

*Antelope Valley-East Kern Water Agency
Request for Proposals for HDWB 24-03
Turnout Stoplog Modification*

August 6, 2024

The Antelope Valley-East Kern Water Agency (AVEK or Agency) is seeking proposals from experienced Contractors for the modification of existing stoplog panels and fabrication of new storage rack assemblies at our High Desert Water Bank (HDWB) Turnout structure (the “Project”).

Bid Opening: August 30, 2024, 2:00 pm

Instruction to Bidders

Antelope Valley-East Kern Water Agency invites sealed bids for the Project. The Agency will receive such Bids at its Administrative Office, 6500 W Avenue N, Palmdale, CA 93551 up to 2:00 pm on August 30, 2024 at which time they will be publicly opened and publicly read aloud. Bids received after this date and time will not be considered. Bids are to be completed on the bid sheet provided in **Appendix A**.

Award of Contract

The Agency reserves the right to reject any or all Bids or any parts thereof or to waive any irregularities or informalities in any Bid or in the bidding. The Contract award, if made, will be to the lowest responsible, responsive Bidder and is anticipated to occur within sixty (60) Days after the Bid opening. The Contract award may be made after that period if the selected Bidder has not given the Agency written notice of the withdrawal of its Bid.

Background

The Agency currently utilizes the HDWB Turnout to take water from the State Water Project and convey it through a series of pipelines to multiple recharge basins, as part of the High Desert Water Bank Recharge Project. The HDWB Turnout was constructed in 2022-2023 and the stoplogs built as a part of that work are in need of modification.

Project Requirements

The Agency is looking for a qualified Contractor to pick up, modify, deliver, and test the modified stoplogs. The Contractor will also be required to fabricate, deliver, and install two stoplog rack assemblies. The modification of the stoplogs consists of shop fabricating and welding two extension sections, removing and replacing rubber seals, and non-destructive testing of welds. The stoplog rack assemblies will be fabricated at the Contractor’s shop, delivered to the site, and anchored to an existing reinforced concrete support block. The Contractor will be required to test each stoplog to confirm its functionality. Additional project requirements are listed in **Appendix B**. All work is to be completed in accordance with the project plans (**Appendix D**), and the original turnout construction plans and specifications (**Appendix G**).

Project Location

The project site address is 50606U 290th Street West, Lancaster CA 93536 in unincorporated Los Angeles County, Antelope Valley, CA. See project location map in **Appendix D**. The facility is accessible from California Highway 138 (Avenue D), turning north along 300th Street West, then turning east immediately after crossing the California State Water Project.

Project Walk

Potential bidders are required to attend the job walk to view/inspect work location for access, information, staging, etc., on August 20, 2024, 9:00AM. The meeting place will be at the project site 50606U 290th Street West, Lancaster CA 93536. There is a total of two (2) stoplogs in need of modification, and two (2) stoplog rack assemblies need to be fabricated. This job walk will include a chance to look at the project site, the existing stoplogs, where the stoplogs will be installed and tested, and the location where the stoplog rack assemblies will be installed.

Requests for Information

All questions, clarifications, or comments must be received in writing no later than 5:00 pm, Pacific Time, August 23, 2024 and be sent via email to Joe Roberts at jroberts@avek.org. All questions received will be responded to by written addenda distributed to all potential bidders.

Required Information

The proposal should include the following:

- Scope of Work and Fee: The Work to be done should consist of furnishing all transportation, labor, materials, tools, equipment, services, permits, utilities, taxes, and all other items necessary or appurtenant to remove, modify, fabricate and install the stoplogs and stoplog rack. Fee proposal should be provided on the Bid Schedule included in **Appendix A**.
- Project Timeline: The Contractor will have 90 calendar days from the Notice to Proceed to complete all work.

AVEK Contract Requirements

- The Contractor will be required to execute an Agency standard contract, see **Appendix C**.
- The Contractor is required to provide insurance and comply with the California Labor Code public works requirements, including, but not limited to, paying prevailing wages, registering with DIR, and maintaining certified payroll records, which is part of the Agency's standard contract for Public Works projects.
- Contractors and Subcontractors must be licensed with Contractors State Licensing Board with the Department of Consumer Affairs and registered as a Public Works Contractor with the Department of Industrial Relations pursuant to Labor Code Section 1725.5. The contractor responsible for installation and testing of the stoplogs and stoplog rack is required to have a Class A General Engineering License. All

shop fabrication of the stoplog modifications and storage rack are to be completed by a Class C 51 Structural Steel or C 60 Welding Contractor.

Contact Information

Joe Roberts

jroberts@avek.org

(661) 943-3201

APPENDIX A

Bid

APPENDIX A

**ANTELOPE VALLEY - EAST KERN WATER AGENCY
HDWB 24-03 STOPLOG MODIFICATIONS [PROJECT]**

TO THE BOARD OF DIRECTORS OF ANTELOPE VALLEY - EAST KERN WATER AGENCY
AND ANTELOPE VALLEY - EAST KERN WATER AGENCY:

The undersigned, as Bidder, declares that: (1) this Bid is made without collusion with any other person and that the only persons or parties interested as principals are those named herein; (2) the undersigned has carefully examined the Contract Documents (including all Addenda) and the Project site; and (3) the undersigned has investigated and is satisfied as to the conditions to be encountered, the character, quality and quantities of Work to be performed, and the materials to be furnished. Furthermore, the undersigned agrees that submission of this Bid shall be conclusive evidence that such examination and investigation have been made and agrees, in the event the Contract be awarded to it, to execute the Contract with Antelope Valley - East Kern Water Agency to perform the Project in accordance with the Contract Documents in the time and manner therein prescribed, and to furnish or provide all materials, labor, tools, equipment, apparatus and other means necessary so to do, except as may otherwise be furnished or provided under the terms of the Contract Documents, for the following stated unit prices or lump-sum price as submitted on the Bid herein.

Bidder acknowledges receipt of all addenda, as follows:

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

Addendum No. _____ Date: _____

The undersigned submits as part of this Bid a completed copy of its Industrial Safety Record. This Safety Record includes all construction Work undertaken in California by the undersigned and any partnership, joint venture or corporation that any principal of the undersigned participated in as a principal or owner for the last five (5) calendar years and the current calendar year before the date of Bid submittal. Separate information is being submitted for each such partnership, joint venture, or corporate or individual Bidder. The undersigned may attach any additional information or explanation of data that it would like to be taken into consideration in evaluating the Safety Record. An explanation of the circumstances surrounding any and all fatalities is attached.

