted for approval on all materials and manufactured products provided under this specification.

B. Shop drawings shall be submitted for approval in accordance with Section 01330: SUBMITTALS. Also submit for approval catalog cuts, templates and erection and installation details, as appropriate, for all miscellaneous metal items. Submittals shall be complete in detail; shall indicate thickness, type grade, class of metal and dimensions; and shall show construction details, reinforcement, anchorage and installation with relation to the structure of which they are part.

##### 1.04 REQUIREMENTS

A. General: The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with Section 05090: WELDING. Items specified to be galvanized, shall be hot-dip processed after fabrication. Galvanizing shall be in accordance with ASTM A123, A153, A386 and A525, as applicable.

- B. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included.
- C. All bolts, anchors, supports, braces, connection and other items necessary for completion of the miscellaneous metal work shall be provided. Necessary lugs and brackets shall be provided so that the work can be assembled in a neat and substantial manner. Holes for bolts and screws shall be drilled or punched. Burning of holes is prohibited. Poor matching of holes shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to the weather shall be formed to exclude water.
- D. Dissimilar Materials: Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of bituminous paint conforming to MIL-C 18484 or to TT-V-51 or a coat of zinc chromate primer conforming to TT-P 645 to prevent galvanic or corrosive action.
- E. Workmanship: Miscellaneous metal work shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean, true lines and surfaces. Welding shall be continuous along the entire area of contact (except where tack welding is specifically shown on the drawings). Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces for work in place shall have a smooth finish, and exposed riveting shall be flush. Where tight fits are required, joints shall be milled to a close fit. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Work shall be executed and finished in accordance with approved drawings, cuts and details.
- F. Qualifications of Welders: Welding to or on structural steel or miscellaneous items of structural steel such as lintels and ladders shall be performed by certified welders qualified in accordance with Section 05090: WELDING using procedures, materials and equipment of the type required for the work.
- G. Anchorage: Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts or expansion shields; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Slotted inserts shall be of types required to engage with the anchors. Do not use power driven fasteners on this job.
- H. Galvanized Materials: Unless otherwise indicated or approved, all exposed ferrous metal and structural steel shall be hot-dipped galvanized. Fabricated items shall be ground smooth at welded joints, edges, and corners and galvanized after fabrication.

Other items to be galvanized shall include, but not necessarily be limited to, the following:

1. All steel hardware, nuts, bolts, washers, anchors, and threaded rods, except as noted, or which are of stainless steel material.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

A. Conformance to Requirements: Materials shall conform to the requirements specified for the particular item; and where these requirements are not specified in detail, the materials shall be suitable for the intended usage of the item. The materials listed below shall conform to the respective specifications and other requirements as designated below:

1. Aluminum: Alloy 6061-T6, raised pattern plate, thickness as indicated, 1/4 inch minimum. Fasten all accessories by welding or stainless steel bolts.
2. Stainless steel bars, plates, bolts and nuts shall conform to ASTM A193 Type 316.
3. Structural carbon steel for riveted, bolted, or welded work shall conform to ASTM A36.
4. Steel pipe for structural use shall conform to ASTM A53.
5. Structural steel tubing for riveted, bolted or welded work shall conform to ASTM A500 or A501.
6. Cover plates shall be raised pattern A36 steel, galvanized after fabrication.
7. Steel nuts and bolts shall conform to ASTM A307.
8. Washers: Circular washers shall be flat and smooth and conform to ANSI B27.2, Type A. Beveled washers for American Standard beams and channels shall be square or rectangular, shall taper in thickness and shall be smooth. Washers shall conform to FF-W-84. Flat washers shall be suitable for the use intended.
9. Hinges: Hinges shall be galvanized.

### **2.02 FABRICATED ITEMS**

A. Miscellaneous Plates and Shapes: Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as miscellaneous mountings, base plates and frames, shall be provided to complete the work.

## 2.03 CASTINGS

- A. All casting shall be sound and free from shrinkage cracks, blow holes and other defects. All fins and burnt sand must be removed. Excessive porosity and spongy surfaces will constitute causes for rejection. The Engineer shall be final judge as to whether the defects present are sufficient to cause rejection.
- B. No welding or patching of defects in castings will be permitted unless authorized by the Engineer. Any such welding or patching done without the Engineer's consent shall be cause for rejection.
- C. All casting shall be true to form and dimensions shown on the drawings. After inspection and prior to shipping, all machined surfaces shall be coated with a blue rust inhibitive lacquer, or other approved materials which can be easily removed, unless otherwise specified.
- D. The dimensions of the finished castings shall not be less than the specified dimensions. Castings shall not be more than seven and one-half (7-1/2) percent overweight. Large casting shall be suspended and hammered over their entire area. No cracks, flaws, or other defects shall appear after such hammering.
- E. Castings shall be provided with adequate, continuous fillets cast in place in all re-entrant angles. The radius of curvature of the exposed surface of a fillet shall define the size of the fillet. The size of fillets shall not be less than one-half (1/2) of the thickness of the thinnest adjoined member nor less than one-half (1/2) inch long.
- F. Iron castings shall be dipped or painted with asphalt, which will form a tough, tenacious, non-scaling coating which does not have a tendency to become brittle when cold or sticky when hot.

## PART 3 - EXECUTION

### 3.01 WELDING

- A. All welding shall be done in conformance with Section 05090 WELDING.

### 3.02 FABRICATION

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength of durability.

### 3.03 SHOP CLEANING

- A. Steel and iron work shall be cleaned by power wire brushing, or other approved manual or mechanical means, for removal of all rust, loose paint, scale and deleterious substances. Cleaned surfaces which become contaminated with rust, dirt, oil, grease or other foreign matter, shall be washed with solvents until

thoroughly clean. The cleaning of steel to be embedded in concrete shall not be required.

### **3.04 PAINTING**

- A. Painting shall conform to the requirements of Section 09900.

### **3.05 GALVANIZING**

- A. All steel is to be galvanized unless indicated otherwise. Galvanizing shall be performed by the hot-dip process after fabrication into the largest practical sections. The galvanizing shall conform to the requirements of ASTM A123. Fabrication shall include all operations such as shearing, punching, forming, bending, welding, riveting, etc. When it is necessary to straighten any sections after galvanizing, such work shall be performed without damage to the spelter coating. For those parts to be painted after galvanizing, do not apply any after galvanizing treatment.
- B. Small structural steel or cast steel articles, such as bolts, nuts, washers, and similar articles that are to be galvanized, shall be galvanized after fabrication in accordance with the requirements of ASTM A153.

### **3.06 INSTALLATION**

- A. Contractor shall be responsible for installation of all miscellaneous metalwork. Items to be attached to concrete after such work is completed shall be installed in accordance with the details shown. All dimensions shall be verified at the site before fabrication is started. All installation shall be done in a workmanlike manner and be set true and plumb and in accordance with the Drawings and this specification.

**\*\*END OF SECTION\*\***

**SECTION 09900**

**PAINTING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. Scope of Work: Contractor shall furnish all labor, materials, equipment, and incidentals necessary to perform all painting as shown on the drawings, and as specified herein, including, but not limited to:
1. Exposed electrical conduit and exposed ductile iron pipe.
  2. The term “paint”, as used herein, includes enamels, sealers, stains, epoxies, and other coatings, whether used as prime, intermediate, or finish coats.

**1.02 REFERENCE PUBLICATIONS**

- A. REFERENCES: This section contains references to the following documents. They are a part of this section as specified and modified. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<b>Federal Specifications:</b>	
FS TT-E-529G	Enamel, Alkyd, Semi-Gloss (For Exterior and Interior Surfaces)
FS TT-P-645B	Zinc-Molybdate, Alkyd Type Primer.
<b>The Society for Protective Coatings (SSPC) Specifications:</b>	
SSPC SP-1	Solvent Cleaning
SSPC SP-6	Commercial Blast Cleaning
SSPC PAINT25	Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel
SSPC-Paint 5	Zinc Dust, Zinc Oxide, and Phenolic Varnish Paint
<b>American Society for Testing and Materials:</b>	
ASTM A780	Repair of Damaged & Uncoated Areas of Hot-Dip Galvanized Coatings

## **PART 2 - PRODUCTS**

### **2.01 ACCEPTABLE MANUFACTURERS**

- A. Glidden, Ameritone, Fuller-O'Brien, Rust-Oleum, H&C (a Division of Sherwin Williams), Monopole, Frazee, Dunn Edwards, or approved equal.

### **2.02 MATERIALS**

- A. General: Materials shall conform to the requirements of the Specifications listed herein, and the **PAINTING SCHEDULE**.
- B. Semi-Gloss alkyd enamel shall conform to Federal Specification TT-E-529G. The associated Primer, unless otherwise approved, shall conform to either Federal Specification TT-P-645B, or SSPC Paint 25. Finish coats shall be the color selected by the Engineer.
- C. Zinc dust-zinc oxide primer coatings for repair of galvanized surfaces shall conform to SSPC-Paint 5, ASTM A780, and shall contain at least 65% zinc dust by weight when dried.
- D. The concrete floor in the electrical control room shall be painted with clear Monochem Aquaseal by Frazee Paint Co., or approved equal. Contractor shall apply the Monochem Aquaseal in the presence of the inspector to insure the sealer is applied correctly.
- E. All exterior and interior masonry surfaces shall be painted with two coats of H&C Shield Plus Concrete Stain (sandstone color), or approved equal. Contractor shall apply the concrete stain in the presence of the inspector to insure the stain is applied correctly.
- F. Polyamide Epoxy shall be a two component semi-gloss pigmented system with separately packaged base and curing agent. Solids content of the finish coat material shall be at least 55% by volume. Provide Sherwin Williams Tile-Clad High Solids, or Porter Coatings' PorterGlaze 4400 HB Semi-Gloss Epoxy, or approved equal finish coat. Use finish coat manufacturer's recommended primer.

## **PART 3 - EXECUTION**

### **3.01 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver paint materials in sealed, original labeled containers, bearing manufacturer's name, type of paint, brand name, color designation, and instructions for mixing and/or reducing.
- B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45 degrees F in well ventilated areas.

- C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

### 3.02 ENVIRONMENTAL CONDITIONS

- A. Ensure surface and surrounding air temperatures are at least 60 °F, unless a higher temperature is recommended by the manufacturer, before applying paint.

### 3.03 PROTECTION

- A. Adequately protect other surfaces from preparation and paint damage. Repair damage and remove all splattered paint as a result of inadequate or unsuitable protection.
- B. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and, in particular, surfaces within storage and preparation area.
- C. Place cotton waste, clothes, and material which may constitute a fire hazard in closed metal containers and remove daily from site.

### 3.04 INSPECTION

- A. Thoroughly examine surfaces scheduled to be painted prior to commencement of work. Report in writing to the Engineer, any condition that may potentially affect proper application. Do not commence until such defects have been corrected.

### 3.05 PREPARATION OF SURFACES

- A. Preparation of metallic surfaces shall be conducted in accordance with the applicable portion of the latest surface preparation specifications of the SSPC, and the coating manufacturer's recommendations. Any sharp or rough areas shall be ground or filed smooth prior to initiation of surface preparation for painting.
- B. Blast cleaning shall conform to SSPC SP-6 "Commercial Blast Cleaning".
- C. Solvent cleaning shall conform to SSPC SP-1 "Solvent Cleaning".
- D. Pressure washing shall be performed using commercial machines operating with a nozzle pressure of at least 1000 psi, unless otherwise approved.
- E. Surfaces to be painted shall be clean before applying paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning. Cleaning solvents shall be of low toxicity with a flashpoint in excess of 100 degrees F. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces.
- F. Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow surface to dry completely.
- G. Remove dirt, powdery residue, and foreign matter from piping and metals designated for finishing.
- H. Remove grease, rust, scale, dirt, and dust from steel and iron surfaces. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting, or any other approved method.

- I. Sand and scrape shop primed steel surfaces to remove loose primer and rust. Feather-out edges to make touch-up patches inconspicuous. Clean surfaces with solvent.
- J. Shop painted ferrous surfaces shall be protected from corrosion by treating and touching-up corroded areas immediately upon detection.
- K. Concrete masonry and concrete floors shall be cleaned and cured as specified in Sections 03300, CAST-IN-PLACE CONCRETE and 04220, CONCRETE MASONRY UNITS, then prepared as specified by the coating manufacturer.

### **3.06 APPLICATIONS**

- A. General: All painting shall conform to the coating manufacturer's submitted, and approved, technical data and recommendations, and to the following general conditions:
  - 1. Thickness of coating in mils shall mean the dry film thickness. The number coats specified shall mean the minimum number of coats to be used. Additional coatings shall be required if necessary to obtain the specified film thickness.
  - 2. Prime coats, where called for, shall be provided as part of the painting system. Shop prime coats shall conform to the specified painting system for the given item. It shall be the responsibility of the Contractor to coordinate work so that factory primed items are primed or painted with a coating compatible with the specified painting system.
- B. Paint may be applied by brush, roller, or spray except as hereinafter specified. At time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be applied so finished surfaces shall be free from runs, drops, ridges, waves, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Each coat shall be applied as a film of uniform thickness.
- C. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all surfaces, including edges, corners, crevices, welds, and rivets receive a film thickness equivalent to that of adjacent painted surfaces. Adequate ventilation shall be provided during paint application. Respirators shall be worn by all persons engaged in spray painting. Adjacent areas shall be protected by the use of drop cloths or other approved precautionary measures shall be taken.
- D. The first coat shall include repeated touching-up of suction spots or overall applications of primer or sealer to produce a uniform color and gloss. Paint shall be applied only to surfaces that are completely free of surface moisture, as determined by sight or touch.
- E. Coating Progress: Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified, as necessary, to suit adverse weather conditions. Oil base or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- F. Metal Surfaces: Apply all coats by spray, unless otherwise approved.

## REHABILITATION OF WELLS PHASE 2A

- G. All galvanized metal surfaces shall be painted, unless specified otherwise.
- H. Time Between Surface Preparation and Painting: Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practicable after such pretreatment has been completed, but prior to any deterioration of the prepared surface.

### 3.07 MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Do not paint over nameplates or other identification plates.
- B. Do not paint flexible conduit or wiring.

### 3.08 CLEANING

- A. As work proceeds, and upon completion, promptly remove paint where spilled, splashed or spattered.
- B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.
- C. Upon completion of work leave premises neat and clean, to the satisfaction of the Engineer.

### 3.09 PAINTING SCHEDULE

The following painting schedule prescribes the surfaces to be painted, required surface preparation, and the number and types of coats of paint to be applied. Applied dry film thicknesses per coat shall conform to the manufacturer's recommended thicknesses.

Surface	Surface Preparation	1st Coat	2 <sup>nd</sup> Coat	3 <sup>rd</sup> Coat
Exterior galvanized surfaces touch-up	Touch-up damaged coatings per paragraph 2.02.C.			
Concrete masonry units, including retaining walls, and control building exterior and interior walls.	See paragraph 3.05	Two coats of H&C Shield. Apply per manufacturer's recommendations. Color shall be light gray.		
Metal doors, door frames, louvers, gutters, & trim of control building.	Solvent Clean, and prepare per paragraph 3.05	One coat of industrial grade primer per TT-P-645B, SSPC Paint 25, or approved equal.	Two coats. Color shall be weathered copper to match the color of the building roof.	

REHABILITATION OF WELLS PHASE 2A

Surface	Surface Preparation	1st Coat	2 <sup>nd</sup> Coat	3 <sup>rd</sup> Coat
Exterior galvanized surfaces touch-up	Touch-up damaged coatings per paragraph 2.02.C.			
Concrete masonry units, including retaining walls, and control building exterior and interior walls.	See paragraph 3.05	Two coats of H&C Shield. Apply per manufacturer's recommendations. Color shall be light gray.		
Trash rake structure. Exposed conduit.	Solvent Clean, and prepare per paragraph 3.05	One coat of industrial grade primer per TT-P-645B, SSPC Paint 25, or approved equal.	Two coats of "City of Sacramento - Centari Brown" alkyd enamel from Spectra-Tone Paints (916) 722-7454, per TT-E-529G, or approved equal.	
Existing metal pump motor housings and exposed pump columns.	Pressure wash, then wire brush, sand, scrape, and solvent clean, per paragraph 3.05	One coat of industrial grade primer per TT-P-645B, SSPC Paint 25, or approved equal.	Two coats of "City of Sacramento Hi-Lite Buff" alkyd enamel from Dunn Edwards, or approved equal.	
Existing steel checker plate.	Blast clean.	One coat of manufacturer's recommended primer.	Two coats of gray Polyamide Epoxy.	
Galvanized surface Repair	Solvent Clean, per paragraph 3.05	Apply one coat SSPC-Paint 5	Apply two coats per TT-E-529G, or as approved.	
Concrete floor of control building	See paragraph 3.05	Two coats of H&C Shield. Apply per manufacturer's recommendations. Color shall be light gray.		

**\*\*END OF SECTION\*\***

**SECTION 11400**

**SUBMERSIBLE PUMPS**

**SUBMERSIBLE WELL PUMPS**

The Contractor shall provide and install a complete submersible type well pump including intake strainer, pump bowl assembly, column, surface pedestal and submersible electric motor. The table below lists current data for each well and estimated pump sizes. **Final pump sizes and intake depth settings will be determined by the Engineer after results from the post cleaning test pumping are received.**

<u>Operating &amp; Site Conditions</u>	<u>Well Sites (2A)</u>								
		<b>83</b>	<b>131</b>	<b>137</b>	<b>143</b>	<b>144</b>	<b>153A</b>	<b>155</b>	<b>164</b>
Well casing diameter	in.	14	12	14	14	14	16	14	16
Well total depth	ft.	240	280	371	330	396	626	427	635
Static water level (below casing top)	ft.	83.8	101.1	88	73.8	92.3	74	90.5	77
Pumping level (at design flow)	ft.	98.8	117.1	108	90.1	112.3	124	105.5	122
Total pump head (exclusive of discharge column)	ft.	214.3	232.6	223.5	205.6	227.8	239.5	221	237.5
Estimated pump capacity	gpm	434.5	517.5	675	489.8	557	1390	541.2	1132
Estimated pump horsepower	hp	40	50	75	50	50	100	50	100
Pump discharge pipe diameter	in.	8	8	8	8	8	10	8	10
Well screen depth	ft.	108	150	80	140	144	260	175	222
Pump setting depth	ft.	130	145	135	130	140	150	140	155
Operating voltage	volts	480 volts AC, 3 phase, 3 wire							

## **Motor**

The 1800 rpm submersible electric motor shall conform to the latest National Electrical Manufacturers Association (NEMA) specifications for submersible motors. The motor thrust bearing shall be sized to carry the weight of all rotating parts plus the hydraulic thrust of the motor regardless of the direction of rotation.

The motor shall be of squirrel cage induction type, suitable for across the line starting (and variable speed operation in conjunction with an adjustable frequency drive) and continuous operation in F 65 water. The output shaft shall be 416 stainless steel. All fasteners used within the well casing shall be of stainless steel.

## **Pump/Motor Shaft Coupling**

The coupling shall be of 416 stainless steel and shall be capable of transmitting the total torque of the unit, regardless of the direction of rotation.

## **Inter-connector**

The inter-connector shall be constructed of close grained cast iron and shall connect the motor and bowl unit. The inter-connector shall include a suction screen which has a net open area of at least 4 times the eye of the impeller. The screen shall be made of corrosion resistant material.

## **Pump**

The pump supplied under this specification shall be of the multi stage turbine type. It shall be fitted with a stainless steel (410 or 416) shaft. Impellers shall be of SAE 40 bronze or stainless steel. Bowls (impeller housings) shall be of close grained cast iron. Bowls shall include sufficient clearance for impeller movement resulting from the combination of thermal expansion, dead weight, and hydraulic thrust.

Impellers shall be securely fastened to the shaft using stainless steel split bushings. Impellers shall be adjustable vertically by an external means.

Pump shaft bearings shall be of SAE 660 bronze and shall be located above and below each impeller. The length of the top and bottom bearings shall be a minimum of 3 times the shaft diameter.

The pump shall be designed for continuous operation in 65 degree Fahrenheit water of the chemical character described in the attached analysis results. Pump shall be selected for a minimum efficiency at the design flow rate of 75%.

### **Wellhead Base Plate**

The base plate shall be constructed of carbon steel plate of a minimum 1" thickness and shall rigidly support the weight of the motor, column pipe, pump, cable bowl assembly and column of water. It shall be equipped with a nominal production flow connection to the system. Baseplate dimensions shall be as shown on the Plans.

### **Pump Discharge Pipe**

The discharge pipe shall be standard weight carbon steel pipe sized as shown above. Pipe shall be A53-GRB or API-5L GRB and shall have ANSI B1.20.1 standard tapered pipe threads per AWWA E101.

### **Submersible Cable**

The cable shall be sized to limit the voltage drop to less than 2% at the motor terminals. Three separate conductors shall be furnished. The conductor insulation shall be water and oil resistant and suitable for continuous immersion.

The length of the cable to be furnished shall be the sum of the pump setting depth, including the bowl assembly, plus four feet for each 50 feet of setting. The cable will be suitably supported from the pump column.

**END OF SECTION**

**SECTION 16010**  
**ELECTRICAL WORK**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. This Specification Section covers all electrical work, which consists of furnishing all labor, equipment and materials required for the complete electrical system as specified and as shown on the Plans.
- B. Work Included:
1. Equipment and materials to be furnished and installed by the Contractor under Division 16 shall include the following:
    - a. Seismic Restraint for Electrical Equipment (16012)
    - b. Short Circuit, Relay, and Flash Analysis (16013)
    - c. Raceway Systems (16110)
    - d. Low Voltage Wire and Cable (16120)
    - e. Low Voltage Main Switchboard (16430)
    - f. Low Voltage Motor Control Center (16480)
    - g. Lighting (16530)
    - h. Operational Testing (16950)

**1.02 SUBMITTALS**

- A. Descriptive literature for all materials furnished under this section shall be submitted in accordance with Section 01330 SUBMITTALS of these specifications.

**1.03 CONSTRUCTION POWER**

- A. The Contractor shall provide his own temporary construction lighting and electrical power as required in areas where work is being performed.
- B. For maintaining power and controls to the facility see sections Summary of Work, section 01110, part 3.02.

**1.04 DRAWINGS**

- A. The Contractor shall verify all conditions at each site, review all measurements to insure adequate space for installation of equipment.

- B. The locations of conduit and equipment, as indicated on the drawings, are in the desired locations. However, locations may be adjusted to meet the electrical and structural conditions as required.
- C. The drawings are essentially diagrammatic to the extent that offsets, bends, pull boxes, conduits, special fittings and the exact locations may not be completely indicated. Furnish and install all conduit and equipment in available locations as required by conditions found at the site and as approved by the Engineer. Carefully study the drawings and premises in order to determine the best methods, exact locations, routes, noting the building obstructions, and etc. for conduit and equipment installation.

### **1.05 ELECTRICAL WORK CLOSEOUT**

- A. Prepare the following items and submit to the Engineer before final acceptance:
  - 1. Copies of all test results as required under this Section 16950.
  - 2. Copies of as-built record drawings and O&M manuals as required under section 01330.
  - 3. Notify the Engineer in writing when installation is complete and that a final inspection of this work can be performed. In the event defects or deficiencies are found during this final inspection they shall be corrected to the satisfaction of the Engineer before final acceptance can be issued.
- B. Electrical and control equipment shall be cleaned both inside and outside.

### **1.06 COORDINATION WITH SUB-CONTRACTORS**

- A. General Contractor shall be responsible to provide all sub-Contractors with all specifications and drawings that pertain to their work on this project.

### **1.07 INTERRUPTION OF SERVICES**

- A. Any interruption of electrical power for the performance of this work shall be made only after consultation with the City and the Superintendent of Plant Operations, and shall be only at such a time and of such duration as directed.
- B. The Contractor shall be responsible for coordination with SMUD for all power requirements.

## **PART 2 - PRODUCTS**

## **2.01 REFERENCES STANDARDS**

- A. Work installed or material used shall comply with latest version of NEC, UL, and other applicable rules and standards of the industry.
- B. Equipment Anchors: Securely anchor electrical equipment. Anchoring shall have the capability of withstanding seismic forces per the 1994 California Code of Regulations, Title 24, Part 2, Section 2312, Seismic Zone 3, with  $C_p = 1.0$  and  $I = 1.5$ . The  $C_p$  may be two-thirds of the value specified for components mounted on foundations at grade or on floor slabs on earth grade.

## **2.02 MISCELLANEOUS EQUIPMENT/MATERIALS**

- A. The Contractor shall include in his work furnishing and installing of the following:
  - 1. Warning Signs: Unless otherwise shown on the plans, use signs of standard manufacture, #18 gauge minimum steel, baked enamel finish, red letters on white background. Provide warning signs per Title 24, CAC.
  - 2. Fuses: Furnish and install fuses of proper type and rating suitable for equipment protected. Upon acceptance of installation, all fusible disconnect switches shall be equipped with correct fuses.

## **2.03 SWITCHBOARDS, MOTOR CONTROL CENTERS, AND PLC CABINET INTERNAL WIRING**

- A. Interior wiring shall conform to the following:
  - 1. Rubber grommets shall be used where wiring passes through holes in sheet metal unless indicated on the drawing.
  - 2. Wiring shall not be tapped or spliced except at device terminals or on terminal blocks.
  - 3. No more than two terminations shall be made at any one terminal.
  - 4. Each terminal connection shall have a pre-insulated ring-tongue, crimp-type connector, and applied to the wire end with a ratchet type or pneumatic operated power tool.
  - 5. B8, Class B minimum stranding and the wire shall have copper conductors and shall be minimum #16 for control and minimum #12 for power circuits. Hinge wiring shall be Class D minimum stranding. Solid wire is not allowed on this project.
  - 6. All MCC and PLC cabinet wiring shall be TEW or MTW, unless otherwise specified. All switchboard wiring shall be SIS, unless otherwise specified. Switchboard wire color shall be gray. MCC wiring colors shall be as

follows:

Neutral:	White
Fused Control Power:	Red
24 Volt Circuits:	Blue
External 120 Volt Circuits:	Yellow
Power Circuits before CPT:	Black

7. All wiring shall be marked using tags with like numbers on both ends with wire numbers shown on the drawings. Tags using adhesives, tapes, or markers are not acceptable.
8. Tags shall be white heat-shrinkable with thermal transfer printing, three to one shrink ratio, 2 inches long and shall meet UL 224. Raychem Tyco shrink mark heat shrinkable sleeves or equal. Labels shall be readable after heat shrinking.

## 2.04 NAMEPLATES

- A. Indoor: Laminated phenolic plastic, black front and back, white core, engraved to show white lettering. Use 3/16" high lettering at push button stations, thermal overload switches, receptacles, wall switches, and similar devices, where nameplate is attached to device plate. Use 1/4" high lettering at all other locations, unless otherwise specified or detailed. Engraved lettering shall be uniform block style all upper case.

Nameplates 1 1/2 inches high and smaller shall be 1/16" thick. Nameplates larger than 1 1/2" high shall be 1/8" thick. Edges of nameplates shall be beveled. Nameplates shall be fastened using nickel plated brass, cadmium plated steel or stainless steel screws. Attachment of nameplates with adhesive is not acceptable.

- B. Outdoor: Engraved or embossed stainless steel.
- C. Inscription: If detailed on plans, use inscription exactly as shown; otherwise, describe adequately the function or use of equipment involved.

## 2.05 PAINTING AND FINISHES

- A. Boxes factory finished as follows:
  1. Surface Mounted Boxes: One prime coat over galvanizing, one coat of light gray synthetic enamel or lacquer.
  2. Flush Mounted Boxes: Galvanized only.

## **REHABILITATION OF WELLS PHASE 2A**

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- B. A three coat finish consisting of primer, undercoat, and alkyd enamel finish of light gray, ANSI No. 61, shall be applied to all electrical enclosures unless otherwise specified.

### **2.06 HOUSE KEEPING PAD**

- A. All switchboard and other free standing equipment and panels shall be placed on a 3 1/2" thick concrete house-keeping pad as directed by the Engineer. The pad shall be so constructed that after the installation of the panel there shall be 3" in the front and on both sides of the panel and 2" on the back of the panel.
- B. The pad shall contain a formed raceway for conduits.

### **2.07 INDICATING LIGHTS, PUSH BUTTONS, AND TERMINAL STRIPS**

- A. Indicating lights shall be industrial, weatherproof NEMA 4/4X, transformer type, with LED type lamps, and push to test. Push buttons and terminal strips shall be NEMA style.

### **2.08 SPARE PARTS**

- A. Fuses: 1 carton (3 fuses, minimum) of each fuse used on this project.

### **2.09 RELAYS, TIMERS, AND SWITCHES**

- A. Contacts for all relays, timers, and switches shall be rated for 10 A minimum.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. All equipment installed by the Contractor shall operate to the Engineer's satisfaction. The Contractor shall be responsible for, and shall correct by repair or replacement, at his own expense, equipment which, in the opinion of the Engineer has been damaged by faulty mechanical or electrical assembly by the Contractor.
- B. The Engineer reserves the right to require changes in equipment location without incurring additional costs.
- C. Outdoor steel items on this job shall be manufactured from cold rolled low carbon steel. Outdoor steel mounting holes and cutting shall all be finished and then the item shall be hot dipped galvanized conforming with ASTM A123 and A153. Outdoor hardware on this job shall be A316 stainless steel.

**END OF SECTION**

## SECTION 16012

### SEISMIC RESTRAINT FOR ELECTRICAL EQUIPMENT

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. Work Included.
  - 1. Seismic restraint for new electrical equipment.
- B. Related Work
  - 1. The provisions of Section 16010 of these Specifications shall apply, unless otherwise specified.

##### 1.02 SUBMITTALS

- A. Submit in accordance with Section 01330 **SUBMITTALS** of these specifications.
- B. Submit equipment anchoring methods. Include anchoring locations, anchor types and minimum anchor embedment depths.

#### PART 2 - MATERIALS

##### 2.01 SEISMIC ANCHORING AND RESTRAINTS

- B. Equipment Anchors: Securely anchor electrical equipment. Anchoring shall have the capability of withstanding seismic forces per the 1994 California Code of Regulations, Title 24, Part 2, Section 2312, Seismic Zone 3, with  $C_p = 1.0$  and  $I = 1.5$ .  $C_p$  maybe be two-thirds of the value specified for components mounted on foundations at grade or on floor slabs on earth grade.

#### PART 3 - EXECUTION

##### 3.01 EQUIPMENT AND RACEWAYS

Install equipment anchors and raceway supports in accordance with the final shop drawings and manufacturer's recommendations. Properly torque all bolts to the required values.

**END OF SECTION**

## SECTION 16013

### SHORT CIRCUIT & PROTECTIVE DEVICE STUDY & COORDINATION AND FLASH ANALYSIS

#### PART 1 – GENERAL

##### 1.01 SUMMARY OF WORK

- A. The Contractor shall provide the following electrical power system studies for all 8 wells. The content of each study is specified in Part 3 of this specification.
  - 1. Short Circuit Study
  - 2. Protective Device Evaluation and Coordination Study
  - 3. Arc Flash Hazard Analysis
- B. The Contractor shall be responsible for ensuring that all parties involved in the studies have the necessary information and data to carry out the studies. The Contractor shall obtain and distribute the information and data from the Utility, the City and the manufacturers of the equipment and materials.
- C. The Contractor shall be responsible for supplying the information and data in a timely manner to allow the short-circuit analysis to be completed prior to final installation.
- E. If during the study, the Contractor finds any inadequacies in the equipment or protective devices, he shall make recommendations for improvements as soon as they are identified.
- F. The Contractor shall provide the City with an electronic copy of the short circuit study, coordination study, and arc flash hazard analysis on a CD or DVD. **The copy shall include all SKM files used to create the study.**
- G. The study and analysis shall be performed using the latest version of the SKM power tools software.

##### 1.02 SUBMITTALS

- A. Submit a draft of the final report for review by the Engineer. The report shall include the following as further described in Part 3:
  - 1. Summary of the results of the short circuit and the protective device evaluation and coordination studies.
  - 2. Description, purpose, basis and scope of the study.

3. Single line diagram generated by the software with node identification.
  4. Tabulations of electrical capacities and characteristics of the equipment and protective devices.
  5. Table comparing the calculated short circuit and the equipment ratings.
  6. Coordination curves showing the proposed settings with the characteristics of the equipment and protective devices shown graphically on industry standard graph paper.
  5. Arc Flash Hazard Analysis to include computed incident energy levels and flash protection boundary distances.
- B. Submit the final report after receiving comments by the Engineer.
- C. **The Contractor shall provide the City with an electronic copy of the software program files used to create the short circuit study, coordination study, and arc flash hazard analysis on a CD or DVD. These program files shall be the actual SKM program files.**

## **PART 2 - PRODUCTS**

### **2.01 STANDARDS**

- A. Institute of Electrical and Electronic Engineers
1. Standard 242, Protection and Coordination
  2. Standard 141, Electric Power Distribution
  3. Standard 299, Power System Analysis
  4. Standard 1584, Guide for Performing Arc Flash Hazard Calculations

## **PART 3 - EXECUTION**

### **3.01 ELECTRICAL POWER SYSTEM STUDIES**

- A. Short-Circuit Analysis
1. Calculation of the maximum rms symmetrical three-phase short-circuit current at each significant location in the electrical system shall be made using the latest version of the SKM power tools software.
  2. Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the computer calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
  3. A tabular computer printout shall be included which lists the calculated

short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.

4. The study shall include a computer printout of input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
5. The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis.
6. The computer printout shall identify the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.
7. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

**B. Protective Device Time-Current Coordination Analysis**

1. The time-current coordination analysis shall be performed using the latest version of the SKM power tools software. It shall include the determination of settings, ratings, or types for the protective devices supplied. It shall also include any proposed adjustments to existing protective devices to which the supplied devices must coordinate.
2. Where necessary, an appropriate compromise shall be made between system protection and service continuity with system protection and service continuity considered to be of equal importance.
3. A sufficient number of computer generated log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.

**C. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, the short-circuit current availability at the device location when known, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.**

- D. The study shall include a separate, tabular computer printout containing the suggested device settings of all adjustable overcurrent protective devices, the equipment where the device is located, and the device number corresponding to the device on the system one-line diagram.
1. A computer generated system one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
  2. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for increasing system protection or device coordination.
  3. Significant deficiencies in protection and/or coordination shall be called to the attention of the engineer and recommendations made for improvements as soon as they are identified. Report shall also include suggestions to:
    - Improve coordination between upstream and downstream devices.
    - Reduce fault current clearing times of upstream devices.
    - Identify equipment protection boundary and inrush current conflicts.
- D. Arc Flash Hazard Analysis
1. Per NEC 110.16, perform an arc-flash analysis according to IEEE Standard 1584, IEEE Guide for Performing Arc Flash Hazard Calculations, based upon results from the short circuit current analysis and optimized overcurrent protective device settings provided in the overcurrent protective device coordination study. The arc flash hazard analysis shall be made using the latest version of the SKM power tools software.
  2. A detailed arc-flash hazard analysis report with computed incident energy levels (Calories per square inches) and flash protection boundary distances at equipment indicated above to insure adequate protection and safety of personnel working in the vicinity of electrical equipment.
  3. Arc Flash Hazard warning stickers, sized 3.75" x 4.75" with computed incident energy levels and flash protection boundary distances shall be located so as to be clearly visible to qualified persons on the electrical equipment.

**END OF SECTION**

**SECTION 16110**  
**RACEWAY SYSTEMS**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. This Specification Section covers the furnishing, installing and testing of all wireway, conduit, fittings, boxes, and supports as specified herein, as shown on the Drawings, and as required for a complete electrical installation.
- B. The provisions of Section 16010 of these Specifications shall apply, unless otherwise specified in this Section.
- C. The raceway system shall consist of the types and sizes as required and shall include all rigid steel conduit, flexible conduit, non-metallic conduit, wireway and accessories as required for the embedded and exposed raceway systems.
- D. Conduit accessories shall include Condulet type fittings, expansion and deflection couplings, chase nipples, locknuts, grounding bushings, flexible conduit fittings, supports, materials for sealing openings, and all other devices and materials required to complete the electrical raceway system.

**1.02 SUBMITTALS**

- A. Descriptive literature for all materials furnished under this section shall be submitted in accordance with Section 01330 **SUBMITTALS** of these specifications.
- B. Submittals for the material and equipment for the Raceway Systems shall include, but shall not be limited to, the following:
  - 1. Catalog cuts showing manufacturer, catalog numbers, dimensions, weights and material for all raceway and accessories, specific items shall be identified on all catalog cuts.
  - 2. Dimensioned shop drawings.
  - 3. Certified test reports prepared by manufacturer.

**PART 2 - PRODUCTS**

**2.01 REFERENCE STANDARDS**

- A. Raceway systems supplied under this contract shall be designed, manufactured, and tested in accordance with the latest version of the following standards:

<b>American National Standards Institute (ANSI) Publications:</b>	
C33.92	Flexible Liquid-tight Metal Conduit
C80.1	Rigid Steel Conduit
C80.4	Rigid Steel Conduit Fittings
<b>National Electrical Manufacturers Association (NEMA)</b>	
FB 1	Fittings and Supports for Conduit Cable Assemblies
TC-2 & TC-3	Non-metallic Conduit and Fittings
RN 1	Rigid Steel Conduit PVC jacketed
<b>Underwriters Laboratories Inc.</b>	
UL 514A	Metallic Outlet Boxes, Electrical
UL-870	Wireways, Auxiliary Gutters and Associated Fittings
UL-6	Rigid Metal Electrical Conduit
UL 651	Schedule 40 and 80 Rigid PVC Conduit

**2.02 CONDUIT AND CONDUIT FITTINGS**

A. Material for the conduit system shall conform to the following:

1. Steel Conduit: Steel conduit, couplings, bends and nipples shall be in accordance with ANSI C80.1 and UL-6, hotdip galvanized inside and outside after fabrication and then coated with a bichromate finish. Conduit sizes shall be not less than 3/4 inch IPS. All fittings shall be listed per UL 514.
2. Flexible Liquid-tight Metal Conduit: Flexible liquid-tight metal conduit shall be in accordance with ANSI C33.92 and shall be galvanized steel core with a copper bonding conductor between the spiral segments and an extruded synthetic jacket overall to insure a liquid-tight conduit. The conduit shall be 3/4 inch American Brass sealtight Flexible conduit, or equal. Flexible conduit fittings shall be the grounding type and a design approved by the manufacturer for this type of flexible conduit.
3. Rigid Galvanized Steel Conduit PVC Bonded (RGS/PVC): Conduit shall conform to the requirements of NEMA RN1, type A40. Plastic coated conduit shall be rigid galvanized steel conduit to which an epoxy acrylic primer and a 40 mil thick polyvinyl chloride coating has been bonded. Bond strength shall exceed the tensile strength of the plastic coat. All elbows shall be factory made and PVC coated. All fittings used with

plastic coated conduit shall be similarly coated with not less than 40 mils of polyvinyl chloride and shall be provided with type #316 stainless steel hardware. Furnish Occidental Coating Company -type OCAL 40, Robroy Industries - type PLASTIBOND, or approved equal. For factory coated conduit, use overlapping PVC sleeves. Sleeves shall extend beyond end of fitting minimum distance equal to nominal diameter of conduit, and shall fit tightly over conduit coating to form a watertight joint. Joints and fittings shall be made tight with strap wrenches. All damage to PVC jacket shall be repaired with four separate applications of PVC paint. Finished patch shall be 0.040 inch minimum thickness. Conduit sizes shall be not less than 3/4 inch IPS.

4. Rigid Polyvinyl Chloride (PVC) conduit: PVC conduit shall be manufactured in accordance with UL 651. PVC conduit shall be Schedule 40 or Schedule 80 high impact polyvinyl chloride, UL listed for direct burial. Minimum size shall be 3/4 inch. Fittings used with PVC conduit shall be PVC solvent weld type.
5. Fittings: Fittings for rigid steel conduit shall be threaded type and shall conform to the requirements of ANSI C80.4. Locknuts shall be extra heavy galvanized steel. Bushings shall be galvanized malleable iron with insulating collars. Grounding bushings shall be locking type and shall be provided with feed-through compression lugs.
6. Locknuts shall be extra heavy electrogalvanized steel for sizes through 2 inches. Locknuts larger than 2 inches shall be electrogalvanized malleable iron. Furnish allied tube and conduit type GRC, Triangle PWC, Inc., type GRS or approved equal.

## **2.03 SUPPORTS**

### **A. General Requirements:**

1. Inserts, hangers, brackets and miscellaneous supports for electrical equipment and conduits must be designed with minimum safety factor of 4, based on ultimate strength of material used. For empty conduits, include weight of 4 Type XHHW copper wires of maximum permissible size.
2. Secure hangers, brackets, conduit straps, supports and electrical equipment by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; wood screws on wood construction. Wood or fiber plugs or concrete nails, are not acceptable.
3. All channels, fittings, clamps and accessories shall be hot dipped galvanized after fabrication for outdoor installations, and electro-

galvanized for dry indoor installations. In wet or corrosive areas, such as well casings and sumps, all channels, fittings, clamps and accessories shall be 316 stainless steel.

B. Support channels steel shall conform to the requirements of ASTM A570. These shall be nominal 1 5/8" x 1 5/8" roll formed low carbon 12 gauge steel. One side of the channel shall have a continuous slot with turned in lips. Double strut shall be two of these welded back to back. Support channels shall be filled with styrofoam to inhibit concrete seepage.

C. Conduit Supports:

1. Single Conduit Hangers: Steel City #C-149, Elcen Figure 13, Unistrut #JI205 through J1260, or equal, with 3/8" minimum diameter steel rod.
2. Trapeze Hangers: Steel City #B-900, Elcen Figure 600, Unistrut #P-1000, or equal, channel with 3/8" minimum diameter steel rods and with conduit clamps, as specified below.
3. Trapeze Conduit Clamps: Steel City #C-105, Elcen Figure 650, Unistrut #P-J111 through P-1124, or equal, for rigid conduit.
4. Riser Supports: Steel City #C-210, Elcen Figure 39, Unistrut #U991-7 through U991-60, or equal.
5. Finish
  - a. Hangers, channels, clamps, supports and rods, galvanized, cadmium plated or standard factory paint finish.
  - b. Conduit straps and single hole clamps, galvanized or cadmium plated.
  - c. Steel bolts, screws, nuts and washers, galvanized or cadmium plated.
5. All conduit supports and hardware mounted inside the wet well shall be 316 stainless steel.

## **2.04 DUCT AND CONDUIT CAULKING COMPOUND**

A. Compounds for sealing ducts and conduit shall have a putty-like consistency workable with the hands at temperatures as low as 35 degrees F. and shall not slump at a temperature of 300 degrees F or harden materially when exposed to the air. Compounds shall readily calk or adhere to lean surfaces of asbestos cement, fiber, or plastic duct; metallic conduits or conduit coatings; concrete masonry, or lead; any cable sheaths, jackets, covers, or insulation materials; and the common metals. Compounds shall form a seal without dissolving, noticeable changing characteristics, or removing any of the ingredients. Compounds shall have no injurious effect upon the hands of workmen or upon materials.

Contractor shall apply duct seal to all conduits entering the wet well or as directed by the Engineer.

## **2.05 BOXES AND CONDULET**

- A. Boxes and Condulet shall be cast ferrous steel Form 7 with gasketed weatherproof covers and #316 stainless steel hardware for all indoor and outdoor applications. NEMA 4X boxes shall be cast nonmetallic screw hub type with gasketed watertight covers and #316 stainless steel hardware. Each box shall be large enough to accommodate the required number and sizes of conduits, conductors, splices and devices per the NEC. Flush boxes shall have the front edge of box or ring flush with wall or ceiling finish.

## **2.06 WIREWAY**

- A. Surface metal raceway shall be constructed in accordance with Underwriters' Laboratories Standards UL 870 for Wireways, Auxiliary Gutters and Associated Fittings. Every component including lengths, connectors and fittings shall be UL listed.
- B. Surface metal raceway shall be suitable for "lay-in" of conductors.
- C. All sheet metal parts shall be provided with a rust inhibiting phosphatizing coating and gray baked enamel finish. All hardware shall be plated to prevent corrosion. All screws installed toward the inside shall be protected by spring nuts or otherwise guarded to prevent wire insulation damage.

## **PART 3 - EXECUTION**

### **3.01 GENERAL REQUIREMENTS**

- A. General Requirements:
  - 1. Install an accessible raceway system for connection of all boxes, panel boards, cabinets, and equipment.
  - 2. All raceway shall be the type and size as shown on the Plans.
  - 3. Make bends for exposed conduit stub-ups completely below the surface. Make stubs vertical and arrange neatly.
  - 4. Where conduits turn up in accessible floor areas or under removable partitions, install coupling flush with finish floor surface (exclusive of floor covering). Provide flush threaded plug in this coupling where conduit is not to be extended.
  - 5. Spare Conduits: For flush mounted panels, run empty conduits from panel to accessible spaces above and below, unless otherwise shown. Install

minimum of two 3/4" conduits (one up and one down) for every 3 single pole spare circuit breakers or spaces, or fraction thereof.