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The undersigned certifies to have a minimum of three (3) consecutive years of current experience in the type of Work related to the Project and that this experience is in actual operation of the firm with permanent employees performing a part of the Work as distinct from a firm operating entirely by subcontracting all phases of the Work. The undersigned also certifies to be properly licensed by the State as a contractor to perform this type of Work. The undersigned possesses California Contractor's License Number _____, Class _____, which expires on _____.

Bidder's Name: _____

Signature: _____ Title: _____ Date: _____

Signature: _____ Title: _____ Date: _____

APPENDIX A

**ANTELOPE VALLEY - EAST KERN WATER AGENCY
 BID SCHEDULE FOR
 HDWB 24-03 STOPLOG MODIFICATIONS [PROJECT]**

Bidder's Name: _____

To Antelope Valley - East Kern Water Agency and its Board of Directors:

In compliance with the Request for Proposals, the undersigned hereby agrees to execute the Contract to furnish all labor, materials, equipment, trucking, and supplies for the Project to the satisfaction and under the direction of the Agency Engineer, at the following prices:

BASE AMOUNT:

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICES	EXTENDED AMOUNT
1	DWR Safety Training	1	LS	\$	\$
2	Project Submittals	1	LS	\$	\$
3	Non-Destructive Weld Testing	1	LS	\$	\$
4	Pickup of Stoplogs from Project Site	1	LS	\$	\$
5	Shop Modifications to Stoplogs	1	LS	\$	\$
6	Shop Fabrication of Stoplog Storage Rack	1	LS	\$	\$
7	Delivery of Stoplogs and Storage Rack to Project Site	1	LS	\$	\$
8	Anchoring and Installation of Storage Racks	1	LS	\$	\$
9	Stoplog Testing	1	LS	\$	\$
TOTAL BASE AMOUNT:					\$

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NOTE TO CONTRACTOR: Bid items and associated quantities identified in the Base Amount table above may be adjusted or deleted. Therefore, regardless of total actual volume (percentage) compared to estimated quantities, the unit prices provided above by the Bidder shall be applied to the final quantity when payment is calculated for these items. No adjustment in the unit prices will be allowed. The Agency reserves the right to not use any of the estimated quantities; and if this right is exercised, the Contractor will not be entitled to any additional compensation. Cost of all import/export of material shall be included in the above unit costs; no additional compensation will be granted for such expenses.

TOTAL BID PRICE = BASE AMOUNT PLUS (+) ALL ADDITIVE ITEMS

TOTAL BID PRICE IN DIGITS: \$ _____

TOTAL BID PRICE IN WORDS: _____

Signature: _____ Title: _____ Date: _____

Signature: _____ Title: _____ Date: _____

APPENDIX B

Bid Item Descriptions

APPENDIX B

BID ITEM DESCRIPTIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section provides the basis for payment of Work performed under the Contract.
- B. Payment for the various items of the Bid Schedule in **Appendix A** as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items of work being described, as necessary to complete the various items of the WORK all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the California Division of Industrial Safety and the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Schedule, and all costs therefor shall be included in the prices named in the Bid Schedule for the various appurtenant items of work.
- C. The RFP, contract, and items in the Standard Specifications and Technical Specifications which are not listed in the schedule of work items of the bid are, in general, applicable to more than one listed work item, and no separate work item is provided therefor. Include the cost of Work not listed but necessary to complete the Project designated in the RFP in the various listed work items on the bid.
- D. The bid for the Work is intended to establish the total cost for the Work in its entirety. Should the CONTRACTOR feel that the cost for the Work has not been established by specific items in the bid, include the cost for that Work in some related bid item so that the bid reflects the total cost for completing the Work in its entirety.

1.2 Bid Item No. 1 – DWR Safety Training

- A. All contractor personnel working on Department of Water Resources (DWR) property are required to complete a 1-hour onsite training prior to beginning any work on the site. This training will be conducted onsite one time by DWR. If additional trainings are required due to a change in staffing by the Contractor, or for any other reason, additional training session(s) will be required and completed at no additional cost to the Agency.
- B. Payment for DWR Safety Training will be made at the lump sum price named in the Bid Schedule under Item No. 1, which price shall constitute full compensation for work necessary for the attendance of all personnel, including travel time, at the mandatory DWR training; and for all other work and operations which must be performed, or costs incurred prior to beginning work.

APPENDIX B

1.3 Bid Item No. 2 – Project Submittals

- A. Contractor is required to provide the following submittals, in accordance with Section 01330 Contractor Submittals of **Appendix G**:
1. Stoplog and Storage Rack Fabrication Drawings
 2. Welder/NDT Technician/Crane Operator Certifications
 3. Product Data Sheets:
 - a. Stainless Steel Anchors
 - b. Epoxy
 - c. Rubber seals
 4. NDT Weld Testing Results
 5. Site Safety Plan
 6. Stoplog Testing Plan
- B. Payment for submittals will be made at the lump sum price named in the Bid Schedule under Item No. 2, which price shall constitute full compensation for the development and submittal, of the required submittals. It shall also include resubmittals as required to ensure compliance with the project requirements.

1.4 Bid Item No. 3 – Non-Destructive Weld Testing

- A. The Contractor is required to perform non-destructive weld testing on the stoplogs as shown on the plans. Non-destructive testing of the storage rack welds is not required.
- B. Payment for non-destructive weld testing will be made at the lump sum price named in the Bid Schedule under Item 3 and shall constitute full compensation for all equipment, materials, labor, tools, and other ancillary items required to complete the work.

1.5 Bid Item No. 4 – Pickup of Stoplogs from Project Site

- A. The Contractor is required to pick up the stoplogs from the Project Site and transport them to the Contractor's shop for modification. The Contractor is responsible for supplying a crane of suitable size to safely pick and load the stoplogs.
- B. Payment for the pickup and hauling of stoplogs to the shop will be made at the lump sum price named in the Bid Schedule under Item 4 and shall constitute full compensation for all equipment, materials, permits, fuel, labor, and other ancillary items required to complete the work.