6. Running Threads: Running threads shall not be acceptable.
7. All bends and offsets, where required, shall either be made with factory made bends or shall be field bends made with a conduit bender designed specifically for use with the type of conduit to be bent.
8. Minimum size of conduit shall be 3/4 inch. In no case shall the conduit size be smaller than that shown on the drawings.
9. The entire electrical raceway system shall be bonded and form a continuous metallic electrical conductor from service point to every box and shall be terminated with ground bushings connected to the panelboard ground bus per NEC.
10. All conduits which are installed shall be capped during construction to prevent the entrance of foreign material.
11. All conduit installed by the Contractor shall be of the type listed in the Conduit Installation Table, at end of this section.
12. The maximum number of conduit bends shall be as follows: 90 degrees of conduit bends for up to 300 feet of conduit, 180 degrees of conduit bends for up to 200 feet of conduit, 270 degrees of conduit bends for up to 100 feet of conduit, 360 degrees of conduit bends for 50 feet of conduit or less.
13. Conduit terminating at floors or in cabinets, cubicles, and walls shall be identified by metal tags bearing the conduit number. The tags shall be securely attached to the conduit directly under the terminating bushing on both ends of the conduit.

**B. Exposed Conduit:**

1. All exposed conduits shall be run in straight lines parallel to column lines, walls or beams. Where conduits are grouped, the bends and fittings shall be installed so as to present an orderly appearance. Unnecessary bending or offsets shall not be acceptable. Conduits shall be kept at least 12 inches away from heating devices or similar equipment.
2. Supports for exposed conduit shall be in accordance with Title 24, CAC.
3. Supports and all hardware inside well casing, tanks, etc. area shall be stainless steel.
4. Support conduits as close to 8 feet intervals as possible and within 1 foot

## REHABILITATION OF WELLS PHASE 2A

of boxes or changes in direction. Use riser supports with clamps for vertical conduit risers.

5. For single conduit runs, use conduit straps with backplates or suspend from ceiling with single conduit hangers. Single hole malleable iron clamps may be used for horizontal runs on vertical surfaces. Perforated strap (plumber's tape), not acceptable.
6. For multiple conduit runs, group conduits together and support from ceiling by means of trapeze hangers. Wall brackets may be used for conduit runs on vertical surfaces. Clamp each conduit to trapeze or bracket, using conduit clamp.
7. Fasten hanger rods to structural steel members with beam clamps or to concrete inserts set flush with surface. Install reinforcing rod through opening in concrete insert.
8. Exposed conduit shall be tightened securely and shall be supported rigidly in place, and all connections to outdoor boxes shall be watertight. All exposed conduit shall include, where required, the drilling of holes in the bottom and top of enclosures or plates and in the sides of enclosures of switchgear and other electrical equipment. The Contractor shall drill all holes in concrete for installation of expansion anchors for exposed conduit runs.

### C. Conduits in Concrete Slabs:

Conduits in concrete slabs shall be rigid galvanized steel and may be installed in structural slabs, or in slabs on fill, having a minimum thickness of 4" of concrete around the entire conduit.

2. Conduits will not be permitted to interfere with proper placement of principal reinforcement steel and must be located as directed. In structural slabs, place conduits carefully between upper and lower layers of steel. In prestressed concrete slab construction, place conduits in center of slab and do not support from prestressed steel.
3. Space conduits 8" minimum on centers, except place as wide as possible where they converge at panels or junction boxes.
4. Place conduits running parallel to slab supports (beams, columns, walls, etc.) not less than 12" from such supports.

### D. Underground Conduits:

#### 1. Buried Conduit:

- a. Buried conduits shall be a minimum of 24 inches below grade on

runs not exposed to vehicular traffic and a minimum of 36 inches below grade when exposed to vehicular traffic. Buried conduits shall be installed per the Conduit Installation Table, see end of section for table. Backfill shall be compacted to 95%. Paved surfaces disturbed during trenching shall be repaired to pre-construction condition after installation is complete.

- b. All conduits entering or leaving the ground shall be sealed to prevent condensation of moisture inside the conduit. Conduit entrances in the bottom of switchgear, power distribution panels, switchboards, etc., shall project into the enclosure a minimum of three inches to prevent water from entering conduits.
- c. Concrete shall be Class D PCC in accordance with section 10-5 of the City of Sacramento Standard Specifications and shall have a compressive strength of 3000 PSI. A red oxide in the amount of 5 lbs. per cubic yard shall be mixed uniformly throughout the concrete.
- d. Contractor to place a 6" wide electrical caution warning tape in trench 12" above concrete as directed by the Engineer.

2. Duct Lines:

- a. Duct lines shall have a continuous slope downward toward pull boxes and away from switchgear with a pitch not less than 4 inches in 100 feet. Install end bells at duct terminations in handholes. Except at conduit risers, changes in direction or more than 5 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet, sweep bends may be made up of one or more manufacturer's 30 degree curved sections and straight sections. Manufactured risers shall have a minimum radius of 18 inches. The joints of the conduits shall be staggered by rows and layers so as to provide a duct line having the maximum strength. All duct runs shall be placed on an undisturbed excavated soil base wherever possible. Where duct runs pass through backfilled areas, the soil base shall be compacted to 95%.
- b. Duct joints shall be made by brushing a plastic solvent cement on insides of plastic coupling fittings and the outside of duct ends. Each duct and fitting shall then be slipped together with a quick one-quarter turn twist and held in to set the joint tightly.
- c. Plastic spacers as manufactured by the conduit supplier shall be used and shall be located five feet on centers. These spacers shall provide for conduit separation by a minimum of two inches between and four inches on the top, bottom and sides. Wire ties shall be

made at each spacer location and shall be securely anchored to prevent conduit flotation during pouring. Duct runs shall be watertight.

- d. All ducts shall be inspected by the Engineer prior to pouring concrete. He shall inspect for backfill compaction, drainage slope, spacers, flotation ties and conduit condition, joints, and end bells. Concrete shall not be poured until this inspection is complete.
- e. Conduits shall be thoroughly swabbed immediately upon completion of pouring.
- f. After the concrete has set, but before backfilling, a mandrel having a diameter the nominal conduit inside diameter, minus 1/4 inch, and not less than 8 inches long, shall be pulled through each conduit. The mandrel shall be lead covered or painted white to give indication of any protrusion on the inside of the conduit, which might injure the cable sheath. The ends of all conduits shall be suitably plugged, capped and protected from damage during construction.
- g. Ducts shall be stored to avoid warping and deterioration with ends plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.
- h. Concrete shall be Class D PCC in accordance with section 10-5 of the City of Sacramento Standard Specifications and shall have a compressive strength of 3000 PSI. A red oxide in the amount of 5 lbs. per cubic yard shall be mixed uniformly throughout the concrete.
- i. Contractor to place a 6" wide electrical caution warning tape in trench 12" above concrete as directed by the Engineer.

3. Conduit in Structural Concrete:

Runs of conduit to be embedded in concrete shall be rigidly supported in their proper positions while concrete is being placed. Ends of conduits shall be suitable plugged or capped during construction to prevent the entrance of concrete or other foreign matter. Connections shall be checked for tightness before being embedded.

4. Vertical Penetration of Grade:

- a. All risers penetrating ground shall extend 6 inches above grade.

- b. Conduit entrances in the bottom of switchgear, power distribution panels, switchboards, etc., shall project into the enclosure a minimum of three inches to prevent water from entering conduits.

5. Conduits Crossing Expansion and/or Contraction Joints:

Expansion couplings used in conduit runs crossing expansion or contraction joints in concrete shall be zinc coated and watertight.

E. Workmanship and Installation Requirements:

1. Where field changes are required, every precaution shall be taken to insure that the change is coordinated with other conduit, structural, and plumbing and piping work. Information shall be obtained regarding the completed raceway runs to insure that there will be no interference when the raceway run is extended or revised. A complete record of such changes shall be made on the Drawings.
2. Conduits shall be cut square, threaded and reamed to remove sharp or rough edges and burrs. No running threads will be allowed. Conduit joints and connections shall be made waterproof and rustproof by application of a non-insulating thread compound, such as white lead or graphite, and zinc sealing material. Each threaded joint shall be thoroughly cleaned to remove cutting oil before the compound is applied.
3. Metallic conduits shall be bent cold to prevent damage to the protective coating. All bending shall be gradual and be done smoothly to permit the pulling on insulated electrical wires and cables without incurring damage to the insulation or sheath. Radius of curvature shall be not less than that permitted by NEC. The number of bends shall not exceed four 90 degree bends between pull points.
4. Conduit shall be rigidly secured to panels and other electrical equipment terminal boxes with locknuts and grounding bushings in such a manner that each system shall be electrically continuous throughout unless otherwise shown on the Drawings.
5. The raceway system shall be installed complete before conductors are installed. Concrete shall be removed from the inside of pull boxes after the forms are removed, and the threads for attaching devices and covers shall be cleaned. As soon as practicable after conduits are installed, conduits shall be swabbed with clean dry rags to show they are clean and dry.
6. To reduce damage to the zinc coating, only strap type wrenches shall be used. All places where the zinc coating is damaged shall be repaired with zinc-rich galvanizing repair compound.

7. Pull boxes, sized in accordance with NEC, shall be installed wherever necessary to avoid overly long straight runs or an excessive number of bends.
8. Raceway shall be installed with necessary fittings and supports.
9. Pull-tape shall be a made out of woven aramid yarns and contain a silicon lubricate. The pull-tape shall have sequential footage markings and have a minimum tensile strength of 2500 lbs. Furnish and install pull-tape in all empty raceways, unless otherwise noted. Pull-tape shall be Dandy-Line or approved equal.
10. All underground conduits shall be inspected by the Engineer before backfilling the trench.

**3.02 OUTLET, DEVICE, PULL AND JUNCTION BOXES**

A. Boxes shall be installed as follows:

1. NEMA 3R indoor and outdoor areas
2. NEMA 4X where specifically shown on the plans and corrosive areas

B. Set boxes in a rigid manner and support independently of conduit by bar hangers in metal studs, or to solid blocking in frame construction, or fasten directly with wood screws on solid wood framing, bolts and expansion shields on concrete or brick, toggle bolts on hollow masonry units, and machine screws or welded threaded studs on steel work. Do not use powder actuated fasteners on this job. All junction boxes shall be installed with covers accessible after installation.

C. Pull boxes shall be located every 400 feet for straight pulls, 300 feet with every 90 degrees of conduit bends, 200 feet with 180 degrees of conduit bends, 100 feet with 270 degrees of conduit bends and every 50 feet with 360 degrees of conduit bends.

**CONDUIT INSTALLATION TABLE**

**CONDUIT INSTALLATION**

**CONDUIT TYPE**

Exposed Conduit (indoor & outdoor):	Rigid galvanized steel conduit.
Conduit in Concrete Slab:	Rigid galvanized steel conduit.
Underground Conduit:	Rigid galvanized steel PVC coated conduit where the conduit is directly in contact with the earth or schedule 40 PVC conduit with concrete encasement minimum of 4" all around for horizontal runs only.

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Conduit in Duct Bank:	Schedule 40 PVC conduit with concrete encasement minimum of 4" all around for horizontal runs only.
Vertical or horizontal sweeps, risers, or stubs into underground boxes:	Rigid galvanized steel PVC coated conduit for entire sweep, underground runs 5' prior to riser or stub, and 6" above finished grade. Conduit 6" above finished grade shall be installed as exposed conduit.
Bottom Entrance of Switchgear, Distribution Panel, MCC, & etc:	Rigid galvanized steel PVC coated conduit.
Side or Top Entrance of Switchgear, Distribution Panel, MCC, & etc:	Rigid galvanized steel conduit.
Conduit exposed to corrosive environment (sewer wet well)	Type 316 stainless steel conduit .
Primary & Secondary of the SMUD Transformer:	Per SMUD standard specifications.
Bottom entrance from SMUD transformer to City main switchgear:	PVC conduit with concrete encasement minimum of 4" all around.
Motor Conduit Box to Rigid Wireway System:	Flexible liquid tight metal conduit.
Door Switch Sensor to Rigid Wireway System:	Flexible liquid tight metal conduit.

**CONDUIT INSTALLATION**

**CONDUIT TYPE**

Conduit From Junction Box to Outside Building Lights:	Rigid galvanized steel conduit.
Conduit From Junction Box to Trash Rack Lights:	Flexible liquid tight metal conduit.
Risers or Conduit Stubs Rising Up From Concrete Duct Bank:	Rigid galvanized steel PVC coated conduit.
Equipment Subject to Vibration	Flexible liquid tight metal conduit.
Conduit from wellhead junction box to wellhead	Rigid galvanized steel conduit with two unions.

Notes

1. All acceptable conduit materials are specified in specification 16110 Section 2.02A.
2. Any conduit not covered in the above categories shall be Rigid Galvanized Steel PVC coated.
3. All underground PVC conduits shall be encased in red concrete.
4. Contractor shall place a 6" wide electrical caution warning tape in all trenches 12" above concrete or as directed by the Engineer.

**END OF SECTION**

## SECTION 16120

### LOW VOLTAGE WIRE AND CABLE

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. This Specification Section covers the furnishing, installing and testing of all wire and cable required to complete the installation of equipment as specified herein and as shown.
- B. The provisions of Section 16010 of these specifications shall apply, unless otherwise specified in this Section.

##### 1.02 SUBMITTALS

- A. Descriptive literature for all materials furnished under this section shall be submitted in accordance with Section 01330 **SUBMITTALS** of these specifications.
- B. Submittals for the wire and Cable shall include, but shall not be limited to, the following:
  - 1. Submittals will include product data sheets for all cables, of each type and voltage rating, on which work is to be performed under this contract.
  - 2. Certified test reports prepared by manufacturer.

##### 1.03 QUALITY ASSURANCE

- A. Wire and cable of the type and voltage rating shown on the contract drawings shall be of a design which has been in satisfactory use for not less than three years in a minimum of 20 installations. For purposes similar to those intended herein.
- B. Manufacturer shall provide certification that the manufacturer has been fabricating and assembling specified equipment (as described in A above) in his current facility for a minimum of five (5) years.
- C. All materials selected for the manufacture of the hardware shall be the best available for the purpose for which they are used, considering strength, ductility, durability and the best engineering practice.
- D. All cable has been manufactured within one year of installation.

**1.04 DELIVERY, STORAGE AND HANDLING**

- A. Wire and cable shall be delivered complete, in manufacturer's original, unopened protective packaging. Packing materials shall be such as to prevent damage to the materials during transportation and handling.
- B. Wire and cable shall be handled in a manner to prevent damage to the coverings and conductor.
- C. Maintain protective coverings until ready for installation.

**PART 2 - PRODUCTS**

**2.01 REFERENCE STANDARDS**

- A. Wire and cable supplied under this contract shall be designed, manufactured, and tested in accordance with the latest version of the following standards:

<b>American Society Testing Materials (ASTM)</b>	
B-8	Concentric-Lay-Stranded Copper Conductors

<b>Insulated Cable Engineers Association (ICEA)</b>	
S-68-516	Ethylene Propylene Rubber Insulation

<b>Underwriters Laboratory (UL)</b>	
UL 20	General Use Snap Switches
UL 486A	Wire Connectors and Soldering Lugs
UL 83	Thermoplastic Insulated Wires
UL 510	Insulating Tape
UL 1072	Medium Voltage Cable

<b>National Electrical Manufacturers Association (NEMA)</b>	
WD-1	General Purpose Wiring Devices

- B. National Electrical Code (NEC)  
 Institute of Electrical and Electronic Engineers (IEEE)  
 California Administrative Code (CAC) Title 24

**2.02 LOW VOLTAGE WIRING**

- A. Low voltage wiring shall be of the size and number shown and shall have the following characteristics. Sizes are indicated by American Wire Gauge (AWG) and minimum size shall be No. 12 AWG for power wiring and No. 14 AWG for control wiring, unless otherwise indicated.
- B. Voltage: 600 V.
- C. Conductors: Annealed copper 98% conductivity. Aluminum conductors are not acceptable.
- D. Conductor Stranding: All Conductors shall be stranded. Solid wire is not acceptable.
- E. Insulation: Thermoplastic insulated wires and cables shall be listed in UL 83. They shall be delivered to the job site in the manufacturer's unopened boxes or reels. Insulation for conductors and cables shall be rated 600 volts and shall be as follows:

Item	Sizes	Insulation
Branch	No. 12 to No. 10	THHN/THWN-2
Grounding	All	TW or bare
Feeders	No. 6 and above	THHN/THWN-2
Cords	No. 12	SO
Wet Locations	All	THWN
Corrosive Locations	All	THHN/THWN-2

- F. Insulation Colors: Insulation shall be continuously colored for the entire conductor length; except that feeders can be phased taped and all insulated grounding conductors must be green.
- G. Instrumentation/Telemetry Cable: Instrumentation and Telemetry Cable shall be multiple-pair, #16 AWG, twisted, overall shielded with PVC jacket. Shield shall be 100% and include #20AWG stranded, tinned copper drain wire. The conductors shall be polyethylene insulated. Manufacturer shall be Belden or equal.

- H. RS-485 Application: tinned copper, polyethylene insulated, twisted pair. Overall aluminum-polyester shield. 24 AWG stranded tinned copper drain wire. Overall tinned copper braid shield. Chrome PVC jacket. The cable shall be Belden 9842, or equal.
- I. Ethernet Application: Approved shielded CAT-5E or CAT-6 cable. Segment of Ethernet shall not exceed 90 meters under any circumstances.

**2.03 COLOR CODE**

- A. Color code for three phase circuits shall be ph-A, ph-B, ph-C front to back, left to right and top to bottom. Color code for three phase circuits are listed in phase order. Color code shall be as follows:

<b>120/240 volt power wiring</b>	
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green

<b>480/277 volt power wiring</b>	
Phase A	Brown
Phase B	Orange
Phase C	Yellow
Neutral	White
Ground	Green

<b>Miscellaneous</b>	
Control wiring	Purple
DC + Wiring	Blue
DC - Wiring	Gray

120 Volt Control Wiring	
Line	Red
Neutral	White
Ground	Green

Signal wiring	
Positive (+)	Red
Negative(-)	Black

**2.04 GROUND CONDUCTOR**

- A. Grounding electrode conductors shall be sized per NEC 2008 edition, table 250.66, unless otherwise noted on the Plans.
- B. Raceway and equipment grounding conductors shall be sized per NEC 2008 edition, table 250.122, unless otherwise noted on the Plans.

**2.05 GROUND RODS**

- A. Provide copper-encased steel ground rods at least 3/4 inch in diameter and 10 feet long unless otherwise indicated. Die-stamp each near the top with the name or trademark of the manufacturer and the length of the rod in feet. The rods shall have a hard, clean, smooth, continuous surface throughout the length of the rod. Ground rods shall be provided with precast ground wells.

**2.06 WIRING MATERIALS**

- A. Compression Connectors: Connectors shall be for use with copper conductors and shall conform to the requirements of UL 486A. Control and signal connectors shall be copper compression type nylon self-insulated grip locking spade lugs. Power and grounding lugs and connectors for conductors No. 6 and larger shall be compression types of one piece tubular construction. These power compression connectors shall be copper long barrel terminals with corrosion resistant tin plating. Connectors shall be marked externally with wire size and type. Power connectors shall have NEMA configuration bolt holes on the pad. Connectors shall also have the proper mating compression die index and color code marked on the barrel. Furnish ILSCO #CRA/B-L series or approved equal.
- B. Splice Waterproofing Kits: Splice waterproofing shall be in kit form. Kit shall contain low viscosity polyurethane sealing and insulating material. The component materials

of the insulation shall be in exact mixing ratio packages. Kit shall employ a gravity poured method of a pressure injected method. Molds shall be flexible plastic with porous webbing. Molds shall be capable of accommodating odd shape splices. Kit shall be rated 600 V and water submersible. Furnish 3M Scotch cast 2104 and 85 series, or approved equal.

- C. Electrical Tapes: Tapes shall conform to the requirements of UL 510 and be rated: 105 degrees C, 600 V, flame retardant, hot and cold weather resistant. Vinyl plastic electrical tape shall be 7 mil black. Phase tape shall be 7 mil vinyl plastic, color code as specified. Electrical insulation putty shall be rubber based, elastic putty in tape form. Varnished cambric shall be 9 mil cotton tape impregnated with yellow insulating varnish and adhesive backed.
- D. Wire and Cable Markers: Every control and signal conductor shall be tagged with a permanently machine imprinted plastic nylon clip sleeve heat shrinkable or adhesive backed strip type labels protected with a clear plastic heat shrinkable tubing.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL REQUIREMENTS**

- A. Wire and cable shall not be installed in conduit until the raceway system has been completed and cleaned. The equipment and methods for the installation of wire and cable shall insure that no cuts or abrasions in the insulation or protective covering or kinks in the conductors occur. Cables shall be pulled down grade with the feed in point at point of the highest elevation.
- B. The Contractor shall pull wire and cable into the conduit with sufficient length remaining at the ends to conveniently make connections to all equipment or devices.
- C. Where practicable, the minimum radius to which an insulated conductor shall be bent, whether permanently or temporarily during installation, shall be ten times the diameter over the outer covering for rubber and thermoplastic insulated cable.
- D. Where a lubricant is needed as an aid in pulling wire or cable, a nonconducting lubricant or cable-pulling compound approved by the wire and cable manufacturer and that is not injurious to the sheath or insulation shall be used. 600 V cable lubricants shall be soapstone, graphite or talc which shall be UL listed for thermoplastic insulation. Oil or grease shall not be used for lubrication. Excessive pulling stresses will not be permitted.
- E. Wire and cable shall be continuous, with no splices permitted except in enclosed steel boxes provided for the purpose, or in manholes. Shipping length of power cable shall be equal to a circuit length or summation of various circuit lengths to minimize cable waste.

### 3.02 INSTALLATION - LOW VOLTAGE WIRING

#### A. General Requirements:

1. Do not use blocks, tackle, or other mechanical means to pull in wires #8 AWG, or smaller. Cable pulling tensions shall not exceed the maximum pulling tension for stranded copper.
2. See section 16110 for pull rope/tape requirements.
3. Unless otherwise specified or shown, leave at least 9" of free conductor length at each unconnected outlet. The free ends of conductors shall be coiled neatly in outlet box.

#### B. Splicing and Termination of Conductors:

1. Conductors #10 AWG and smaller:
  - a. Twist conductors together to be electrically and mechanically secure.
  - b. Insulate splices, joints and free ends of conductors with insulation equivalent to that of conductors by taping with varnish-cambridge rubber tapes, or with high dielectric strength plastic tape.
2. Conductors #8 AWG and larger:
  - a. Splice and terminate conductors by use of connectors and terminal lug.
  - b. To not use split bolt type connectors.
  - c. After initial set has been taken, re-tighten all pressure type connectors and lugs.
  - d. Insulate all splices, joints, and free ends of conductors as specified above.
  - e. Where aluminum lug is bolted with steel or copper bolt, use Belleville spring washer and flat washer. Belleville washer, either hardened and tempered steel, tin plated, or stainless steel. Flat washer, mild steel, tin plated, and slightly larger than Belleville washer.
3. Low Voltage Control Wiring: Splice by twisting conductors together so as to be electrically and mechanically secure. Other methods may be used if specifically approved by Engineer.
4. Underground Splices: Conductor and cable splices installed underground in

manholes, pullholes and similar locations, shall be made watertight. Install waterproofing after insulating with tape on all splices in junction boxes or handholes. Follow manufacturer's written instructions. As a minimum molds shall be fitted uniformly webbed around the spliced conductors. Insulating and waterproofing material shall then be poured or injected into the mold. Do not allow cables to move until after material has cured one hour at 70 degrees F or eight hours below 70 degrees F.

**C. Marking:**

1. In addition to color coding, identify circuits as follows:
  - a. The Contractor shall assign to each wire or cable a unique identification number unless a number has been pre-assigned on the Plans.
  - b. Where an identification number has been pre-assigned on the Plans the Contractor shall use that number.
  - c. The same identification number shall be used for conductors having common terminals.
  - d. Identification numbers shall be shown on all As-Built drawings.
  - e. Identification numbers shall be located within 3" of wire terminations and shall not be located such that they are concealed in any raceway.
2. Each multiconductor cable shall be assigned a unique identification number. It is required that this cable number shall form part of the individual wire identification number for each conductor in the cable. Cable markers shall be attached to each cable at stub-up locations and at all intermediate pull box locations.

**3.03 GROUNDING**

- A. Permanently and effectively ground noncurrent metal parts of conduit systems, supports, cabinets, switchboards, equipment cases, motor frames, etc., and system neutral conductors per NEC. Install metal raceway couplings, fittings and terminations secure and tight to insure good ground continuity. Provide grounding bushing and bonding jumper where conduits enter any panel or device, panels with open bottom or where shown on the drawings. Install a ground conductor in each raceway system. Contractor to install Ufer ground per NEC section 250.
- B. Grounding details shown on plans are minimum. If additional equipment, such as ground rods, clamps, conductors, etc., is required, furnish and install same without additional cost to City.

- C. Use ground clamps specifically designed for grounding purposes. Where ground conductor is in conduit, use ground clamp which grounds both conductor and conduit.
- D. Shielded instrumentation cable shall be grounded at one end of circuit only unless explicitly required by manufacturer of instrument or device to be grounded at multiple locations. Single ground point in each circuit shall be at the receiving end of the signal carried by the cable.

### **3.04 PREPARATION FOR OPERATION**

- A. The wire and cable shall be properly installed, connected and tested by the Contractor before such equipment will be taken over for operational service.
- B. Identification markers and nameplates shall be properly and accurately installed.
- C. Torquing: Every worker assigned to tightening bolted connections on this job shall be required to have either a torque screwdriver or a torque wrench on site in their tool box. Each crew shall have one of each. All electrical, mechanical and structural threaded connections shall be torqued. Torque connections to the value recommended by the equipment manufacturer. If they are not available, see Section 16950 for torque requirements.

### **3.05 TESTS AND INSPECTIONS**

- A. Insulated wire and Cable Dielectric Tests: After the wiring is installed and all taps and splices are completed, but before making connections to equipment terminals, the cable shall be given insulation tests in accordance with Section 16950 and NEMA and ICEA Standards.
- B. Continuity Tests:
  - 1. After wiring connections to equipment and devices have been made, the circuits shall be tested for continuity. The Contractor shall be responsible for notifying the City Resident Inspector when the wire or cable is ready to be tested, and the Contractor shall conduct the tests as instructed by the Engineer.
  - 2. If a failure is detected, the Contractor shall locate and determine the trouble, make necessary corrections to the installation and retest without additional cost to the City.
  - 3. Connection of the wiring to equipment or device terminal blocks or other connection points and furnishing and installing conductor identification tags at terminals or other connections shall be included as part of the equipment's installation.
- C. All testing required to ensure the satisfactory installation, adjustment, operation, and

performance of all equipment and materials installed under this specification shall be the responsibility of the Contractor.

- D. The Contractor shall also responsible for furnishing all electrical test equipment, meters, instruments and miscellaneous equipment and perform all work required for the tests.
- E. The Contractor shall furnish the Engineer three copies of certified test reports showing the results of all tests specified herein.

**3.06 DEMONSTRATION OF COMPLETE ELECTRICAL SYSTEMS**

- A. Demonstration of the operation of segments of systems shall not be construed as acceptability of the complete system. Acceptance will only be made on satisfactory demonstration of the complete operation of the system as a whole.
- B. If, in the opinion of the Engineer, test results show improper adjustment, operation, or performance of any equipment, and these deficiencies are due to negligence or unsatisfactory installation by the Contractor, the Contractor shall remedy the situation at no additional cost to the city.

**END OF SECTION**

## SECTION 16432

### LOW VOLTAGE COMMERCIAL SAFETY SOCKET

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. This specification section covers the commercial safety socket and includes coordinating the new electrical hookup with SMUD. The City will provide the commercial safety socket for each well.
- B. The provisions of Sections 16010 and 16120 of these specifications shall apply unless otherwise specified in this Section.

##### 1.02 ELECTRIC SERVICE COORDINATION

- A. The existing electrical services are provided by SMUD and are 480 VAC either 3 or 4 wire systems. SMUD will change out any transformer(s) that are 480 VAC and 3 wire to a 4 wire system.
- B. The Contractor shall coordinate the electric service hookup with SMUD such that the service is available to match the project schedule (Sacramento Utility District Service Number is (916) 732-7074). The SMUD Service Notification numbers are to be provided at a later date.
- C. The Contractor shall furnish and install the underground conduits, conductors, risers, and pull boxes as shown on the Plans and in accordance with SMUD requirements. SMUD will make all connections at the transformer.
- D. The Contractor shall make sure that the electrical service phase rotation matches SMUD.

#### PART 3 - EXECUTION

##### 3.02 INSTALLATION AND TESTS

- A. Facilities for SMUD service shall be inspected and approved prior to acceptance of the Contractor's work.
- B. Contractor shall furnish all material and labor including, but not limited to, transportation, loading, lifting, jacking, wiring to completely install the main switchboard as shown on the drawings and shall conform to the latest edition of the National Electric Code (NEC).

- C. Refer to Section 16950 for all the testing requirements.
- D. The contractor shall be responsible for picking up the MCC, meter, and generator receptacle and delivering these items to each job site

**END OF SECTION**

## SECTION 16480

### LOW VOLTAGE MOTOR CONTROL CENTER

#### PART 1 -- GENERAL

##### 1.01 SCOPE

- A. This Specification Section covers the installing and testing of the Motor Control Center as specified herein, as shown on the Drawings, and as required for a complete electrical installation.
- B. The provisions of Sections 16010 and 16120 of these specifications shall apply unless otherwise specified in this Section.

#### PART 2 -- PRODUCTS

##### 2.01 MATERIAL AND EQUIPMENT

- A. The City has purchased the motor control centers (MCCs) and meters through a separate procurement contract. The Contractor shall install this equipment at the respective sites as indicated on the plan sheets. The City has purchased MCCs with different size motor starters for each well pump. The motor starter sizes are either 40hp, 50hp, 75hp, or 100hp.

The MCCs are rated NEMA 3R.

- B. The motor starter size will be determined after pump testing and the appropriate MCC shall be installed to match the pump size.

#### PART 3 -- EXECUTION

##### 3.01 INSTALLATION

- A. Contractor shall furnish all material and labor including, but not limited to, transportation, loading, lifting, jacking, wiring to completely install Motor Control Center as shown on the drawings and shall conform with the National Electrical Code (NEC). The Contractor shall transport each MCC from the electrical distributor facility to each job site. The electrical distributor is CED in Rancho Cordova, CA.

**END OF SECTION**

## SECTION 16530

### LIGHTING

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. This specification section covers the furnishing, and installing of lighting fixtures, wiring devices, poles, conduit, wiring and other material for the complete indoor and outdoor lighting as shown on the drawings. Lighting fixtures and hardware shall be installed as shown on the Plans.

##### 1.02 SUBMITTALS

- A. Catalog cuts showing manufacturer, catalog numbers, dimensions, weights and material for fixtures and poles shall be submitted to the Engineer for review in accordance with Section 01330.

#### PART 2 - PRODUCTS

##### 2.01 REFERENCE STANDARDS

- A. Materials and equipment supplied under this contact shall be designed, manufactured, and tested in accordance with the latest version of the following standard:
1. National Electrical Manufacturers Association (NEMA).
  2. Underwriters Laboratories Inc.
  3. National Electrical Code.

##### 2.02 LIGHTING FIXTURES, DEVICES, AND POLES

- A. Lighting Fixtures shall be complete with mounting brackets and hardware, lamps, lenses, fixtures wire, and all required accessories as specified and as required by NEC. The lighting fixtures and fixture accessories shall be as shown on the drawings, or approved equal.

- B. Lighting fixtures shall be of the LED type.
- C. Light Poles shall be anchor base, round, tapered steel, hot dipped galvanized, height as indicated, complete with handhole and gasketed cover, anchor bolts with leveling and locking screws and cover, and grounding connection.
- D. Light Switches: Switches shall be single pole, specification grade, 277 volt, 3 wire, 20 ampere A.C., ivory in color with stainless steel cover plates. Furnish Hubbell 1221, Leviton 1201-2, or approved equal. Outdoor light switches shall be weatherproof. **Light switches shall be labeled with nameplates per section 16010.**
- E. GFCI Receptacles shall be ivory, 20 A, NEMA 5-20R furnished with stainless steel plates. Outdoor receptacles shall be weatherproof. Receptacles shall be Leviton #6899, G.E. #TGTR115, Square D #GFDR120, or approved equal.
- F. Motion detectors shall be rated for outdoor use with an input voltage of 120 V and an isolated relay contact. Motion detectors shall EW outdoor motion sensor model number EW-100-120 or approved equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. All lighting poles and fixtures shall be directly grounded to the site grounding system by means of a conductor of a size not less than that required by NEC. If insulated, the ground conductor insulation shall be colored green.
- B. The Contractor shall install all lighting fixtures in accordance with the manufacturer's instructions and recommendations.
- C. All exterior fixtures shall be aligned and directed as shown on the Plans and as directed by the Engineer in order to illuminate the desired area properly. Fixtures shall be directly and rigidly mounted on Contractor provided supporting structures.
- D. Unless otherwise noted on the plans: general use receptacles shall be mounted 18" above the finish floor to device centerline, light switches shall be mounted 48" above finish floor to device centerline.
- E. Prior to acceptance by the City the Contractor shall thoroughly clean the fixtures and lamps.

**END OF SECTION**

## SECTION 16950

### OPERATIONAL TESTING

#### PART 1 - GENERAL

##### 1.01 SCOPE

###### A. General

1. Independent test company pre-operational testing.
2. Contractor operational testing.

##### 1.02 GENERAL REQUIREMENTS

- A. The Contractor shall engage and pay for the services of an approved independent testing company for the purpose of performing inspections and electrical preoperational tests as specified. The testing company shall provide all material, equipment, labor and technical supervision to perform such tests and inspections. The Contractor shall also perform all mechanical preoperational tests as herein specified.
- B. These tests shall assure that all equipment is operational within industry and manufacturer's tolerances and is installed in accordance with design plans and specifications. The tests and inspections shall determine the suitability for energization and the suitability for Owner acceptance of the Contractor's work.

##### 1.03 FAILURE TO MEET TEST

- A. Contractor shall replace the defective material or equipment and have tests repeated until test proves satisfactory to the Engineer without additional cost to the Owner.

##### 1.04 SUBMITTALS

- A. The Contractor shall submit the following tests to the Engineer:
1. Grounding system test.
  2. Phase rotation test.
  3. MCC device test including MCP and breaker test.
  4. Switchboard and MCC device test, generator receptacle test
  5. 600 volt conductor test.
  6. Wiring test.

- B. Three copies of each test mentioned above shall include the following data and be submitted with the Operation and Maintenance Manual:
1. Summary of project, construction contract numbers
  2. Description of equipment tested
  3. Description of test
  4. Test personnel
  5. List of test equipment used and calibration date
  6. Test results, date and weather conditions
  7. Conclusions and recommendations
  8. Appendix, including all test forms

## **PART 2 - PRODUCTS**

### **2.01 TESTING COMPANY**

- A. The testing company shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907. Membership in the International Electrical Testing Association constitutes proof of meeting such criteria. The testing shall be performed by Electro Test, Apparatus Unlimited, Power Systems Testing, Hart Testing, or approved equal.

### **2.02 TESTING**

- A. California Electrical Safety Orders (ESO) and Occupational Safety and Health Act (OSHA): The Contractor is cautioned that testing and equipment shall comply with ESO and OSHA as to safety, clearances, padlocks and barriers around electrical equipment energized during testing.

## **PART 3 – EXECUTION**

### **3.01 PREOPERATIONAL TESTING**

- A. All testing shall conform to International Electrical Testing Association (NETA) Maintenance and Acceptance specifications and shall utilize manufacturer's instruction manuals applicable to each particular apparatus.
- B. Upon completion of the test and inspections noted in these specifications, a label shall be attached to all serviced devices. These labels will indicate date serviced and the service company responsible.

### **3.02 GROUND RESISTANCE PREOPERATIONAL TEST**

- A. Test the entire ground system for ground resistance value. Perform fall of potential method with ground test instrument. Record weather and soil conditions at the time measurements are made. Make ground resistance measurements in normally dry weather, not less than 48 hours after rainfall. The current reference rod shall be driven at least 100 feet from the ground rock or grid under test, and the measurements shall be made at 10 foot intervals beginning 25 feet from the test electrode and ending 75 feet from it, all in direct line between the ground rod, or center of grid and the current reference electrode.
- B. Grounds and grounding systems shall have a resistance to solid earth ground not exceeding 5 ohms.

### **3.03 PHASE ROTATION PREOPERATIONAL TEST**

- A. Check connections to all equipment for proper phase relationship. During this test, disconnect all devices which could be damaged by the application of voltage or reversed phase sequence. Three phase equipment shall be tested for the phase sequence "ABC" front to back, left to right and top to bottom.

### **3.04 MOTOR CIRCUIT PROTECTOR (MCP) AND CIRCUIT BREAKER PREOPERATIONAL TEST**

- A. All MCPs and circuit breakers shall be checked for proper mounting, conductor size and feeder designation.
- B. All MCPs and only breakers 100 amp and above shall be tested. Time current characteristic tests shall be performed bypassing three hundred percent (300%) rated current through each pole separately. Trip time shall be determined. Instantaneous pickup current shall be determined by run up or pulse method. Clearing times should be within 4 cycles or less.
- C. Contact and Insulation Resistance: Contact resistance shall be measured and be compared to adjacent poles and similar breaker. Deviations of more than 50% shall be rejected. Insulation resistance shall be measured and shall not be less than 50 megohms. All trip times shall fall within NETA table values. Instantaneous pickup current levels should be within 20% of manufacturer's published values.
- D. Circuit breakers with adjustable settings shall have all of the settings tested and test results shall be submitted to the engineer. The following settings shall be tested: long time pickup, long time delay, short time pickup, short time delay, and the instantaneous settings.
- E. Circuit breakers with ground fault protection shall be performance tested and test results shall be submitted to the engineer. The testing agency shall verify that the

ground protection is connected properly per the manufacturer’s recommendations. The testing agency shall test the ground fault pickup and ground delay and submit the test results to the Engineer.

**3.05 SWITCHBOARD & MCC PREOPERATIONAL TEST**

A. Visual and Mechanical Inspection:

1. Inspect for physical damage, proper anchorage and grounding.
2. Compare equipment nameplate data with design plans and starter schedule.
3. Compare overload heaters with motor full load current for proper size.
4. Check torque of bolted connections. Torque connections shall be per manufacturer’s recommendation or use the following table if the manufacturer’s data is not available:

**NOMINAL TORQUE REQUIREMENTS FOR BOLTED BONDS**

BOLT SIZE	THREADS /INCH	TORQUE IN/LBS	TORQUE FT/LBS
#8	32	18	
	34	20	
#10	24	23	
	32	32	
1/4"	20	80	6
	28	100	8
5/16"	18	140	11
	20	150	12
3/8"	16	250	20
	24	275	22
7/16"	14	400	33
	20	425	35
1/2"	13	550	45
	20	575	47
5/8"	11	920	76
3/4"	10	1,400	116
7/8"	9	1,950	162
1"	8	2,580	215

B. Electrical Tests:

1. Measure insulation resistance of starter phase to phase and phase to ground with the starter contacts closed and the protective device open. Test voltage and minimum acceptable values shall conform to NETA Section 3 "Test Values." Measure insulation resistance of each control circuit with respect to ground.
2. Motor overload units shall be tested by injecting primary current through overload unit and monitoring trip time.
3. Perform control functional tests by initiating control devices to affect proper operation with motor feeder disconnected

C. Generator Breaker, Interlock and Generator Receptacle Tests:

The generator breaker, the interlock and the generator receptacles shall be tested to insure proper functionality. The City will provide a portable generator of the appropriate size and connection hardware from its fleet. The Contractor shall demonstrate to the City that the generator breaker, the interlock and the generator receptacles are working properly to run the well loads. The correct power source phase rotation shall be verified (the phase rotation of the City's portable generators are always A-B-C clockwise).

**3.06 600 VOLT CONDUCTOR TEST**

- A. Megger and record insulation resistances of all 600 volt insulated conductors using a 500 volt megger for thirty seconds. Make tests with circuits installed in conduit and isolated from source and load. Each conductor shall be meggered conductor to conductor and conductor to ground. These tests shall be made on cable after installation with all splices made up and terminators installed but not connected to the equipment.

**3.07 WIRING TEST**

Verify all wire connections/terminations are per contract drawings or approved changes. Check for proper termination of all wires.

**3.08 OPERATIONAL TESTING**

- A. After preoperational tests are complete, the Contractor shall conduct overall operational testing of the plant which shall be witnessed by the Engineer and other City personnel. City O&M personnel will assist the Contractor during operational testing.

**END OF SECTION**

## SECTION 17100

### PROCESS CONTROL AND INSTRUMENTATION SYSTEMS

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. The **CONTRACTOR** shall provide the following Instrumentation and Control components in accordance with the Contract Documents. The components shall include, but not be limited to, the following:
1. Instruments specified in Division 17000.
  2. Local control stations not provided as components of the specified equipment.
  3. All Control Cabinets which are NOT equipped with the PLCs.
  4. Fiber optic cabling, area switches (where noted on the drawings), hubs, valve networks, copper cabling, and related equipment.
  5. ~~Programmable Logic Controllers (PLC) and/or Remote Strickout line Unit (RTU).~~
- B. The requirements of this Section apply to all components of the CONTROL SYSTEM unless indicated otherwise.
- C. Responsibilities:
1. The **CONTRACTOR**, through the use of a qualified Instrumentation Supplier and qualified Electrical and Mechanical installers, shall be responsible to the City for the supplying, installation, labeling and termination of all instruments to the City furnished control cabinets and consoles.
  2. The **CONTRACTOR** shall install all City furnished control cabinets and install City furnished consoles and connect external wires i.e. power and Ethernet.
  3. Due to the complexities associated with the interfacing of numerous instruments, panels, local controls, PLC I/O devices, it is the intent of these specifications that the Instrumentation Supplier be responsible to the **CONTRACTOR** for the installation and termination of the components to both new and existing devices provided under other sections of this contract.
  4. The Instrumentation Supplier shall perform the following work:
    - a. Prepare submittals.
    - b. Design, develop, and electronically draft loop drawings and control panel designs.
    - c. Prepare the test plan and the spare parts submittals.
    - d. Perform setup, bench calibration and loop checks after installation.

- e. Oversee and certify installation of all devices provided under Division 17.
  - f. Oversee, document, and certify loop testing.
  - g. Provide hardware support during the performance test.
  - h. Prepare record drawings.
5. The **City** shall perform all PLC and operator interface panel programming.

### 1.02 REFERENCE PUBLICATIONS

- A. The equipment covered under this contract shall be designed, manufactured, and tested in accordance with the latest version of the applicable industrial standards.

### 1.03 SUBMITTALS

- A. Provide submittals in accordance with the Special Provisions. Submittals shall be approved by the Engineer prior to manufacture and shipment.
- B. Provide Operations and Maintenance Manuals as specified in the Special Provisions.

### 1.04 QUALITY ASSURANCE

- A. The manufacturer shall verify that they have been fabricating and assembling similar equipment for a minimum of five (5) years.

## PART 2 -- PRODUCTS

### 2.01 GENERAL

- A. **Code and Regulatory Compliance:** All work shall conform to or exceed the applicable requirements of the National Electrical Code.
- B. **Current Technology:** All meters, instruments, and other components shall be the most recent field-proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise required to match existing equipment.
- C. **Hardware Commonality:** All instruments which utilize a common measurement principle (for example, d/p cells, pressure transmitters, level transmitters which monitor hydrostatic head) shall be furnished by a single Manufacturer. All panel mounted instruments shall have matching style and general appearance. Instruments performing similar functions shall be of the same type, model, or class, and shall be from a single Manufacturer.
- D. **Loop Accuracy:** The accuracy of each instrumentation system or loop shall be determined as a probable maximum error; this shall be the square-root of the sum of the

squares of certified "accuracies" of the designated components in each system, expressed as a percentage of the actual span or value of the measured variable. Each individual instrument shall have a minimum accuracy of plus and minus 0.5 percent of full scale and a minimum repeatability of plus and minus 0.25 percent of full scale unless otherwise indicated. Instruments which do not conform to or improve upon these criteria are not acceptable.

- E. **Instrument and Loop Power:** Power requirements and input/output connections for all components shall be verified. Power for transmitted signals shall, in general, originate in and be supplied by the control panel devices. All power supplies shall be mounted within control panels or in the field at the point of application.

## 2.02 SPARE PARTS AND SPECIAL TOOLS

- A.. The CONTRACTOR shall furnish a list of all spare parts and special tools required to calibrate and maintain all of the instrumentation provided under the Contract Documents.

## 2.03 FACTORY TESTING

- A. The CONTRACTOR shall provide copies of all factory tests for each piece of instrumentation.
- B. **The Contractor shall provide the Engineer with a factory calibration sheet on the flow meter indicating that the flow tube was calibrated at the factory.**
- C. **The Contractor shall provide the Engineer with a factory calibration sheet on the drawdown transducer indicating that it was calibrated at the factory.**
- D. **The Contractor shall provide the Engineer with a factory calibration sheet on the CI2 leak detector indicating that it was calibrated at the factory.**
- E. **The Contractor shall provide the Engineer with a calibration certificate that includes the following:**
  - 1. **Model and serial number of each instrument tested**
  - 2. **NIST report numbers**
  - 3. **The actual test data**
  - 4. **Test standards**
  - 5. **Date and time of the test**

## PART 3 -- EXECUTION

### 3.01 PRODUCT HANDLING

- A. **Tagging:** Each component shall be tagged to identify its location, instrument tag number, and function in the system. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the plans, shall be provided on each piece of the instrumentation. Identification shall be prominently displayed on the outside of the package.

### 3.02 MANUFACTURER'S SERVICES

- A. The CONTRACTOR shall furnish the following Manufacturer's services for the instrumentation listed below:

1. Perform factory calibration
2. Oversee installation
3. Verify installation of installed instrument
4. Certify installation and reconfirm Manufacturer's accuracy statement
5. Oversee loop testing, prepare loop validation sheets, and certify loop testing
6. Oversee pre-commissioning, prepare pre-commissioning validation sheets, and certify pre-commissioning
7. Train the OWNER's personnel

- B. Manufacturer's services shall be furnished for the following equipment:

1. All probes
2. Flow meters
3. Drawdown transmitter
4. Chlorine leak detector

### 3.03 INSTALLATION

- A. **General:**

All instrumentation, including instrumentation furnished under other Divisions, shall be installed under Division 17 and the manufacturers' instructions.

The monitoring and control system configurations indicated are diagrammatic. The locations of equipment are approximate. The exact locations and routing of wiring and cables shall be governed by structural conditions and physical interferences and by the location of electrical terminations on equipment. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. Where job conditions require reasonable changes in approximated locations and arrangements, or when the City exercises the right to require changes in location of equipment which do not impact material quantities or cause material rework, the CONTRACTOR shall make such changes without additional cost to the City.

All power and signal wires shall be terminated with crimped type lugs.

All connectors shall be water tight.

All wires shall be mounted clearly with an identification tag that is of a permanent and reusable nature.

All wire and cable shall be arranged in a neat manner and securely supported in cable groups and connected from terminal to terminal without splices unless specifically approved by the ENGINEER. All wiring shall be protected from sharp edges and corners.

All mounting stands and bracket materials and workmanship shall comply with requirements of the Contract Documents.

### **3.04 CALIBRATION**

#### **A. General:**

All devices provided under Division 17 shall be calibrated according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.

#### **B. Calibration Points:**

Each instrument shall be calibrated at 20, 40, 60, 80 and 100% of span using test instruments to simulate inputs. The test instruments shall have accuracy's traceable to National Institute of Testing Standards.

#### **C. Factory Calibration:**

Instruments which have been factory calibrated shall be examined in the field to determine whether any of the calibrations are in need of adjustment. Such adjustments, if required, shall be made only after consultation with the ENGINEER.

#### **D. Field Calibration:**

Instruments which were not bench-calibrated shall be calibrated in the field to insure proper operation in accordance with the instrument loop diagrams or specification data sheets.

E. **Calibration Sheets:**

Each instrument calibration sheet shall provide the following information and a space for sign-off on individual items and on the completed unit:

1. Project name
2. Loop number
3. Tag number
4. Manufacturer
5. Model number
6. Serial number
7. Calibration range
8. Calibration data: Input, output, and error at 10 percent, 50 percent and 90 percent of span
9. Switch setting, contact action, and deadband for discrete elements
10. Space for comments
11. Space for sign-off by Instrumentation Supplier and date
12. Test equipment used and associated serial numbers

F. **Calibration Tags:** A calibration and testing tag shall be attached to each piece of equipment or system at a location determined by the ENGINEER. The CONTRACTOR shall have the Instrumentation Supplier sign the tag when calibration is complete. The ENGINEER will sign the tag when the calibration and testing has been accepted.

**3.05 LOOP TESTING**

A. **General:** Individual instrument loop diagrams per ISA Standard S5.4 - Instrument Loop Diagrams, expanded format, shall be submitted to the ENGINEER for review prior to the loop tests. The CONTRACTOR shall notify the ENGINEER of scheduled tests a minimum of 30 days prior to the estimated completion date of installation and wiring of

the instrument. After the ENGINEER'S review of the submitted loop diagrams for correctness and compliance with the specifications, loop testing shall proceed. The loop check shall be witnessed by the ENGINEER.

- B. **Control Valve Tests:** All control valves, cylinders, drives and connecting linkages shall be stroked from the operator interface units as well as local control devices and adjusted to verify proper control action, hand switch action, limit switch settings, torque settings, remote control actions, and remote feedback of valve status and position. Control valve actions and positioner settings shall be checked with the valves in place to insure that no changes have occurred since the bench calibration.
- C. **Interlocks:** All hardware and software interlocks between the instrumentation and the motor control circuits, control circuits of variable-speed controllers and packaged equipment controls shall be checked to the maximum extent possible.
- D. **Instrument and Instrument Component Validation:** Each instrument shall be field tested, inspected, and adjusted to its indicated performance requirement in accordance with its Manufacturer's specifications and instructions. Any instrument which fails to meet any Contract requirement, or, in the absence of a Contract requirement, any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the ENGINEER at no additional cost to the OWNER.
- E. **Loop Validation Sheets:** The CONTRACTOR shall prepare loop confirmation sheets for each loop covering each active instrumentation and control device except simple hand switches and lights. Loop confirmation sheets shall form the basis for operational tests and documentation. Each loop confirmation sheet shall cite the following information and shall provide spaces for sign-off on individual items and on the complete loop by the Instrumentation Supplier:
  - 1. Project name
  - 2. Loop number
  - 3. Tag number, description, manufacturer and model number for each element
  - 4. Installation bulletin number
  - 5. Specification sheet number
  - 6. Loop description number
  - 7. Adjustment check
  - 8. Space for comments

9. Space for loop sign-off by Instrumentation Supplier and date
10. Space for ENGINEER witness signature and date

F. **Loop Certifications:** When installation tests have been successfully completed for all individual instruments and all separate analog control networks, a certified copy of all test forms signed by the ENGINEER or the ENGINEER's representative as a witness, with test data entered, shall be submitted to the ENGINEER together with a clear and unequivocal statement that all instrumentation has been successfully calibrated, inspected, and tested.

### 3.06 PRECOMMISSIONING

- A. **General:** Pre-commissioning shall commence after acceptance of all wire tests, calibration tests and loop tests, and all inspections have demonstrated that the instrumentation and control system complies with all Contract requirements. Pre-commissioning shall demonstrate proper operation of all systems with process equipment operating over full operating ranges under conditions as closely resembling actual operating conditions as possible.
- B. **Pre-commissioning Procedures and Documentation:** All pre-commissioning and test activities shall follow detailed test procedures and check lists accepted by the ENGINEER. All test data shall be acquired using equipment as required and shall be recorded on test forms accepted by the ENGINEER, which include calculated tolerance limits for each step. Completion of all system pre-commissioning and test activities shall be documented by a certified report, including all test forms with test data entered, delivered to the ENGINEER with a clear and unequivocal statement that all system pre-commissioning and test requirements have been satisfied.
- C. **Loop Tuning:** All electronic control stations incorporating proportional, integral or differential control circuits shall be optimally tuned, experimentally, by applying control signal disturbances and adjusting the gain, reset, or rate settings as required to achieve a proper response. Measured final control element variable position/speed set point settings shall be compared to measured final control element position/speed values using percentages of 20, 40, 60, 80, 100, 80, 60, 40, and 20% of span and the results checked against indicated accuracy tolerances.
- D. **Pre-commissioning Validation Sheets:** Pre-commissioning shall be documented on one of two types of test forms as follows:
1. For functions which can be demonstrated on a loop-by-loop basis, the form shall include:
    - a. Project name
    - b. Loop number

- c. Loop description
    - d. Tag number, description, manufacturer and data sheet number for each component.
  - 2. For functions which cannot be demonstrated on a loop-by-loop basis, the test form shall be a listing of the specific tests to be conducted. With each test description the following information shall be included:
    - a. Specification page and paragraph of function demonstrated
    - b. Description of function
    - c. Space for sign-off and date by both the Instrumentation Supplier and ENGINEER
- D. **Pre-commissioning Certification:** The CONTRACTOR shall submit an instrumentation and control system pre-commissioning completion report which shall state that all Contract requirements have been met and shall include a listing of all instrumentation and control system maintenance and repair activities conducted during the pre-commissioning testing. Acceptance of the instrumentation and control system pre-commissioning testing must be provided in writing by the ENGINEER before the performance testing may begin. Final acceptance of the control system shall be based upon plant completion as stated in the General Conditions.

### 3.09 TRAINING

- A. **General:** The CONTRACTOR shall train the OWNER'S personnel on the maintenance, calibration and repair of all instruments provided under this Contract.
- B. **Instructions:** The training shall be performed by qualified representatives of the equipment manufacturers and shall be specific to each piece of equipment.
- C. **Duration:** Each training class shall be a minimum of 8 hours in duration and shall cover, as a minimum, operational theory, maintenance, troubleshooting/repair, and calibration of the instrument.
- D. **Schedule:** Training shall be performed during the pre-commissioning phase of the project. The training sessions shall be scheduled a minimum of 3 weeks in advance of when the courses are to be initiated. The ENGINEER will review the course outline for suitability and provide comments that shall be incorporated.
- E. **Agenda:** The training shall include operation and maintenance procedures, troubleshooting with necessary test equipment, and changing set points, and calibration for that specific piece of equipment.

- F. **Documentation:** The Contractor shall provide a copy of the training materials utilized during the lesson with all notes, diagrams, and comments.

**3.10 ACCEPTANCE**

- A. For the purpose of this Section, the following conditions shall be fulfilled before the WORK is considered substantially complete:
1. All submittals have been completed and approved.
  2. The instrumentation has been calibrated, loop tested and pre-commissioned.
  3. The OWNER training has been performed.
  4. All required spare parts and expendable supplies and test equipment have been delivered to the ENGINEER.
  5. The performance test has been successfully completed.
  6. All punch-list items have been corrected.
  7. All record drawings in both hard copy and electronic format have been submitted.
  8. Revisions to the OWNER'S Manuals that may have resulted from the field tests have been made and reviewed.
  9. All debris associated with installation of instrumentation has been removed.
  10. All probes, elements, sample lines, transmitters, tubing, and enclosures have been cleaned and are in like-new condition.

**END OF SECTION**

**SECTION 17101**  
**INSTRUMENTATION**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. This Section covers the furnishing, installation, and testing of instrumentation as specified herein, as shown on the Drawings, and as required for a complete installation.

**1.02 REFERENCE PUBLICATIONS**

- A. The equipment covered under this contract shall be designed, manufactured, and tested in accordance with the latest version of the applicable industrial standards.

**1.04 SUBMITTALS**

- A. Provide submittals in accordance with the Special Provisions. Submittals shall be approved by the Engineer prior to manufacture and shipment.
- B. Provide Operations and Maintenance Manuals as specified in the Special Provisions.

**1.04 QUALITY ASSURANCE**

- A. The manufacturer shall verify that they have been fabricating and assembling similar equipment for a minimum of five (5) years.

**PART 2 – PRODUCTS**

**2.01 PRESSURE TRANSMITTER**

- A. The water pressure transmitter shall have an accuracy of  $\pm 0.25\%$  of span with a power supply voltage varying between 12.5 to 36 volts DC. The static pressure ratings shall be 150 psi and the diaphragm material shall be stainless steel. Pressure transducer shall be equipped with built-in LCD indicator, Rosemount Option M6. The pressure transmitter shall be Rosemount “Smart” transmitter model No 3051TG-2-A-2B-2-1-J-S1-B4-M6 or approved equal. Each unit shall be calibrated for 0-85 psi at the factory and recorded on a calibration sheet. The calibration sheet shall be provided to the Engineer and filed in the O&M manual.

**2.02 DRAWDOWN TRANSMITTER**

- A. The drawdown transmitter shall be a small bore submersible level transducer. It shall have following features:
  - 1. Ported nose cap
  - 2. Vented gage
  - 3. Analog output of 4~20mA
  - 4. 316 Stainless steel construction
  - 5. Molded cable seal
  - 6. Polyurethane cable
  - 7. Lightning protection
  - 8. Vented (Desiccant) Filter
  - 9. Junction box with vent filter
- B. The drawdown transmitter shall be Esterline Series 300 or approved equal.
- C. The level range, cable length and exact part number will be dependent on the well pump test, water column, and submersible pump set level. The Contractor shall provide submittals to the City and the City will select the level range of each drawdown transmitter.

The drawdown transmitter shall be installed in a still well as shown on the Plans and shall be installed 10 feet above the suction opening of the pump. The Contractor shall order enough cable so there are no splices between each drawdown transmitter and the PLC with minimum spare cable. Contractor shall not trim the transmitter cable for any reason.

The Contractor shall order the junction box (model number 840) with the vent filter for each drawdown transmitter. The contractor install mount the junction box inside the PLC cabinet. The contractor shall install the lighting protection module inside the PLC cabinet on the DIN rail and install per the manufacturer’s instructions.

The level range, cable length and part number are shown in the following table:

	Level Range	Cable Length	Part #*
Well 83	0’~150’	See below	330 S14 B0B 065.010 004.334 B1 ##### B
Well 131	0’~150’	See below	330 S14 B0B 065.010 004.334 B1 ##### B
Well 137	0’~150’	See below	330 S14 B0B 065.010 004.334 B1 ##### B
Well 143	0’~150’	See below	330 S14 B0B 065.010 004.334 B1 ##### B
Well 144	0’~150’	See below	330 S14 B0B 065.010 004.334 B1 ##### B
Well 153A	0’~150’	See below	330 S14 B0B 065.010 004.334 B1 ##### B
Well 155	0’~150’	See below	330 S14 B0B 065.010 004.334 B1 ##### B
Well 164	0’~150’	See below	330 S14 B0B 065.010 004.334 B1 ##### B

\* 10 ft of water / 2.3073 = 4.334 psi

The submersible pumps and drawdown transmitters shall be set as shown in the following table.

	Pump Intake Depth	Drawdown Transmitter Depth
Well 83	130'	120'
Well 131	145'	135'
Well 137	135'	125'
Well 143	130'	120'
Well 144	140'	130'
Well 153A	150'	140'
Well 155	140'	130'
Well 164	155'	145'

The length of the transmitter cable for each well shall be equal to the drawdown transmitter depth plus the distance from the well head to the PLC plus 1%. Contractor shall confirm well drawdown water surface elevation prior to ordering the drawdown transmitters. Contractor shall obtain written approval from the City prior to ordering the drawdown transmitters.

**2.03 CHLORINE GAS MONITOR**

- A. The chlorine gas monitor shall have the following features:
  - 1. LED Display
  - 2. Analog Outputs 4~20mA
  - 3. Alarm Set Points and Relays
  - 4. Sensor Auto-test
  - 5. NEMA 4X enclosure
  
- B. The Chlorine Gas Monitor shall be Analytical Technology, Inc. GasSens Modular Gas Detector Model A14/A11-11-0026-1-2 including the following parts:
  - 1. Two Module Enclosure: 80-0006
  - 2. Power Supply Module: 00-0055
  - 3. Calibration adapter for A10 sensor: 00-0118
  - 4. A10 Sensor: 00-0081

**2.04 AIRCHARGING SYSTEM**

- A. The Universal Aircharging System for the hydropneumatic tank shall have the following characteristics:

1. Dual voltage motor, auto ranging 115v/230v level control, and wide pressure range.
  2. Dual voltage motor with selector switch for easy voltage selection 115v/230v
  3. Direct access terminal block for faster installation.
  4. High capacity compressor for faster tank charging and larger tank capacity.
  5. Strain relief on probe connection
  6. Stainless steel fasteners
  7. Rodent proof air vents, improved air lines and heavy duty cover for harsh environments.
  8. Wire probe.
  9. Liquid level switch.
  10. Pressure switch.
- B. The Universal Aircharging System shall be ChargeAir 2000 manufactured by MAASS Midwest Inc. or Engineer approved equal.
- C. The Contractor shall furnish and install the Universal Aircharging System as specified above at all eight wells. It should include all the mounting brackets, hardware, pipes, conduits, wires and all the labor and material for a complete working system.

## **2.05 CABINET DOOR SWITCH**

- A. The Contractor shall install a cabinet door switch to each door on each MCC unit. The Contractor shall mount the cabinet door switch near the bottom of each cabinet. The cabinet door switch shall be Eaton model number 10316H828 with plunger or approved equal.

## **2.06 MAGNETIC DOOR SWITCH**

- A. The Contractor shall install a magnetic door switch to each motor junction box for each well. The magnetic door switch shall be Sentrol model number 1044TW or approved equal. Color shall be natural (off-white).

## **PART 3 - EXECUTION**

### **3.01 SHIPPING, HANDLING, AND DELIVERY**

- A. The instrumentation equipment shall be protected for shipment by the manufacturer.

### **3.02 INSTRUMENTATION EQUIPMENT INSTALLATION**

- A. The instrumentation equipment shall be installed per the manufacturer's recommendation and as shown on the plans.

### **3.03 STARTUP ASSISTANCE BY MANUFACTURE'S LOCAL REPRESENTATIVE**

- A. The manufacturer shall provide delivery inspection, technical advice, startup inspection, job site operational diagnostics and calibration, approve/certify for operation, operational assistance, and one 2-hour Operation and Maintenance training class covering all instrumentation specified in this section. The Contractor shall provide an ISA calibration sheet for each instrument supplied. Each instrument shall then be calibrated to ISA standards and recorded.
- B. Pressure measuring systems shall be handled, installed, calibrated, loop-tested, pre-commissioned, and performance tested according to Section 17100, "Process Control and Instrumentation Systems."
- C. All instrumentation shall be tested and calibrated as outlined in Section 17100.
- D. **All sensors shall be loop calibrated at the factory as a complete assembly, see Section 17100.**

## **PART 4 - WARRANTY**

### **4.01 MANUFACTURER'S WARRANTY**

- A. The manufacturer shall provide a one year warranty that covers parts, labor and travel. The warranty period shall start of the day the City accepts the project.

**END OF SECTION**

**SECTION 17102**

**FLOW MEASURING SYSTEMS**

**PART 1 - GENERAL**

**1.01 SCOPE**

- A. This Section covers the furnishing, installation, and testing of eight (8) magnetic flow measuring systems as specified herein, as shown on the Drawings, and as required for a complete installation. The Contractor shall install a new magnetic flow measuring systems as shown below for each well site:

<u>Well No.</u>	<u>Meter Size:</u>
Well 83	8"
Well 131	8"
Well 137	8"
Well 143	8"
Well 144	8"
Well 153	10"
Well 155	8"
Well 164	10"

- B. The Contractor shall remove and salvage the existing flow meter at each well site.

**1.02 REFERENCE PUBLICATIONS**

- A. The equipment covered under this contract shall be designed, manufactured, and tested in accordance with the latest version of the applicable industrial standards.

**1.03 SUBMITTALS**

- A. Provide submittals in accordance with Section 01330. Submittals shall be approved by the Engineer prior to manufacture and shipment.
- B. Provide Operations and Maintenance Manuals as specified in Section 01330.

**1.04 QUALITY ASSURANCE**

- A. The manufacturer shall verify that they have been fabricating and assembling similar equipment for a minimum of five (5) years.

**PART 2 - PRODUCTS**

**2.01 MAGNETIC FLOW MEASURING SYSTEMS**

A. General: Magnetic flow measuring systems shall measure volumetric flow rate by detecting the velocity of a conductive liquid that passes through a magnetic field. The flowtube shall be installed in-line with the process piping. Coils located on opposite sides of the flowtube shall create a magnetic field. As the conductive fluid moves through this field, a voltage shall be generated that is linearly proportional to the flow. The transmitter shall condition this voltage and produce output signals that are proportional to the velocity of the fluid being metered.

Each magnetic flow measuring system shall include a flowtube, signal cable, transmitter, and grounding rings. Each system shall be FM approved and intrinsically safe.

B. Flowtube:

1. Flanged Type: In-line flow element with no constrictions in flow of fluid through meter consisting of metallic tube with ANSI B16.5, Class 150 bolt pattern. Flange material shall be compatible with the piping material and corrosion resistant. This flowtube will be installed in an area subject to periodic submergence and shall be I.P. 68 rated.
2. Electrode and Liner Materials: Shall be fully compatible with the process fluid. Refer to the chart below for electrode and liner material requirements. The liner shall meet the current requirements of the NSF/ANSI Standard 61. Provide written certification of the NSF/ANSI Standard 61 for each meter.

Process Fluid	Liner	Electrode
Drinking Water	Polyurethane	316 Stainless Steel

3. Grounding Rings: 316L SST, with an external tab to attach ground wiring. Contractor shall connect the grounding rings per the manufacturer's recommendations.

C. Transmitter:

1. Transmitter shall be integral mount.
2. Transmitter shall contain a backlit LCD display used for programming as well as for simultaneous display of flow rate and total flow in user-

## REHABILITATION OF WELLS PHASE 2A

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- selectable engineering units, and readout of diagnostic error messages
  - 3. Shall be furnished with local flow rate indication and local flow totalization indication, and scaled in user selectable engineering units.
  - 4. Diagnostics shall include self-test, transmitter faults, tunable empty pipe parameter, reverse flow testing, coil circuit fault, electronics temperature monitoring, magnetic field strength, ground wiring fault, high process noise analysis, and shall provide for calibration verification.
  - 5. Power Supply: 24 VDC.
  - 6. System Accuracy +/- 0.25% of rate from 1.0 to 30 feet per second.
  - 7. Provide the manufacturer's cable(s) to be installed between the transmitter and the flowtube.
  - 8. Housing shall be rated NEMA 4X.
  - 9. Operating range shall be from -5 to 140 degrees Fahrenheit and 0 to 100 percent relative humidity.
  - 10. Local confirmation and diagnostic capability by a handheld communicator or software.
- D. Signal Converter/Transmitter Output:
- 1. Ethernet IP or Modbus TCP/IP communication protocol.
  - 2. Shall be capable of indicating reverse flow and zero flow.
  - 3. Security lockout to prevent unwanted or unintentional changes.
  - 4. The transmitter shall have an Ethernet port and built-in webserver for easy data access and configurations.
- E. Factory Calibration:
- 1. Flowtube shall be hydraulically calibrated at a facility, which is traceable to internationally recognized Calibration Standards. The calibration procedure shall conform to the requirements of (ISO) 10012- 1, and "Quality Assurance Requirements for Measuring Equipment". A real-time computer generated printout of the actual calibration data indicating a three point calibration of the entire operating range shall be submitted to the ENGINEER prior to shipment of the meters to the project site. The calibration sheet shall also be filed with the O&M manual.

F. Approved Manufacturers

1. Endress & Hauser Promag L 400
2. Approved equal.

**PART 3 - EXECUTION**

**3.01 SHIPPING, HANDLING, AND DELIVERY**

- A. The flow meters and associated equipment shall be protected for shipment by the manufacturer. **The manufacturer shall take pictures of the flowmeter(s) and associated equipment before and during the crating process. The pictures shall be submitted to the Engineer. The manufacturer's Local Representative shall be present at the delivery of each flow meter to the job site.**
- B. **The Engineer as well as the manufacture's local representative must be on-site to witness the Contractor's unloading of the flow meter(s) and associated equipment. The manufacturer's local representative shall witness the uncrating of each meter and then inspect, verify, and certify in a written inspection report to the Engineer that all flowmeters and associated equipment have been inspected, are present, damage free, and ready for installation.**

**3.02 FLOWMETER AND ASSOCATED EQUIPMENT INSTALLATION**

- A. The flow meter(s) shall be installed per the manufacturer's recommendations and as shown on the Plans.
- B. The work to install the flow meters shall consist of cutting the existing water pipe and welding matching steel flanges on the pipe side if necessary. The Contractor shall paint the flanges with two coats of paint. The Contractor shall also provide stainless steel bolts, nuts, the pipe seals, and ground rings.

**3.03 STARTUP ASSISTANCE BY MANUFACTURE'S LOCAL REPRESENTATIVE**

- A. The manufacturer shall provide delivery inspection, technical advice, startup inspection, Job-site operational diagnostics and calibration, approve/certify for operation, operational assistance, and one 2-hour Operation and Maintenance training class.

**PART 4 - WARRANTY**

**4.01 MANUFACTURER'S ORIGINAL WARRANTY AND EXTENDED WARRANTY**

- A. The manufacturer shall provide a one year warranty that covers parts, labor and travel. The warranty period shall start of the day the City accepts the project.

**END OF SECTION**

## SECTION 17520

### PROGRAMMABLE LOGIC CONTROLLER SYSTEM

#### PART 1 - GENERAL

##### 1.01 SCOPE

- A. This Section covers the furnishing, programming, and installation of a Programmable Logic Controller (PLC) system, antenna cable, and other appurtenances necessary for a complete and operating system. **All items covered in this Specification shall be included as part of this contract. All items covered in this Specification shall be provided by the Contractor.** The PLC system shall contain a Modicon PLC, I/O modules, power supply, radio transceiver, circuit breakers, fuses, panduit, terminal blocks and all devices necessary for a complete system. **This system shall be mounted on DIN rail inside the control panel as shown on the Plans. The City will provide all the programming for the PLC and operator interface panel.** The City will be responsible for providing all necessary work so that the PLC communicates with its regional site. This includes development of SCADA display graphic screens on the master SCADA network.
- B. The Contractor shall make all connections to the PLC per Plans. The City will verify Contractor made interconnection wiring, will perform software upgrade, display screen upgrade, communication establishment and testing.
- C. The Contractor shall cooperate with the City during testing and start up. The contractor shall perform an input output check on all devices connected to the PLC before the City installs the PLC and operator interface programs.
- D. The contractor shall remove the existing PLC and back pan at each well site.
- E. The contractor shall reuse the existing antenna pole and antenna. The contractor shall intercept the existing antenna conduit from each antenna pole and extend it into the new control panel.
- F. The Contractor shall replace the existing antenna cable with new antenna cable at each well site. The contractor shall order enough antenna cable so there are no splices between the antenna and the radio. The Contractor shall deliver the existing antenna cable to the City.

##### 1.02 REFERENCE STANDARDS

- A. The equipment covered under this contract shall be designed, manufactured, and tested in accordance with the latest version of the following industrial standards:

1. American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE):
  - a. C37.90.2, Trial-Use Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers.
  - b. C62.41, IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
2. Electronic Industries Association (EIA):
  - a. TIA-232-E, Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.
  - b. 422-A, Electrical Characteristics of Balanced Voltage Digital Interface Circuits.
3. National Electrical Manufacturers Association (NEMA):
  - a. ICS 1, General Standards for Industrial Control and Systems.
  - b. ICS 1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid State Control.
  - c. ICS 4, Terminal Blocks for Industrial Use.
  - d. ICS 6, Enclosures for Industrial Controls and Systems.
4. National Fire Protection Association (NFPA):
  - a. National Electric Code (NEC).

### **1.03 SUBMITTALS**

- A. Provide four copies of submittals, in accordance with the Special Provisions, for all PLC and radio components within the PLC system including the following:
  1. All PLC components.
  2. Radio.
  3. Antenna and transmission cables.

## **PART 2 - PRODUCTS**

### **2.01 PLC SYSTEM**

- A. PLC and associated equipment shall be mounted on DIN rail as shown on the Plans. The PLC system shall contain the following features:
- B. PLC system grounding and electrical spacing shall be in accordance with NEMA ICS 6.
- C. PLC shall be wired as defined below:
  - 1. Install all wiring without splicing in panduit raceways as shown on the plans.
  - 2. Wire bending space shall be in accordance with Tables 3-7B, C in NEMA ICS 6.
  - 3. Keep AC power lines separate from low-level DC lines, I/O power supply cables, and all I/O rack interconnect cables.
  - 4. Keep AC signal wires separate from DC signal wires.
  - 5. When I/O wiring must cross AC power wiring, it shall only do so at right angles.
  - 6. Allow 2 inches between the I/O modules and any raceway, between the terminal strip and raceway, and between the terminal strip and I/O modules.
  - 7. Bundle and tie down wires in a neat and orderly manner.
- D. The PLC system shall be grounded as follows:
  - 1. Separate ground wires from power wiring at the point of entry.
  - 2. Minimize ground wire length by locating the ground reference point as close as possible to the point of entry of the plant power supply.
  - 3. Ground all electrical racks or chassis and machine elements to a central ground bus.
- E. PLC termination requirements:
  - 1. Terminal block markings, mechanical characteristics and electrical characteristics shall be in accordance with NEMA ICS 4.

2. Make connections to I/O modules by terminating all field wiring to terminals and then installing wiring to each I/O modules as shown on the Plans.
3. Terminals shall facilitate wire sizes 12 AWG and 14 AWG rated for 120 VAC applications.
4. Provide terminal blocks as shown on the Plans and with continuous marking strip.
5. Label each wire within the PLC system with wire numbers as shown on the Plans.
6. Provide terminals for individual termination of each signal shield.
7. Provide all wiring between the terminal blocks and the PLC components.
8. Field wiring shall not be disturbed when removing or replacing an I/O module.

## **2.02 PLC AND INTERFACE MODULES**

- A. The programmable logic controllers shall be **Groupe Schneider, Modicon 340 Series**. No other manufacturer shall be permitted as this equipment matches the City's installed base of Modicon PLCs. The City has standardized on Modicon PLCs throughout the City and has an installed base of several hundred units.
- B. **Provide the following Modicon M340 PLC parts**
  1. **One Rack – model number BMX XBP 1200**
  2. **One Processor – model number BMX P34 2020**
  3. **One Power Supply – model number BMX CPS 3020**
  4. **One Discrete Digital Input Module – model number BMX DDI 1602**
  5. **One Discrete Digital Output Module – model number BMX DDO 1602**
  6. **One Analog Input Module – model number BMX AMI 0810**
  7. **One Analog Output Model – model number BMX AMO 0410**
  8. **One Communication Module – model number BMX NOC 0401**
  9. **One Communication Module – model number BMX NOE 0100**
  10. **One Communication Module – model number BMX NOM 0200**
  11. **One Shielded Cord set – model number BMX FTW 308S**
  12. **Two Shielded Cord set – model number BMX FTW 501S**
  13. **One Cord set – model number BMX FTW 301**
  14. **One set of empty slots – model number BMX XEM 010**
- C. **Provide one Magelis Operator Interface panel model number HMISTU855**

### 2.03 PERFORMANCE AND DESIGN REQUIREMENTS

- A. The PLC system shall accomplish the control requirements of the I/O list, Drawings, and Specifications.
- B. The design application and installation of the PLC system shall conform to NEMA ICS 1.1.
- C. The PLC system shall operate in ambient conditions of 32 to 140 Degree F temperature and 0 to 95 percent relative humidity without the need for purging or air conditioning.
- D. Input/Output Connection Requirements:
  - 1. Discrete inputs/outputs and analog outputs shall be fused as recommended by the manufacturer:
    - a. ~~Provide blown fuse indication for all fuses.~~
    - b. Fuses shall be in accordance with module manufacturer's specifications and installed at terminal block.
- E. All PLC control system components shall be capable of meeting or exceeding electromagnetic interference tests per ANSI/IEEE C37.90.2.
- F. Incorporate the following minimum safety measures:
  - 1. ~~A main circuit breaker shall be placed in the power circuit as a means of removing power from the entire PLC system. Each power supply shall be protected by its own circuit breaker. Size the breaker as shown on plans.~~
- G. Fuses:

Provide all fuse holders and fuses as shown on the plans.

### 2.04 MAINTENANCE MATERIALS

- A. Furnish the City with operation and maintenance manuals in accordance with the Special Provisions. Operation and maintenance manuals shall contain information on all components within this specification. The operations and maintenance manuals shall also be provided on a CD in accordance with the Special Provisions.

### 2.05 RADIO TRANSCEIVERS

- A. Provide one Microhard Systems Nano Series IPn920 Radio. Install radio as shown on the plans. The radio shall be capable of transmitting data either serial or Ethernet.

The operating frequency shall be 902 MHz to 928 MHz. The radio shall be powered by 24 VDC.

## 2.06 DIRECTIONAL ANTENNA FOR RADIO

- A. The contractor shall reuse the existing antenna on the existing antenna pole. Provide one lightning arrester model number Polyphaser Corp. IS-50NX-C2 or approved equal.

## 2.07 TRANSMISSION CABLE(S)

- A. Supply the transmission cables to connect each radio antenna port (via 50 ohm "Superflex" cable/lightning arrester) with the existing antennas. The cables shall be low-loss foam-dielectric type, 1/2 inch in diameter, and sufficient length to route each cable from the existing antennas to each lightning arrester (field verify). The transmission cables shall be weatherproof suitable for direct environmental exposure. Use "O" ring seals on all connectors. **The transmission cables shall be Andrew Corp. LDF4-50A.** The cables shall be installed without splices.
- B. **Provide a section of "Superflex" cable between each radio and the lightning arresters. The cables shall be Andrew Corp. FSJ1-50A or equal with factory installed type N connectors.**
- C. Connectors for the transmission cable shall be type N.
- D. The Contractor shall field verify the length of antenna cable required for the project. The cables shall be installed without splices.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. The Contractor shall be responsible for the installation of the PLC system and shall pull all the cables and wires and make all the connections as shown on the Plans or as directed by the Engineer. The PLC system shall be installed in accordance with manufacturer's written instructions.
- B. The City will perform the following work:
  - 1. Verification of correct installation of PLC system.
  - 2. Verification of correct installation, type, and size of wiring terminated from field devices, and to the PLC system.
  - 3. Verification of correct connection of all power sources supplied to and from the PLC system.

4. Verification of I/O terminations and proper device calibrations.
  5. Verify that all data points are transmitted back to control 12 and update the control 12 database.
- C. If deficiencies are found in section 3.01 B items 1 through 5 above, the Contractor shall immediately correct the problem at no cost to the City.
  - D. The Contractor shall terminate the antenna and signal transmission cables with type N connectors.
  - E. The Contractor shall install the lightning protector, copper strap, and instrument grounding. The Contractor shall install a number 6 copper wire to connect the lightning arresters to the ground bus.

### **3.02 PLC FIELD TESTING**

- A. After finishing all the connections, the Contractor shall cooperate with the City during the field testing.
- B. The City will perform the following:
  1. Configure radio communication parameters.
  2. Configure radio output power.
- C. The Contractor shall perform a point to point test of all wiring between the PLC and field devices before the City installs the PLC and operator interface panel programs.
- D. All devices connected to the digital input card shall be operated to ensure that the PLC recognizes the changed state of each device.
- E. The City will program the PLC to operate all devices connected to the digital output card and then trigger these devices to operate. Any device that fails to operate shall be replaced at the contractor's expense.
- F. All analog devices connected to the PLC shall be calibrated per Section 17100. Each analog device shall be operated to determine if the PLC recognizes the analog signal.

### **3.03 DEMONSTRATION**

- A. The Contractor shall demonstrate that the PLC system operates according to Plans and specifications. If defects are found in the hardware or installation Contractor shall fix problems at no cost to the City.

**END OF SECTION**

### **SECTION 3 – ITEMS OF THE PROPOSAL**

The items described below correspond to the items on the bid schedule. It is understood, that the Contractor shall furnish all labor, equipment, material, tools, parts and other items necessary to complete the work as described in the Plans and these Special Provisions at all eight well sites.

**All bidders are required to provide the following information for the well casing rehabilitation components of the project:**

1. Contractor qualifications
  - a. A list of key staff that shall work on the project and descriptions of their experience on similar projects.
  - b. Descriptions of at least five similar projects completed during the past five years including client contact information.
  - c. A company profile including the number of years the company has been performing well screen rehabilitation.
  - d. Current C-57 Water Well Drilling and Class A Contractor license numbers.
2. Details regarding specific materials, chemicals, concentrations, quantities, techniques (including details for agitating the near-well environment), tool specifications, chemistry monitoring techniques (for both the well and wastewater discharge) and Subcontractors to be used for work described in the Technical Specifications.
3. Details of any proposed variations from the Technical Specifications.
4. A statement that all staff that shall be on-site during the handling of chemicals shall be HAZWOPER trained with current annual refresher training.

#### **ITEM 1: Pre-Mobilization Site Video**

##### A. Description

This item shall include the creation of a video that documents above ground site conditions before the Contractor mobilizes to each site. See Section 2.1 of the Technical Specifications.

##### B. Measurement and Payment

Pre-Mobilization Site Video shall be measured and paid on a lump sum basis. Measurement shall be based on the percentage of work completed as determined by the City. Payment shall include full compensation for furnishing

all supervision, labor, materials, tools and equipment necessary to complete this item, including transportation.

**ITEM 2: Mobilization, Site Setup, Demobilization and Site Cleanup**

This item shall include the mobilization, demobilization, establishment of storage and staging areas, all materials, tools, equipment, labor, supervision and other items necessary to facilitate mobilization to the sites and demobilization from each site. Other aspects of this item include 1) preparation of the site for performance of the project work, 2) providing site security, 3) providing a portable toilet and sanitation facilities, 4) per diem and 5) other costs that may not be shown as line items on the bid schedule. See Section 2.2 of the Technical Specifications.

Mobilization, Demobilization and Site Setup shall be measured and paid on a lump sum basis. The value of this item shall not exceed five percent of the total value bid for the project. Measurement shall be based on the percentage of work completed as determined by the City. Payment shall include full compensation for furnishing all supervision, labor, materials, tools and equipment necessary to complete this item, including transportation.

**ITEM 3: Pre-Cleaning Test Pumping**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to test pump the well. See Section 2.3 of the Technical Specifications.

Pre-Cleaning Test Pumping shall be measured and paid per each test pumping completed to the satisfaction of the City. Payment shall be at the unit price bid per each and shall include full compensation for furnishing all supervision, labor, materials, tools, equipment and other items necessary to complete this item. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project.

**ITEM 4: Pre-Cleaning Spinner Logging**

This item shall include providing all equipment, materials and labor, as necessary to complete the spinner log at each site. A report on the spinner logging and the sand testing results shall be provided to the Engineer within 48 hours of performing the work. See Section 2.4 of the Technical Specifications.

Pre-Cleaning Spinner Logging shall be measured and paid per each spinner log completed to the satisfaction of the City. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project.

Payment shall include full compensation for furnishing all supervision, labor, materials, tools, equipment and other items necessary to complete this item.

**ITEM 5: Traffic Control**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to provide traffic control at sites where direct discharge into a drainage inlet, or drainage or sewer manhole is performed in a City right of way. See General Requirements, Section 1.27.

Traffic Control shall be measured and paid on a lump sum basis. Measurement shall be based on the percentage of work completed as determined by the City. Payment shall include full compensation for furnishing all supervision, labor, materials, tools, equipment and other items necessary to complete this item.

**ITEM 6: Well Casing Video Surveys**

This item shall include providing all equipment, materials and labor, as necessary to complete all requested video surveys. The video logging shall be in color, include down-hole viewing and side-scan viewing (with 360 degree capability), and extend to the total well depth. See Section 2.7 of the Technical Specifications.

Video Surveys shall be measured and paid for each video completed. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project. Measurement shall be based on the amount of work completed as determined by the City. Payment shall include full compensation for furnishing all materials, tools, equipment, labor, parts and other items necessary to complete the work.

**ITEM 7: Screen and Casing Repair**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to repair the well screen and casing. The exact scope of this item shall not be known until Bid Item #6 is completed. It is anticipated that the work shall entail swaging into place a mild steel liner with a rubber sleeve and video confirmation of the work. See Section 2.9 of the Technical Specifications. For the purposes of the bid, provide costs for lining a 10-foot section of casing or screen.

Payment for Screen and Casing Repair shall be at the unit price bid per lineal foot of steel liner placed. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project. Payment shall include full compensation for furnishing all materials, tools, equipment, labor, parts and other items necessary to repair the well screen and casing.

**ITEM 8: Post-Cleaning Spinner Logging**

This item shall include providing all equipment, materials, and labor as necessary to complete each spinner log. See Section 2.14 of the Technical Specifications.

Payment shall be at the unit price bid per each Post-Cleaning Spinner Logging completed as determined by the City. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project. Payment shall include full compensation for furnishing all supervision, labor, materials, tools, equipment and other items necessary to complete the work.

**ITEM 9: Deviation Surveys**

This item shall include providing all equipment, materials and labor, as necessary to complete the deviation survey. See Section 2.15 of the Technical Specifications.

Payment for Deviation Surveys shall be at the unit price bid per each deviation survey completed as determined by the City. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project. Payment shall include full compensation for furnishing all supervision, labor, materials, tools, equipment and other items necessary to complete this item.

**ITEM 10: Post-Cleaning Test Pumping**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to test pump the well. See Section 2.16 of the Technical Specifications.

Payment for Post-Cleaning Test Pumping shall be at the unit price bid per each test pumping completed as determined by the City. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project. Payment shall include full compensation for furnishing all supervision, labor, materials, tools, equipment and other items necessary to complete this item.

**ITEM 11: Waste Solids Disposal**

This item shall include providing all equipment, materials, and labor as necessary to dispose of waste solids generated during the project. See Section 2.19 of the Technical Specifications.

Waste Solids Disposal shall be measured and paid on a lump sum basis. Measurement shall be based on the amount of work completed as determined by the City. Payment shall include full compensation for furnishing all

materials, tools, equipment, labor, parts and other items necessary to properly dispose of waste solids generated during the project.

**ITEM 12: Brushing and Sediment Removal**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to brush the well and remove accumulated sediment. The work shall be performed in a single pass down the well. See Section 2.6 of the Technical Specifications.

Brushing and Sediment Removal shall be measured and paid per linear foot of casing brushed below the static water line of each well. Measurement shall be based on the amount of work completed as determined by the City. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project. Payment shall include full compensation for furnishing all materials, tools, equipment, labor, parts and other items necessary to brush the well, and remove accumulated sediment.

**ITEM 13: Agitating the Near-Well Environment**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to agitate the near-well environment. See Section 2.10 of the Technical Specifications. For the purposes of the bid, provide costs for performing a shot for every foot of screen length.

Payment for Agitating the Near-Well Environment shall be per linear foot screen agitated. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantity differ upon completion of the project. Payment shall include full compensation for furnishing all materials, tools, equipment, labor, parts and other items necessary to agitate the near-well environment.

**ITEM 14: Mechanical Cleaning**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to mechanically clean the well. See Section 2.11 of the Technical Specifications.

Mechanical Cleaning shall be measured and paid per each mechanical cleaning process completed at a single well. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantities differ upon completion of the project. Measurement shall be based on the amount of work satisfactorily completed as determined by the City. Payment shall include full compensation for furnishing all materials, tools, equipment, labor, parts and other items necessary to mechanically clean the well.

**ITEM 15: Chemical Cleaning**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to chemically clean the well. See Section 2.12 of the Technical Specifications.

Chemical Cleaning shall be measured and paid per each chemical cleaning process completed at a single well. Although a quantity is given for this item for purposes of identifying the low bidder, the unit price bid shall not be adjusted should the final quantities differ upon completion of the project. Measurement shall be based on the amount of work completed as determined by the City. Payment shall include full compensation for furnishing all materials, tools, equipment, labor, parts and other items necessary to chemically clean the well.

**ITEM 16: Well Disinfection**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to disinfect the well. See Section 2.17 of the Technical Specifications.

Payment shall be at the unit price per each well disinfected and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in well disinfection in accordance with the Plans and these Special Provisions.

**ITEM 17: Wastewater Treatment and Disposal**

This item shall include all materials, tools, equipment, labor, parts and other items necessary to treat and dispose of wastewater generated by the project. See Section 2.18 of the Technical Specifications.

Wastewater Treatment and Disposal shall be measured and paid on the lump sum price bid. Measurement shall be based on the amount of work completed as determined by the City. Payment shall include full compensation for furnishing all materials, tools, equipment, labor, parts and other items necessary for proper wastewater treatment and disposal in accordance with the Plans and these Special Provisions.

**ITEM 18: Install New 8" Flow Meter**

**ITEM 19: Install New 10" Flow Meter**

The work to be performed for Items 18 and 19 includes furnishing and installing a new 8" or 10" diameter flow meter at each site per the manufacturer's recommendations, and as indicated in the Plans and these Special Provisions. This includes the flow tube, transmitter, grounding rings and all appurtenances as required for a complete installation. Conduit and conductors shall be paid for under Item 20.

Payment shall be at the unit price per each and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in furnishing and installing each flow meter in accordance with the Plans and these Special Provisions.

**Item 20: Electrical Improvements**

The work to be performed for this item includes but is not limited to furnishing and installing all necessary equipment and materials for the well head junction box, well tank hydro pneumatic system, NEMA 4X enclosure, modifying the probe well, air compressors, instrumentation, chlorine detectors, pressure switch, pressure transmitter, drawdown transducer, sounding tube, pull boxes, lighting fixtures, lighting poles, lighting pole foundations, conduits, conductors, and all electrical appurtenances at all well sites as indicated in the Plans and within these Special Provisions.