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1.6 Bid Item No. 5 – Shop Modifications to Stoplogs

- A. The Contractor is required to modify the existing stop logs as shown on the plans. This includes removal of existing seals, removal of existing lifting lugs from bottom panels, pressure washing of existing stoplogs to remove debris, fabrication and hot dip galvanizing of new 2'-3" center panels, welding of panel sections, installation of new seals, replacement of seal bolts as necessary, and all other items required by the plans.
- B. Payment for the shop modifications to stoplogs will be made at the lump sum price named in the Bid Schedule under Item No. 5, which price shall constitute full compensation for all equipment, materials, labor, and other ancillary items required to complete the work.

1.7 Bid Item No. 6 – Shop Fabrication of Stoplog Storage Rack

- A. The Contractor is required to fabricate two new stoplog storage racks as shown on the plans, including hot dip galvanizing after fabrication.
- B. Payment for the shop fabrication of the stoplogs storage rack will be made at the lump sum price named in the Bid Schedule under Item No. 6, which price shall constitute full compensation for all equipment, materials, labor, and other ancillary items required to complete the work.

1.8 Bid Item No. 7 – Delivery of Stoplogs and Storage Rack to Project Site

- A. The Contractor is required to deliver the modified stoplogs and new storage racks to the Project Site. The Contractor is responsible for supplying a crane of suitable size to safely pick and unload the stoplogs.
- B. Payment for the pickup and hauling of stoplogs to the shop will be made at the lump sum price named in the Bid Schedule under Item 7 and shall constitute full compensation for all equipment, materials, permits, fuel, labor, and other ancillary items required to complete the work.

1.9 Bid Item No. 8 – Anchoring and Installation of Storage Racks

- A. The Contractor is required to drill and epoxy stainless steel anchors, install the storage rack, install steel shims as needed to level the storage racks, and secure them to the existing concrete anchor blocks as shown on the Plans. The Contractor is responsible for supplying a crane of suitable size to safely pick and set the stoplog storage racks. All work is required to be completed in the presence of DWR.
- B. Payment for the anchoring and installation of the storage racks will be made at the lump sum price named in the Bid Schedule under Item 8 and shall constitute full compensation for all equipment, materials, permits, tools, fuel, labor, and other ancillary items required to complete the work.

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1.10 Bid Item No. 9 – Stoplog Testing

- A. The Contractor is required to install each stoplog into its designated turnout bay and pump out all water between the stoplogs and slide gate to check for leakage. Concurrent testing of the stoplogs will not be permitted. Only one bay will be tested at a time providing AVEK full operation of the turnout.
- B. The Contractor shall supply, at a minimum, a minimum, a 6-inch trash pump to quickly dewater the area and a 3-inch trash pump to maintain flow.
- C. The stop logs will be considered passing if a single 3-inch trash pump can maintain the leakage for two hours.
- D. If the leakage rate exceeds the pumping capacity of the 3-inch trash pump the contractor will be required to lift, remove and reinstall, adjust, shim, or wedge the stoplogs as needed to ensure a proper seal.
- E. The contractor is required to give the Agency a minimum 14 calendar day notice before performing the stoplog test. All testing is to be conducted in the presence of DWR or their inspector.
- F. Upon completion of successful test, Contractor is required to remove both stop logs and place them in the storage rack.
- G. Payment for the testing of stoplogs of the storage racks will be made at the lump sum price named in the Bid Schedule under Item 9 and shall constitute full compensation for all equipment, materials, permits, tools, fuel, labor, and other ancillary items required to complete the work.

PART 2 PRODUCTS (Not Used).

PART 3 EXECUTION

3.1 WORK LISTED IN THE SCHEDULE OF WORK ITEMS

- A. Work under this contract will be paid on lump-sum basis as outlined on the Bid Schedule for the quantity of work installed.
- B. The lump-sum prices include full compensation for furnishing the labor, materials, tools, taxes, and equipment and doing all the work involved to complete the work included in the contract documents.
- C. The application for payment will be for specific item based on the value of the partially completed work relative to the value of the time when entirely completed and ready for service.

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3.2 WORK NOT LISTED IN THE SCHEDULE OF WORK ITEMS

- A. Items which are not listed in the schedule of work items of the Bid Schedule are, in general, applicable to more than one listed work item, and no separate work item is provided therefor. Include the cost of work not listed but necessary to complete the project designated in the contract documents in the various listed work items of the Bid Schedule.
- B. The bids for the work are intended to establish the total cost for the work in its entirety. Should the CONTRACTOR feel that the cost for the work has not been established by specific items in the Bid Schedule, include the cost for that work in some related bid item so that the Proposal for the project reflects the total cost for completing the work in its entirety.

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APPENDIX C

Sample Contract

APPENDIX C

CONSTRUCTION CONTRACT
FOR INFORMALLY BID PROJECTS

THIS CONTRACT ("Contract") is made and entered into this ____ day of _____, by and between Antelope Valley - East Kern Water Agency, a public entity (hereinafter the "Agency"), and _____, a _____ (hereinafter the "Contractor"). Contractor and Agency are collectively referred to herein as the "parties."

R E C I T A L S:

1. The Public Contract Code and Water Code Appendix provide that certain public works contracts can be awarded without submission to the competitive bidding procedure, but instead, through an alternate informal bidding procedure for the bidding of public works projects.
2. The Agency has invited the submission of informal bids for:

HDWB 24-03 Turnout Stoplog Modification Project (the "Project").
3. The Contractor is the lowest responsible bidder for the Project.
4. The Agency and Contractor enter this Contract in order to set forth terms and conditions applicable to completion of the Project.

A G R E E M E N T:

NOW, THEREFORE, in consideration of the foregoing premises and the mutual promises and covenants herein contained, the parties hereto agree as follows:

1. Scope of Work. Contractor shall complete the Project in accordance with this Contract. Contractor shall furnish all materials and perform all work required for the completion of the Project. The agreement between the Agency and the Contractor consists of this Contract and all of the following (as applicable), each of which is made a part of this Contract:
 - a. Solicitation of Informal Sealed Bids for the Project.
 - b. Instructions to Bidders.
 - c. Plans for the Project.
 - d. General Specifications for the Project.
 - e. Special Provisions for the Project.
 - f. Standard Specifications.
 - g. Contractor's signed bid.