The City will supply the MCC for each well. The Contractor shall pickup each MCC from Consolidated Electrical Distributors, Inc. in Rancho Cordova, and transport the equipment to each well site. The Contractor shall install the MCC per the Plans, these Special Provisions, and the manufacturer's recommendations.

The Contractor shall make all connections to the MCC for the well pump and chlorine booster pump for each well. The Contractor shall complete all input and output connections to the PLC as shown in the Plans for each well.

Payment shall be at the lump sum price bid and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in constructing the electrical improvements at each well site in accordance with the Plans and these Special Provisions.

**Item 21: Install City Supplied Fluoride System**

The work to be performed for this item includes, but is not limited to, demolition of the existing fluoride system and furnishing and installing all necessary equipment and materials to install a new City supplied fluoride system, and all necessary appurtenances at each well site as indicated in the Plans and these Special Provisions.

The Contractor shall be responsible for making all of the electrical and water connections to the fluoride system as shown in the Plans. The Contractor shall make any necessary modifications to the existing water supply, electrical system (conduit, junction boxes, fans, lighting, electrical outlets), and chlorine system to accommodate the new fluoride system. The City will remove any hazardous materials within the existing chemical building.

Payment shall be at the unit price per each and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in installing each new fluoride system at each well in accordance with the Plans and these Special Provisions.

**Item 22: Chain Link Fencing and Gates**

The work to be performed for this item includes but is not limited to demolition of existing fencing, gates, and footings, and installation of new eight feet tall chain link fencing and gates, and all necessary appurtenances at each well site as indicated in the Plans and these Special Provisions. This item shall also include the pavement and erosion repair indicated in the Plans for Wells 153A, 155, and 144.

Payment shall be at the lump sum price bid and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in demolition and removal of the existing fencing and construction of new fencing at each well site in accordance with the Plans and these Special Provisions.

**Item 23: Wellhead Construction**

The work to be performed for this item includes but is not limited to demolition of the existing wellhead, new wellhead construction, fabrication and installation of a new wellhead base plate and discharge head piping, and all appurtenances necessary for a complete installation at seven well sites as indicated in the Plans and these Special Provisions.

Wells 83 and 164 require installation of new 8" and 10" steel (Schedule 30, A53, Grade B) discharge pipe and fittings from the wellhead to the hydropneumatic tank and shall be included in this item. Well 144 has an existing submersible pump wellhead installation that is expected to be reused.

Payment shall be at the unit price per each and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in constructing and installing a new functional wellhead at each well in accordance with the Plans and these Special Provisions.

- Item 24: 40 Horsepower Submersible Pump Installation**
- Item 25: 50 Horsepower Submersible Pump Installation**
- Item 26: 75 Horsepower Submersible Pump Installation**
- Item 27: 100 Horsepower Submersible Pump Installation**

The work to be performed for Items 24 through 27 includes but is not limited to purchase and installation of a new submersible pump and all appurtenances necessary for a complete installation at each well site as indicated in the Plans

and these Special Provisions.

Payment shall be at the unit price per each site installation and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in installing each new submersible pump at each well site as directed by the Engineer, and in accordance with the Plans and these Special Provisions.

- Item 28:**     **8" Pump Column Piping**  
**Item 29:**     **10" Pump Column Piping**

The work to be performed for Items 28 and 29 includes installation of new 8 or 10 inch diameter pump column piping(Schedule 30, A53, Grade B, tapered thread) and all appurtenances necessary at each well site as directed by the Engineer and as indicated in the Plans and these Special Provisions.

Payment shall be at the unit price bid per linear foot of piping installed and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work involved in installing new pump column piping at each well in accordance with the Plans and these Special Provisions. Although a quantity is given for this item for purposes of identifying the low bidder, the quantity to be installed will depend on the final pump depth as determined from post cleaning test pumping of each well. The unit price will not be adjusted regardless of the quantity installed.

**END OF SECTION**

**ATTACHMENT A**

**Sanitary District Wastewater Discharge Permit**



Wastewater Management

June 6, 2013

Main Office  
10000 Weather Road  
Sacramento, CA 95822-7300  
Phone: (916) 876-4000  
Fax: (916) 876-4340

City of Sacramento  
Department of Utilities  
1395 35<sup>th</sup> Avenue  
Sacramento, CA 95822  
Attn: Mark Elliott

**SUBJECT: TEMPORARY DISCHARGE PERMIT TDP-13015**

Sacramento Regional Wastewater  
Treatment Plant  
9221 Laguna Station Road  
Elk Grove, CA 95758-0550  
Phone: (916) 876-4000  
Fax: (916) 876-4000

Enclosed is a temporary wastewater discharge permit from the Sacramento Regional County Sanitation District (SRCSD). The permit is effective from October 15, 2013 to April 15, 2014. A copy of this permit should be presented if requested during disposal and retained in your files for three years.

The subject permit covers the discharge of approximately 3,200,000 gallons of wastewater associated with rehabilitation activities at eight drinking water wells (City of Sacramento well numbers: 83, 131, 137, 143, 144, 153A, 155, 164) in Sacramento as described in the application dated May 22, 2013.

**Board of Directors**  
Representing:

- County of Sacramento
- County of Yolo
- City of Citrus Heights
- City of Elk Grove
- City of Folsom
- City of Rancho Cordova
- City of Sacramento
- City of West Sacramento

The enclosed permit has conditions in it that may require your immediate attention, including the following:

- a requirement to sample specific constituents and to report data as stated in Requirement #2
- a discharge rate limitation specific to each well
- a requirement to notify Sacramento Area Sewer District (SASD) staff prior to discharge (Well 83)
- a requirement to provide notification of the exact date(s) of discharge and volume of wastewater disposed after completion of the discharge or within two weeks after permit expiration

The fee for this permit is \$1,984, which covers SRCSD's cost of administration of this permit, capacity evaluation fee for one discharge location, and disposal of the initial 3,200,000 gallons. Any additional volumes discharged will be invoiced after submittal of the closure report when a more accurate discharge amount is known. Please refer to the attached invoice for payment details.

Stan Dean  
District Engineer  
Ruben Rohles  
Director of Operations  
Prabhakar Somavarapu  
Director of Policy & Planning  
Karcu Stoyanowski  
Director of Internal Services  
Joseph Maestri  
Chief Financial Officer  
Claudia Goss  
Public Affairs Manager

If you have any questions or comments, please contact Sabina Rynas at (916) 876-6522 or rynasS@sacsewer.com.

Respectfully,

Rachel Gillis  
Environmental Specialist  
Wastewater Source Control Section

SACRAMENTO REGIONAL COUNTY SANITATION DISTRICT (SRCSD)  
SACRAMENTO AREA SEWER DISTRICT (SASD)  
TEMPORARY WASTEWATER DISCHARGE PERMIT

Permit No: TDP-13015 Effective Date: October 15, 2013

Company/ Discharge Owner: City of Sacramento, Department of Utilities  
1395 35<sup>th</sup> Avenue, Sacramento, CA 95822

Site Name/Address: Well 83 at 6562 Wyndham Drive, Well 131 at 1707 North Avenue,  
Well 137 at 1941 Los Robles Boulevard, Well 143 at 3001 Rio Linda Boulevard,  
Well 144 at 1715 Eldridge Avenue, Well 153A at 201 Main Avenue,  
Well 155 at 2320 Roanoke, Well 164 at 0 Kelton Way

Contact Person: Mark Elliott Phone: (916) 808-8894

City of Sacramento, Department of Utilities is hereby authorized to use the public sewer system, subject to the limitations and requirements as stated below or additional limitations or requirements as circumstances may require. This discharge must cease if the applicant is so directed by the SRCSD District Engineer or designated representative.

Limitations and Requirements:

1. Disposal of waste is limited to discharge of approximately 3,200,000 gallons of wastewater associated with rehabilitation activities at eight drinking water wells (City of Sacramento well numbers: 83, 131, 137, 143, 144, 153A, 155, 164) in Sacramento as described in the application dated May 22, 2013. Discharge frequencies will be intermittent: from 4 to 6 hours/day, from 3 to 5 days/week, for up to 4 weeks for each well. Discharge volumes will be up to 50,000 gallons per day for each well.
2. Discharge of the acid stage wastewater must be tested at least once for each well for the following total metals: Al, As, Cd, Cr, Cu, Pb, Mn, Hg, Mo, Ni, Ag, Zn.  
Each sample must be representative of the discharge. All metal samples must be field-preserved as required by method, and acid-digested prior to analysis.  
A full laboratory report with QA/QC should be submitted to SRCSD as soon as available and no later than 30 days after the sample collection date.
3. Specific Requirements for Well 83
  - a. All wastewater must be discharged to SASD manhole #292-164-1007, which connects to an 8-inch sewer pipe. The manhole is in Wyndham Drive and is located approximately 750 feet east of the intersection of Valley Hi Drive and Wyndham Drive.
  - b. The maximum discharge rate to the SASD system must **not exceed 150 gpm**.
  - c. This discharge is **not permitted during and 24 hours after measurable precipitation**.
  - d. Permittee is to call (916) 876-6164 at least 48 hours prior to initiating each discharge event. Provide the following information: permit number (TDP-13015), company name, contact name, contact phone number, and date, time and location of anticipated discharge. This is required for the purpose of monitoring SASD facilities.
  - e. An in-line volumetric flow meter must be installed in the discharge line to measure the rate of discharge (gpm) and total volume (gallons) discharged to sewer.

TDP-13015 (City of Sacramento, Dept. of Utilities)

4. Specific Requirements for Wells 131, 137, 143, 144, 153A, 155, and 164
  - a. Discharge is not permitted during and 48 hours after measurable precipitation.
  - b. All wastewater must be discharged to a designated manhole at a specific rate. Manholes and rates were approved by the City of Sacramento Associate Civil Engineer Humberto Amador in the approval email dated May 23, 2013.
  - c. These sites are located within the City of Sacramento collection system, which may have additional discharge requirements. The permittee is required to check with all applicable local agencies for any restrictions and/or requirements.
  - d. An in-line volumetric flow meter must be installed in the discharge line to measure the total volume (gallons) discharged to sewer.
5. The pH of the wastewater discharged to the sewer must be 5 or greater and less than 12.5.
6. If needed, wastewater must be treated to eliminate silt and sand prior to discharge into the sewer.
7. The discharge hose must be placed at the bottom of the manhole and in the direction of flow to minimize scouring and other damage to manholes associated with high-pressure discharges.
8. No cross connection between domestic water supply and sewer conduits may occur unless there is provided a backflow prevention device approved for the potential hazard. See Uniform Plumbing Code 602 and 603 for approved backflow devices.
9. A **closure report** must be submitted to this office at the completion of all discharge activities and no later than April 29, 2014. The report must include the start and stop date(s) of the discharge and the total volume(s) discharged.

In addition to the above limitations and requirements, the permittee is responsible for determining if any other permits are required for activities performed under this permit including, but not limited to, an encroachment permit.

The permittee assumes the responsibility for assuring that all proper safety procedures are followed concerning the opening of manhole lids. Responsibilities include, but are not limited to, testing the atmosphere in the sewer system before opening the manhole lid, directing traffic, assuring that all personnel are equipped with the proper personal protective equipment and clothing, and securely replacing the manhole lid. Under no circumstances will a person enter the sewer manhole.

The permittee must comply, at a minimum, with all applicable standards outlined by Cal OSHA and any additional Federal, State, and local rules, regulations, and standards for workplace safety relating to the permit activity.

Strict adherence to these conditions is required. Failure to comply may result in sanitary sewer overflows for which the permittee will be held directly responsible.

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**THIS PERMIT EXPIRES APRIL 15, 2014**

Sacramento Regional County Sanitation District

By: \_\_\_\_\_

*Linda Stevens*

Linda Stevens  
Environmental Program Manager  
Wastewater Source Control Section

TDP-13015 (City of Sacramento, Dept. of Utilities)

ATTACHMENT B

Project Task Completion Form

Item	Task	Completion Date							
		Well 83	Well 131	Well 137	Well 143	Well 144	Well 153A	Well 155	Well 164A
A	Pre-mobilization site video								
B	Initial Video Survey								
C	Pre-cleaning test pumping								
D	Pre-cleaning spinner log								
E	Traffic control								
F	Brushing and sediment removal								
G	Post-brushing video survey								
H	Addl. brushing & sediment removal								
I	Additional post-brushing video								
J	Screen and casing repair								
K	Agitating near-well environment								
L	Mechanical cleaning								
M	Chemical cleaning								
N	Post-cleaning video survey								
	Addl. cleaning								
O	Mechanical								
P	Chemical								
Q	Additional post-cleaning video								
R	Post-cleaning spinner logging								
S	Deviation survey								
T	Post-cleaning test pumping								
U	Disinfect well								
V	Wastewater treatment & disposal								
W	Waste solids disposal								

**ATTACHMENT C**

**Daily Field Log**

## Daily Field Log

Well:

Owner:

Page:

Date:

Day: M T W Th F

Operator:

Activity	Start Time	End Time	Well Discharge				Materials Used
			Totalizer Start (gal)	Totalizer End (gal)	Imhoff Cone (ml)	Visual Appearance	
<b>Phase 2A: Rehabilitation</b>							
Pre-mobilization site video							
Mobilization, site setup, demobilization							
Pre-cleaning test pumping							
Pre-cleaning spinner log							
Traffic control							
Brushing and sediment removal							
Post-brushing video							
Additional brushing and sediment removal							
Addl. post-brushing video							
Screen and casing repair							
Agitating the near-well environment							
Mechanical cleaning							
Chemical cleaning							
Post-cleaning video							
Addl. cleaning							
Mechanical							
Chemical							
Addl. post-cleaning video							
Post-cleaning spinner log							
Deviation survey							
Post-cleaning test pumping							
Disinfect well							
Wastewater treatment and disposal							
Waste solids disposal							
Other							

Owner Representative      Date

Contractor Representative      Date

**ATTACHMENT D**

**Neighborhood Notification Letter**

Dear Resident,

The City of Sacramento, Department of Utilities, awarded a construction contract to our firm, (Contractor) to perform a well rehabilitation project in your neighborhood.

During the course of the project, temporary sidewalk and street detours adjacent to the well site may occur. In addition, on-street parking may be temporarily unavailable to accommodate traffic and construction work. Our work hours are typically between 7 AM to 6 PM.

General public and construction crew safety is of primary concern to us and we remind you to observe the construction signs. We realize this project may be a temporary inconvenience and we shall strive to minimize the impacts to the residents.

**If you have any questions or problems, please contact any one of the project representatives listed below:**

**Contractor Superintendent: Name : Phone Number**  
**City Inspector: Name: Phone Number**  
**City Project Manager: Name : Phone Number**

**Construction work is scheduled to begin in your neighborhood on \_\_\_\_\_.**  
The anticipated project completion date is \_\_\_\_\_.

Thank you for your cooperation on this important project.  
Sincerely,  
Contractor Representative

cc: Project Manager, Utilities  
Jessica Hess, Utilities  
City Council Member's Assistant

# CITY OF SACRAMENTO

## IMPROVEMENT PLANS FOR

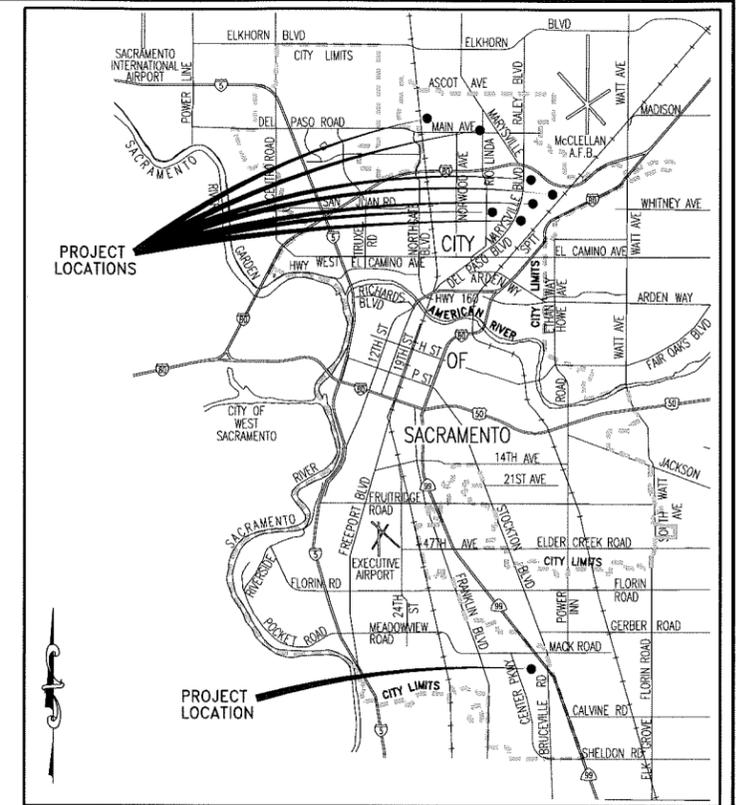
# WELL REHABILITATION PROJECT PHASE 2A

APPROVED BY: *Pete Miller* 4/1/14  
 PETE MILLINO DATE  
 WATER & SEWER SUPERINTENDENT

APPROVED BY: *D. Sherry* 4/1/14  
 DANIEL SHERRY, R.C.E. 53638 DATE  
 SUPERVISING ENGINEER

APPROVED BY: *David K. Hansen* 4/2/14  
 DAVID K. HANSEN, R.E.E. 12512 DATE  
 SUPERVISING ENGINEER

SUBMITTED BY: *Mark M. Elliott* 4/1/14  
 MARK ELLIOTT, R.C.E. 63770 DATE  
 ASSOCIATE CIVIL ENGINEER



VICINITY MAP

### INDEX OF SHEETS

G-1 COVER SHEET	E-12 TYPICAL WELL PLC COMMUNICATIONS DIAGRAM	E-25 CHLORINE DETECTOR WIRING DIAGRAM
E-1 ELECTRICAL SYMBOLS, ABBREVIATIONS AND GENERAL NOTES	E-13 WELL 83 SITE PLAN	C-1 SWITCHGEAR COVER
E-2 TYPICAL WELL SINGLE LINE DIAGRAM	E-14 WELL 131 SITE PLAN	C-2 SWITCHGEAR COVER DETAILS
E-3 TYPICAL WELL MCC ELEVATION AND PLAN	E-15 WELL 137 SITE PLAN	C-3 SWITCHGEAR COVER DETAILS
E-4 TYPICAL WELL PUMP MOTOR CONTROL DIAGRAM	E-16 WELL 143 SITE PLAN	C-4 WELLHEAD AND FENCE DETAILS
E-5 TYPICAL CHLORINE BOOSTER PUMP CONTROL DIAGRAM	E-17 WELL 144 SITE PLAN	
E-6 TYPICAL WELL PLC ELEVATION DIAGRAM	E-18 WELL 153A SITE PLAN	
E-7 TYPICAL WELL PLC POWER DISTRIBUTION DIAGRAM	E-19 WELL 155 SITE PLAN	
E-8 TYPICAL WELL PLC DIGITAL INPUTS DIAGRAM	E-20 WELL 164 SITE PLAN	
E-9 TYPICAL WELL PLC DIGITAL OUTPUTS DIAGRAM	E-21 CONDUIT, LIGHTING PANEL, AND LIGHTING SCHEDULES	
E-10 TYPICAL WELL PLC ANALOG INPUTS DIAGRAM	E-22 ELECTRICAL STANDARD DETAILS	
E-11 TYPICAL WELL PLC ANALOG OUTPUTS DIAGRAM	E-23 ELECTRICAL STANDARD DETAILS	
	E-24 ELECTRICAL STANDARD DETAILS	

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II S:\Electrical Drawings Well Rehab Phase 2

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____
FIELD BOOK	

1"
SCALE: ON ORIGINAL SCALE, DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

<b>CITY OF SACRAMENTO</b>			
<b>DEPARTMENT OF UTILITIES</b>			
DRAWN BY: A. VELAZQUEZ	DESIGNED BY: M. ELLIOTT	CHECKED BY: D. SHERRY	
DATE: MAR 2014	R.C.E. NO. C63770 DATE: MAR 2014	R.C.E. NO. C63770 DATE: MAR 2014	

IMPROVEMENT PLANS FOR:	
WELL REHABILITATION PROJECT PHASE 2A	
<b>COVER SHEET</b>	

GIS GRID NO. 001 GIS?	PN: Z14110104	DWG. NO. G-1
	SHEET 1 OF 30	1 OF 30

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
(E)	EXISTING	MCC	MOTOR CONTROL CENTER
(N)	NEW	NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
3-PH	THREE PHASE	NEUT	NEUTRAL
3-W	THREE WIRE	NON-SH	NON-SHIELDED
A	AMP	No.	NUMBER
AB	ALLEN BRADLEY	OL	OVERLOAD
AC	ALTERNATING CURRENT	P	POLE
AICS	AVAILABLE INTERRUPTING CURRENT SYMMETRICAL	PB	PULLBOX
AM	AMP METER	PDS	PRESSURE DIFFERENTIAL SWITCH
ATS	AUTOMATIC TRANSFER SWITCH	PFR	PLANT FAILURE RELAY
AUX	AUXILIARY	PH or Ø	PHASE
AWG	AMERICAN WIRE GAUGE	PLC	PROGRAMMABLE LOGIC CONTROLLER
BCW	BARE COPPER WIRE	PMP	PUMP
BLDG	BUILDING	PNL	PANEL
C	CONDUIT	PR	PAIR
CAB	CABINET	PSI	POUNDS PER SQUARE INCH
CKT	CIRCUIT	PTT	PUSH TO TEST
CLF	CURRENT LIMITING FUSE	PVC	POLYVINYL CHLORIDE
CNTL	CONTROL	PWR	POWER
CONN	CONNECTION	RECEPT	RECEPTACLE
CPT	CONTROL POWER TRANSFORMER	RVNR	REDUCED VOLTAGE NON REVERSING
CR_	CONTROL RELAY (i.e. CR1)	RGS	RIGID GALVANIZED STEEL CONDUIT
DIFF	DIFFERENTIAL	ROMTS	REQUIREMENTS
DS	DOOR SWITCH	SCFH	STANDARD CUBIC FOOT per HOUR
EG	ENGINE GENERATOR	SCH	SCHEDULE
ENG	ENGINE	SEC	SECOND
EQUIP	EQUIPMENT	SH	SHIELDED (CABLE)
ETM	ELAPSED TIME METER	SHT	SHEET
FAE	FOUL AIR EXHAUST	SMUD	SACRAMENTO MUNICIPAL UTILITY DISTRICT
FVNR	FULL VOLTAGE NON REVERSING	SS	SURGE SUPPRESSOR
G	GROUND WIRE	SW	SWITCH
GEN	GENERATOR	SWGR	SWITCHGEAR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER	TD_ or TDR	TIME DELAY RELAY
GFP	GROUND FAULT PROTECTION	TERM	TERMINAL
GND	GROUND(ING)	TRANSF. or TXF	TRANSFORMER
H & V	HEATING AND VENTILATION	TS	TEMPERATURE SWITCH
HI	HIGH	TYP	TYPICAL
HTR	HEATER	UPS	UNINTERRUPTIBLE POWER SUPPLY
HOA	HAND-OFF-AUTO	V	VOLT
HP	HORSEPOWER	VA	VOLT-AMP
IC	ISOLATION CONTACTOR	VAC	VOLTS - ALTERNATING CURRENT
JB	JUNCTION BOX	VDC	VOLTS - DIRECT CURRENT
kcM (or MCM)	1000 CIRCULAR MILS	VFD	VARIABLE FREQUENCY DRIVE
KVA	KILOVOLT AMPERES	VM	VOLT METER
KW	KILOWATT	W	WATT or WIRE
L	LINE	W/	WITH
LO	LOW	WP	WEATHER PROOF
LOS	LOCK OUT SWITCH	XDUCER	TRANSDUCER
LTG	LIGHTING		
ma	MILLIAMPERE		

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	TRANSFORMER		NORMALLY CLOSED CONTACT
	LOW VOLTAGE CIRCUIT BREAKER OR MOTOR CIRCUIT PROTECTOR 600 = SIZE, 3P = 3 POLE MCP = MOTOR CIRCUIT PROTECTOR LSIG = LONG TIME, SHORT TIME, INSTANTANEOUS & GROUND (CHARACTERISTICS)		NORMALLY OPEN CONTACT
	FUSE		NORMALLY CLOSED LIMIT SWITCH
	DISCONNECT SWITCH		TIME DELAY CONTACT - (TDC) CLOSE AFTER ENERGIZE & DELAY
	CURRENT TRANSFORMER		TIME DELAY CONTACT - (TDO) OPEN AFTER ENERGIZE & DELAY
	POTENTIAL TRANSFORMER OR CONTROL POWER TRANSFORMER		NORMALLY OPEN PUSH BUTTON
	POWER FAILURE RELAY		NORMALLY CLOSED PUSH BUTTON
	VOLTMETER & VOLTMETER SWITCH		CONTROL SWITCH
	AMMETER & AMMETER SWITCH		PRESSURE SWITCH - NORMALLY CLOSED OPEN ON RISE IN PRESSURE TO SETPOINT
	CONTACTOR COIL: M = MAIN, F = FORWARD, R = REVERSE OR RUN, S = START		PRESSURE SWITCH - NORMALLY OPEN CLOSE ON RISE IN PRESSURE TO SETPOINT
	SOLENOID VALVE COIL		FLOAT SWITCH - NORMALLY OPEN CLOSE ON RISE IN LEVEL TO SETPOINT
	THERMAL OVERLOAD RELAY		PUSH-TO-TEST INDICATING LIGHT R = RED, G = GREEN, W = WHITE, A = AMBER
	MOTOR (HP WRITTEN WITHIN)		DISCONNECT SWITCH
	ELECTRICAL CONNECTION TO MECHANICAL EQUIPMENT (PLAN)		CONTROL RELAY (X REFERENCE NUMBER) DPDT=2 POLE DOUBLE THROW, 3PDT=3 POLE DOUBLE THROW
	JUNCTION BOX SIZE AND TYPE AS SHOWN ON PLANS NUMBER CORRESPONDS WITH CONDUIT SCHEDULE		TIME DELAY RELAY (X REFERENCE NO) TDPJ=DELAY ON PICK UP, TDDO=DELAY ON DROP OUT
	DOOR SWITCH		LEVEL SWITCH (X: L=LO, H=HI, 1,2 ETC = SWITCH REF No.)
	MANUAL CONTROL STATION		ELAPSED TIME METER
	DUPLEX RECEPTACLE WP=WEATHERPROOF BOX: GFCI=GROUND FAULT INTERRUPTER TYPE		CONNECTION NODE
	POWER OUTLET SIZE AND TYPE AS SHOWN ON PLANS		RESISTOR/HEATER
	FLOODLIGHT		TERMINAL BLOCK POINT FOR FIELD TERMINATIONS
	BUBBLER TUBE EMMITER LOCATION		TERMINATION IN MCC
	ULTRASONIC LEVEL SENSOR LOCATION		TERMINATION IN CONTROL PANEL
	FLOAT LOCATION		TERMINATION IN RTU OR PLC
	GROUND		GROUND ROD INSERT
	GROUND ROD & WELL		

**GENERAL NOTES:**

- PLAN AND ELEVATION DRAWINGS ARE SCHEMATIC IN FORM.
- PLAN AND ELEVATION DRAWINGS ILLUSTRATE APPROXIMATE LOCATIONS AND LAYOUT OF EQUIPMENT. THE CONTRACTOR SHALL DETERMINE ACTUAL LOCATIONS OF EQUIPMENT AND QUANTITIES OF MATERIALS FROM FIELD MEASUREMENTS.
- CONDUIT ROUTING IS SHOWN DIAGRAMATICALLY AND THE CONTRACTOR SHALL INSTALL THE CONDUIT SYSTEMS CONSISTENT WITH FIELD CONDITIONS.
- CONDUIT TYPE SHALL BE AS FOLLOWS UNLESS OTHERWISE NOTED.  
ALL ACCEPTABLE CONDUIT MATERIALS ARE SPECIFIED IN SPECIFICATION SECTION 16110, 2.02 A.  
EXPOSED CONDUIT (INDOOR AND OUTDOOR) SHALL BE RIGID GALVANIZED STEEL (RGS).  
CONDUIT IN CONCRETE SLAB SHALL BE RIGID GALVANIZED STEEL.  
UNDERGROUND CONDUIT SHALL BE RGS PVC COATED CONDUIT WHERE CONDUIT IS DIRECTLY IN CONTACT WITH THE EARTH.  
OR SCHEDULE 40 PVC CONDUIT WITH RED CONCRETE ENCASEMENT MINIMUM OF 4" ALL AROUND FOR HORIZONTAL RUNS ONLY. (SEE NOTE 5)  
CONDUIT IN DUCT BANK SHALL BE SCH. 40 PVC CONDUIT WITH RED CONCRETE ENCASEMENT MIN. OF 4" ALL AROUND FOR HORIZONTAL RUNS ONLY. (SEE NOTE 5)  
VERTICAL SWEEP AND RISER FROM BURIED RUNS SHALL BE PVC COATED RGS CONDUIT FROM UNDERGROUND RUNS 5' PRIOR TO RISER AND 6" ABOVE FINISHED GRADE.  
BOTTOM ENTRANCE OF SWITCHGEAR, DISTRIBUTION PANEL, MCC, ETC., SHALL BE PVC COATED RGS.  
SIDE OR TOP ENTRANCE OF SWITCHGEAR, DISTRIBUTION PANEL, MCC, ETC., SHALL BE RGS.  
CONDUIT EXPOSED TO CORROSIVE ENVIRONMENT (SEWER WET WELL, EXAMPLE) SHALL BE PVC COATED RGS.  
PRIMARY AND SECONDARY OF THE SMUD TRANSFORMER SHALL BE PER SMUD STANDARD SPECIFICATIONS.  
BOTTOM ENTRANCE FROM SMUD TRANSFORMER TO CITY MAIN SWITCHGEAR SHALL BE PVC CONDUIT, WITH CONCRETE ENCASEMENT MINIMUM OF 4" ALL AROUND.  
CONNECTING RIGID CONDUIT SYSTEM TO UTILIZATION EQUIPMENT SHALL BE LIQUID-TIGHT FLEXIBLE METAL CONDUIT.  
ANY SITUATION NOT COVERED ABOVE SHALL BE PVC COATED RGS.
- BURIED CONDUITS SHALL BE A MINIMUM OF 24 INCHES BELOW GRADE ON RUNS NOT EXPOSED TO VEHICULAR TRAFFIC AND A MINIMUM OF 36 INCHES BELOW GRADE WHEN EXPOSED TO VEHICULAR TRAFFIC. BURIED CONDUITS SHALL BE EMBEDDED IN CONCRETE WITH 4" MINIMUM CONCRETE COVERAGE AROUND CONDUIT. BACKFILL SHALL BE COMPACTED TO 95%. ROADBED SURFACES DISTURBED DURING TRENCHING SHALL BE REPAIRED TO PRE-CONSTRUCTION CONDITION AFTER INSTALLATION IS COMPLETE. CONTRACTOR SHALL PLACE A 6" WIDE ELECTRICAL WARNING TAPE IN ALL TRENCHES 12" AND ABOVE CONCRETE.
- CONDUIT AND CABLE DESIGNATIONS ARE AS FOLLOWS (TYPICAL):  
1" 3-1PR#16, SH=1" CONDUIT WITH THREE INDIVIDUAL SHIELDED SINGLE PAIR #16 AVG CABLES.  
3/4" 2#10 & #12G=3/4" CONDUIT WITH TWO #10 CONDUCTORS AND A #12 CONDUCTOR GROUND.
- CONTRACTOR SHALL FOLLOW ALL REQUIREMENTS STATED WITHIN SRCSD WASTEWATER DISCHARGE PERMIT ISSUED TO THE CITY, SEE SPECIFICATIONS.

PN: Z14110104

REVISIONS				BENCH MARK DESCRIPTION:	ELEV. _____	FIELD BOOK
NO.	DESCRIPTION	DATE	BY			

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

SCALE: 1" = \_\_\_\_\_

ON ORIGINAL SCALE  
DRAWING ADJUST  
SCALED DIMENSIONS  
IF THIS DOES NOT  
SCALE AT 1"

DRAWN BY: P. BARNES  
DATE: MAR 2014

DESIGNED BY: P. BARNES  
R.E.E. NO. 15329 DATE: MAR 2014

CHECKED BY: D. HANSEN  
R.E.E. NO. E12512 DATE: MAR 2014

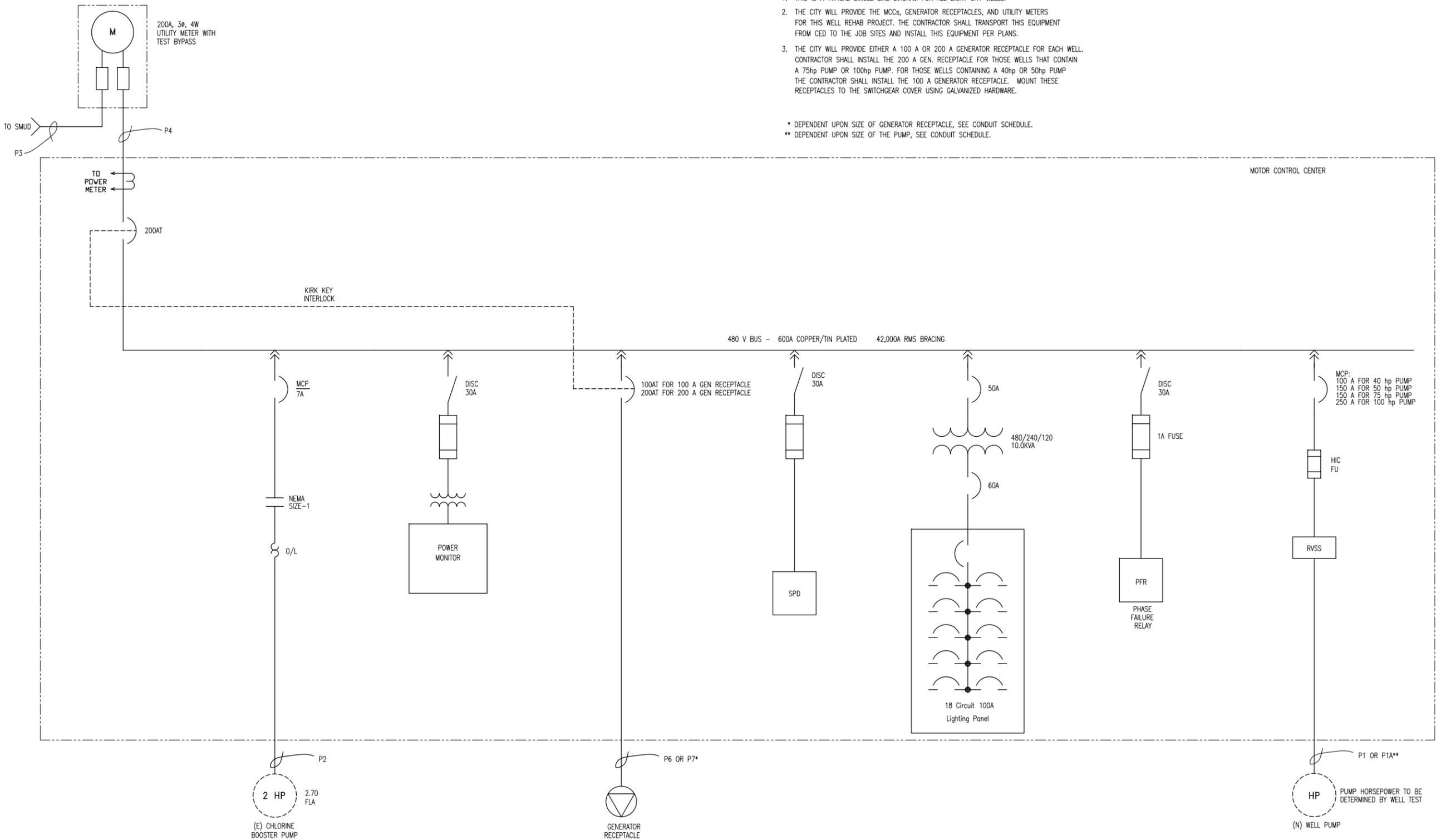


IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

**ELECTRICAL SYMBOLS, ABBREVIATIONS AND GENERAL NOTES**

DWG. NO. **E-1**  
SHEET **230**  
OF **30**

PN: Z14110104



NOTES:

1. THIS IS A TYPICAL SINGLE LINE DIAGRAM FOR ALL EIGHT CITY WELLS.
2. THE CITY WILL PROVIDE THE MCCs, GENERATOR RECEPTACLES, AND UTILITY METERS FOR THIS WELL REHAB PROJECT. THE CONTRACTOR SHALL TRANSPORT THIS EQUIPMENT FROM CED TO THE JOB SITES AND INSTALL THIS EQUIPMENT PER PLANS.
3. THE CITY WILL PROVIDE EITHER A 100 A OR 200 A GENERATOR RECEPTACLE FOR EACH WELL. CONTRACTOR SHALL INSTALL THE 200 A GEN. RECEPTACLE FOR THOSE WELLS THAT CONTAIN A 75hp PUMP OR 100hp PUMP. FOR THOSE WELLS CONTAINING A 40hp OR 50hp PUMP THE CONTRACTOR SHALL INSTALL THE 100 A GENERATOR RECEPTACLE. MOUNT THESE RECEPTACLES TO THE SWITCHGEAR COVER USING GALVANIZED HARDWARE.

\* DEPENDENT UPON SIZE OF GENERATOR RECEPTACLE, SEE CONDUIT SCHEDULE.  
 \*\* DEPENDENT UPON SIZE OF THE PUMP, SEE CONDUIT SCHEDULE.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____

FIELD BOOK	SCALE: _____
H: N.A.	
V: N.A.	

**CITY OF SACRAMENTO**  
 DEPARTMENT OF UTILITIES

ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

DRAWN BY: E. SALCEDO	DESIGNED BY: P. BARNES	CHECKED BY: D. HANSEN
DATE: MAR 2014	R.E.E. NO. E15329 DATE: MAR 2014	R.E.E. NO. E12512 DATE: MAR 2014

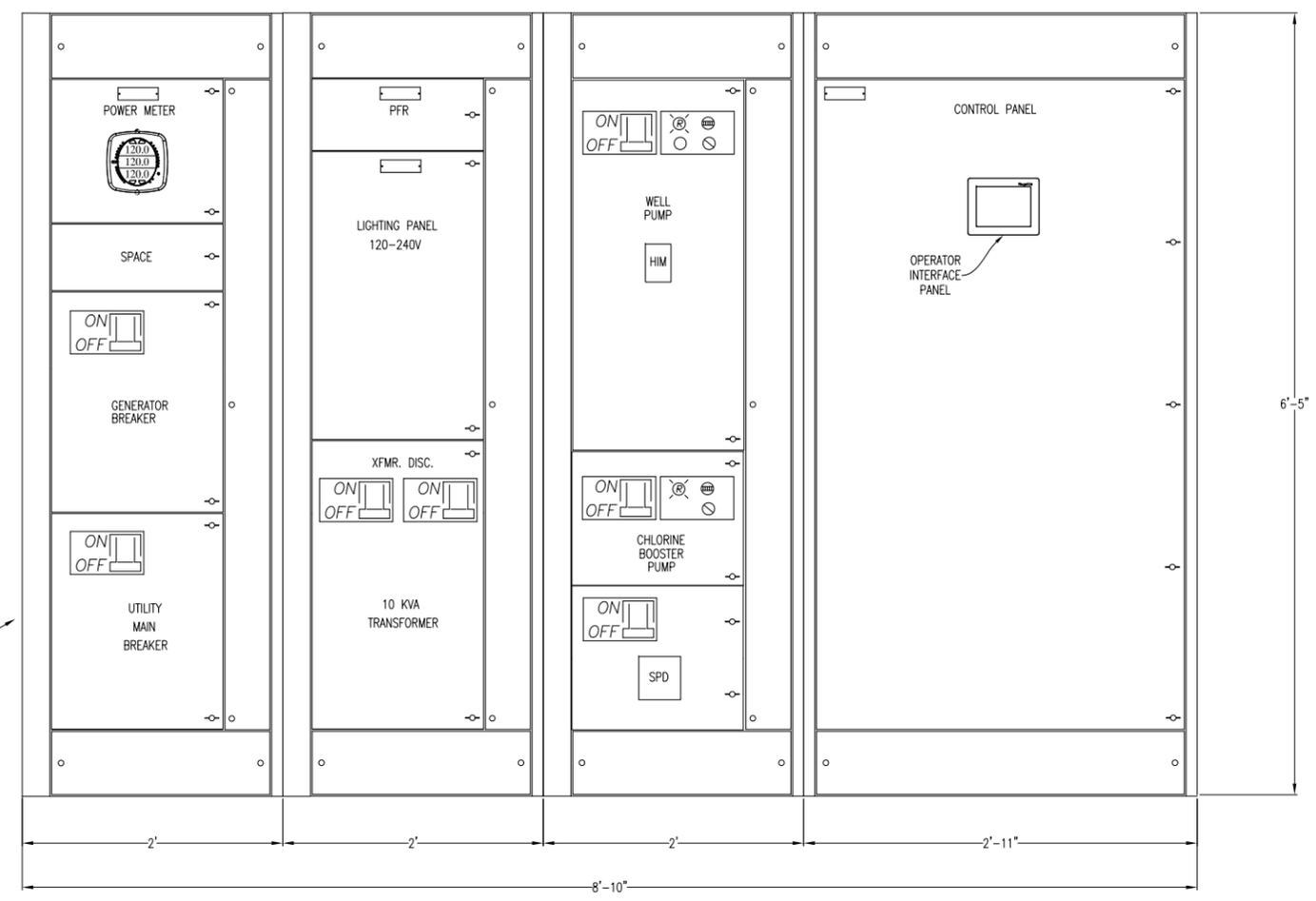


IMPROVEMENT PLANS FOR:  
 WELL REHABILITATION PROJECT PHASE 2A

**TYPICAL WELL SINGLE LINE DIAGRAM**

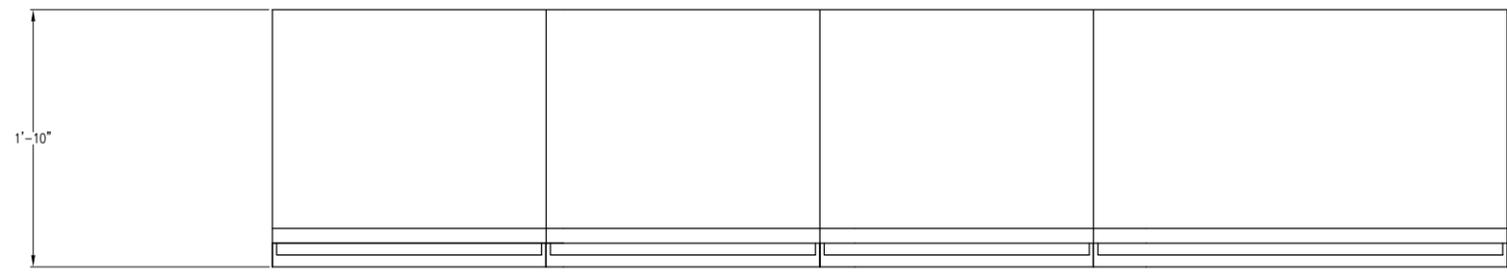
GIS GRID NO. 2014	DWG. NO. E-2
GOT. 2014	SHEET 30
PN: Z14110104	OF 30

PN: Z14110104  
 WELL REHABILITATION PROJECT PHASE II  
 (S:\Electrical Drawings\Well Rehab Phase 2



**ELEVATION**

- NOTES:
1. ALL EIGHT MCC'S WILL BE PROVIDED BY THE CITY TO THE CONTRACTOR.
  2. THE MCC SHOWN HERE IS A TYPICAL.
  3. THE CONTRACTOR SHALL TRANSPORT THE MCCs FROM CED TO EACH JOB SITE. THE CONTRACTOR SHALL INSTALL THESE MCCs AT EACH JOB SITE PER PLANS AND MANUFACTURER'S RECOMMENDATIONS.
  4. CONTRACTOR SHALL PROVIDE AN MCC HOUSE KEEPING PAD AS SHOWN IN THE CIVIL SHEETS.



**PLAN**

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____

FIELD BOOK	SCALE: 1"
H: N.A.	ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
V: N.A.	

**CITY OF SACRAMENTO**  
 DEPARTMENT OF UTILITIES

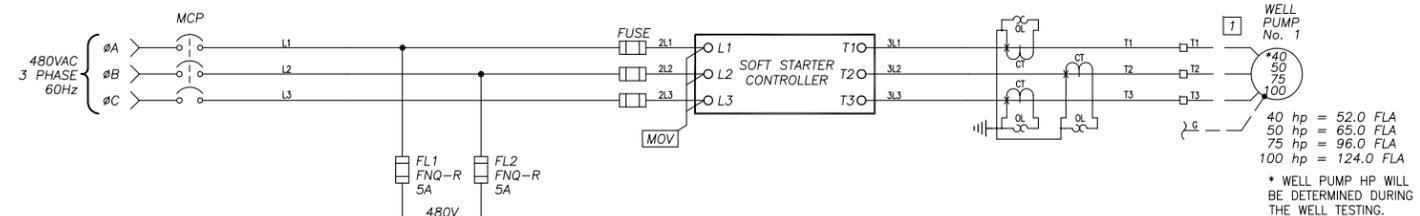
DRAWN BY: E. SALCEDO	DESIGNED BY: P. BARNES	CHECKED BY: D. HANSEN
DATE: MAR 2014	R.E.E. NO. E15329 DATE: MAR 2014	R.E.E. NO. E12512 DATE: MAR 2014



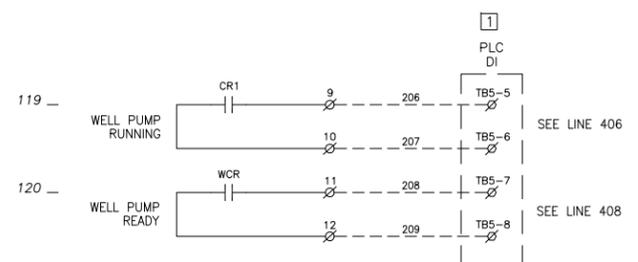
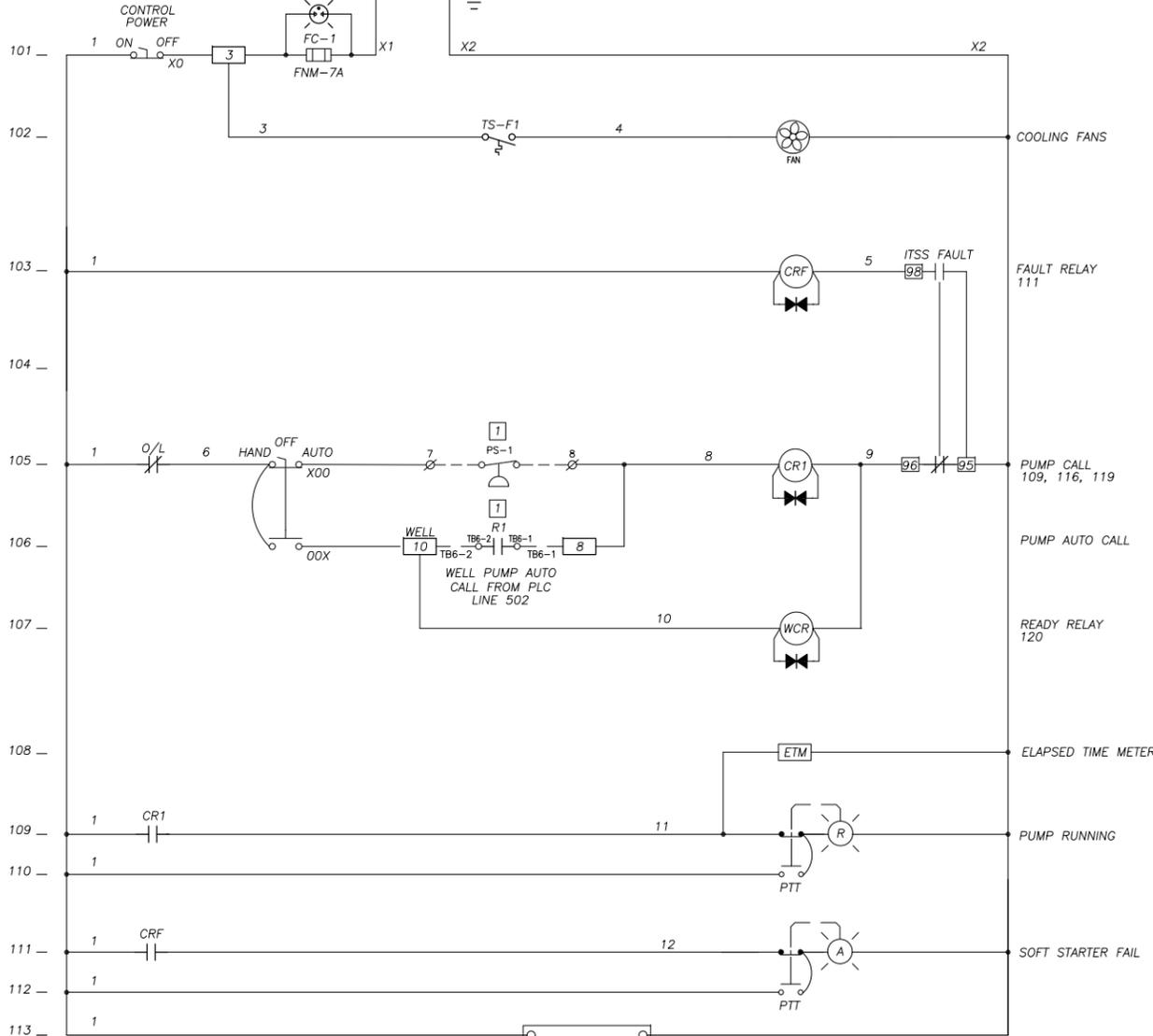
IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**TYPICAL WELL MCC ELEVATION AND PLAN**

GIS GRID NO. GOT CHS	PN: Z14110104	DWG. NO. E-3
		SHEET OF 30

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II



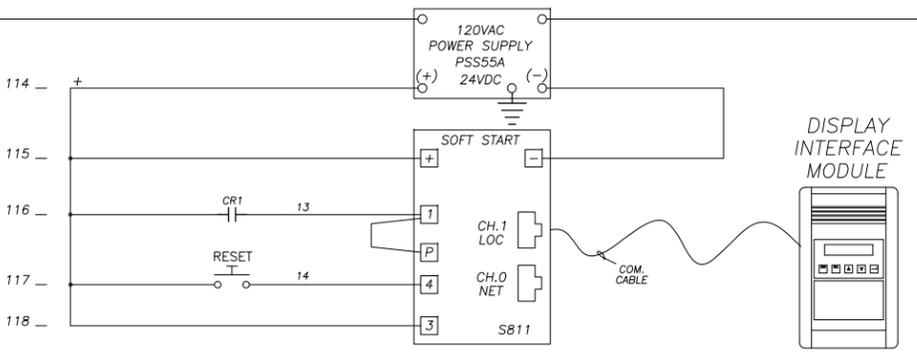
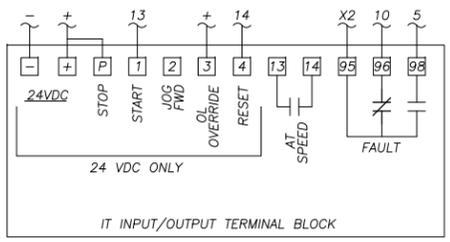
WELL PUMP No. 1  
 40 hp = 52.0 FLA  
 50 hp = 65.0 FLA  
 75 hp = 96.0 FLA  
 100 hp = 124.0 FLA  
 \* WELL PUMP HP WILL BE DETERMINED DURING THE WELL TESTING.



NOTES:

1. THE CONTRACTOR SHALL CONNECT THE NEW PRESSURE SWITCH CONTACT TO THE NEW MOTOR CONTROL DIAGRAM AS SHOWN.
2. SEE SHEETS E-8 AND E-9 FOR PLC CONNECTIONS.
3. DASHED LINES INDICATE REMOTE WIRING.
4. THE CONTRACTOR SHALL MAKE THE CONNECTIONS FOR THE RUN, RUNNING, AND READY RELAY CONTACTS BETWEEN THE MOTOR CONTROL DIAGRAM AND THE PLC AS SHOWN.

1 REMOTE LOCATION



PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____
FIELD BOOK	SCALE: _____
H: N.A.	ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
V: N.A.	

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DESIGNED BY: P. BARNES  
 CHECKED BY: D. HANSEN  
 DATE: MAR 2014

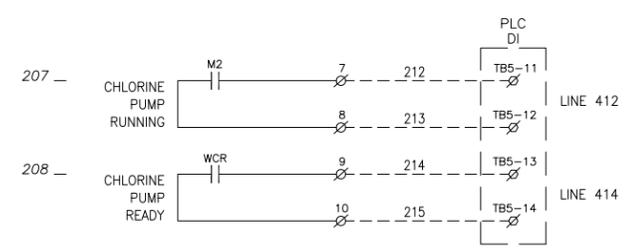
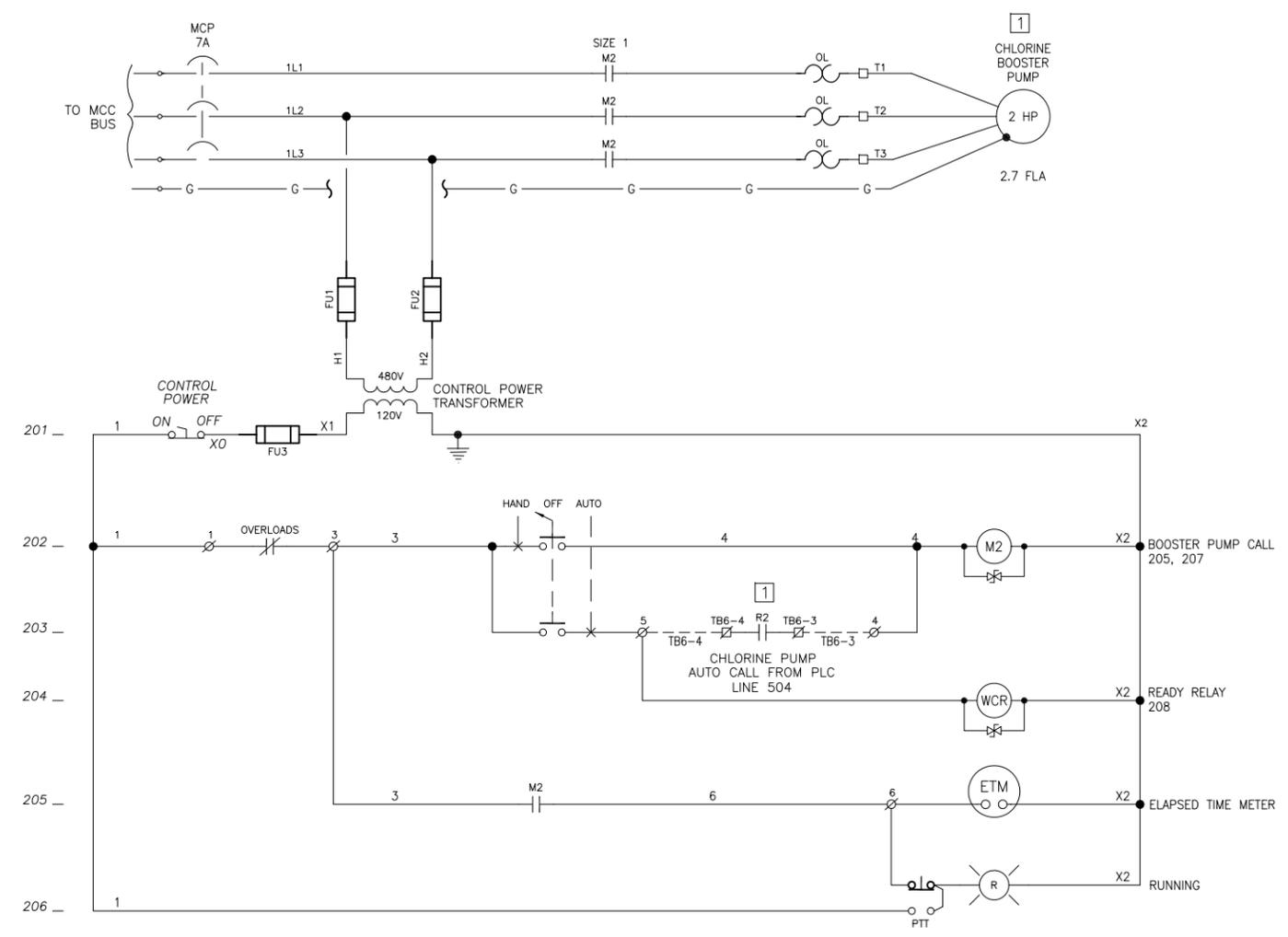


IMPROVEMENT PLANS FOR:  
WELL REHABILITATION PROJECT PHASE 2A

**TYPICAL WELL PUMP MOTOR CONTROL DIAGRAM**

DWG. NO. E-4  
SHEET 205 OF 330  
OF 30

PN: Z14110104  
 WELL REHABILITATION PROJECT PHASE II  
 (S:\Electrical Drawings\Well Rehab Phase 2



**NOTE**

1. THE CONTRACTOR SHALL MAKE THE CONNECTIONS FOR THE RUN, RUNNING, AND READY RELAY CONTACTS BETWEEN THE MOTOR CONTROL DIAGRAM AND THE PLC AS SHOWN.
2. SEE SHEETS E-8 AND E-9 FOR PLC CONNECTIONS.
3. DASHED LINES INDICATE REMOTE WIRING.

1 REMOTE LOCATION

PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____

FIELD BOOK	
SCALE:	
H: N.A.	
V: N.A.	

**CITY OF SACRAMENTO**  
 DEPARTMENT OF UTILITIES

ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

DRAWN BY: E. SALCEDO	DESIGNED BY: P. BARNES	CHECKED BY: D. HANSEN
DATE: MAR 2014	R.E.E. NO. E15329 DATE: MAR 2014	R.E.E. NO. E12512 DATE: MAR 2014



IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

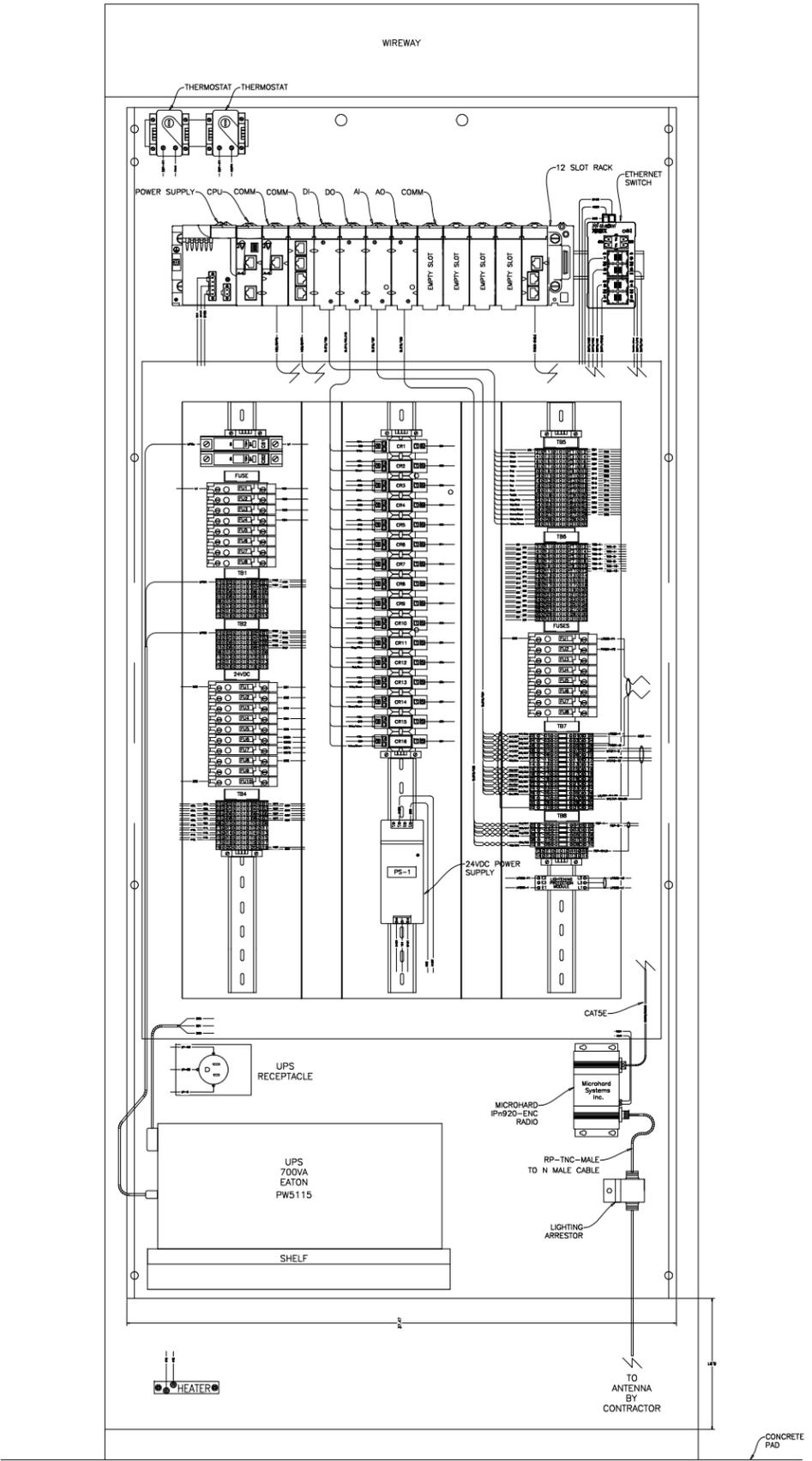
**TYP. CHLORINE BOOSTER PUMP CONTROL DIAGRAM**

GIS GRID NO. GOT CHS	PN: Z14110104	DWG. NO.
		E-5
SHEET	OF	205 of 230
		30

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

PN: Z14110104  
 WELL REHABILITATION PROJECT PHASE II  
 (S:\Electrical Drawings\Well Rehab Phase 2

- NOTE:  
 1. THE CONTRACTOR SHALL MOUNT THE PLC AND RADIO INSIDE THE CITY SUPPLIED CONTROL CABINET AS SHOWN.  
 2. THE CITY WILL PROVIDE THE PLC CABINET WITHOUT THE PLC AND RADIO. ALL OTHER COMPONENTS WITHIN THE PLC CABINET WILL BE PROVIDED BY THE CITY.  
 3. THE CONTRACTOR SHALL MOUNT THE LIGHTNING PROTECTION MODULE FOR THE DRAW DOWN TX ON THE DIN RAIL INSIDE THE PLC CABINET.  
 4. THE CONTRACTOR SHALL MOUNT THE DRAW DOWN TX JUNCTION BOX WITH FILTER INSIDE THE PLC CABINET.



FRONT VIEW

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____
FIELD BOOK	SCALE: _____
H: N.A.	ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
V: N.A.	

**CITY OF SACRAMENTO**  
 DEPARTMENT OF UTILITIES

DRAWN BY: E. SALCEDO      DESIGNED BY: P. BARNES      CHECKED BY: D. HANSEN  
 DATE: MAR 2014      R.E.E. NO. E15329      DATE: MAR 2014      R.E.E. NO. E12512      DATE: MAR 2014

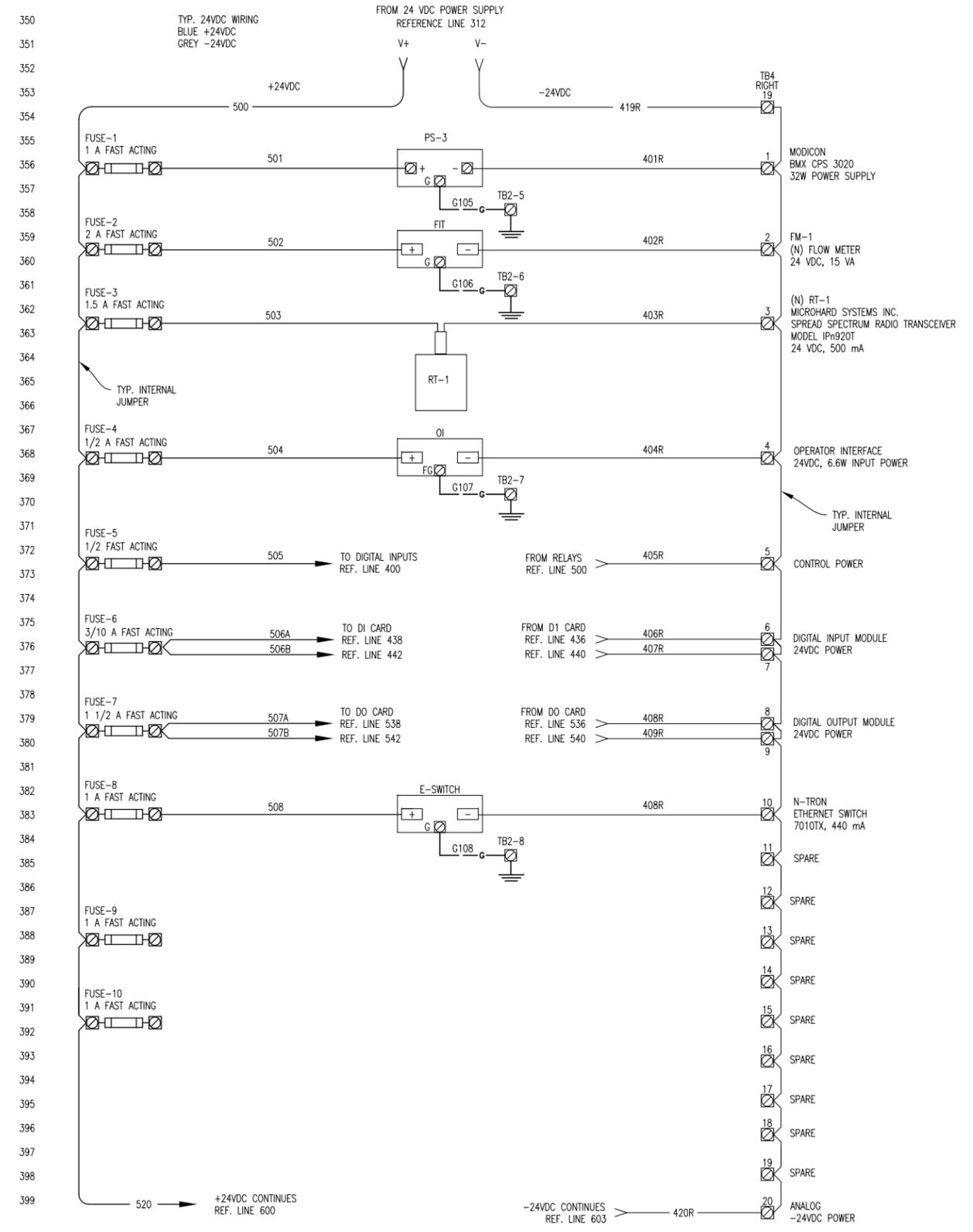
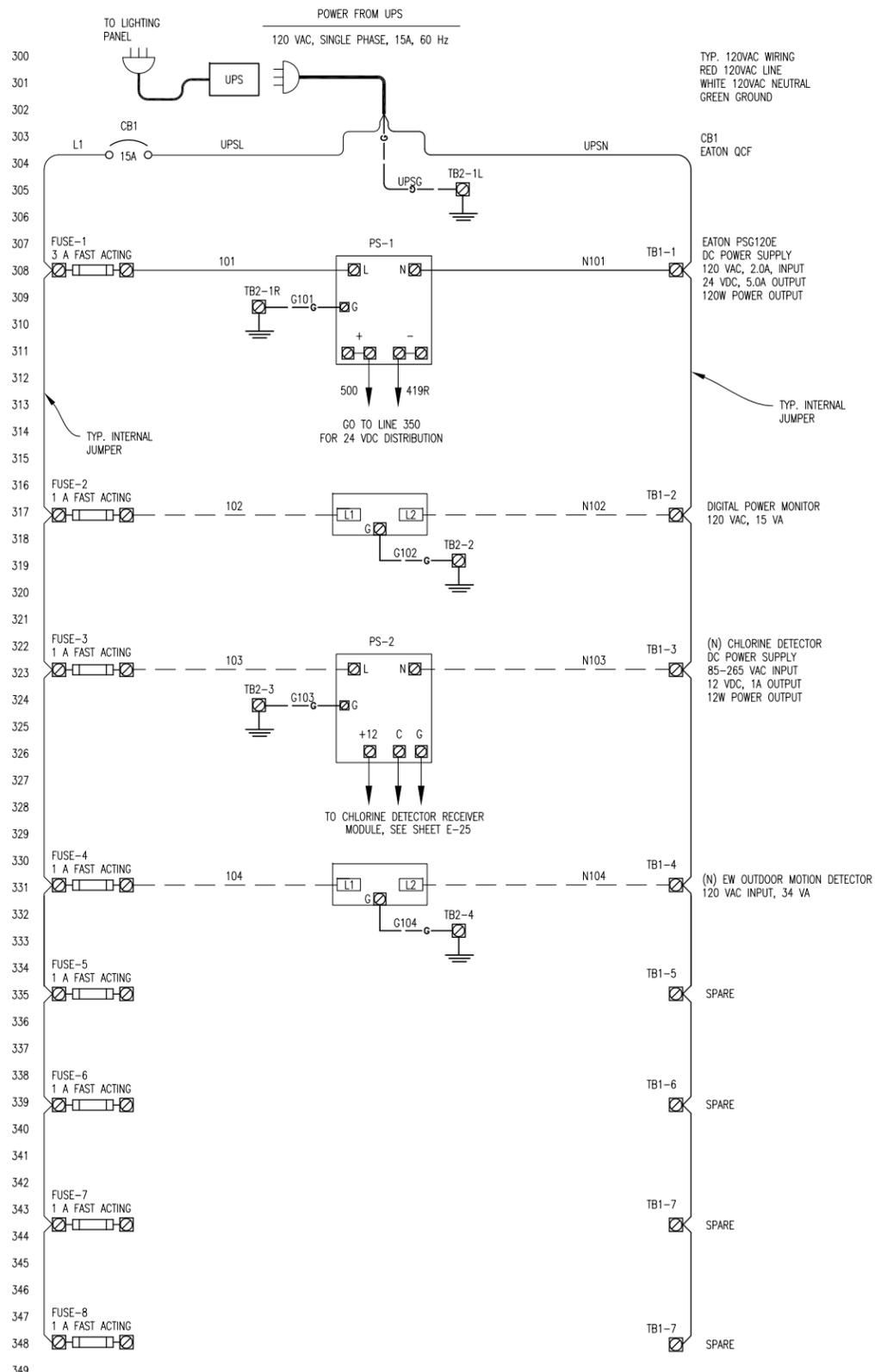


IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

**TYPICAL WELL PLC ELEVATION DIAGRAM**

GIS GRID NO. 2017  
 GOT CHS  
 PN: Z14110104  
 DWG. NO. E-6  
 SHEET OF 230  
 OF 30

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II



- NOTES:
1. CONTRACTOR SHALL INSTALL AND CONNECT WIRES TO THE CL2 POWER SUPPLY AND CL2 DISPLAY MODULE.
  2. CONTRACTRO SHALL ADD FUSES TO FUSE HOLDERS PER THE DRAWINGS.
  3. CONTRACTOR SHALL PROVIDE AND INSTALL NEW CHLORINE DETECTOR POWER SUPPLY, FLOW METER TX, RADIO, AND MOTION DETECTOR.

PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV.	FIELD BOOK
DESCRIPTION:		

SCALE:	1"
H:	N.A.
V:	N.A.

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: E. SALCEDO  
DATE: MAR 2014

DESIGNED BY: P. BARNES  
R.E.E. NO. E15329  
DATE: MAR 2014

CHECKED BY: D. HANSEN  
R.E.E. NO. E12512  
DATE: MAR 2014



IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

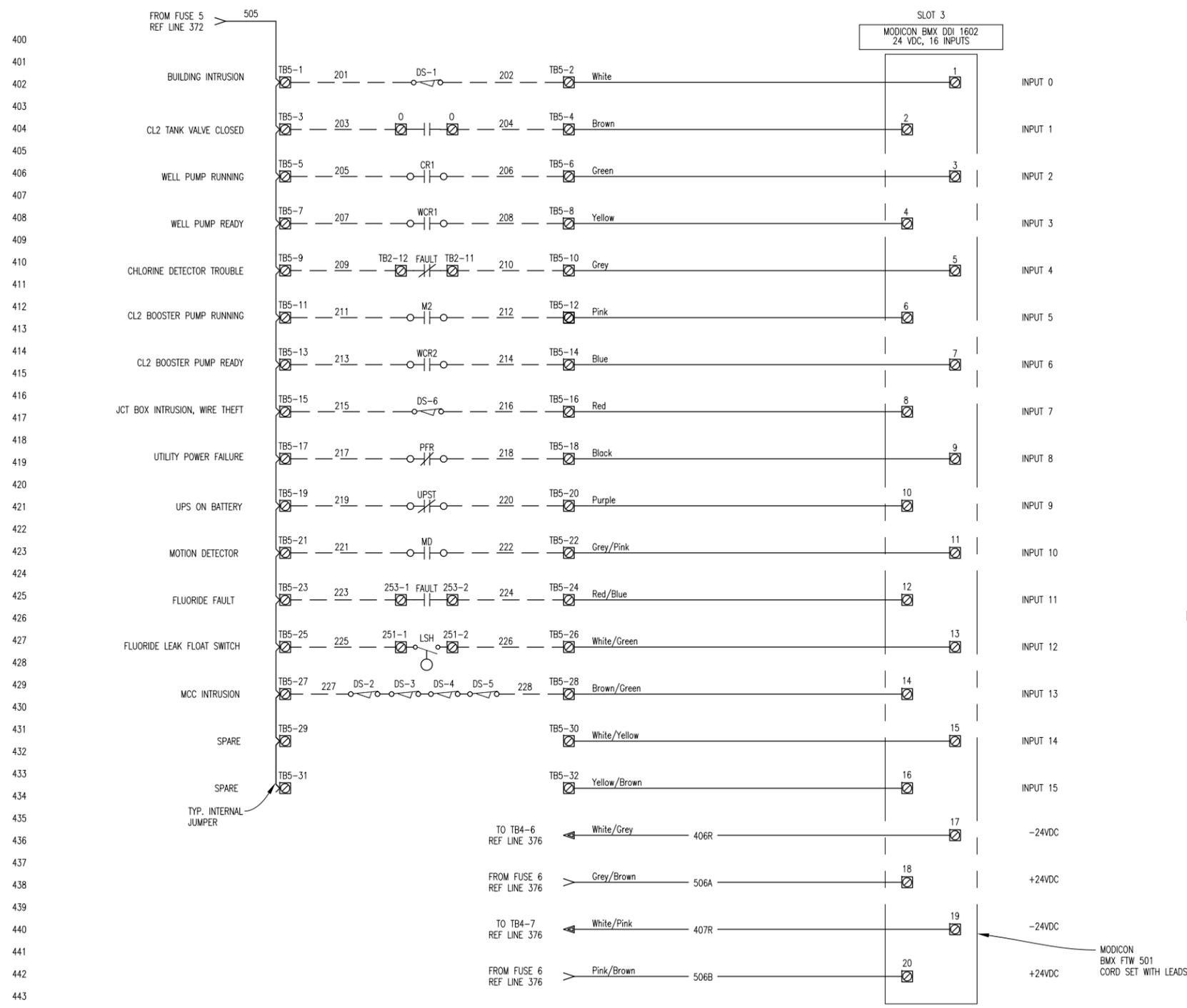
**TYPICAL WELL PLC POWER DISTRIBUTION DIAGRAM**

GIS GRID NO. 2014  
GOT CHS 10104

DWG. NO. E-7  
SHEET 20 of 30  
OF 30

PN: Z14110104

WELL REHABILITATION PROJECT PHASE II  
 (S:\Electrical Drawings\Well Rehab Phase 2



- NOTES:
1. CONTRACTOR SHALL FURNISH, INSTALL AND CONNECT ALL WIRES TO THE PLC.
  2. CONTRACTOR TO PROVIDE AND INSTALL HEAT SHRINKABLE WIRE LABELS WITH THE NUMBERS SHOWN ON THE PLANS.
  3. THE CITY WILL PROVIDE ALL PLC PROGRAMMING.
  4. INTERNAL WIRING TO BE TEW MIN. 16AWG. COLOR AS SHOWN.
  5. CONTRACTOR SHALL INSTALL CABINET DOOR SWITCHES ON EACH DOOR OF THE MCC AND CONNECT TO THE PLC, SEE SPECIFICATIONS.
  6. CONTRACTOR SHALL CONNECT THE EXISTING CHEMICAL BUILDING MAGNETIC DOOR SWITCH AND CHLORINE TANK VALVE CLOSED CONTACT TO THE PLC AS SHOWN.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____
FIELD BOOK	SCALE: _____
H: N.A.	V: N.A.

ON ORIGINAL SCALE  
DRAWING ADJUST  
SCALED DIMENSIONS  
IF THIS DOES NOT  
SCALE AT 1"

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: E. SALCEDO    DESIGNED BY: P. BARNES    CHECKED BY: D. HANSEN  
 DATE: MAR 2014    R.E.E. NO. E15329    DATE: MAR 2014    R.E.E. NO. E12512    DATE: MAR 2014



IMPROVEMENT PLANS FOR:  
WELL REHABILITATION PROJECT PHASE 2A  
TYPICAL WELL PLC  
DIGITAL INPUTS DIAGRAM

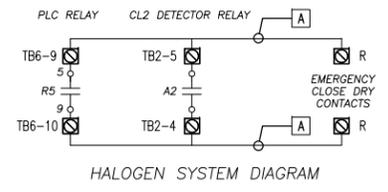
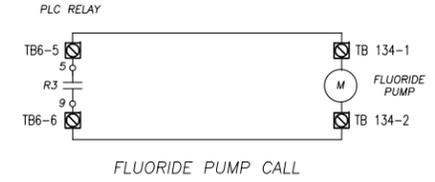
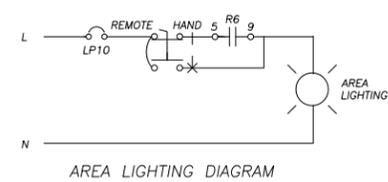
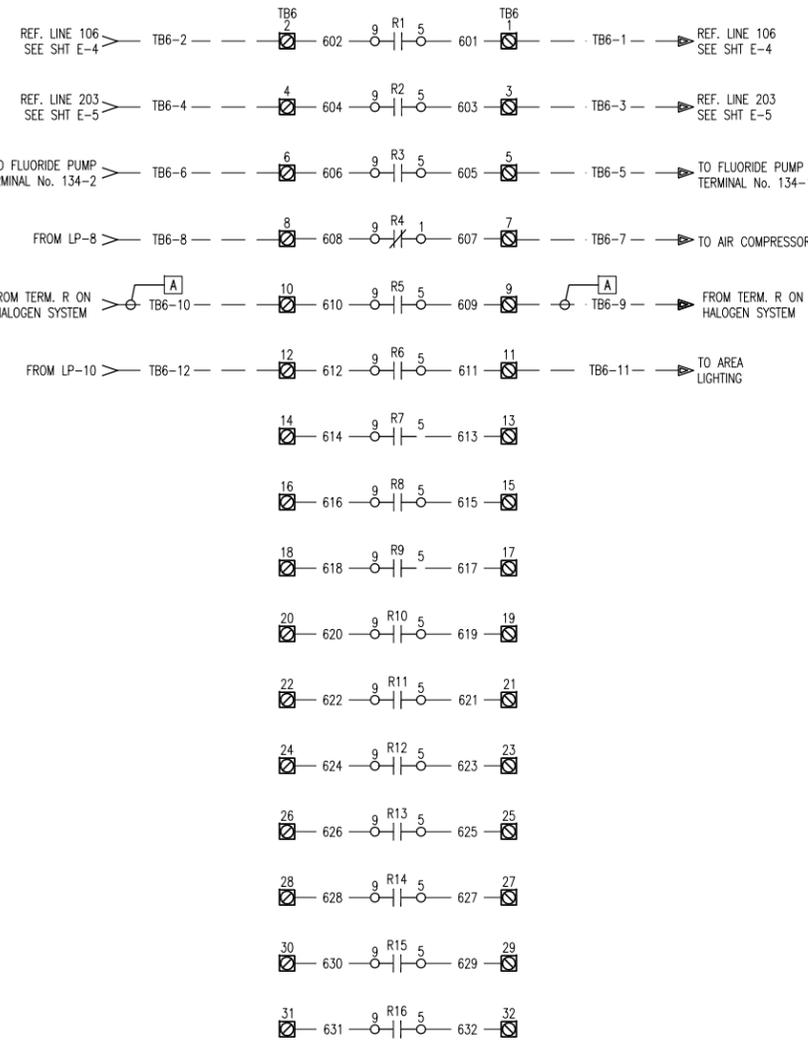
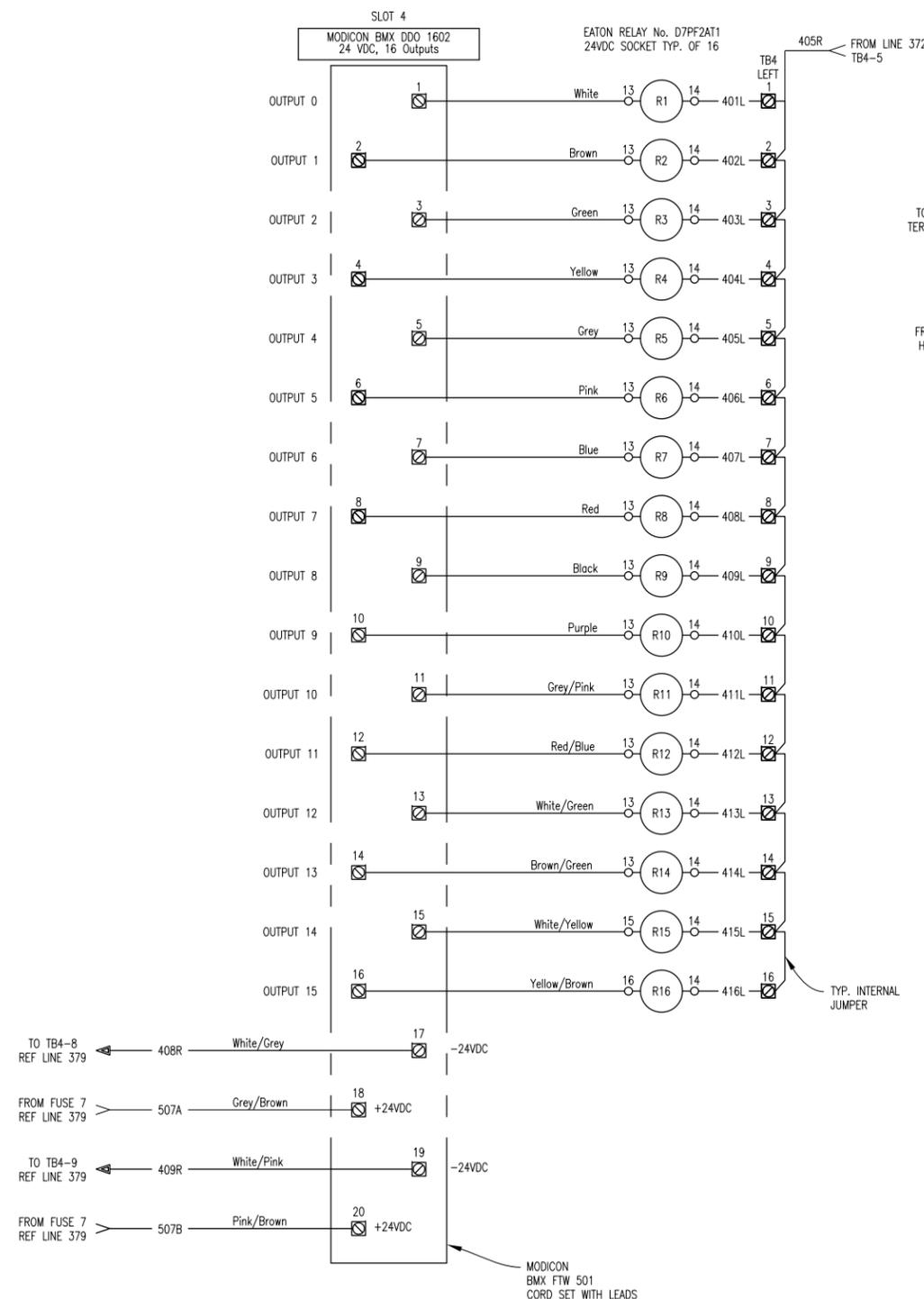
GIS GRID NO. \_\_\_\_\_  
COT. CHG. \_\_\_\_\_  
PN: Z14110104

DWG. NO. E-8  
SHEET 20 of 30  
OF 30

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

PN: Z14110104

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NOTES:  
1. THE CONTRACTOR SHALL USE THE NORMALLY CLOSED CONTACT ON RELAY R4.  
[A] USE 24AWG, TWSH CABLE BELDEN 9501

THE HALOGEN SYSTEM PROVIDES THE SOURCE VOLTAGE  
USE 24AWG TWSH CABLE BELDEN 9501 FOR ALL WIRING

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____
FIELD BOOK	
SCALE:	
H: N.A.	
V: N.A.	

ON ORIGINAL SCALE  
DRAWING ADJUST  
SCALED DIMENSIONS  
IF THIS DOES NOT  
SCALE AT 1"

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DESIGNED BY: P. BARNES  
R.E.E. NO. E15329 DATE: MAR 2014

CHECKED BY: D. HANSEN  
R.E.E. NO. E12512 DATE: MAR 2014

DRAWN BY: E. SALCEDO  
DATE: MAR 2014



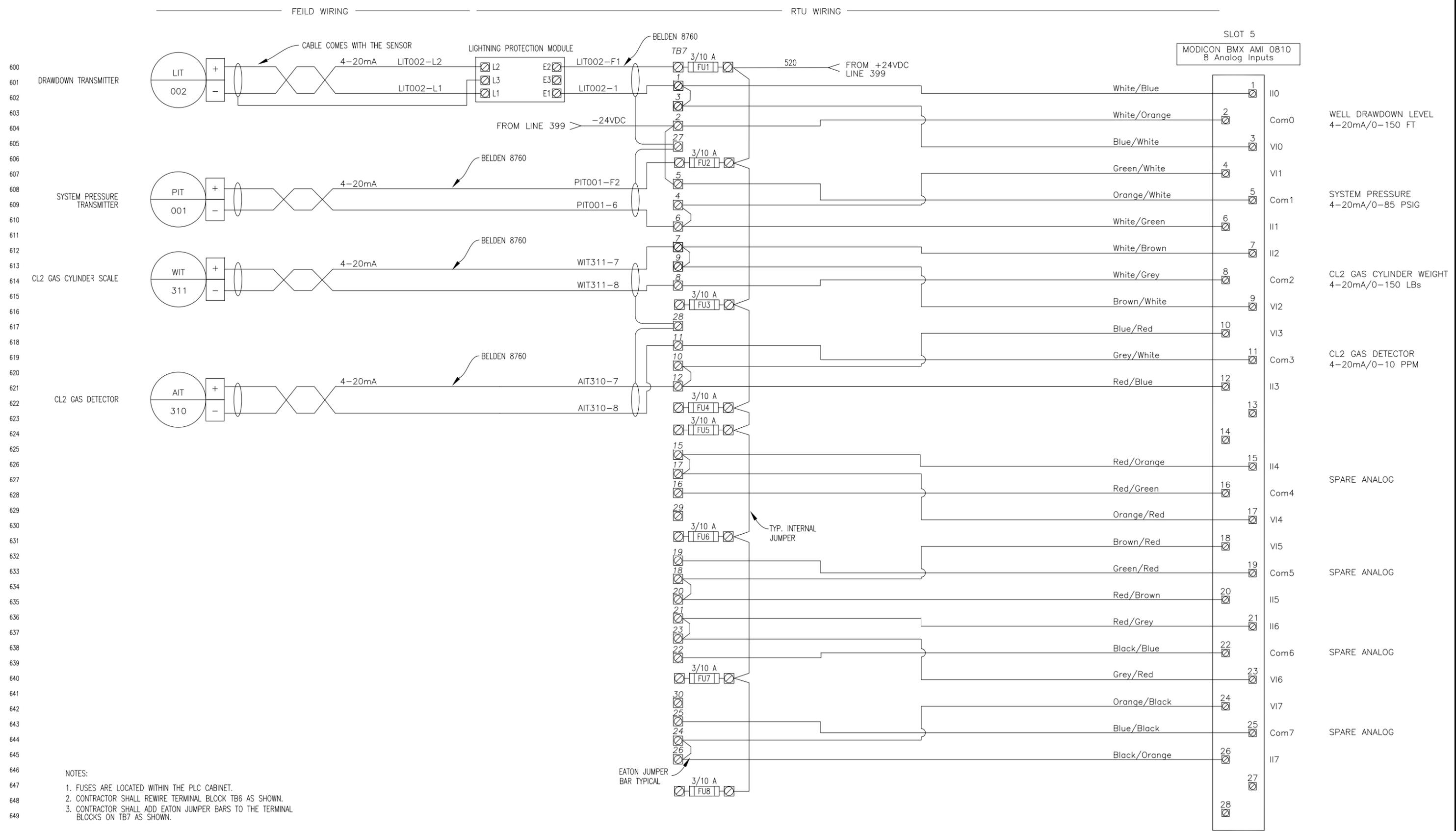
IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
TYPICAL WELL PLC  
DIGITAL OUTPUTS DIAGRAM

DWG. NO. **E-9**  
SHEET **13**  
OF **30**

PN: Z14110104

PN: Z14110104

WELL REHABILITATION PROJECT PHASE II  
S:\Electrical Drawings\Well Rehab Phase 2



PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____
FIELD BOOK	SCALE: _____
H: N.A.	ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
V: N.A.	