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2. Standard Specifications. Standard Specifications for Agency projects are those contained in the 2018 edition of the "Standard Specifications for Public Works Construction" (the "Greenbook"). Except as otherwise expressly provided herein, the Standard Specifications shall control the general provisions, construction materials, and construction methods for this Contract (except as amended by the Plans for the Project), the General Specifications for the Project, the Special Provisions for the Project, any technical specifications for the Project, and any other contract documents.

3. Compensation. Agency shall pay Contractor the total, all-inclusive, NOT-TO-EXCEED amount of _____ Dollars (\$ _____) for the construction of the Project. This amount shall cover all expenses for labor, materials, and any and all other costs incurred by Contractor to satisfactorily construct the Project. Unless otherwise provided in the bid documents or agreed upon by the parties, Contractor shall submit detailed, monthly invoices for work actually performed.

4. Completion Date. The construction of the Project shall commence upon Contractor being given a written notice to proceed, and shall be completed within ninety (90) days of issuance of the written notice to proceed.

5. Payment and Performance Bonds; Guaranty. Unless otherwise expressly provided in the bid documents, prior to commencing work, Contractor shall provide a payment bond and performance bond, each in an amount equal to 100% of the Contract price. The bond forms required to be executed are attached hereto and incorporated by reference herein. Pursuant to the bid documents for this Project, the Contractor is required to provide a written guaranty of Contractor's work. In furtherance thereof, Contractor shall execute the written form of Guaranty attached hereto and incorporated by reference herein.

6. Licenses. At all times during the term of this Contract, Contractor shall possess a valid and current Class A Contractor's License or Specialty Contractor License consisting of Class C-51 or C-60 license to perform the required work ("Work"). Contractor hereby certifies that it holds the required license(s).

7. Subcontracting. Subject to any self-performance requirements herein, Contractor may subcontract any portion of the work required by this Contract to other persons or firms, and Contractor submitted with its bid a list of those subcontractors who will perform work in an amount in excess of one-half of one percent (1%) of the Contractor's total bid, in compliance with the Subletting and Subcontracting Fair Practices Act, California Public Contract Code § 4100, et seq. Only such listed subcontractors may perform on this Project.

8. Non-Assignability. Neither this Contract nor any rights, title, interest, duties or obligations under this Contract may be assigned, transferred, conveyed or otherwise disposed of by Contractor without the prior written consent of Agency.

9. Administration. This Contract will be administered by the Public Works Department of the Agency. The Director of Public Works/Agency Engineer or his or her designee

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shall be considered the Project Administrator and shall have the authority to act for the Agency under this Contract.

10. Indemnification. To the maximum extent permitted by law, Contractor shall indemnify, protect, defend and hold harmless the Agency, its Board of Director, the Agency's officers, employees, agents, volunteers, and representatives ("Indemnitees") with respect to any and all claims, suits, actions, stop notices, liabilities and/or damages, including related expenses, attorney's fees and costs, based on, arising out of, or in any way related to the work undertaken by Contractor pursuant to this Contract, and in connection with the Project.

11. Liability Insurance. Without limiting Contractor's indemnification of Agency, as described in paragraph 10, and unless modified by Agency, Contractor shall obtain, provide and maintain, at its own expense, during the term of this Contract, a policy or policies of insurance, satisfactory to the Agency, from insurance carriers admitted to do business in the State of California, which contain the coverage described below.

- a. The Contractor shall at all times during the term of the Contract carry, maintain, and keep in full force and effect a commercial general liability insurance policy (CGL) or policies (Occurrence Form CG 00 01) including products and completed operations, property damage, bodily injury, personal and advertising injury with the minimum limits of five million dollar(s) (\$5,000,000) per occurrence or the full per occurrence limits of the policies available, whichever is greater. If a general aggregate applies, either the general aggregate limit shall apply separately to this project/location (coverage as broad as the ISO CG 25 03, or ISO CG 25 04 endorsement provided to the Agency) or the general aggregate limit shall be twice the required occurrence limit. Said policy or policies shall be issued by an insurer admitted to do business in the State and rated in A.M. Best's Insurance Guide with a rating of A:VII or better.

Contractor shall at all times during the term of this Contract obtain, maintain, and keep in full force and effect, a policy or policies of Automobile Liability Insurance (any auto), with minimum limits of one million dollars (\$1,000,000) per claim and occurrence and two million dollars (\$2,000,000) in the aggregate for bodily injuries or death of any person and for property damage arising from any incident. Said policy or policies shall be issued by an insurer admitted to do business in the State and rated in Best's Insurance Guide with a rating of A:VII or better.

- b. Certificates of Insurance and original endorsements shall be provided by Contractor for the above-indicated policies.
- c. Antelope Valley - East Kern Water Agency, its Board of Directors, and the Agency's officers, employees, volunteers, agents and representatives shall be named as additional insureds under the CGL and auto policies.

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- d. Said Certificates of Insurance shall provide that thirty (30) days' prior written notice of cancellation shall be given to the Agency in the event of cancellation and/or reduction in coverage of any nature.
- e. The required CGL, auto and workers compensation policies of insurance shall be endorsed to waive all rights of subrogation. Contractors waives all rights of subrogation.
- f. The required policies of insurance shall not have a deductible exceeding \$10,000 unless such amount is approved in writing by the Agency.
- g. The required policies of insurance shall otherwise be in such form and contain such limits as required by the Agency.

12. Workers' Compensation Insurance. Contractor acknowledges the provisions of State Labor Code Section 3700, which requires every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of the Labor Code, and Contractor certifies that it will comply with these provisions before commencing performance of work under this Contract. The Contractor shall sign a Workers' Compensation Insurance Certificate, using the form attached hereto and incorporated by reference herein, and submit the signed Certificate to the Agency prior to commencing work under this Contract.

13. State Labor Code.

a. This Contract calls for work to be performed constituting public works. Contractor and all subcontractors shall pay the general prevailing rate of per diem wages as determined and as published by the State Director of the Department of Industrial Relations pursuant to Article 2 of Chapter 1 of Part 7, of Division 2 of the State Labor Code, including, but not limited to, Sections 1770, 1771, 1773, 1773.2 and 1774.

b. This is a public work and requires the payment of prevailing wages for the work or craft in which the worker is employed for any public work done under the contract by Contractor or by any subcontractor pursuant to Section 1771 of the Labor Code. Pursuant to the provisions of Section 1773 of the Labor Code of the State of California, the Agency has obtained the general prevailing rate of per diem wages and the general rate for holiday and overtime work in this locality for each craft, classification, or type of workman needed to execute this contract from the Director of the Department of Industrial Relations. These rates are on file with the Agency or may be obtained at <http://www.dir.ca.gov/OPRL/DPreWageDetermination.htm>.

Contractor shall post a copy of such wage rates at the job site and shall pay the adopted prevailing wage rates as a minimum. Contractor shall comply with the provisions of Sections 1775, 1776, 1777.5, 1777.6, and 1813 of the Labor Code. Pursuant to the provisions of 1775 of the Labor Code, Contractor shall forfeit to the Agency, as a penalty, not more than \$200.00 for each calendar day, or portion thereof, for each laborer, worker, or mechanic employed, paid less than the stipulated prevailing rates for any work done under this Contract, by him or by any subcontractor under him, in violation of the provisions of this Agreement.

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c. Contractors and subcontractors who are ineligible to bid for work on, or be awarded, a public works project pursuant to Labor Code Sections 1777.1 and 1777.7 are prohibited from bidding on, being awarded, or performing work as a subcontractor, on this Project pursuant to Public Contract Code Section 6109.

d. Contractor's attention is directed to the provisions in Sections 1774, 1775, 1776, 1777.5 and 1777.6 of the Labor Code. Contractor shall comply with the provisions in these Sections. The statutory provisions for penalties for failure to comply with the State's wage and hours laws will be enforced. Pursuant to Section 1775 of the Labor Code, the Contractor and any subcontractors, shall, as a penalty to the Agency forfeit the prescribed amounts per calendar day, or portion thereof, for each worker paid less than the prevailing wage rates.

e. Pursuant to Labor Code Section 1771.4, the Project is subject to compliance monitoring and enforcement by the California Department of Industrial Relations.

f. Each Contractor and subcontractor shall furnish the records specified in Labor Code Section 1776 directly to the State Labor Commissioner at least monthly in the format prescribed by the State Labor Commissioner.

g. Sections 1774 and 1775 require the Contractor and all subcontractors to pay not less than the prevailing wage rates to all workmen employed in the execution of the Contract and specify forfeitures and penalties for failure to do so. The minimum wages to be paid are those determined by the State Director of the Department of Industrial Relations. Section 1776 requires the Contractor and all subcontractors to keep accurate payroll records, specifies the contents thereof, their inspection and duplication procedures and certain notices required of the Contractor pertaining to their location.

h. Section 1777.5 of the Labor Code requires Contractor or subcontractor employing workers in any apprenticeable occupation to apply to the Joint Apprenticeship Committee nearest the site of the public works project, which administers the apprenticeship program in that trade for a certificate of approval. The certificate will also fix the ratio of apprentices to journeymen to be used in the performance of the Contract. The Contractor is required to make contributions to funds established for the administration of apprenticeship programs if he employs registered apprentices or journeymen in any apprenticeable trade and if other contractors on the public works site are making such contributions. Information relative to apprenticeship standards, contributions, wage schedules and other requirements may be obtained from the State Director of Industrial Relations or from the Division of Apprenticeship Standards. Section 1777.6 of the Labor Code provides that it shall be unlawful to refuse to accept otherwise qualified employees as registered apprentices solely on the grounds of race, religious creed, color, national origin, ancestry, sex, or age.

i. Eight hours labor constitutes a legal day's work, as set forth in Labor Code Section 1810. The statutory provisions for penalties for failure to comply with the State's wage and hour laws will be enforced as set forth in Labor Code Section 1813.

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14. Antitrust Claims. In entering into this Agreement, Contractor offers and agrees to assign to the Agency all rights, title, and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the California Business and Professions Code) arising from purchases of goods, services, or materials pursuant to the Agreement. This assignment shall be made and become effective at the time the Agency tenders final payment to Contractor without further acknowledgment by the parties.

15. Trenching and Excavations. Pursuant to Public Contract Code Section 7104, if the Project involves trenching more than four (4) feet deep, Contractor shall promptly and before the following conditions are disturbed notify the Agency in writing of any:

a. Material that Contractor believes may be material that is hazardous waste, as defined in California Health and Safety Code Section 25117, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law; and/or

b. Subsurface or latent physical conditions at the site differing from those indicated; and/or

c. Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

d. As required by Labor Code Section 6705 and in addition thereto, whenever work under the Contract that involves an estimated expenditure in excess of twenty-five thousand dollars (\$25,000) for the excavation of any trench or trenches five (5) feet or more in depth, Contractor shall submit for acceptance by Agency in advance of excavation, a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation, of such trench or trenches. If such plan varies from the shoring system standards established by the Construction Safety Orders of the Division of Industrial Safety, the plan shall be prepared by a registered civil or structural engineer employed by Contractor, and all costs therefor shall be included in the price of the Contract. Nothing in this provision shall be deemed to allow the use of a shoring, sloping, or other protective system less effective than that required by the Construction Safety Orders. Nothing in this provision shall be construed to impose tort liability on the Agency or on any Agency officer, agent, consultant, representative, or employee. All plans, processing and shoring costs are Contractor's responsibility and must be included in Contractor's bid.

16. Location of Existing Elements. Pursuant to Government Code Sections 4216 to 4216.9, the methods used and costs involved to locate existing elements, points of connection and all construction methods are Contractor's sole responsibility. Accuracy of information furnished, as to existing conditions, is not guaranteed. Contractor, at its sole expense, must make all investigations necessary to determine locations of existing elements, which may include, without limitation, contacting U.S.A. alert and other private underground locating firm(s), and/or utilizing potholes, specialized locating equipment and/or hand trenching.