1"  
DRAWN BY: E. SALCEDO  
DATE: MAR 2014

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DESIGNED BY: P. BARNES  
R.E.E. NO. E15329 DATE: MAR 2014

CHECKED BY: D. HANSEN  
R.E.E. NO. E12512 DATE: MAR 2014



IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
TYPICAL WELL PLC  
ANALOG INPUTS DIAGRAM

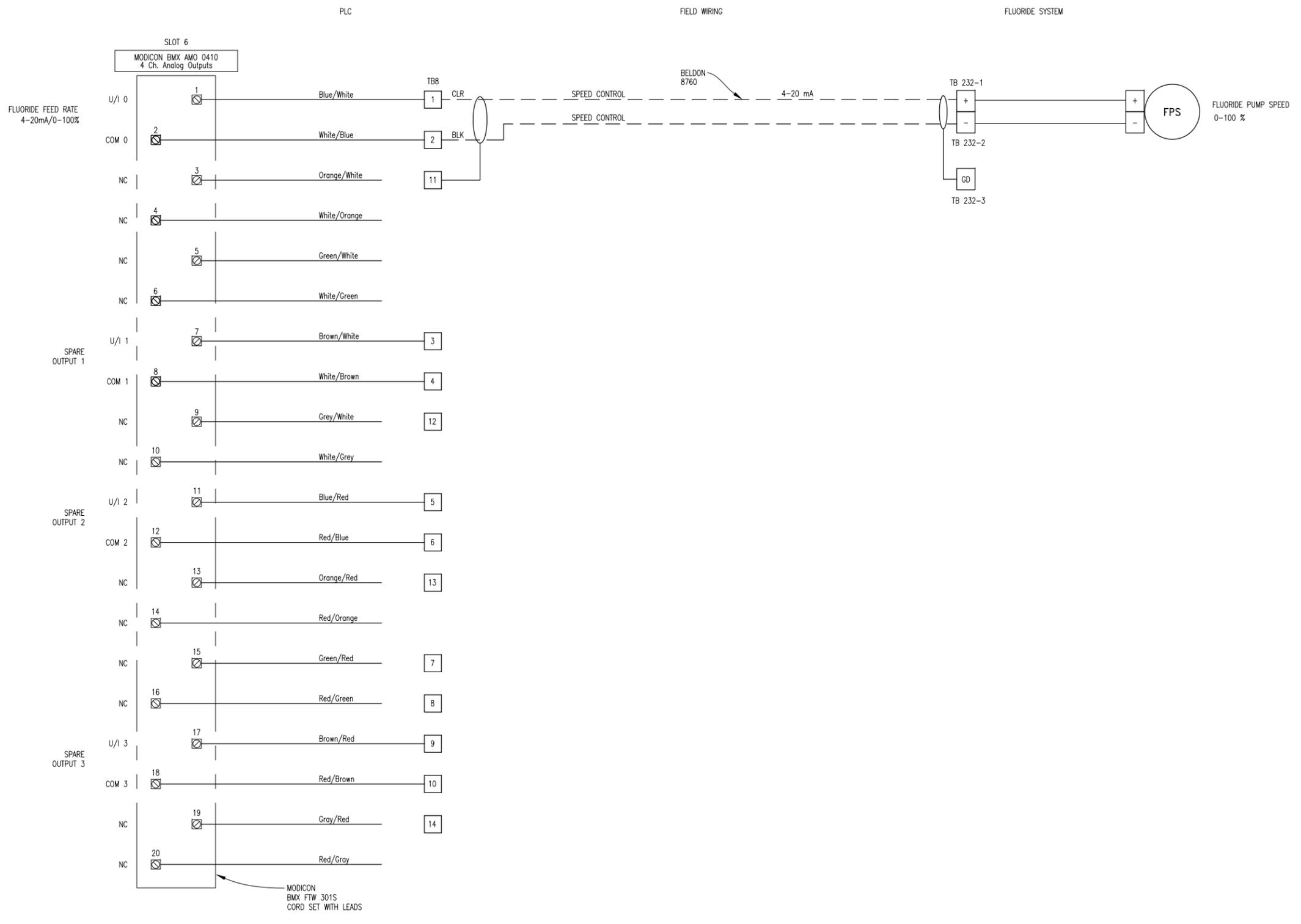
GIS GRID NO. GOT CHS  
PN: Z14110104  
DWG. NO. E-10  
SHEET OF 230  
OF 30

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

PN: Z14110104

WELL REHABILITATION PROJECT PHASE II  
 (S:\Electrical Drawings\Well Rehab Phase 2

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REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV.
DESCRIPTION:	

FIELD BOOK
SCALE:
H: N.A.
V: N.A.

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

1" SCALE

ON ORIGINAL SCALE  
DRAWING ADJUST  
SCALED DIMENSIONS  
IF THIS DOES NOT  
SCALE AT 1"

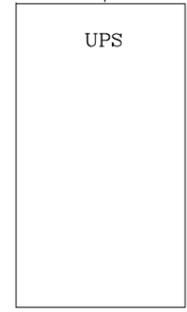
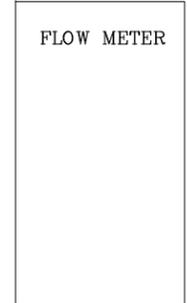
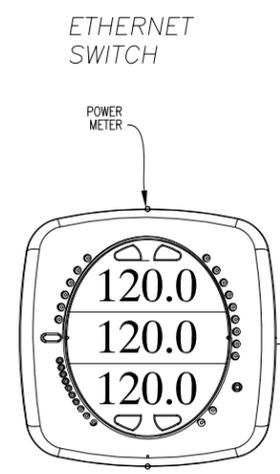
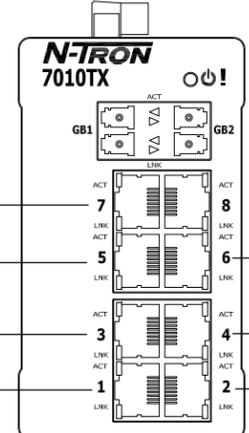
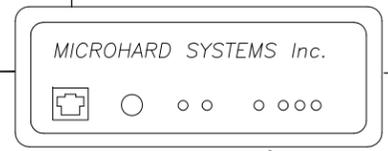
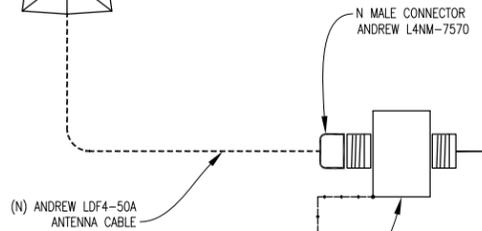
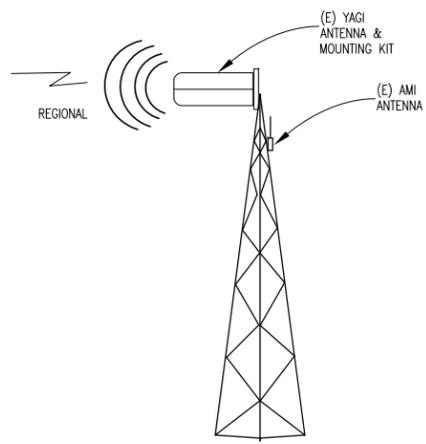
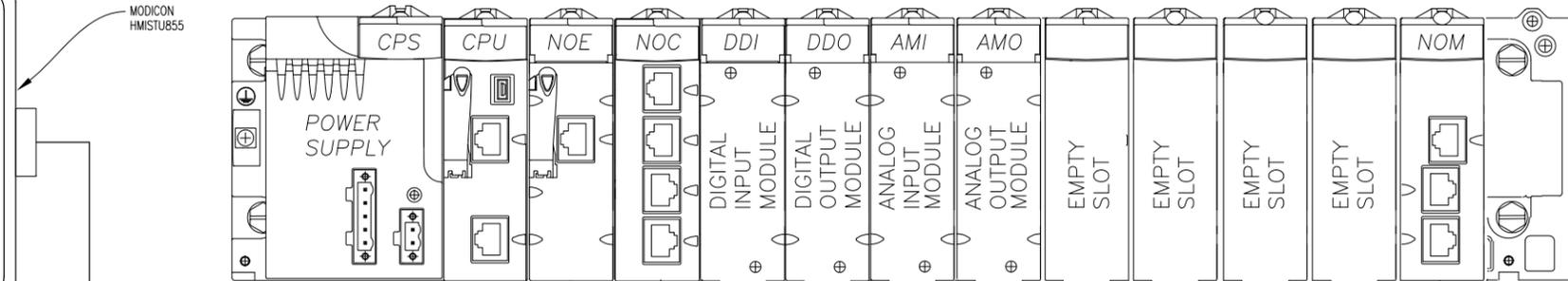
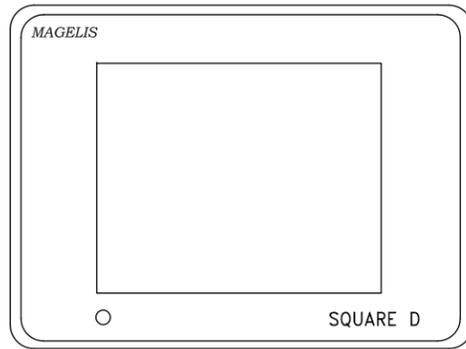
DRAWN BY: E. SALCEDO	DESIGNED BY: P. BARNES	CHECKED BY: D. HANSEN
DATE: MAR 2014	R.E.E. NO. E15329 DATE: MAR 2014	R.E.E. NO. E12512 DATE: MAR 2014



IMPROVEMENT PLANS FOR:  
WELL REHABILITATION PROJECT PHASE 2A  
TYPICAL WELL PLC  
ANALOG OUTPUTS DIAGRAM

GIS GRID NO.	PN: Z14110104	DWG. NO. E-11
COT. CHS.		SHEET OF 230
		OF 30

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II



- NOTES:
1. FOR THOSE WELL SITES CONTAINING AN (E) AMI ANTENNA THE CONTRACTOR SHALL POWER THE ANTENNA FROM THE NEW LIGHTING PANEL.
  2. CONTRACTOR SHALL INSTALL A CAT 6 CABLE FROM SWITCH TO THE FLOW METER TX, NOE CARD, RADIO, AND NOC CARD.
  3. CONTRACTOR SHALL INSTALL THE PLC COMPONENTS AS SHOWN.

PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____
FIELD BOOK	SCALE: _____
H: N.A.	ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
V: N.A.	

1"  
DRAWN BY: E. SALCEDO  
DATE: MAR 2014

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DESIGNED BY: P. BARNES  
R.E.E. NO. E15329 DATE: MAR 2014

CHECKED BY: D. HANSEN  
R.E.E. NO. E12512 DATE: MAR 2014



IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

**TYPICAL WELL PLC COMMUNICATIONS DIAGRAM**

GIS GRID NO. GOT CHS  
PN: Z14110104  
DWG. NO. **F-12**  
SHEET **OF 330**  
OF **30**

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

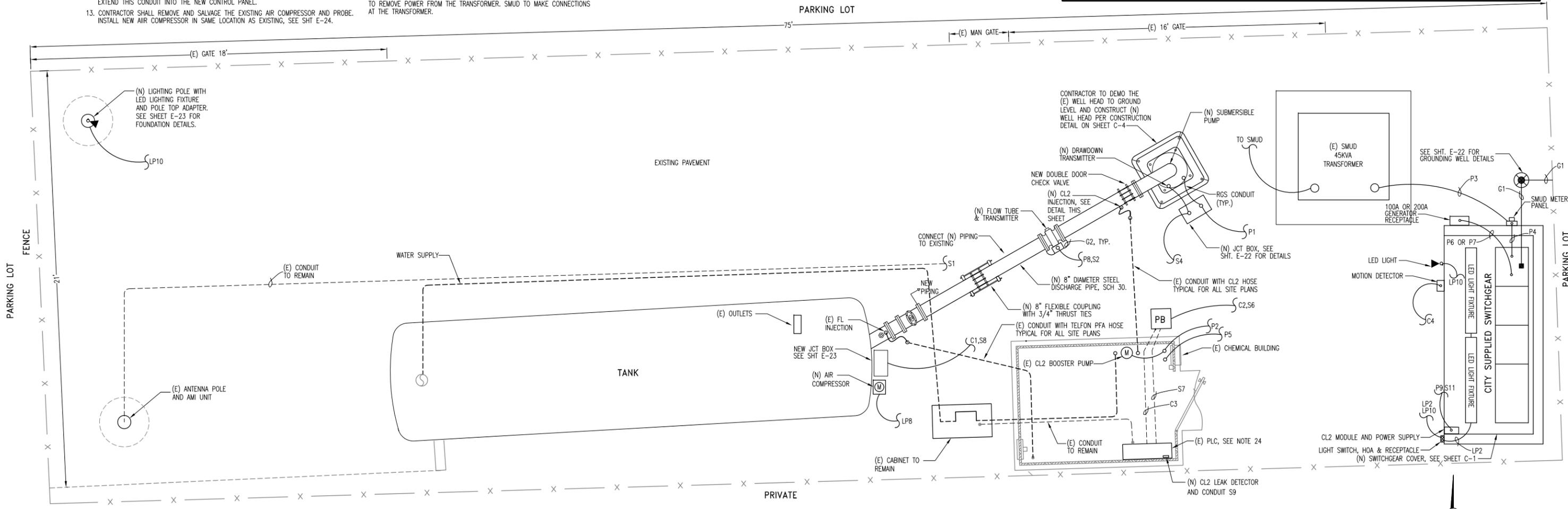
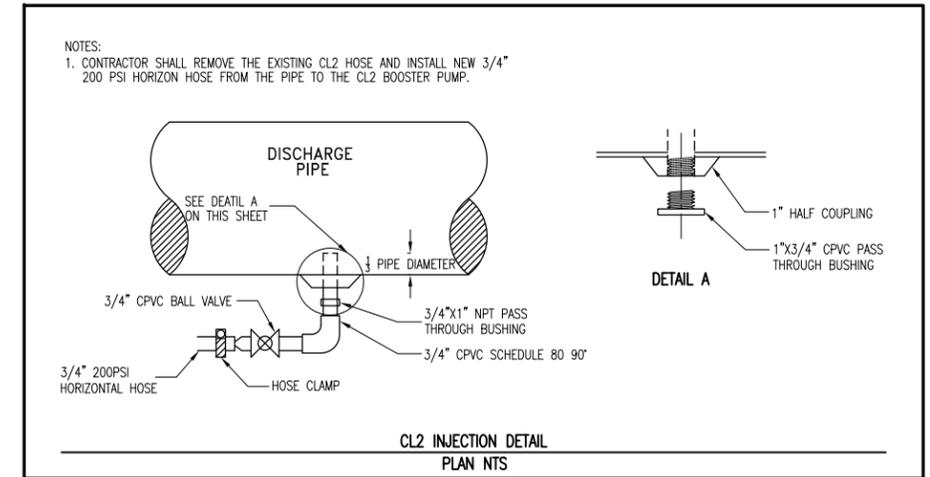
**ELECTRICAL NOTES:**

- CONTRACTOR SHALL REMOVE THE EXISTING CHLORINE LEAK DETECTOR AND RETURN TO THE CITY. CONTRACTOR SHALL MOUNT NEW CHLORINE LEAK DETECTOR IN SAME LOCATION AS THE EXISTING.
- THE CONDUIT TO THE GENERATOR RECEPTACLE SHALL BE DETERMINED BY THE WELL TEST WHICH DETERMINES THE SIZE OF THE WELL PUMP.
- CONTRACTOR SHALL REMOVE AND SALVAGE THE EXISTING SWITCHGEAR AND ALL APPURTENANCES. CUT SUPPORT POSTS FLUSH WITH GRADE.
- CONTRACTOR SHALL MOUNT NEW SMUD METER PANEL AND GENERATOR RECEPTACLE TO THE NEW SWITCHGEAR COVER USING GALVANIZED HARDWARE.
- CONTRACTOR SHALL REMOVE THE EXISTING JUNCTION BOX MOUNTED TO THE TANK. INSTALL A NEW JUNCTION BOX PER DETAILS SHOWN ON SHEET E-23.
- CONTRACTOR SHALL PROVIDE OUTDOOR RATED BYPASS SWITCH FOR AREA LIGHTING.
- CONTRACTOR SHALL INSTALL SIMKAR LED LIGHTING FIXTURE MODEL No. ENZLED 4 RFA S 46 41 U1, 120 V OUTDOOR RATED RECEPTACLE, AND OUTDOOR RATED SWITCH FOR THE SWITCHGEAR COVER LIGHTS.
- CONTRACTOR SHALL INSTALL GE LED LIGHTING FIXTURES MODEL No. EPMR-1-WF-43-F-G-4-T-DKBZ FOR ALL OF THE SWITCHGEAR COVER AND LIGHTING POLE FIXTURES. CONTRACTOR SHALL PROVIDE POLE TOP ADAPTER AND WALL MOUNT LIGHTING BRACKET AS REQUIRED.
- CONTRACTOR SHALL GROUND THE EXISTING FENCE, SEE SHIT E-23 FOR DETAILS. SEE SHEET E-22 FOR GROUNDING WELL DETAILS.
- CONTRACTOR SHALL REMOVE AND SALVAGE THE EXISTING FLOW METER AND PRESSURE TRANSMITTER.
- CONTRACTOR SHALL SAW CUT (E) CONDUIT STUBS FLUSH WITH GRADE.
- CONTRACTOR SHALL INTERCEPT THE EXISTING 1 1/2" CONDUIT S1 AND EXTEND THIS CONDUIT INTO THE NEW CONTROL PANEL.
- CONTRACTOR SHALL REMOVE AND SALVAGE THE EXISTING AIR COMPRESSOR AND PROBE. INSTALL NEW AIR COMPRESSOR IN SAME LOCATION AS EXISTING, SEE SHIT E-24.

- CONTRACTOR SHALL REMOVE THE EXISTING ELECTRICAL OUTLETS FROM THE TANK AND CUT OFF THE EXISTING CONDUIT FLUSH WITH THE GRADE.
- CONTRACTOR SHALL INTERCEPT AND EXTEND CONDUITS P2 AND P5 INTO THE NEW MCC.
- CONTRACTOR SHALL SAW CUT THE EXISTING FACILITY PAVEMENT (CONCRETE OR CA) TO FACILITATE THE INSTALLATION OF THE SWITCHGEAR COVER.
- SEE SHEETS E-22, E-23, E-24, AND E-25 FOR ADDITIONAL WORK.
- CONTRACTOR SHALL INSTALL THE NEW FLUORIDE SYSTEM AND CONNECT TO THE EXISTING WATER INLET LINE AND MAKE ALL NEW ELECTRICAL CONNECTIONS AS REQUIRED FOR A COMPLETE OPERATIONAL SYSTEM.
- THE LAYOUT OF THE EXISTING EQUIPMENT SHOWN IN EACH CHEMICAL BUILDING IS APPROXIMATE ONLY, SEE SHEET E-24 FOR DETAILS.
- FOR ALL OF THE WELL SITES, EXCEPT WELL 164, THERE IS AN EXISTING PULL BOX INSTALLED ADJACENT TO THE CHEMICAL BUILDING.
- CITY WILL REMOVE ANY HAZARD MATERIALS FROM EACH WELL SITE AS NEEDED.
- CONTRACTOR SHALL INSTALL AND CONNECT THE NEW CHLORINE DETECTOR SYSTEM PER PLAN SHEET E-25.
- CONTRACTOR SHALL MODIFY THE EXISTING PROBE WELL PER PLAN SHEET E-24.
- CONTRACTOR SHALL INSTALL NEW STAINLESS STEEL NIPPLES AND PROBE WELL. CONTRACTOR SHALL INSTALL NEW VICTAULIC FITTINGS.
- CONTRACTOR SHALL REMOVE AND SALVAGE THE (E) PLC CABINET. CONTRACTOR SHALL INSTALL (N) NEMA 1 12"X12"X6" JUNCTION BOX. CONTRACTOR SHALL EXTEND (E) CONDUITS INTO NEW JCT BOX AND MATCH CONDUIT MATERIAL.
- CONTRACTOR SHALL EXTEND CONDUIT P3 INTO THE BOTTOM OF THE EXISTING SMUD TRANSFORMER. CONTRACTOR SHALL CONTACT SMUD TO REMOVE POWER FROM THE TRANSFORMER. SMUD TO MAKE CONNECTIONS AT THE TRANSFORMER.

**CIVIL NOTES FOR ALL WELLS:**

- CONTRACTOR SHALL PROVIDE ANY PIPE OR FITTINGS NECESSARY TO CONNECT (P) WELLHEAD DISCHARGE PIPE TO (E) PIPE AND (P) FLOW METER.
- PROVIDE CLASS B CONCRETE WITH 4000 PSI MINIMUM 28-DAY COMPRESSIVE STRENGTH FOR THE WELLHEAD (6 SACK MINIMUM CEMENT CONTENT, 4" MAXIMUM SLUMP) PER CSSS SECTIONS 10 AND 20.
- USE INTERMEDIATE GRADE ASTM A615, GRADE 60 REINFORCING, EXCEPT USE ASTM A706, GRADE 60 SUBMERGED UNDER WATER.
- OBSERVE FOLLOWING REINFORCEMENT CLEARANCES: 3" SURFACES POURED AGAINST EARTH OR THAT ARE TO BE SUBMERGED UNDER WATER. 2" AT FORMED SURFACES EXPOSED TO EARTH OR WEATHER, 1-1/2" AT OTHER SURFACES (EXCEPT WHERE SHOWN OTHERWISE).
- PROVIDE 3/4" CHAMFER OR TOOLED EDGE AT EXPOSED EDGES OF CONCRETE, UNLESS OTHERWISE SHOWN.
- SECURE REINFORCING, ANCHOR BOLTS, ETC. RIGIDLY IN PLACE PRIOR TO POURING CONCRETE.
- SUPPORT HORIZONTAL REINFORCING ON MORTAR BLOCKS (OR OTHER APPROVED METHOD OF SUPPORT) AT FOOTINGS.
- MAKE HOOKS A/CI STANDARD HOOKS UNLESS NOTED OTHERWISE.
- CONFORM TO AISC SPECS AND CODE OF STANDARD PRACTICES. USE AWS SPECS FOR WELDING.
- CONTRACTOR SHALL ADD NEW PIPING, VALVES, AND FLEXIBLE COUPLINGS TO WELLS 83 AND 164. FOR THE REMAINING WELLS THE DISCHARGE PIPING EXISTS BETWEEN THE WELL HEAD AND TANK.
- CONTRACTOR SHALL REMOVE THE EXISTING AIR RELEASE VALVE FROM EACH HYDROPNEUMATIC TANK. CONTRACTOR SHALL INSTALL NEW CRISPEN AR8 SERIES OR EQUAL AIR RELEASE VALVE FOR EACH HYDROPNEUMATIC TANK. SIZE OF NEW AIR RELEASE VALVE SHALL MATCH THE EXISTING VALVE. CONTRACTOR SHALL REATTACH THE EXISTING VENT TO THE NEW AIR RELEASE VALVE.



**NOTE:**

- (E) CORNER POSTS ARE 2X2 7" CHANNEL. CONTRACTOR SHALL PLACE A 3" DIAMETER ROUND GALVANIZED POST OVER THE (E) 7" CHANNEL POST AND SECURE ROUND POST VIA PLUG WELDING OR DRILLING AND GALVANIZED SCREWS. EXISTING I-BEAM TOP RAILS SHALL BE REPLACED WITH ROUND GALVANIZED RAILS. (E) GALVANIZED POSTS SHALL BE EXTENDED 24". POST EXTENSIONS SHALL BE WELDED AND COLD GALVANIZED. INSTALL NEW 3 BAND BARBED WIRE AND EXTENSIONS, 8' TALL 9 GAUGE 2X2 KNUCKLE BARBED FENCE FABRIC, AND 8' TALL GATES.

PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV.

FIELD BOOK

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

SCALE: 1" = 10'

ON ORIGINAL SCALE. DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

DRAWN BY: E. SALCEDO	DESIGNED BY: P. BARNES	CHECKED BY: D. HANSEN
DATE: MAR 2014	R.E.E. NO. E15329 DATE: MAR 2014	R.E.E. NO. E12512 DATE: MAR 2014



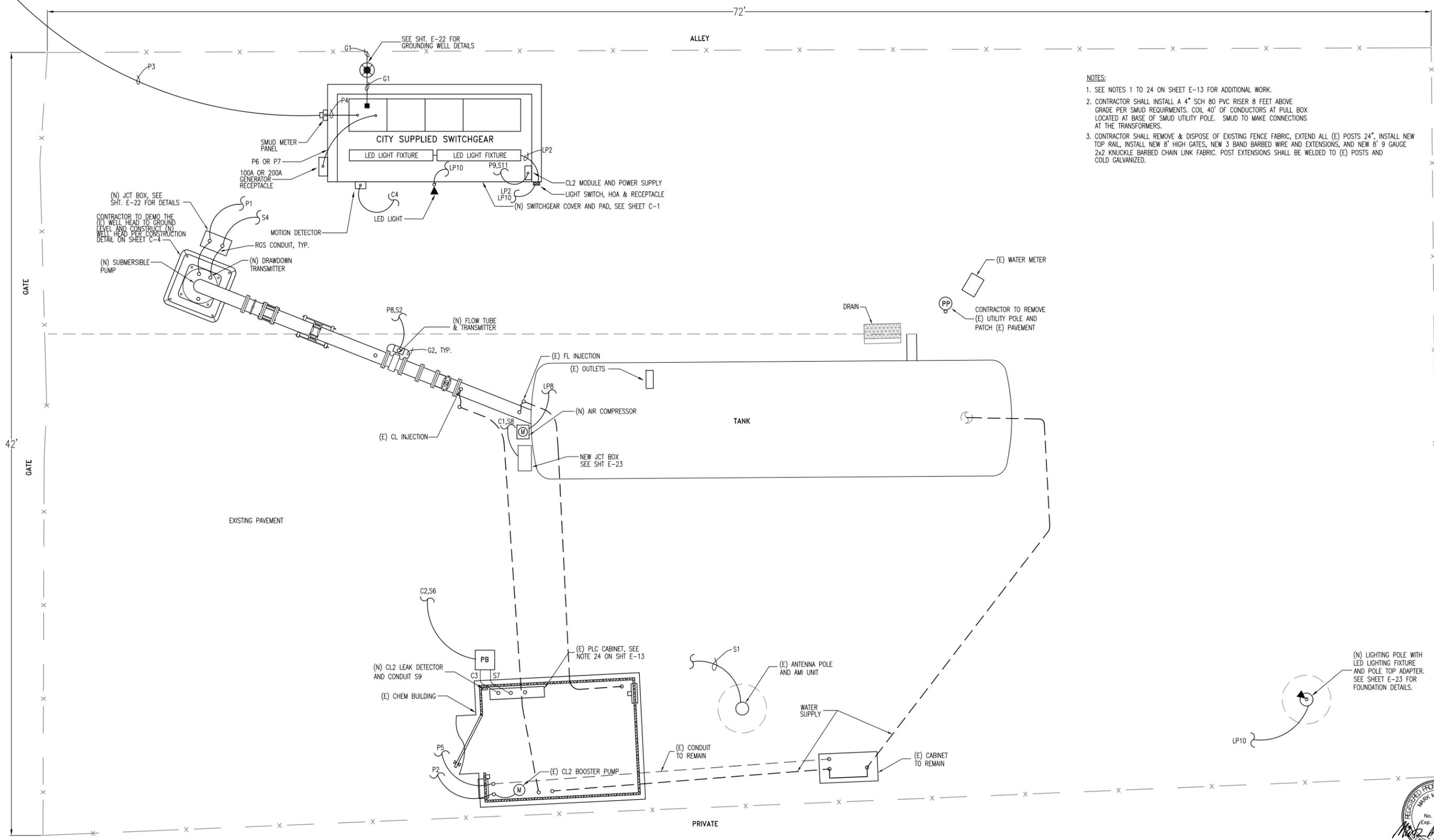
IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**WELL 83 SITE PLAN**  
**6252 WYNDHAM WAY**

GIS GRID NO. 214110104  
SHEET 230 OF 30  
DWG. NO. E-13



PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

PP (E) SMUD UTILITY POLE LOCATED AT CORNER OF NORTH AVE. AND ALLEY. SEE NOTE 2 THIS SHT.  
 PLACE 17"x30"x18" PULL BOX WITH 6" CONCRETE COLLAR AROUND PULL BOX.



- NOTES:**
- SEE NOTES 1 TO 24 ON SHEET E-13 FOR ADDITIONAL WORK.
  - CONTRACTOR SHALL INSTALL A 4" SCH 80 PVC RISER 8 FEET ABOVE GRADE PER SMUD REQUIREMENTS. COIL 40' OF CONDUCTORS AT PULL BOX LOCATED AT BASE OF SMUD UTILITY POLE. SMUD TO MAKE CONNECTIONS AT THE TRANSFORMERS.
  - CONTRACTOR SHALL REMOVE & DISPOSE OF EXISTING FENCE FABRIC, EXTEND ALL (E) POSTS 24", INSTALL NEW TOP RAIL, INSTALL NEW 8' HIGH GATES, NEW 3 BAND BARBED WIRE AND EXTENSIONS, AND NEW 8' 9 GAUGE 2x2 KNUCKLE BARBED CHAIN LINK FABRIC. POST EXTENSIONS SHALL BE WELDED TO (E) POSTS AND COLD GALVANIZED.

PRIVATE

PRIVATE



PN: Z14110104

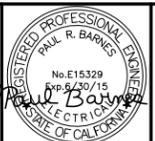
NO.	REVISIONS DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____

FIELD BOOK
SCALE: 1" = 40' KELTON WAY
V: N.A.

**CITY OF SACRAMENTO**  
**DEPARTMENT OF UTILITIES**

DRAWN BY: P. BARNES      DESIGNED BY: P. BARNES      CHECKED BY: D. HANSEN  
 DATE: MAR 2014      R.E.E. NO. 15329      DATE: MAR 2014      R.E.E. NO. E12512      DATE: MAR 2014

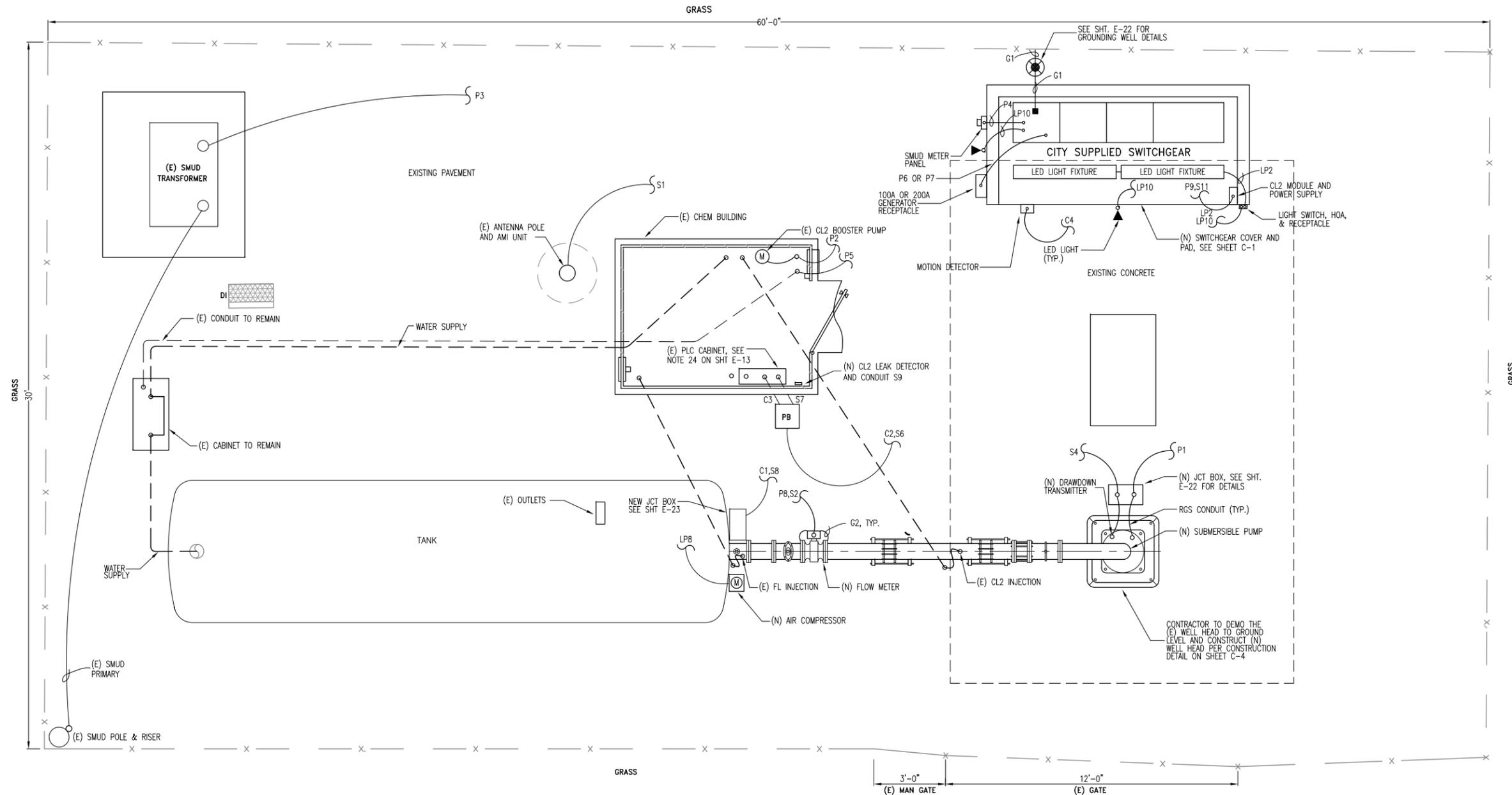


IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**WELL 131 SITE PLAN**  
**1704 NORTH AVE**

PN: Z14110104      DWG. NO. E-14      SHEET 15 OF 30

**NOTES:**

1. SEE NOTES 1 TO 24 ON SHEET E-13 FOR ADDITIONAL WORK.
2. CONTRACTOR SHALL EXTEND CONDUIT S1 INTO THE BASE OF THE ANTENNA POLE.
3. CONTRACTOR SHALL SAW CUT THE EXISTING FACILITY CONCRETE TO FACILITATE THE INSTALLATION OF THE SWITCHGEAR COVER AND CONDUITS.
4. CONTRACTOR SHALL EXTEND CONDUIT P3 INTO THE BOTTOM OF THE EXISTING SMUD TRANSFORMER. CONTRACTOR SHALL CONTACT SMUD TO REMOVE POWER FROM TRANSFORMER. SMUD TO MAKE CONNECTIONS AT THE TRANSFORMER.
5. CONTRACTOR SHALL REMOVE & DISPOSE OF EXISTING FENCE FABRIC, EXTEND ALL (E) POSTS 24", INSTALL NEW TOP RAIL, INSTALL NEW 8' HIGH GATES, NEW 3 BAND BARBED WIRE AND EXTENSIONS, AND NEW 8' 9 GAUGE 2x2 KNUCKLE BARBED CHAIN LINK FABRIC. POST EXTENSIONS SHALL BE WELDED TO (E) POSTS AND COLD GALVANIZED.



PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	
DESCRIPTION:	ELEV. _____

FIELD BOOK	
SCALE:	ON ORIGINAL SCALE, DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
H: N.A.	
V: N.A.	

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: P. BARNES	DESIGNED BY: P. BARNES	CHECKED BY: D. HANSEN
DATE: MAR 2014	R.E.E. NO. 15329 DATE: MAR 2014	R.E.E. NO. E12512 DATE: MAR 2014



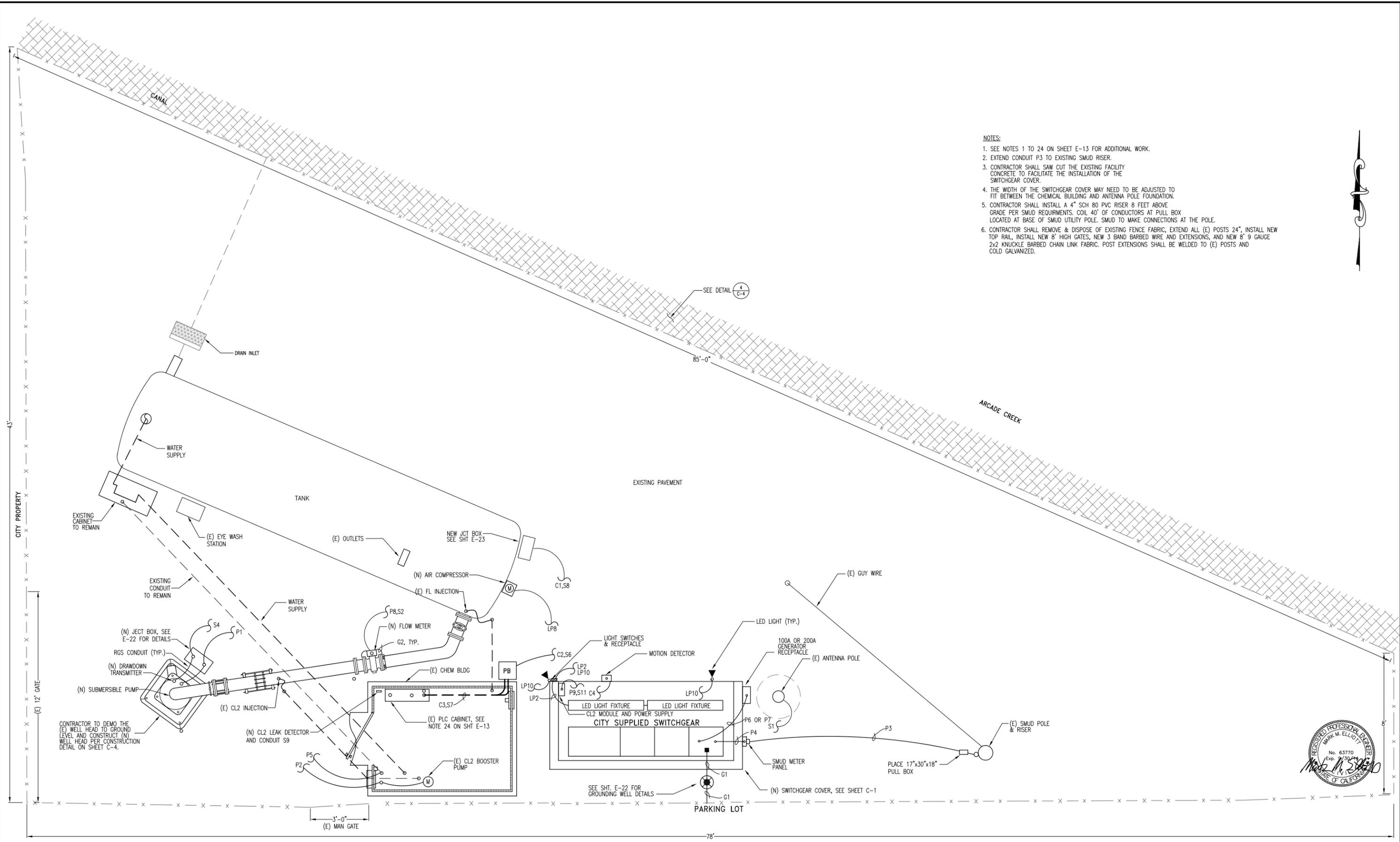
IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**WELL 137 SITE PLAN**  
**1939 LOS ROBLES BLVD**

GIS GRID NO. GOT: 214110104	DWG. NO. <b>E-15</b>
	SHEET <b>16</b> OF <b>30</b>



PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

PN: Z14110104  
 WELL REHABILITATION PROJECT PHASE II  
 S:\Electrical Drawings\Well Rehab Phase 2



- NOTES:**
- SEE NOTES 1 TO 24 ON SHEET E-13 FOR ADDITIONAL WORK.
  - EXTEND CONDUIT P3 TO EXISTING SMUD RISER.
  - CONTRACTOR SHALL SAW CUT THE EXISTING FACILITY CONCRETE TO FACILITATE THE INSTALLATION OF THE SWITCHGEAR COVER.
  - THE WIDTH OF THE SWITCHGEAR COVER MAY NEED TO BE ADJUSTED TO FIT BETWEEN THE CHEMICAL BUILDING AND ANTENNA POLE FOUNDATION.
  - CONTRACTOR SHALL INSTALL A 4" SCH 80 PVC RISER 8 FEET ABOVE GRADE PER SMUD REQUIREMENTS. COIL 40' OF CONDUCTORS AT PULL BOX LOCATED AT BASE OF SMUD UTILITY POLE. SMUD TO MAKE CONNECTIONS AT THE POLE.
  - CONTRACTOR SHALL REMOVE & DISPOSE OF EXISTING FENCE FABRIC, EXTEND ALL (E) POSTS 24", INSTALL NEW TOP RAIL, INSTALL NEW 8' HIGH GATES, NEW 3 BAND BARBED WIRE AND EXTENSIONS, AND NEW 8' 9 GAUGE 2x2 KNUCKLE BARBED CHAIN LINK FABRIC. POST EXTENSIONS SHALL BE WELDED TO (E) POSTS AND COLD GALVANIZED.



PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV.
DESCRIPTION:	

FIELD BOOK
SCALE: 1" = 10'
H: N.A.
V: N.A.

**CITY OF SACRAMENTO**  
**DEPARTMENT OF UTILITIES**

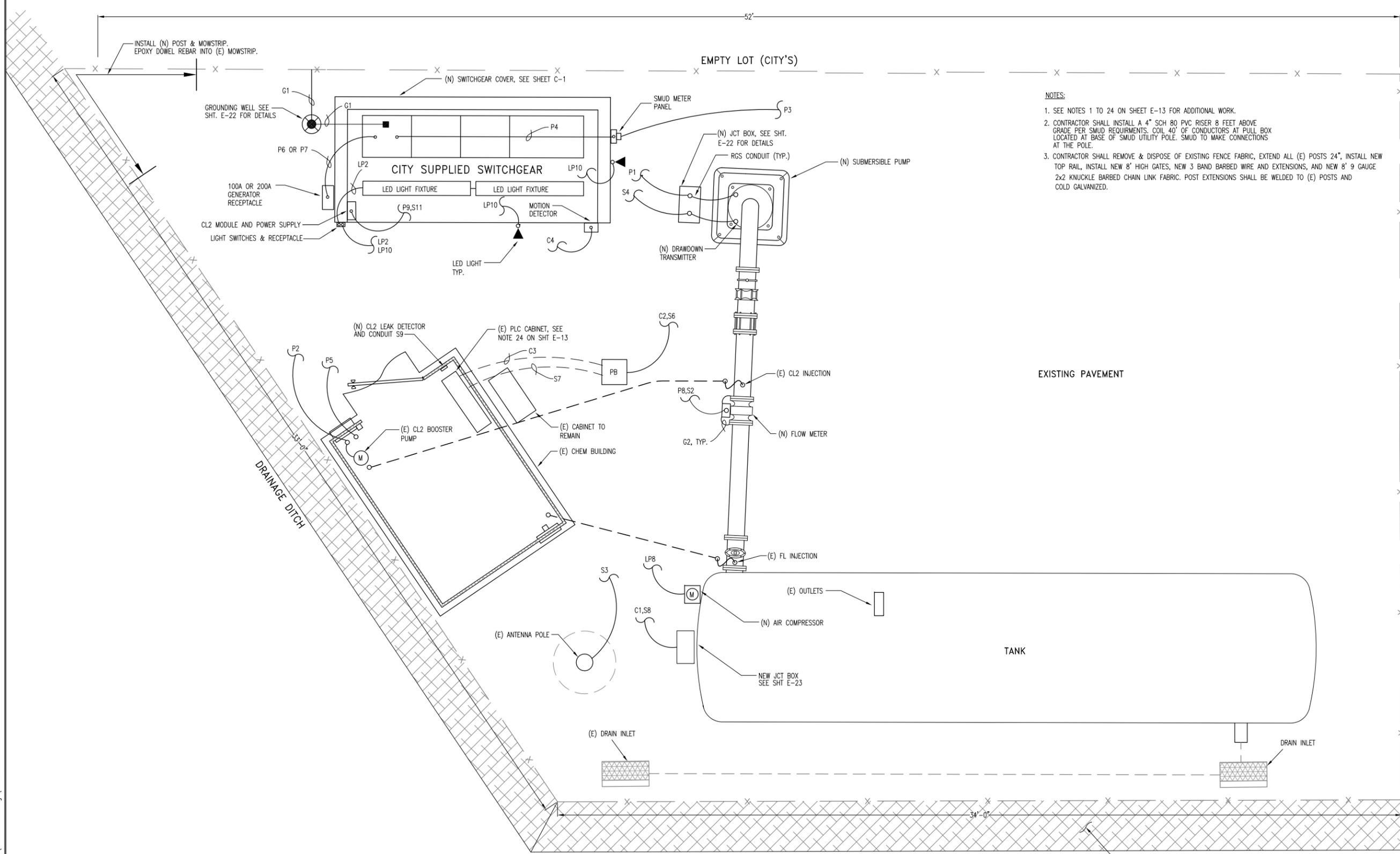
ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

DRAWN BY: E. SALCEDO	DESIGNED BY: P. BARNES	CHECKED BY: D. HANSEN
DATE: MAR 2014	R.E.E. NO. E15329 DATE: MAR 2014	R.E.E. NO. E12512 DATE: MAR 2014

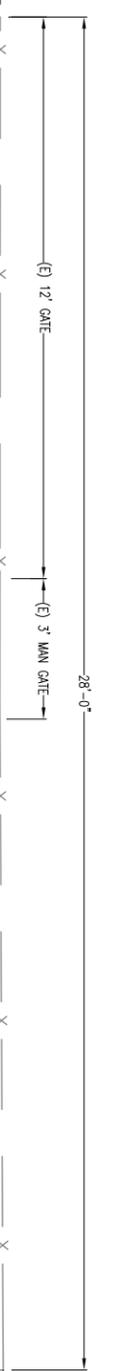


IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**WELL 143 SITE PLAN**  
**3001 RIO LINDA BLVD**

GS GRID NO. 214110104  
 DWG. NO. E-16  
 SHEET 17 OF 30  
 OF 30



- NOTES:**
1. SEE NOTES 1 TO 24 ON SHEET E-13 FOR ADDITIONAL WORK.
  2. CONTRACTOR SHALL INSTALL A 4" SCH 80 PVC RISER 8 FEET ABOVE GRADE PER SMUD REQUIREMENTS. COIL 40' OF CONDUCTORS AT PULL BOX LOCATED AT BASE OF SMUD UTILITY POLE. SMUD TO MAKE CONNECTIONS AT THE POLE.
  3. CONTRACTOR SHALL REMOVE & DISPOSE OF EXISTING FENCE FABRIC, EXTEND ALL (E) POSTS 24", INSTALL NEW TOP RAIL, INSTALL NEW 8' HIGH GATES, NEW 3 BAND BARBED WIRE AND EXTENSIONS, AND NEW 8' 9 GAUGE 2x2 KNUCKLE BARBED CHAIN LINK FABRIC. POST EXTENSIONS SHALL BE WELDED TO (E) POSTS AND COLD GALVANIZED.