APPENDIX C

17. Third Party Claims. Pursuant to Public Contract Code Section 9201, the Agency has full authority to compromise or otherwise settle any claim relating to this Contract at any time. The Agency shall timely notify Contractor of the receipt of any third-party claim relating to the Contract. The Agency shall be entitled to recover its reasonable costs incurred in providing the notification required by Public Contract Code Section 9201(b).

18. Non-Collusion. Contractor hereby certifies that this bid is genuine and not a sham or collusive, or made in the interest or on behalf of any person or business not herein named. Contractor further certifies that Contractor has not directly or indirectly induced or solicited any other bidder to furnish a sham bid, or any other person or business to refrain from bidding, and Contractor has not in any manner sought by collusion to secure itself an advantage over any other bidder. Contractor also affirms that it has signed and submitted with its bid to the Agency a Non-collusion Declaration as required by Public Contract Code Section 7106.

19. Conflicts of Interest. Contractor agrees not to accept any employment or representation during the term of this Contract or within twelve (12) months after completion of the work under this Contract which is or may likely make Contractor “financially interested,” as provided in Government Code Section 1090 and 87100, in any decisions made by Agency on any matter in connection with which Contractor has been retained pursuant to this Contract.

20. Audit. The Agency or its representative shall have the option of inspecting and/or auditing all records and other written materials used by Contractor in preparing its billings to the Agency as a condition precedent to any payment to Contractor. Contractor will promptly furnish documents requested by the Agency. Additionally, pursuant to Government Code Section 8546.7, if this Contract involves the expenditure of public funds in excess of ten thousand dollars (\$10,000), Contractor shall be subject to State Auditor examination and audit at the request of the Agency or as part of any audit of the Agency, for a period of three (3) years after final payment under this Contract.

21. Substitute Security. Pursuant to Public Contract Code Section 22300, the substitution of securities for any moneys withheld by the Agency to ensure performance under a contract is permitted, except where financing will be provided by the Farmers Home Administration of the United States Department of Agriculture pursuant to the Consolidated Farm and Rural Development Act (7 U.S.C. Sec. 1921 *et seq.*) or where federal regulations or policies, or both, do not allow the substitution of securities. At the request and expense of Contractor, securities equivalent to the amount withheld shall be deposited with the Agency, or with a state or federally chartered bank in the State of California as the escrow agent, that shall then pay those moneys to Contractor. Upon satisfactory completion of the Contract, the securities shall be returned to Contractor.

Alternatively, Contractor may request and the Agency shall make payment of retentions earned directly to the escrow agent at the expense of Contractor. At the expense of Contractor, Contractor may direct the investment of the payments into securities, and Contractor shall receive the interest earned on the investments upon the same terms provided for securities deposited by Contractor. Upon satisfactory completion of the Contract, Contractor shall receive from the escrow agent all securities, interest, and payments received by the escrow agent from the Agency, pursuant to the terms of this section.

APPENDIX C

Securities eligible for investment shall include those listed in California Government Code Section 16430, bank or savings and loan certificates of deposit, interest-bearing demand deposit accounts, standby letters of credit, or any other security to which Contractor and the Agency agree in writing. Contractor shall be the beneficial owner of any securities substituted for moneys withheld and shall receive any interest thereon.

If Contractor elects to receive interest on moneys withheld in retention by the Agency, it shall, at the request of any subcontractor performing more than five percent (5%) of Contractor's total bid, make that option available to the subcontractor regarding any moneys withheld in retention by Contractor from the subcontractor. If Contractor elects to receive interest on any moneys withheld in retention by the Agency, then the subcontractor shall receive the identical rate of interest received by Contractor on any retention moneys withheld from the subcontractor by Contractor, less any actual pro rata costs associated with administering and calculating that interest. In the event that the interest rate is a fluctuating rate, the rate for the subcontractor shall be determined by calculating the interest rate paid during the time that retentions were withheld from the subcontractor. If Contractor elects to substitute securities in lieu of retention, then, by mutual consent of Contractor and its subcontractor, the subcontractor may substitute securities in exchange for the release of moneys held in retention by Contractor. No Contractor shall require any subcontractor to waive any provision of this paragraph.

The escrow agreement for security deposits in lieu of retention shall be substantially similar to the form provided in Public Contract Code Section 22300(f).

22. Claims Dispute Resolution. In the event of any dispute or controversy with the Agency over any matter whatsoever, the Contractor shall not cause any delay or cessation in or of Work, but shall proceed with the performance of the Work in dispute. The Contractor shall retain any and all rights provided that pertain to the resolution of disputes and protests between the parties. The Disputed Work will be categorized as an "unresolved dispute" and payment, if any, shall be as later determined by mutual agreement or a court of law. The Contractor shall keep accurate, detailed records of all Disputed Work, claims and other disputed matters.

All claims arising out of or related to the Contract documents or this Project, and the consideration and payment of such claims, are subject to the Government Claims Act (Government Code Section 810 et seq.) with regard to filing claims. All such claims are also subject to Public Contract Code Section 9204 and Public Contract Code Section 20104 et seq. (Article 1.5), where applicable. This Contract hereby incorporates those provisions as though fully set forth herein. Thus, the Contractor or any Subcontractor must file a claim in accordance with the Government Claims Act as a prerequisite to filing a construction claim in compliance with Section 9204 and Article 1.5 (if applicable), and must then adhere to Section 9204 and Article 1.5 (as applicable), pursuant to the definition of "claim" as individually defined therein.

23. Nondiscrimination by Contractor. Contractor represents and agrees that Contractor, its affiliates, subsidiaries, or holding companies do not and will not discriminate against any subcontractor, consultant, employee, or applicant for employment because of race, religion, color, sex, handicap, or national origin. Such nondiscrimination shall include, but not be limited to, the following: employment, upgrading, demotion, transfers, recruitment, recruitment

APPENDIX C

advertising, layoff, termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

24. Integration. This Contract supersedes any and all agreements, either oral or written, between the parties hereto with respect to the construction of the Project by Contractor for Agency and contains all of the covenants and agreements between the parties with respect to the construction of the Project. Each party to this Contract acknowledges that no representations, inducements, promises, or agreements, orally or otherwise, have been made with regard to the construction of the Project by any party, or anyone acting on behalf of any party, which are not embodied herein, and that no other agreement, statement, or promise regarding work not contained in this Contract shall be valid or binding. Any modification or amendment of this Contract will be effective only if it is in writing and signed by the parties to this Contract. Any changes to the work required by this Contract will be by change order signed by the parties.

25. Governing Law. This Contract will be governed by and construed in accordance with the laws of the State of California without reference to change of venue laws. Any legal action in which enforcement of the terms and conditions of this Contract is requested, or in which it is alleged that a breach of this Contract has taken place, shall be filed and prosecuted in the County of Los Angeles, California.

26. Successors and Assigns. The terms and conditions of this Contract shall be binding on the successors and assigns of the parties to this Contract.

27. Exhibits. The exhibits and attachments referenced in this Contract are attached hereto and incorporated herein by this reference as though set forth in full in the Contract.

28. Authority to Sign. The person or persons executing this Contract on behalf of the Contractor warrant and represent that they have the authority to execute this Contract on behalf of the Contractor and have the authority to bind Contractor to the construction of the Project.

29. Time is of the Essence. Time is of the essence in every provision of this Agreement in which time to perform is a factor.

APPENDIX C

IN WITNESS WHEREOF, the parties hereto have executed this Contract as of the date first above written.

"AGENCY"

ANTELOPE VALLEY - EAST KERN WATER
AGENCY

General Manager

"CONTRACTOR"

a, _____ corporation

By: _____

Print Name: _____

Title: _____

By: _____

Print Name: _____

Title: _____

[Signatures of contractor must be notarized. Obtain two corporate signatures if contractor is a corporation.]

APPENDIX C

ANTELOPE VALLEY - EAST KERN WATER AGENCY

FAITHFUL PERFORMANCE BOND

KNOW ALL PERSONS BY THESE PRESENTS:

WHEREAS, Antelope Valley - East Kern Water Agency (hereinafter referred to as the “AGENCY”), awarded _____, hereinafter referred to as the “Contractor/Principal” a contract for the work described as _____ in the amount of _____ (“Penal Sum”);

WHEREAS, said Contractor/Principal is required under the terms of said contract to furnish a bond for the faithful performance of said contract which contract is incorporated herein by reference;

NOW, THEREFORE, we, the undersigned Contractor, as Principal, and _____, as Surety, a California admitted surety insurer, are held and firmly bound unto the AGENCY for one hundred percent (100%) of the total amount payable by the AGENCY under the terms of the contract awarded by AGENCY to the Contractor/Principal, lawful money of the United States of America for payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH that if said Contractor/Principal, its heirs, executors, administrators, successors, or assigns, or a subcontractor, shall in all things stand to and abide by and well and truly keep and perform all the undertakings, terms, covenants, conditions, and agreements in the said contract which is attached hereto and incorporated herein by reference and any alteration and/or amendments thereof, made as therein provided, including, but not limited to, the provisions regarding contract duration and liquidated damages, all within the time and in the manner therein designated in all respects according to their true intent and meaning, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

As a condition precedent to the satisfactory completion of the contract, the above obligation shall hold good for a period of one (1) year(s) after the acceptance of the work by AGENCY, during which time if Contractor/Principal shall fail to make full, complete, and satisfactory repair and replacements and totally protect the AGENCY from loss or damage made evident during the period of one (1) year(s) from the date of completion of the work, and resulting from or caused by defective materials or faulty workmanship, the above obligation in penal sum thereof shall remain

APPENDIX C

in full force and effect. The obligation of Surety hereunder shall continue so long as any obligation of Contractor remains.

Whenever Contractor/Principal shall be, and is declared by the AGENCY to be, in default under the contract, the AGENCY having performed the AGENCY's obligations thereunder, the Surety shall promptly remedy the default in a manner mutually agreeable to both AGENCY and SURETY:

1. SURETY's takeover of the performance obligations to complete the contract by entering into an agreement with a completion contractor with terms and conditions consistent with the original contract between AGENCY and Contractor ; or

2. SURETY shall obtain a bid or bids for completing the contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsive and responsible bidder, prepare a contract between such bidder and the AGENCY (to the AGENCY's satisfaction), and make available as work progresses sufficient funds to pay the cost of completion less the balance of the contract price, but not exceeding, including other costs and damages for which Surety may be liable hereunder, the Penal Sum.

The term "balance of the contract price" as used in this paragraph shall mean the total amount payable to Contractor/Principal by the AGENCY under the contract and any modifications thereto, less the amount previously properly paid by the AGENCY to the Contractor/Principal.

Surety expressly agrees that the AGENCY may reject any contractor or subcontractor, which may be proposed by Surety in fulfillment of its obligations in the event of default by the Principal. Surety shall not utilize Contractor/Principal in completing the contract nor shall Surety accept a bid from Contractor/Principal for completion of the work if the AGENCY, when declaring the Contractor/Principal in default, notifies Surety of the AGENCY's objection to Contractor's/Principal's further participation in the completion of the work.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the AGENCY named herein or the successors or assigns of the AGENCY.

The said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or modification of the Project documents, or of the work to be performed thereunder, shall in any way affect its obligations on this bond; and it does hereby waive notice of any change, extension of time, alteration or modification of the Project documents or of work to be performed thereunder.

APPENDIX C

The prevailing party on any dispute (whether legal, equitable, or otherwise) regarding the interpretation, enforcement, and respective rights and obligations under this Performance Bond shall be entitled to recovery of reasonable attorney’s fees and costs (including but not limited to consultant’s and/or expert fees and costs). .

IN WITNESS HEREOF, we have hereto set our hands and seals on this _____ day of _____, _____.

Contractor/Principal
By: _____
Signature

Print Name and Title
By: _____
Signature

Print Name and Title

Surety
By: _____
Signature

Print Name and Title

(Mailing Address, Telephone and
Facsimile No. of Surety)

(Attach the Attorney-in-Fact Certificate for Surety. Attach notarial acknowledgements for signatures of both Contractor/Principal and Surety.) The date of this bond shall not be prior to the Contract date.