PLACE 17"x30"x18" PULL BOX WITH 6" CONCRETE COLLAR AROUND PULL BOX

(E) SMUD POLE



PN: Z14110104

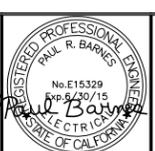
REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV.
DESCRIPTION:	

FIELD BOOK
SCALE: 1" = 30'
H: N.A.
V: N.A.

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

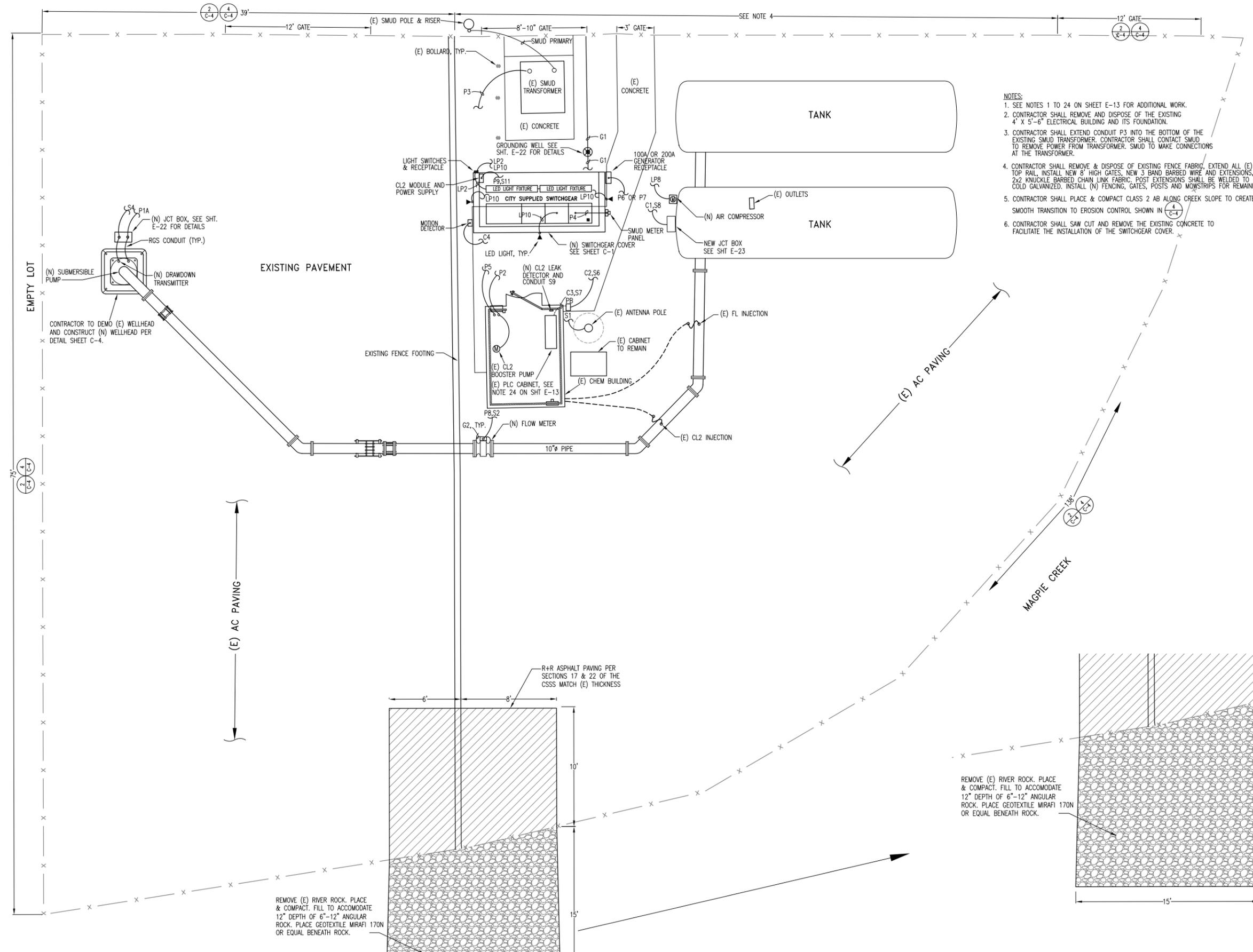
DRAWN BY: P. BARNES    DESIGNED BY: P. BARNES    CHECKED BY: D. HANSEN  
DATE: MAR 2014    R.E.E. NO. 15329    DATE: MAR 2014    R.E.E. NO. E12512    DATE: MAR 2014



IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**WELL 144 SITE PLAN**  
**1715 ELDRIDGE AVE**

GIS GRID NO. 214510104  
DWG. NO. E-17  
SHEET 18 OF 30  
PN: Z14110104

PN: Z14110104  
 WELL REHABILITATION PROJECT PHASE II  
 S:\Electrical Drawings\Well Rehab Phase 2



- NOTES:**
- SEE NOTES 1 TO 24 ON SHEET E-13 FOR ADDITIONAL WORK.
  - CONTRACTOR SHALL REMOVE AND DISPOSE OF THE EXISTING 4" X 5-6" ELECTRICAL BUILDING AND ITS FOUNDATION.
  - CONTRACTOR SHALL EXTEND CONDUIT P3 INTO THE BOTTOM OF THE EXISTING SMUD TRANSFORMER. CONTRACTOR SHALL CONTACT SMUD TO REMOVE POWER FROM TRANSFORMER. SMUD TO MAKE CONNECTIONS AT THE TRANSFORMER.
  - CONTRACTOR SHALL REMOVE & DISPOSE OF EXISTING FENCE FABRIC. EXTEND ALL (E) POSTS 24". INSTALL NEW TOP RAIL. INSTALL NEW 8' HIGH GATES, NEW 3 BAND BARBED WIRE AND EXTENSIONS, AND NEW 8' 9 GAUGE 2x2 KNUCKLE BARBED CHAIN LINK FABRIC. POST EXTENSIONS SHALL BE WELDED TO (E) POSTS AND COLD GALVANIZED. INSTALL (N) FENCING, GATES, POSTS AND MOWSTRIPS FOR REMAINING SITE PERIMETER.
  - CONTRACTOR SHALL PLACE & COMPACT CLASS 2 AB ALONG CREEK SLOPE TO CREATE SMOOTH TRANSITION TO EROSION CONTROL SHOWN IN C-4
  - CONTRACTOR SHALL SAW CUT AND REMOVE THE EXISTING CONCRETE TO FACILITATE THE INSTALLATION OF THE SWITCHGEAR COVER.

REMOVE (E) RIVER ROCK. PLACE & COMPACT. FILL TO ACCOMMODATE 12" DEPTH OF 6"-12" ANGULAR ROCK. PLACE GEOTEXTILE, MIRAFI 170N OR EQUAL BENEATH ROCK.

REMOVE (E) RIVER ROCK. PLACE & COMPACT. FILL TO ACCOMMODATE 12" DEPTH OF 6"-12" ANGULAR ROCK. PLACE GEOTEXTILE, MIRAFI 170N OR EQUAL BENEATH ROCK.



REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV.

FIELD BOOK	
SCALE:	ON ORIGINAL SCALE. DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
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V:	NA.

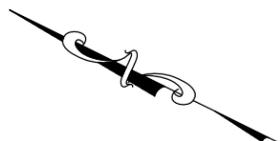
**CITY OF SACRAMENTO**  
**DEPARTMENT OF UTILITIES**

DRAWN BY: P. BARNES      DESIGNED BY: P. BARNES      CHECKED BY: D. HANSEN  
 DATE: MAR 2014      R.E.E. NO. 15329      DATE: MAR 2014      R.E.E. NO. E12512      DATE: MAR 2014



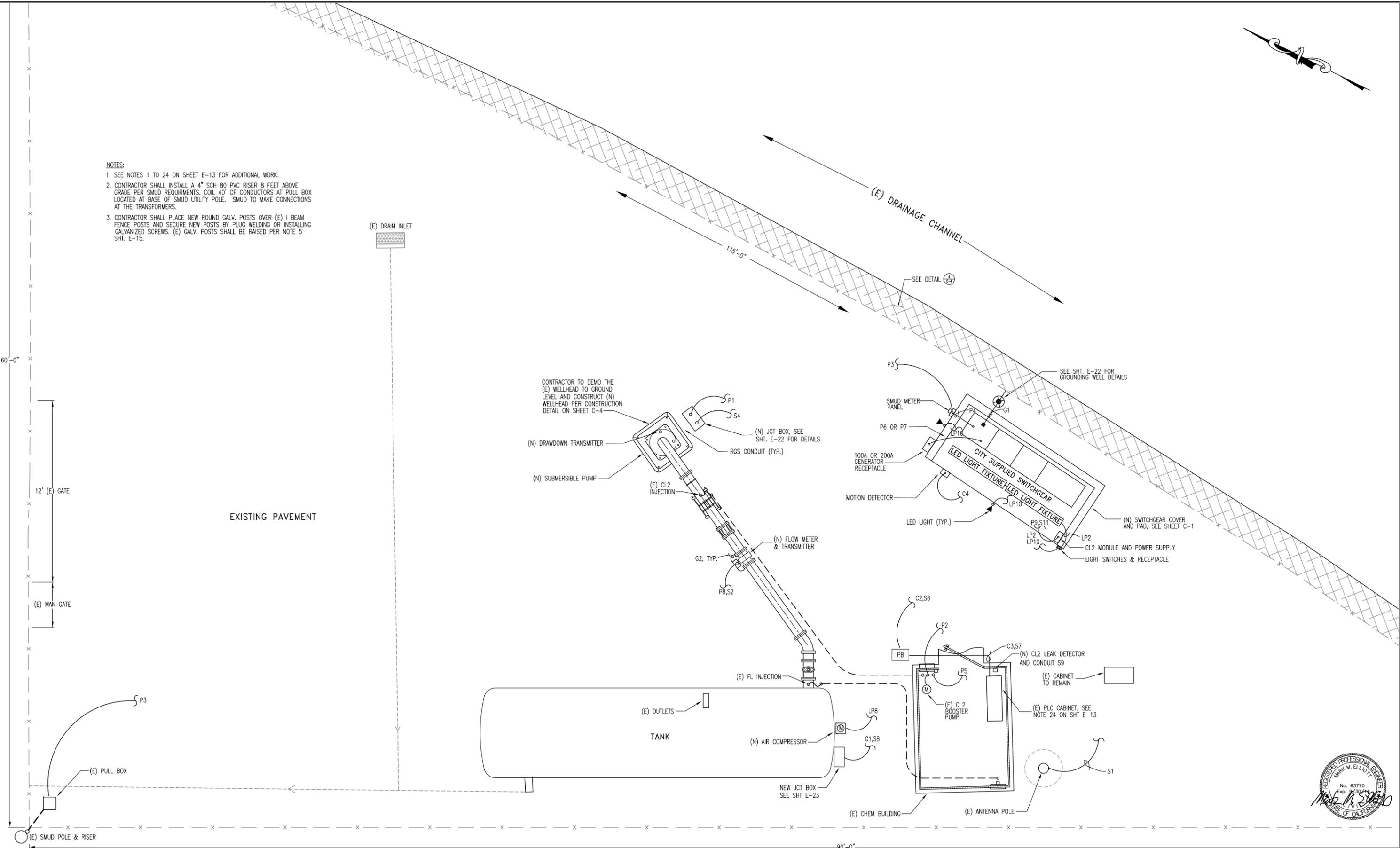
IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**WELL 153A SITE PLAN**  
**742 MAIN AVENUE**

GIS GRID NO. GOT: 2145  
 PN: Z14110104  
 DWG. NO. **E-18**  
 SHEET **19** OF **30**



**NOTES:**

1. SEE NOTES 1 TO 24 ON SHEET E-13 FOR ADDITIONAL WORK.
2. CONTRACTOR SHALL INSTALL A 4" SCH 80 PVC RISER 8 FEET ABOVE GRADE PER SMUD REQUIREMENTS. COIL 40' OF CONDUCTORS AT PULL BOX LOCATED AT BASE OF SMUD UTILITY POLE. SMUD TO MAKE CONNECTIONS AT THE TRANSFORMERS.
3. CONTRACTOR SHALL PLACE NEW ROUND GALV. POSTS OVER (E) I BEAM FENCE POSTS AND SECURE NEW POSTS BY PLUG WELDING OR INSTALLING GALVANIZED SCREWS. (E) GALV. POSTS SHALL BE RAISED PER NOTE 5 SHT. E-15.



PN: Z14110104  
 WELL REHABILITATION PROJECT PHASE II  
 S:\Electrical Drawings\Well Rehab Phase 2

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV.
DESCRIPTION:	

FIELD BOOK	
SCALE:	ON ORIGINAL SCALE, DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
H: NA.	
V: NA.	

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: P. BARNES      DESIGNED BY: P. BARNES      CHECKED BY: D. HANSEN  
 DATE: MAR 2014      R.E.E. NO. 15329      DATE: MAR 2014      R.E.E. NO. E12512      DATE: MAR 2014



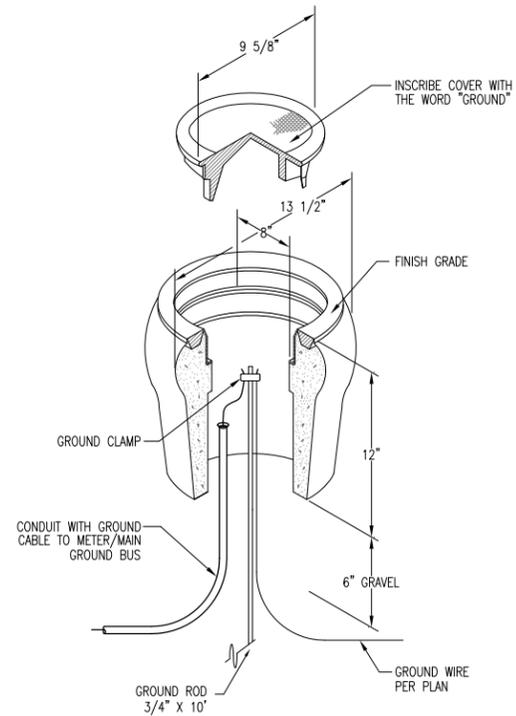
IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**WELL 155 SITE PLAN**  
**2320 ROANOKE AVE**

DWG. NO. **E-19**  
 SHEET **25** OF **230**  
 OF **30**

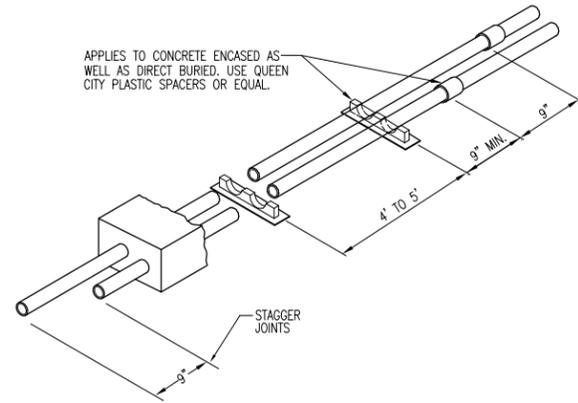
REGISTERED PROFESSIONAL ENGINEER  
 MARK M. ELLIOTT  
 No. 63770  
 Exp. 7/30/14  
 State of California



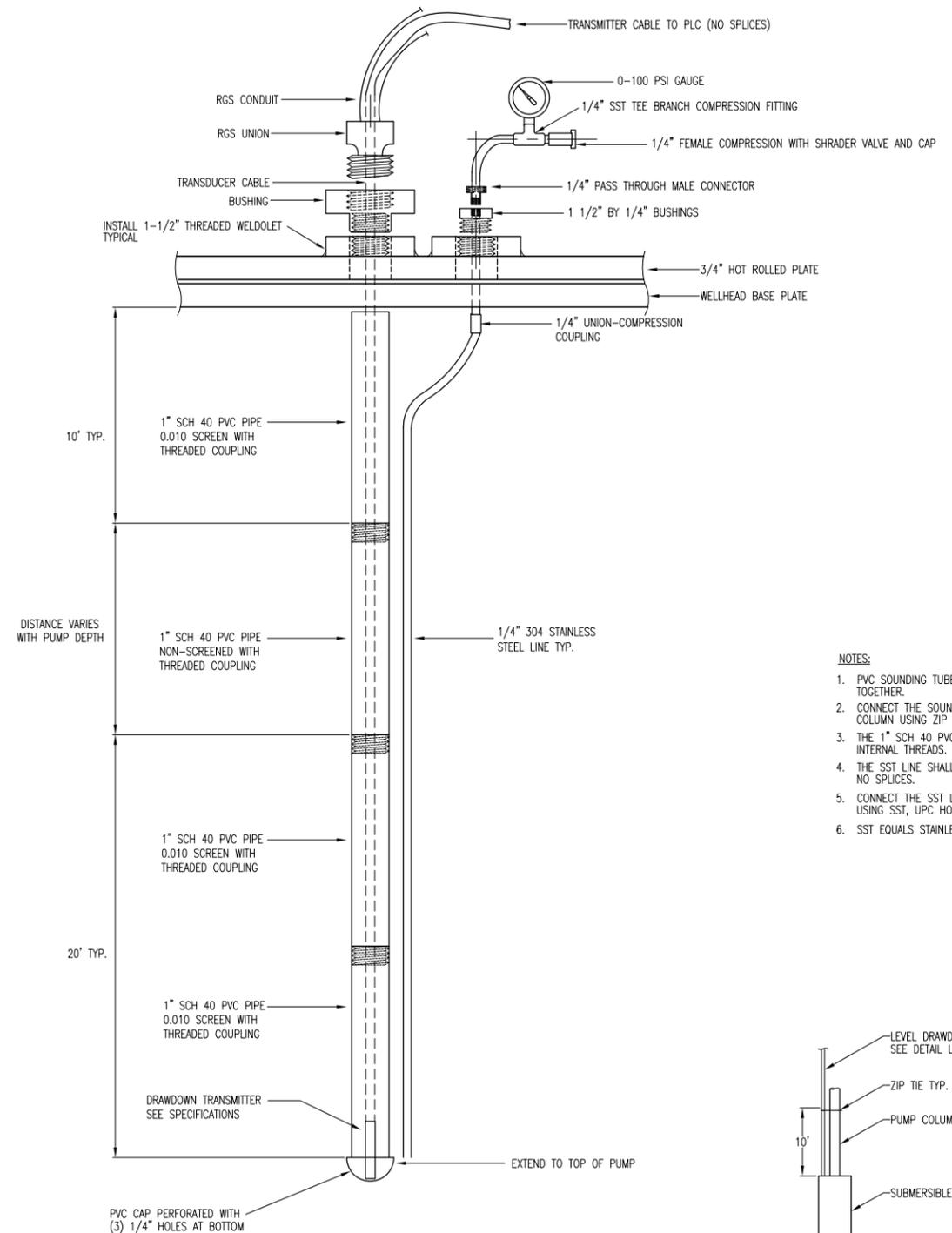




**GROUND WELL  
INSTALLATION  
DETAIL**

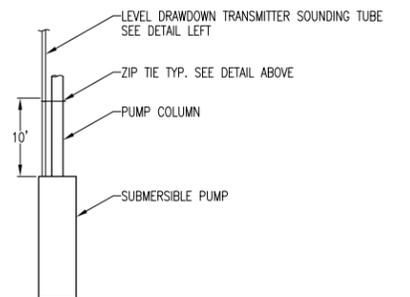


**SPACERS AND JOINTS  
INSTALLATION  
DETAIL**

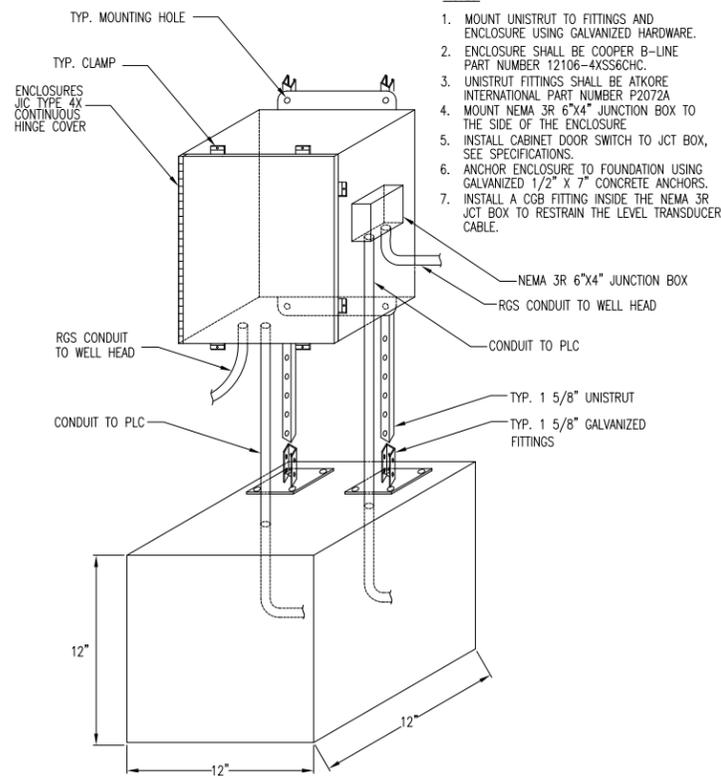


**SOUNDING TUBE FOR DRAWDOWN TRANSMITTER  
DETAIL**

- NOTES:
1. PVC SOUNDING TUBE SHALL BE THREADED TOGETHER.
  2. CONNECT THE SOUNDING TUBE TO THE PUMP COLUMN USING ZIP TIES, EVERY 5 FEET.
  3. THE 1" SCH 40 PVC PIPE SHALL HAVE INTERNAL THREADS.
  4. THE SST LINE SHALL BE ONE PIECE WITH NO SPLICES.
  5. CONNECT THE SST LINE TO THE SOUNDING TUBE USING SST, UPC HOSE CLAMP, EVERY 5 FEET.
  6. SST EQUALS STAINLESS STEEL.

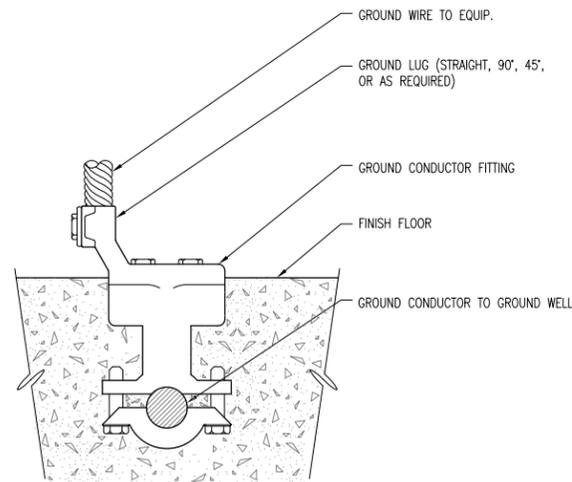


**ELEVATION**



**WELLHEAD JUNCTION BOX  
DETAIL**

- NOTES:
1. MOUNT UNISTRUT TO FITTINGS AND ENCLOSURE USING GALVANIZED HARDWARE.
  2. ENCLOSURE SHALL BE COOPER B-LINE PART NUMBER 12106-4XSS6CHC.
  3. UNISTRUT FITTINGS SHALL BE ATKORE INTERNATIONAL PART NUMBER P2072A
  4. MOUNT NEMA 3R 6\"/>



**GROUNDING INSERT  
DETAIL**

NOTE:  
BOLTS SHALL BE INSERTED IN BOLT HOLES BEFORE CONNECTOR IS EMBEDDED.

WELL REHABILITATION PROJECT PHASE II  
S:\Electrical Drawings\Well Rehab Phase 2

PN: Z14110104

NO.	REVISIONS	DATE	BY

BENCH MARK	ELEV.

FIELD BOOK

<b>CITY OF SACRAMENTO DEPARTMENT OF UTILITIES</b>			
SCALE: 1" = 1'	ON ORIGINAL SCALE DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"	DRAWN BY: E. SALCEDO DATE: MAR 2014	DESIGNED BY: P. BARNES R.E.E. NO. E15329 DATE: MAR 2014
CHECKED BY: D. HANSEN R.E.E. NO. E12512 DATE: MAR 2014		REGISTERED PROFESSIONAL ENGINEER PAUL R. BARNES No. E15329 Exp. 6/30/15 ELECTRICAL STATE OF CALIFORNIA	



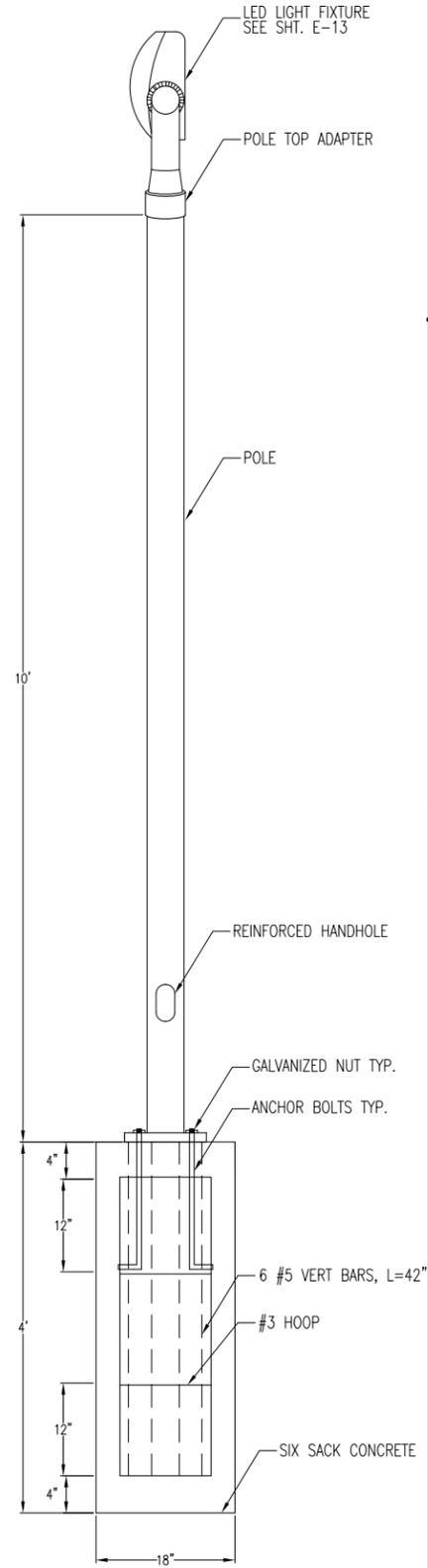
IMPROVEMENT PLANS FOR: <b>WELL REHABILITATION PROJECT PHASE 2A</b>		DWG. NO. <b>E-22</b>
<b>ELECTRICAL STANDARD DETAILS</b>		SHEET <b>23</b> OF <b>30</b>
GS GRID NO. <b>22510104</b>	PN: Z14110104	OF 30

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II

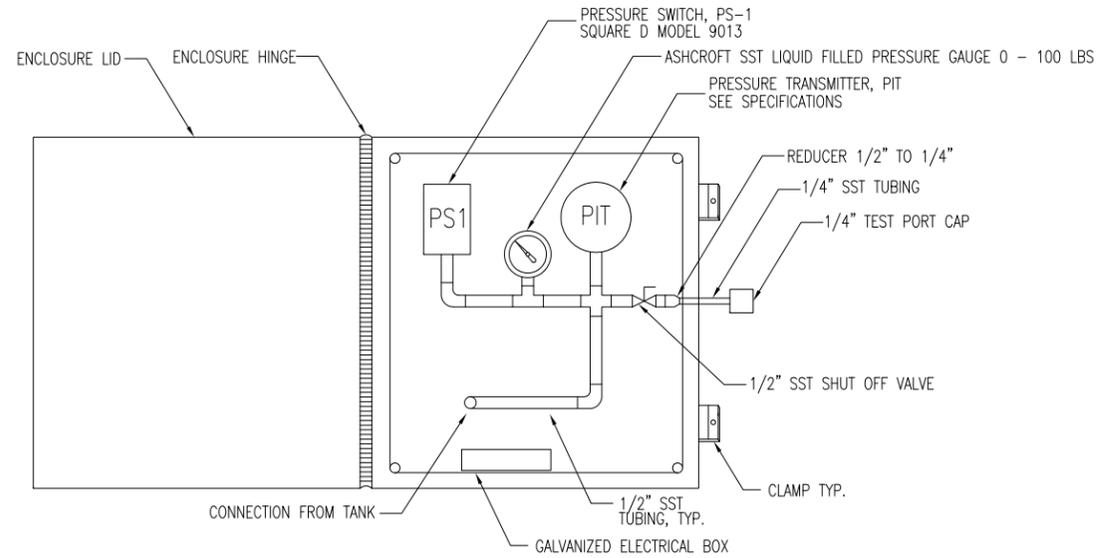
WELL REHABILITATION PROJECT PHASE II  
S:\Electrical Drawings\Well Rehab Phase 2

PN: Z14110104

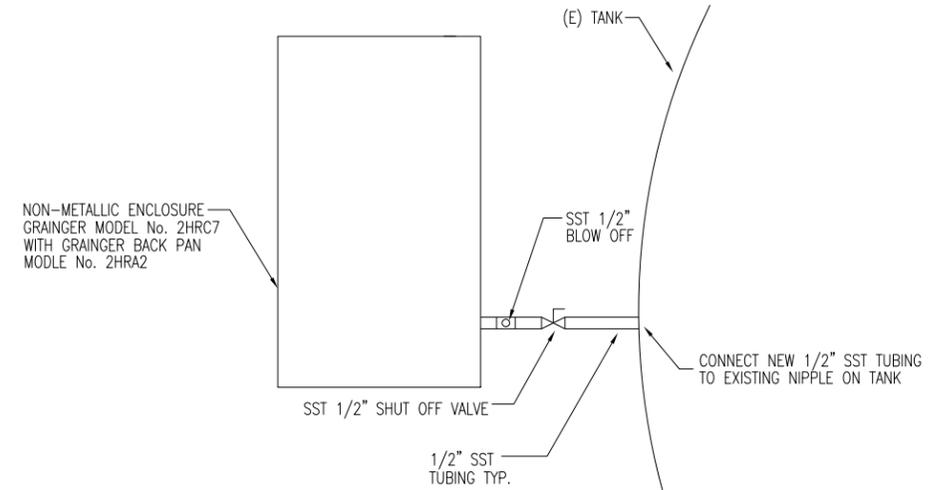
NOTES:  
1. CONTRACTOR SHALL PROVIDE ANCHOR BOLTS.



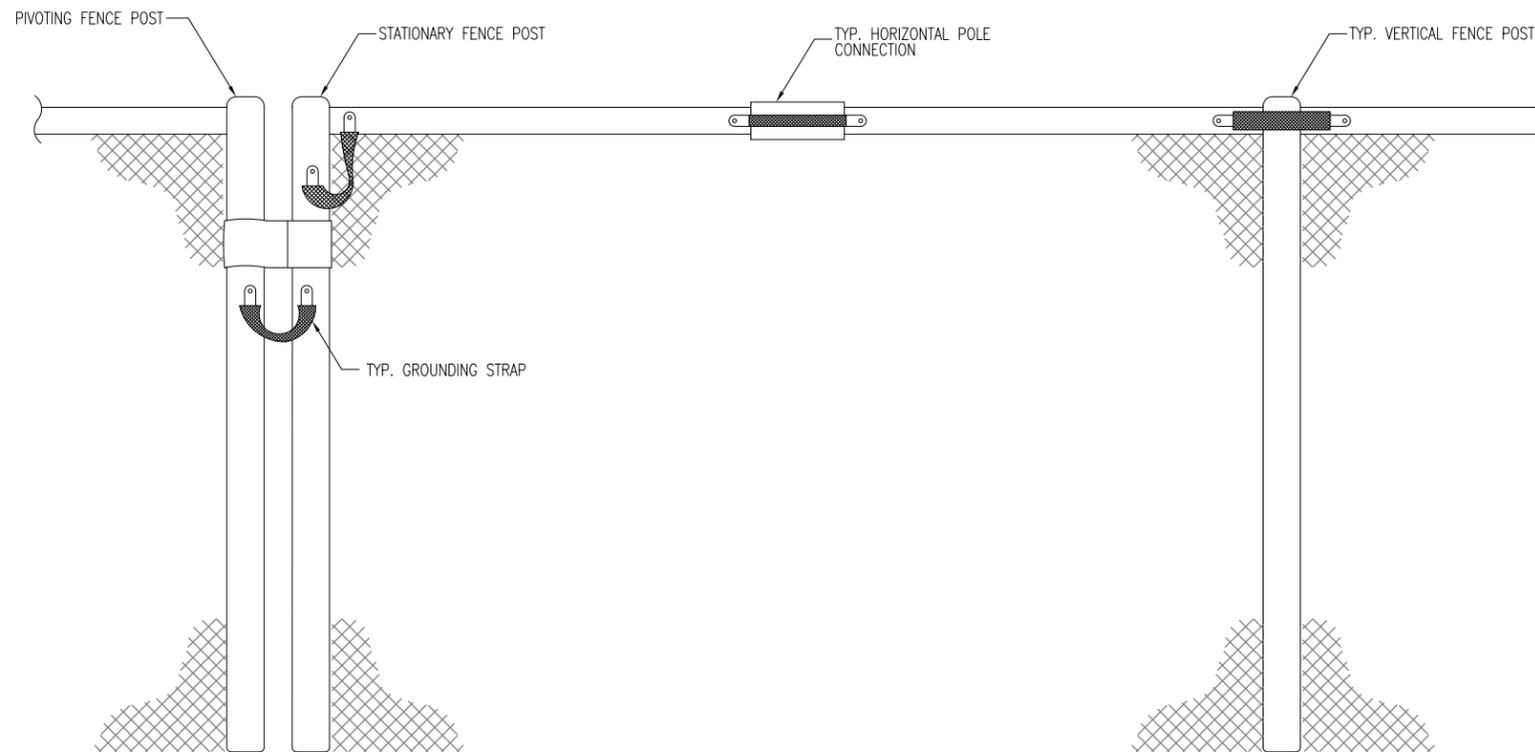
LIGHT POLE FOUNDATION  
BASE DETAIL



NEMA 4X NONMETALIC  
ENCLOSURE DETAIL



NOTES:  
1. PAINT ENCLOSURE TO MATCH EXISTING TANK  
2. SST = STAINLESS STEEL  
3. CONTRACTOR SHALL ATTACH THE PRESSURE SWITCH, PRESSURE TRANSDUCER AND TUBING TO THE BACK PAN USING STAINLESS STEEL BRACKETS AND HARDWARE.  
4. CONTRACTOR SHALL SEAL ALL OPENINGS IN THE ENCLOSURE USING COMPRESSION SEAL FITTINGS AND/OR CONDUIT SEAL FITTINGS.  
5. CONTRACTOR SHALL WELD NEW STEEL BRACKETS TO THE TANK AND CONNECT TO THE ENCLOSURE. PAINT BRACKETS TO MATCH TANK.



FENCE GROUNDING  
DETAIL

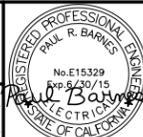
NOTES:  
1. CONTRACTOR SHALL PROVIDE A GROUND STRAP AT EVERY VERTICAL FENCE POST.  
2. CONTRACTOR SHALL PROVIDE A GROUND STRAP AT EVERY HORIZONTAL POLE CONNECTION AND VERTICAL COUPLING.

NO.	REVISIONS DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV.

FIELD BOOK
SCALE: 1" = 1'
H: N.A.
V: N.A.

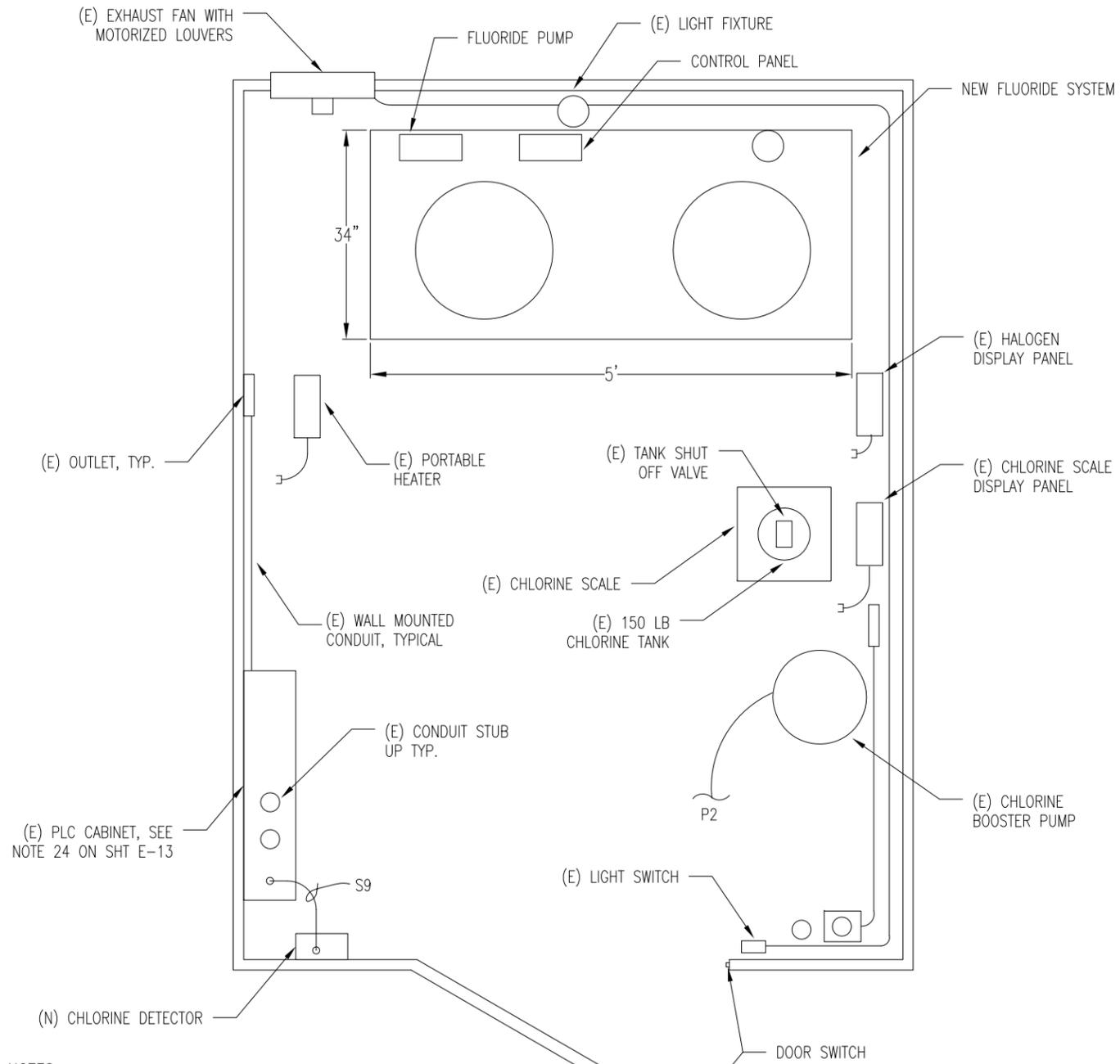
<b>CITY OF SACRAMENTO</b> DEPARTMENT OF UTILITIES			
DRAWN BY: E. SALCEDO	DESIGNED BY: P. BARNES	CHECKED BY: D. HANSEN	DATE: MAR 2014
R.E.E. NO. E15329	DATE: MAR 2014	R.E.E. NO. E12512	DATE: MAR 2014



IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**  
**ELECTRICAL STANDARD DETAILS**

GS GRID NO. 22410104  
DWG. NO. **E-23**  
SHEET **24** OF **30**

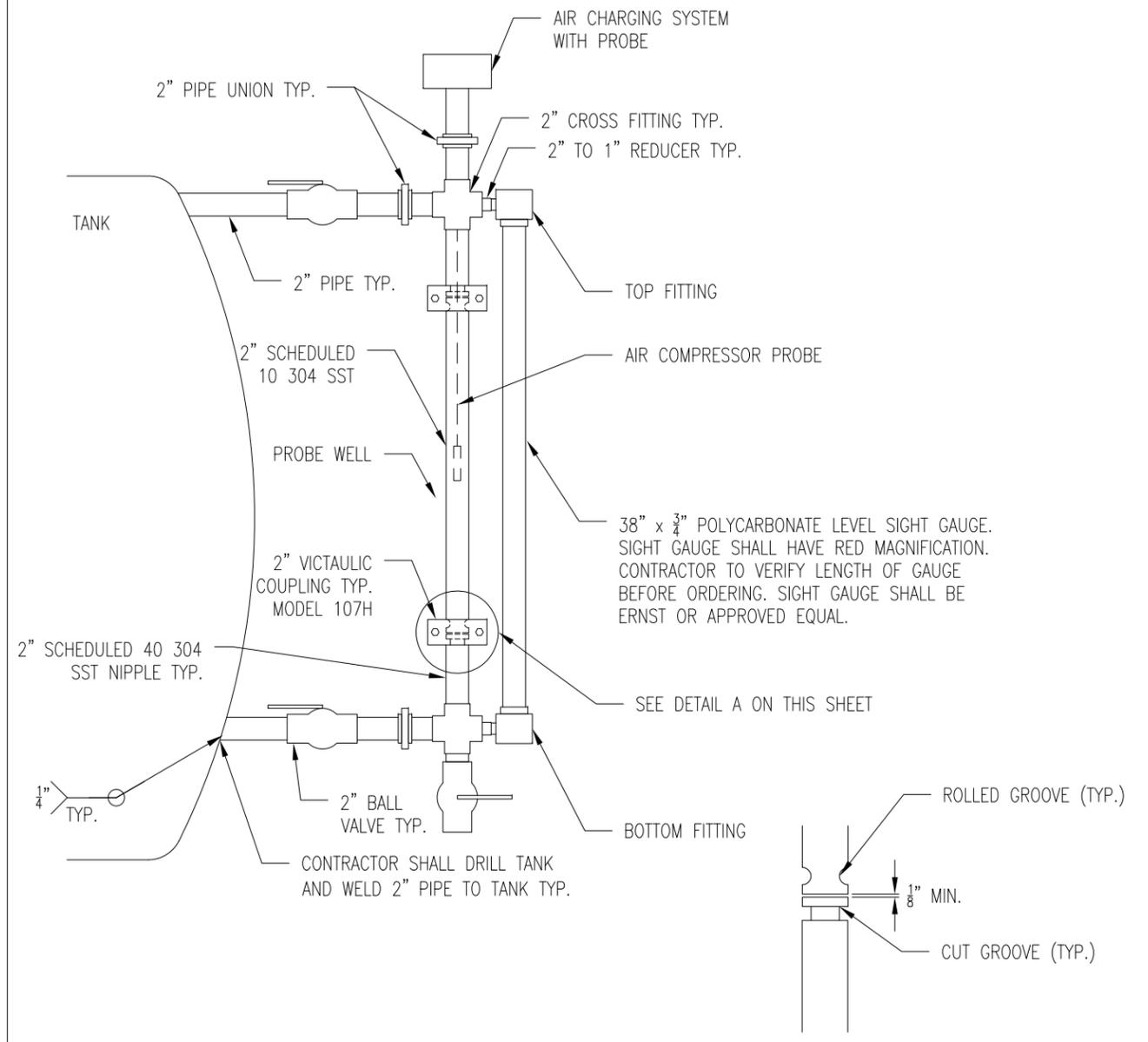
PN: Z14110104 WELL REHABILITATION PROJECT PHASE II



- NOTES:
1. CONTRACTOR SHALL RELOCATE ELECTRICAL CONDUITS, JUNCTION BOXES, OUTLETS, EXHAUST FAN, WATER SOFTENER BRACKET AND (E) CHLORINE SYSTEM TO ACCOMMODATE THE (N) FLUORIDE SYSTEM.
  2. CONTRACTOR SHALL DEMO (E) FLUORIDE SYSTEM.

CHEMICAL BUILDING EQUIPMENT  
TYPICAL LAYOUT

- NOTES:
1. ALL PIPE SHALL BE GALVANIZED STEEL PIPE, UNLESS OTHERWISE NOTED.
  2. SST = STAINLESS STEEL
  3. PLACE FOAM PIPE INSULATION OVER LEVEL SIGHT GAUGE.
  4. CONTRACTOR SHALL MOUNT THE COMPRESSOR PROBE 12" ABOVE THE CENTERLINE OF THE HYDROPNEUMATIC TANK.



DETAIL A

HYDROPNEUMATIC SYSTEM  
DETAIL

PN: Z14110104

NO.	REVISIONS DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____

FIELD BOOK
SCALE: _____
H: N.A.
V: N.A.

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: E. SALCEDO    DESIGNED BY: P. BARNES    CHECKED BY: D. HANSEN  
DATE: MAR 2014    R.E.E. NO. E15329    DATE: MAR 2014    R.E.E. NO. E12512    DATE: MAR 2014

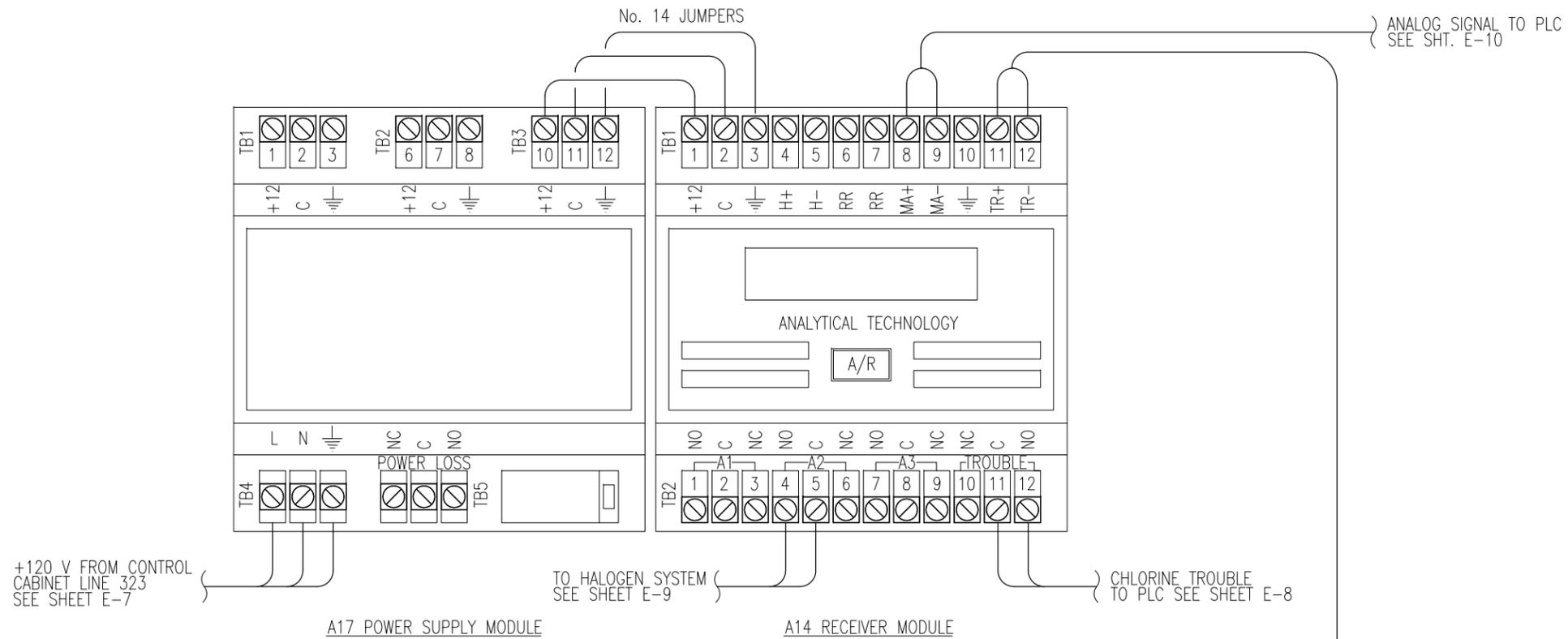


IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

**ELECTRICAL STANDARD DETAILS**

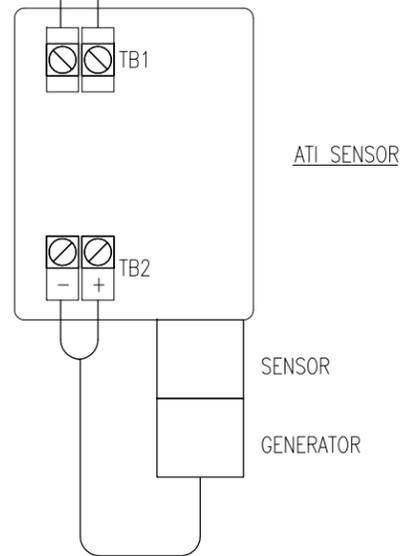
DWG. NO. **F-24**  
SHEET **25** OF **30**  
PN: Z14110104

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II



**NOTES:**

1. CONTRACTOR SHALL CONNECT THE POWER SUPPLY MODULE TO THE RECEIVER MODULE AS SHOWN.
2. CONTRACTOR SHALL INSTALL A No. 16 PAIR UNSHIELDED CABLE BETWEEN THE RECEIVER MODULE AND THE SENSOR..



PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____

FIELD BOOK	SCALE: _____
H: N.A.	
V: N.A.	

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: E. SALCEDO      DESIGNED BY: P. BARNES      CHECKED BY: D. HANSEN  
 DATE: MAR 2014      R.E.E. NO. E15329      DATE: MAR 2014      R.E.E. NO. E12512      DATE: MAR 2014

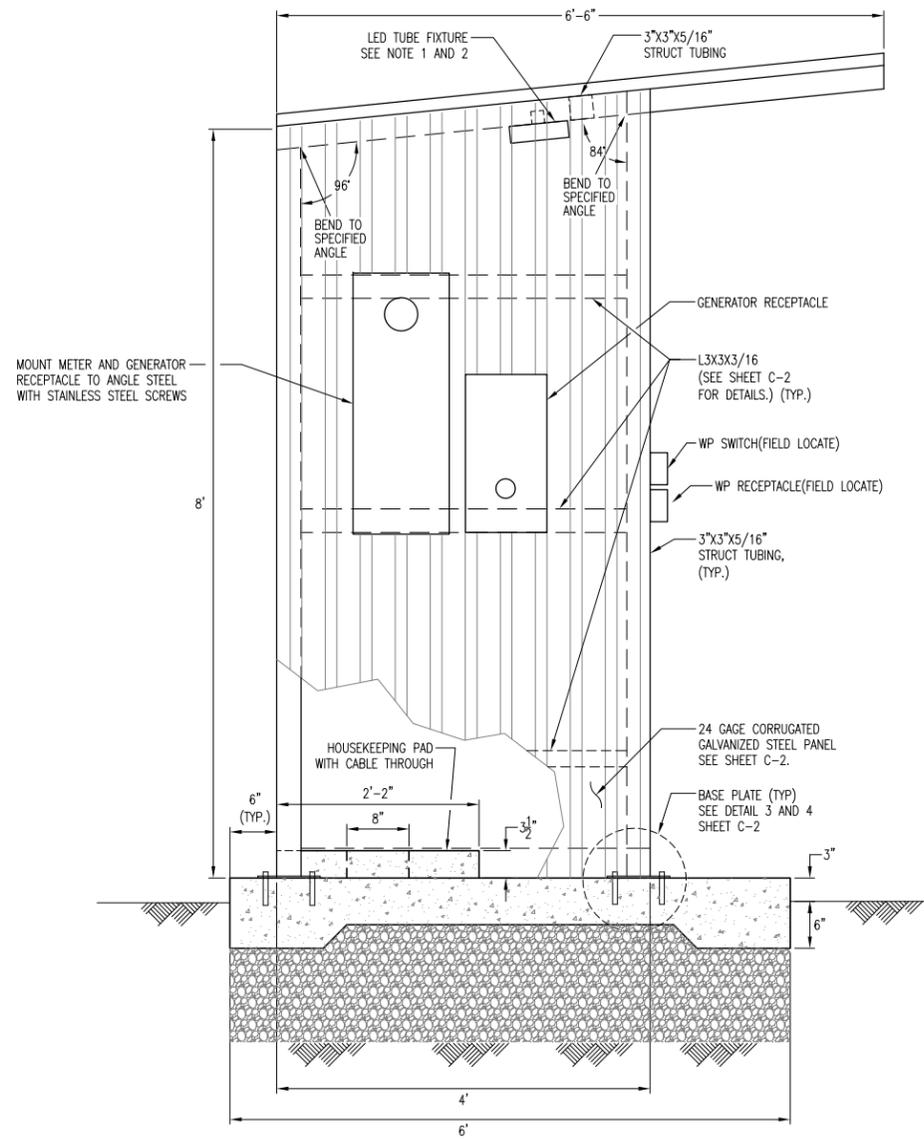


IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

**CHLORINE DETECTOR WIRING DIAGRAM**

DWG. NO. **F-25**  
SHEET **26** OF **30**

PN: Z14110104



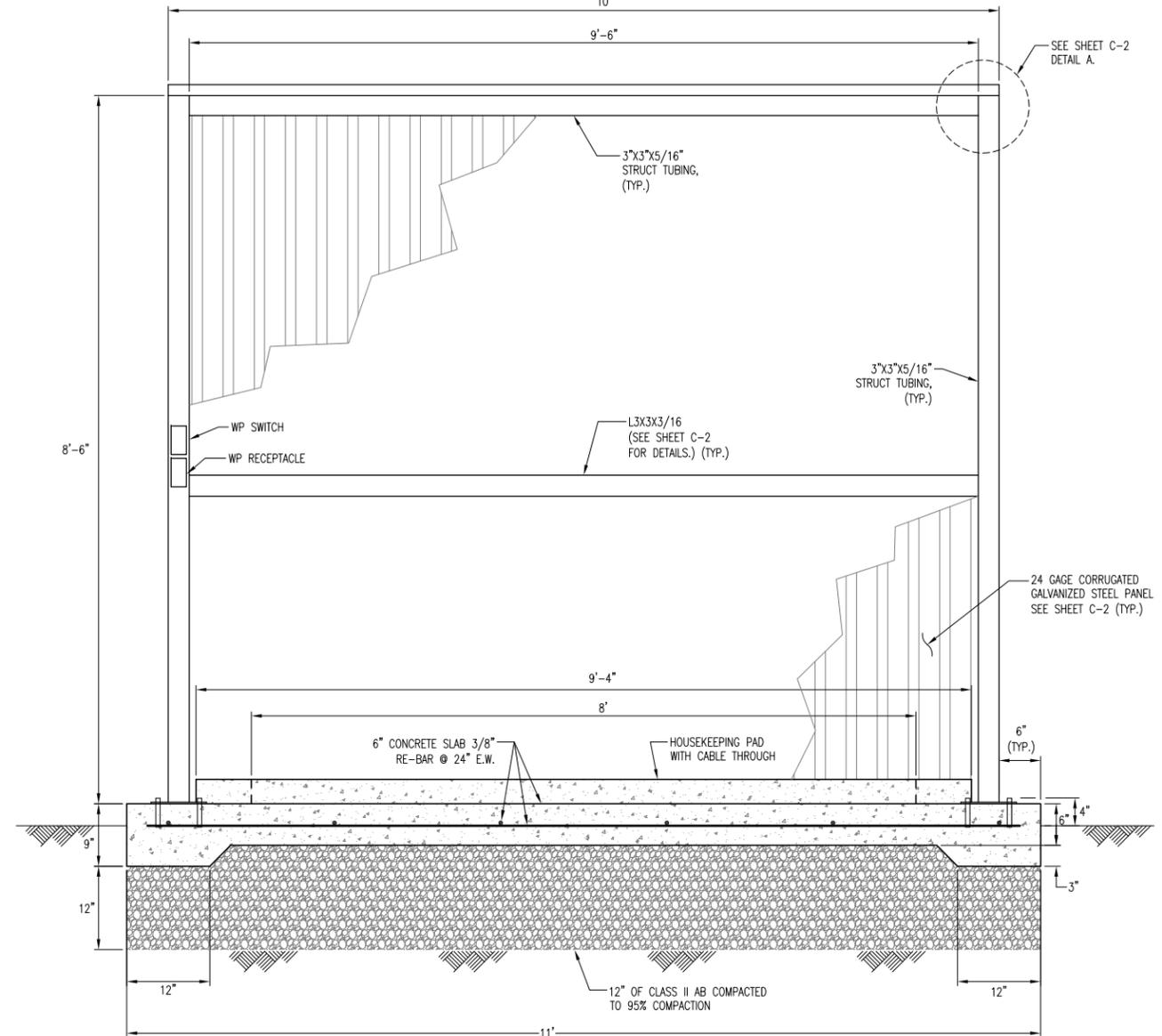
NOTES:

1. MOUNT A 10" PIECE OF 1-5/8" X 1-5/8" SLOTTED GALVANIZED STEEL UNISTRUT ABOVE AND IN FRONT OF SWITCHGEAR, BETWEEN STRUCTURE TUBING. USE A 1-3/4" X 1-3/4" "L" BRACKET AT EACH END OF UNISTRUT TO MOUNT TO STRUCTURE TUBING.
2. MOUNT LIGHT FIXTURE TO UNISTRUT USING CHANNEL NUTS.
3. CONTRACTOR TO INSTALL LED LIGHTING FIXTURE, RECEPTACLE, AND OUTDOOR SWITCH FOR THE SWITCHGEAR COVER LIGHTS.
4. SEE SHEETS C-2 AND C-3 FOR ADDITIONAL DETAILS.

1  
C-1

SIDE ELEVATION

SCALE: 1"=1'-0"



NOTES:

1. ALL SIDE PANELS SHALL BE POWDER COATED. COLOR TO BE SELECTED BY THE ENGINEER.
2. ALL STEEL SHALL BE HOT DIPPED GALVANIZED.
3. ATTACH CORRUGATED PANELS PER MANUFACTURERS RECOMMENDATION.
4. ALL MOUNTING HARDWARE SHALL BE STAINLESS STEEL.
5. CONTRACTOR SHALL REMOVE EXISTING CONCRETE OR PAVEMENT TO FACILITATE INSTALLATION OF FOUNDATIONS.
6. SEE ELECTRICAL SITE PLANS FOR EXACT LOCATION OF WP SWITCH AND RECEPTACLE.

2  
C-1

FRONT ELEVATION

SCALE: 1"=1'-0"

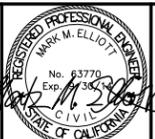
REVISIONS				BENCH MARK DESCRIPTION:	ELEV. _____	FIELD BOOK
NO.	DESCRIPTION	DATE	BY			

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

SCALE: 1" = 1'-0"

ON ORIGINAL SCALE, DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"

DRAWN BY: A. VELAZQUEZ	DESIGNED BY: M. ELLIOTT	CHECKED BY: D. SHERRY
DATE: MAR 2014	R.C.E. NO. C63770 DATE: MAR 2014	R.C.E. NO. C63770 DATE: MAR 2014

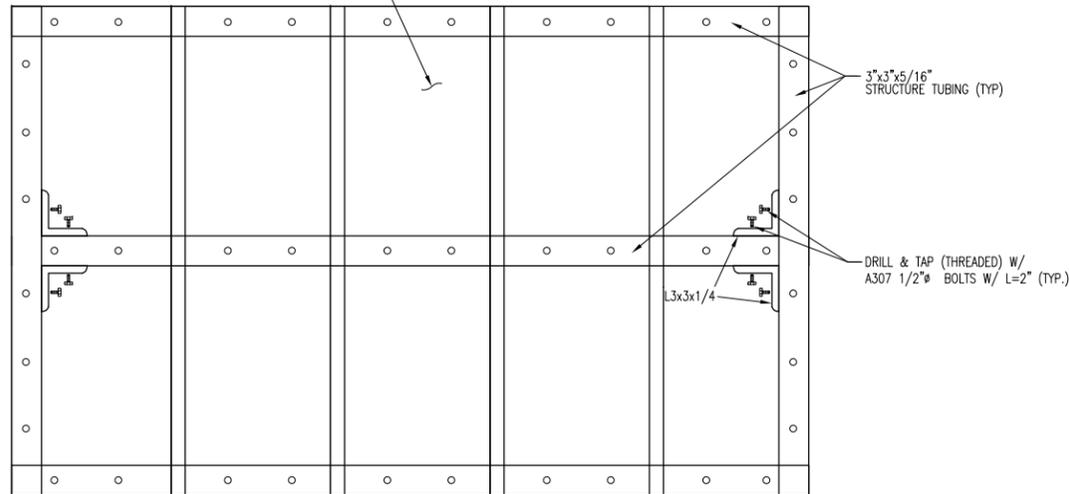


IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

**SWITCHGEAR COVER**

GIS GRID NO. GOT. 082	PN: Z14110104	DWG. NO. C-1
		SHEET 27
		OF 30

THE SHEET METAL ROOF SHALL BE A KLIP RIB ROOF MANUFACTURED BY IMSA BUILDING PRODUCTS. ROOF SHALL BE 24 GAUGE GALVANIZED STEEL AND SHALL CONFORM TO ASTM A792. ROOF SHALL BE PRE-COATED WITH KYNAR 500 COATING. COLOR TO BE SELECTED BY THE ENGINEER.

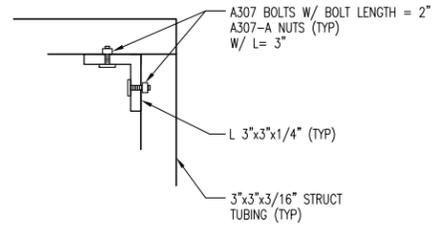


1. CONTRACTOR SHALL INSTALL ROOF PER MANUFACTURERS RECOMMENDATION.

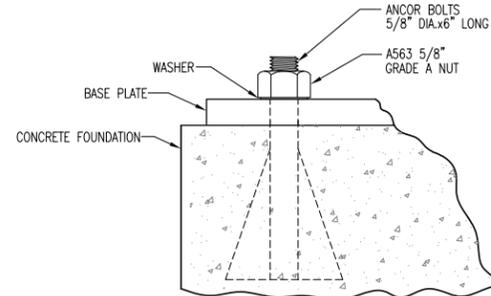
1  
C-2

TOP VIEW

N.T.S.

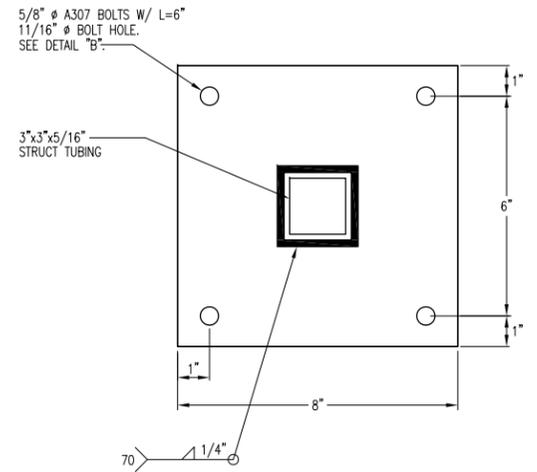


DETAIL "A"



DETAIL "B"

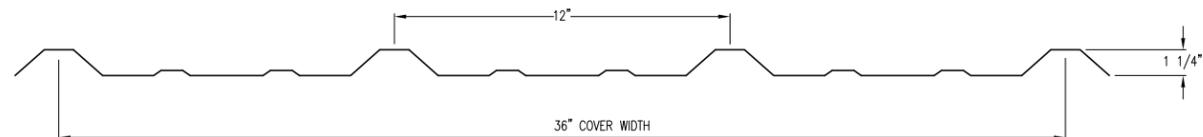
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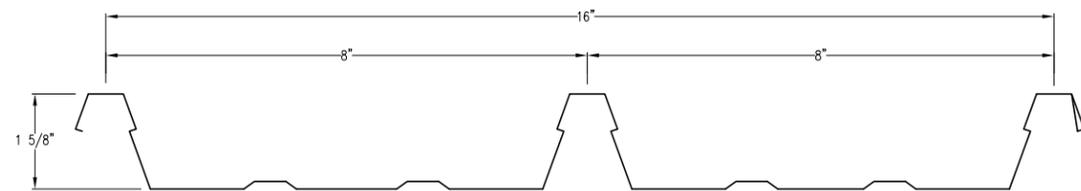
BASE PLATE DETAIL

(8"x8"x3/8")

N.T.S.



CORRUGATED GALVANIZED STEEL SIDE PANEL

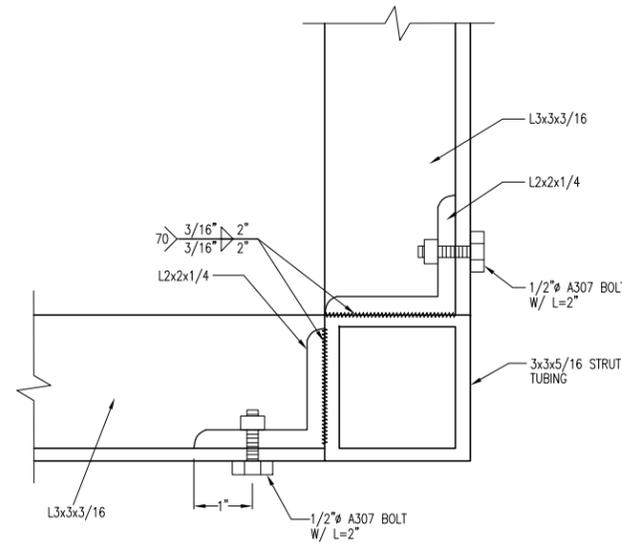


KLIP-RIB ROOF

5  
C-2

SIDE ELEVATION

N.T.S.



BOTTOM, MID BEAM-COLUMN CONNECTION

N.T.S.

7  
C-2

WELL REHABILITATION PROJECT PHASE II  
S:\Electrical Drawings\Well Rehab Phase 2

PN: Z14110104

NO.	DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV. _____

FIELD BOOK
SCALE: _____
H: NA.
V: NA.

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: A. VELAZQUEZ    DESIGNED BY: M. ELLIOTT    CHECKED BY: D. SHERRY

DATE: MAR 2014    R.C.E. NO. C63770    DATE: MAR 2014    R.C.E. NO. C63770    DATE: MAR 2014

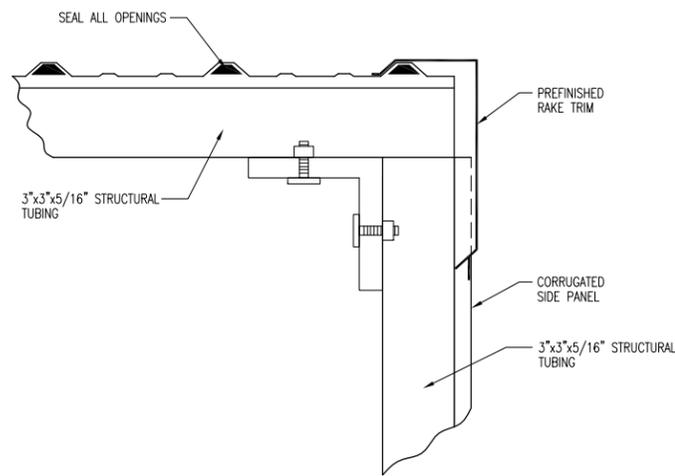


IMPROVEMENT PLANS FOR:  
WELL REHABILITATION PROJECT PHASE 2A

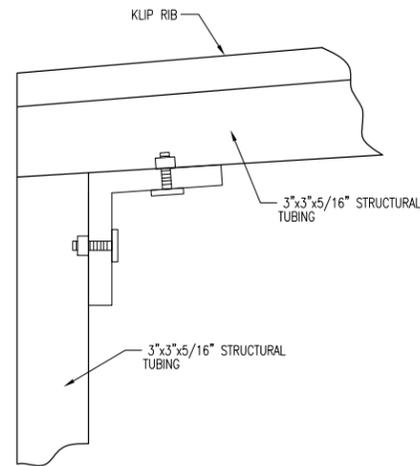
SWITCHGEAR COVER DETAILS

GIS GRID NO. _____	PN: Z14110104	DWG. NO. C-2
COT. NO. _____	228	SHEET OF 28
		OF 30

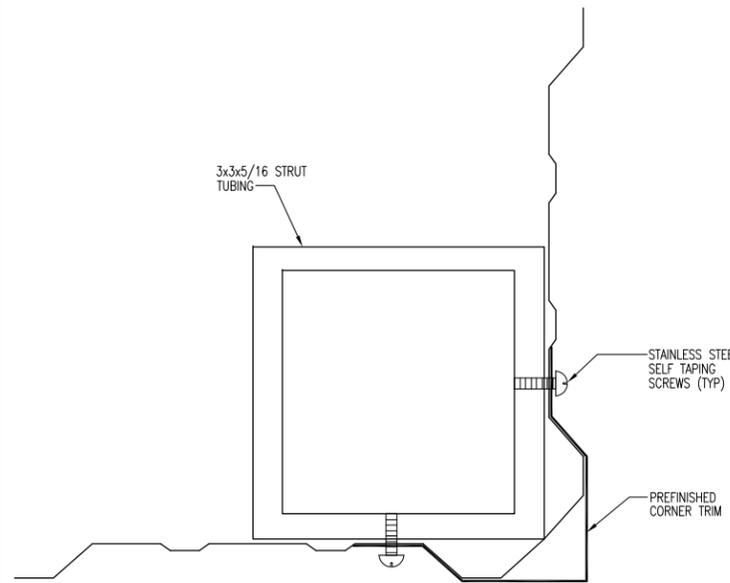
PN: Z14110104 WELL REHABILITATION PROJECT PHASE II



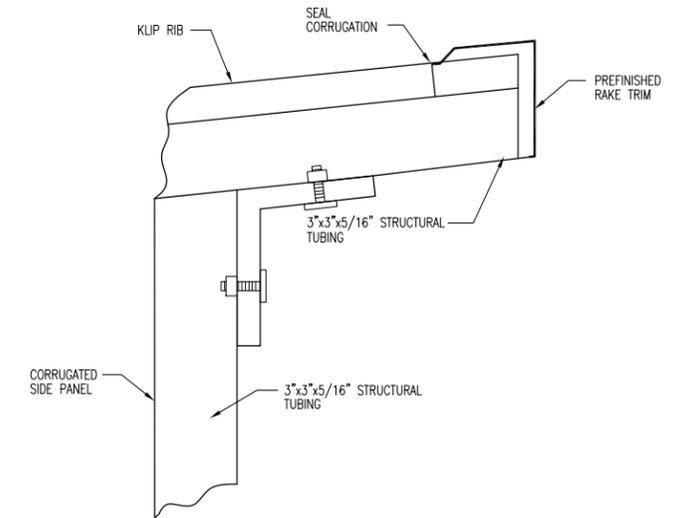
1  
C-3 RAKE DETAIL N.T.S.



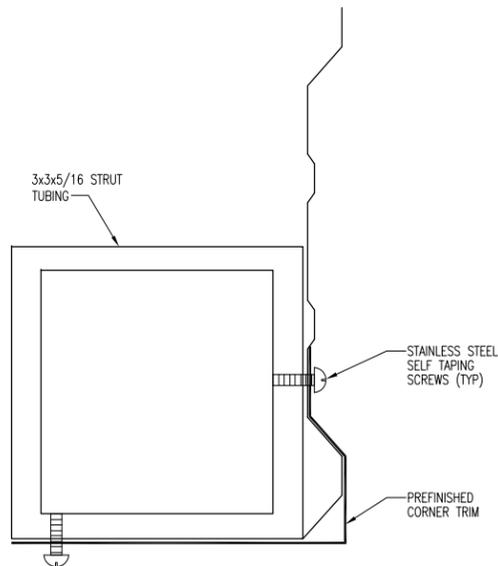
2  
C-3 EAVE DETAIL N.T.S.



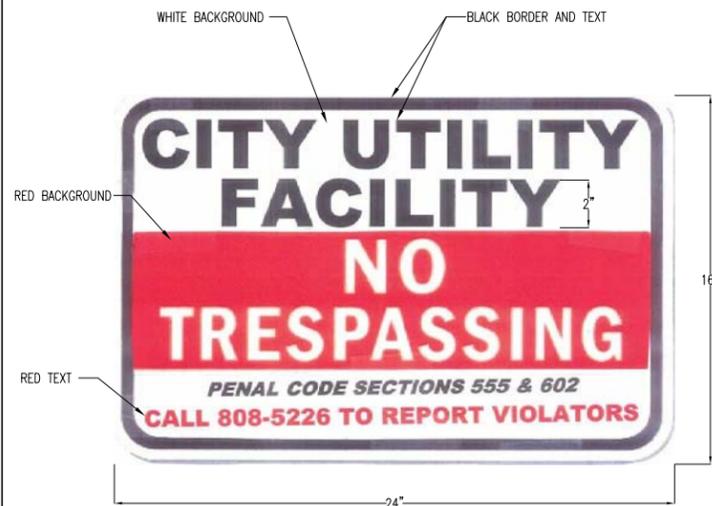
3  
C-3 REAR CORNER DETAIL N.T.S.



4  
C-3 HIGH EAVE DETAIL N.T.S.



5  
C-3 FRONT CORNER DETAIL N.T.S.



6  
C-3 TRESPASSING N.T.S.

PN: Z14110104

REVISIONS			
NO.	DESCRIPTION	DATE	BY

BENCH MARK	ELEV.

FIELD BOOK	
SCALE:	ON ORIGINAL SCALE, DRAWING ADJUST SCALED DIMENSIONS IF THIS DOES NOT SCALE AT 1"
H:	NA.
V:	NA.

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: A. VELAZQUEZ    DESIGNED BY: M. ELLIOTT    CHECKED BY: D. SHERRY

DATE: MAR 2014    R.C.E. NO. C63770    DATE: MAR 2014    R.C.E. NO. C63770    DATE: MAR 2014



IMPROVEMENT PLANS FOR:

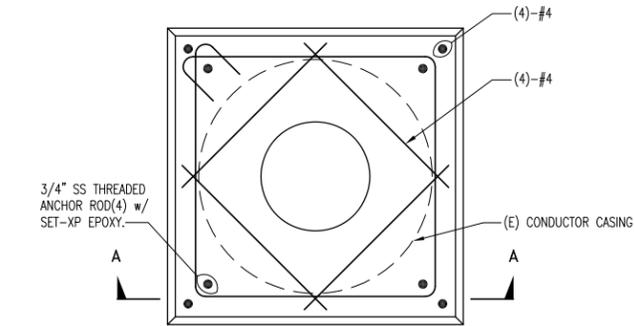
**WELL REHABILITATION PROJECT PHASE 2A**

**SWITCHGEAR COVER, SIGNAGE, DETAILS**

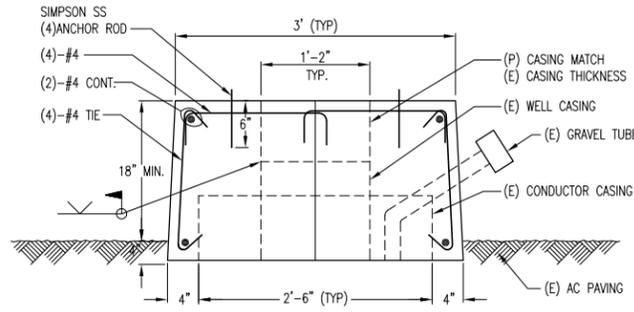
DWG. NO. **C-3**  
SHEET **29** OF **30**

GIS GRID NO. GOT: **225**  
PN: Z14110104

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II



PLAN VIEW

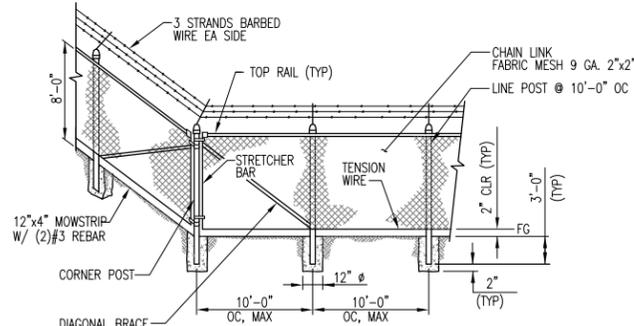


SECTION A-A

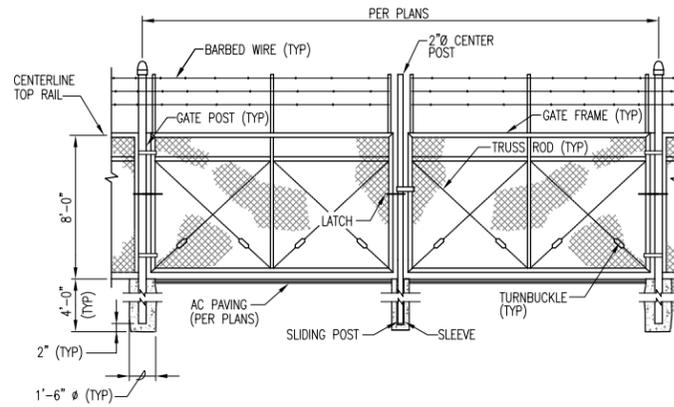
NOTES:  
 1.- PROVIDE CLASS B CONCRETE AND INTERMEDIATE GRADE ASTM A615 GRADE 60 REINFORCING STEEL  
 2.- EXTEND (E) GRAVEL TUBE AS NECESSARY.

1  
C-4

WELLHEAD DETAIL

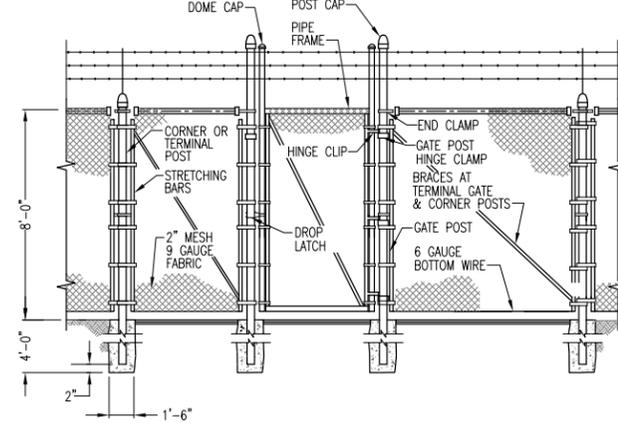


CHAIN LINK FENCE DETAIL



CHAIN LINK SWING GATE DETAILS

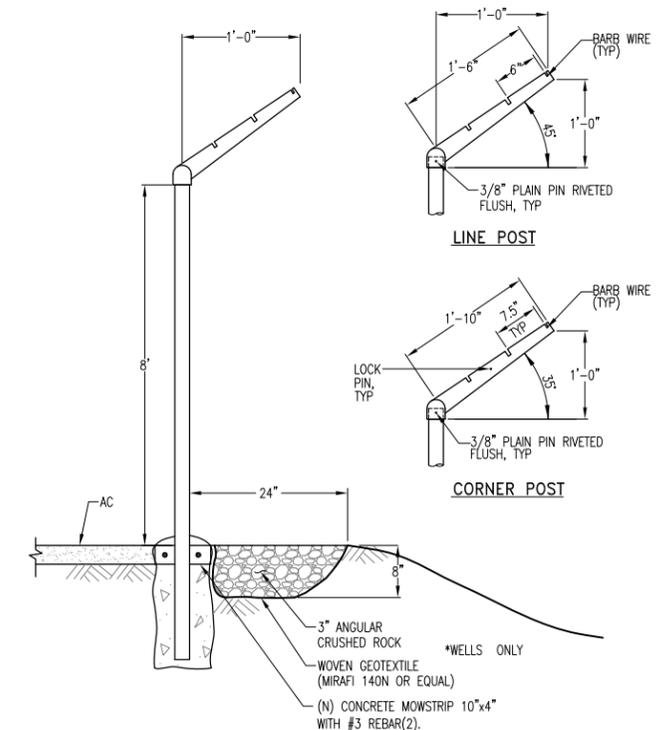
2  
C-4



NOTES:  
 1. CONTRACTOR SHALL INSTALL 8" GALVANIZED FENCE POSTS OVER (E) I-BEAM FENCE POSTS AT WELLS 83 AND 155. SECURE ROUND POSTS TO I-BEAMS POSTS WITH 3/8" DIAMETER GALVANIZED SCREWS, OR PLUG WELD.

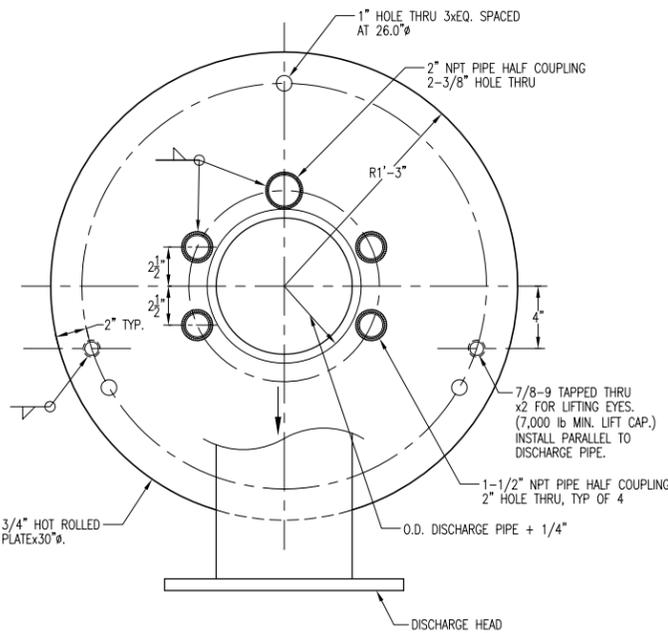
3  
C-4

MAN GATE



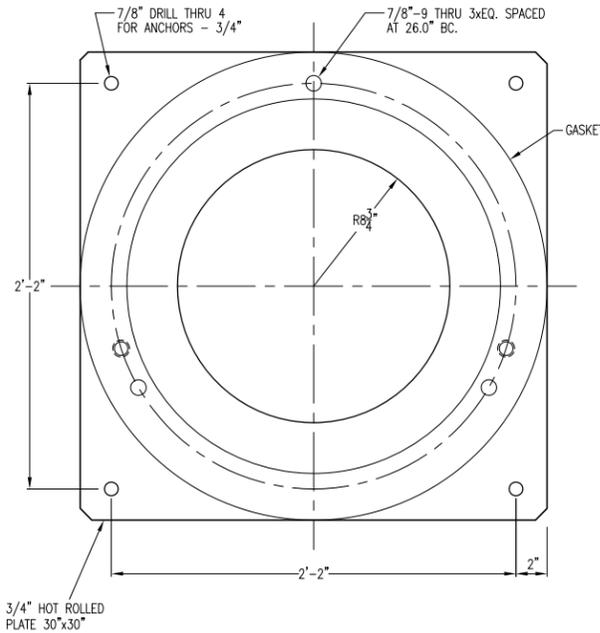
CHAIN LINK FENCE w/ EROSION CONTROL (153a, 144, 155)

4  
C-4



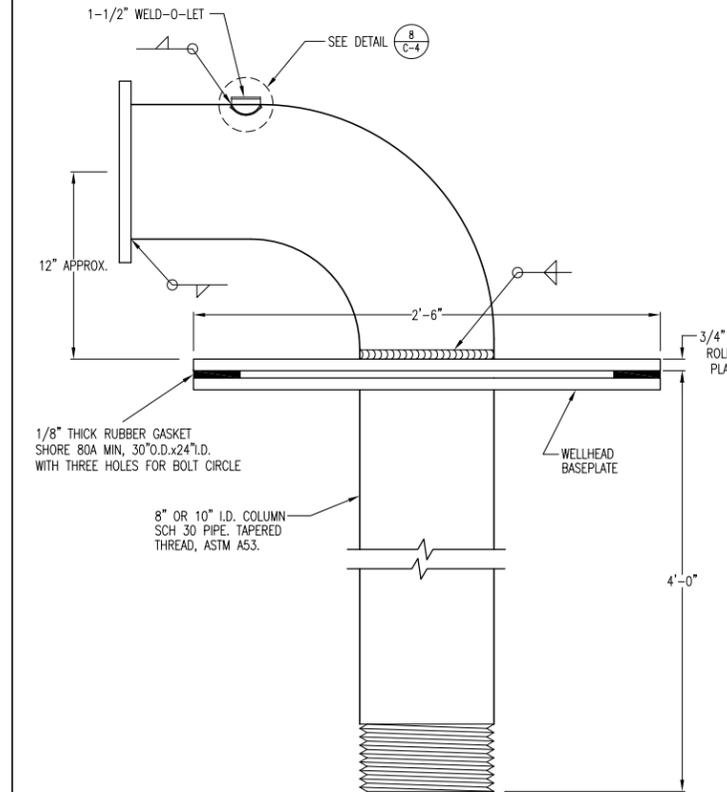
WELLHEAD DISCHARGE PIPING (PLAN)

5  
C-4



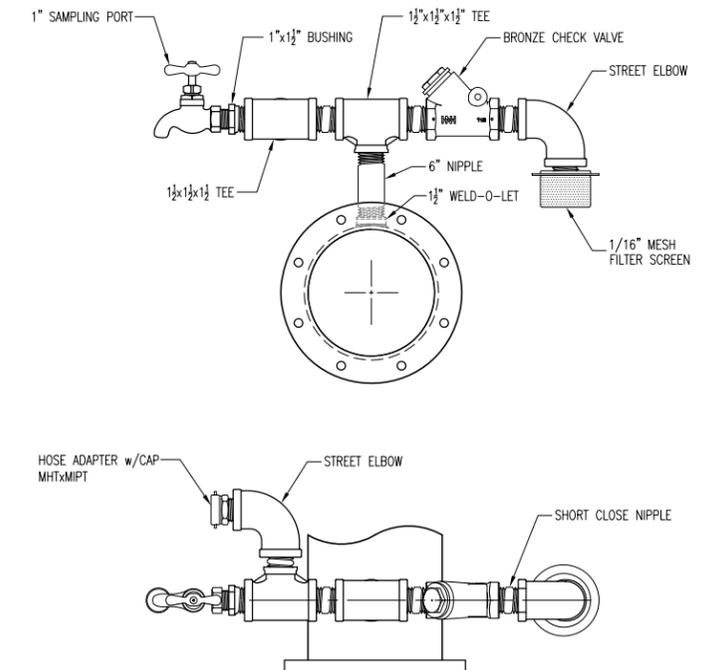
WELLHEAD BASEPLATE

6  
C-4



WELLHEAD DISCHARGE PIPING (PROFILE)

7  
C-4



SAMPLE PORT & AIR RELEASE ASSEMBLY

8  
C-4

NO.	REVISIONS DESCRIPTION	DATE	BY

BENCH MARK DESCRIPTION:	ELEV.

FIELD BOOK

**CITY OF SACRAMENTO**  
DEPARTMENT OF UTILITIES

DRAWN BY: A. VELAZQUEZ    DESIGNED BY: M. ELLIOTT    CHECKED BY: D. SHERRY  
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IMPROVEMENT PLANS FOR:  
**WELL REHABILITATION PROJECT PHASE 2A**

**WELLHEAD & FENCE DETAILS**

GIS GRID NO. C-4  
 DWG. NO. C-4  
 SHEET 30 OF 30  
 PN: Z14110104

PN: Z14110104

PN: Z14110104 WELL REHABILITATION PROJECT PHASE II