Bond No. _____

**PAYMENT BOND
(LABOR AND MATERIALS)**

KNOW ALL PERSONS BY THESE PRESENTS that:

WHEREAS Antelope Valley - East Kern Water Agency (“Public Agency”), State of California,
has _____ awarded _____ to

_____ (“Principal”)

(Name and address of Contractor)

a contract (the “Contract”) for the Work described as follows:

(Project name)

WHEREAS, under the terms of the Contract, the Principal is required before entering upon the performance of the Work, to file a good and sufficient payment Bond with the Public Agency to secure the claims to which reference is made in Title 3 (commencing with Section 9000) of Part 6 of Division 4 of the Civil Code.

NOW, THEREFORE, we, the undersigned Principal, and _____

(Name and address of Surety)

(“Surety”) a duly admitted surety insurer under the laws of the State of California, as Surety, are held and firmly bound unto the Public Agency and all contractors, subcontractors, laborers, material suppliers, and other persons employed in the performance of the Contract and referred to in Title 3 (commencing with Section 9000) of Part 6 of Division 4 of the Civil Code in the penal sum of _____

Dollars (\$ _____), for materials furnished or labor thereon of any kind, or for amounts due under the Unemployment Insurance Act with respect to this Work or labor, that the Surety will pay the same in an amount not exceeding the amount hereinabove set forth, and also in case suit is brought upon this Bond, will pay, in addition to the face amount thereof, costs and reasonable expenses and fees, including reasonable attorneys’ fees, incurred by Public Agency in successfully enforcing this obligation, to be awarded and fixed by the court, and to be taxed as costs and to be included in the judgment therein rendered.

It is hereby expressly stipulated and agreed that this Bond shall inure to the benefit of any and all persons, companies, and corporations entitled to file claims under Title 3 (commencing with Section 9000) of Part 6 of Division 4 of the Civil Code, so as to give a right of action to them or their assigns in any suit brought upon this Bond.

APPENDIX C

Upon expiration of the time within which the California Labor Commissioner may serve a civil wage and penalty assessment against the principal, any of its subcontractors, or both the principal and its subcontractors pursuant to Labor Code Section 1741, and upon expiration of the time within which a joint labor management committee may commence an action against the principal, any of its subcontractors, or both the principal and its subcontractors pursuant to Labor Code Section 1771.2, if the condition of this Bond be fully performed, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

The Surety hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract or the Specifications accompanying the same shall in any manner affect its obligations on this Bond, and it does hereby waive notice of any such change, extension, alteration, or addition.

IN WITNESS WHEREOF, two (2) identical counterparts of this instrument, each of which shall for all purposes be deemed an original hereof, have been duly executed by Principal and Surety, on the date set forth below, the name of each corporate party being hereto affixed and these presents duly signed by its undersigned representative(s) pursuant to authority of its governing body.

Dated: _____

“Principal”

“Surety”

By: _____
Its

By: _____
Its

By: _____
Its

By: _____
Its

(Seal)

(Seal)

Note: This Bond must be executed in duplicate and dated, all signatures must be notarized, and evidence of the authority of any person signing as attorney-in-fact must be attached. DATE OF BOND MUST NOT BE BEFORE DATE OF CONTRACT. Surety companies executing Bonds must appear on the Treasury Department’s most current list (Circular 570 as amended) and be authorized to transact business in the State where the project is located.

ANTELOPE VALLEY - EAST KERN WATER AGENCY

WORKERS' COMPENSATION INSURANCE CERTIFICATE

Pursuant to Section 1861 of the State Labor Code, and all amendments thereto, each contractor to whom a public works contract has been awarded shall sign the following certificate and shall submit same to the Agency prior to performing any work on the contract:

“I am aware of the provisions of Section 3700 of the Labor Code which requires every employer to be insured against liability for Worker’s Compensation or to undertake self-insurance in accordance with the provisions of that Code, and I will comply with such provisions before commencing the performance of work of this contract.”

Contractor

By _____
Print Name

Signature

Title

Date

Section 3700 of the State Labor Code reads as follows:

“Every employer except the State shall secure the payment of compensation in one or more of the following ways:

- (a) By being insured against liability to pay compensation in one or more insurers duly authorized to write compensation insurance in this state.
- (b) By securing from the Director of Industrial Relations a certificate of consent to self-insure, which may be given upon furnishing proof satisfactory to the Director of Industrial Relations of ability to self-insure and to pay any compensation that may become due to his employee.”

ANTELOPE VALLEY - EAST KERN WATER AGENCY

GUARANTY

In accordance with the terms of the _____ Contract between Antelope Valley - East Kern Water Agency, (hereinafter referred to as the Agency) and the undersigned, under which contract the undersigned shall complete work as described in the Contract documents, the following guarantee of said work is hereby made.

Should any of the items installed pursuant to said Contract, prove defective or should the item as a whole prove defective, due to faulty workmanship, material furnished or methods of installation, or should the said item or any part thereof fail to operate properly, as planned, due to any of the above causes, all within one (1) year after date on which the work is accepted by the Agency, the undersigned agrees that the repairs shall be made and such materials as are necessary shall be furnished and installed within thirty (30) days after the receipt of demand from the Agency. In the event repairs are not made within thirty (30) days, the Agency shall have the unqualified option to make any needed repairs or replacements itself or by any other Contractor. The undersigned agrees to reimburse the Agency, upon demand, of its expenses incurred in restoring said items to the condition contemplated in said contract, including the cost of any equipment or materials replaced, or upon demand by the Agency, to replace any such equipment and repair said items completely without cost to the Agency so that they will operate successfully as originally contemplated.

Emergency repairs must necessarily be made by the Agency; therefore, when defective material or workmanship results in emergency repairs, the undersigned agrees to reimburse the Agency, upon demand, expenses incurred.

Said items will be deemed defective within the meaning of this Guaranty in the event that they fail to operate as originally intended thereof and in accordance with the plans and specifications included in said contract. The Faithful Performance Bond for this project shall remain in full force and effect for the entire guarantee period as required in the specifications and contract documents.

Date

Contractor

APPENDIX D

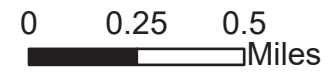
Stoplog Modification Plans

HDWB 24-03 Stoplog Modification Project

Project location
50606U 290th St W
Lancaster CA 93536

Legend

-  AVEK Service Area Boundary
-  HDWB Boundaries
-  HDWB Turnout
-  California State Water Project



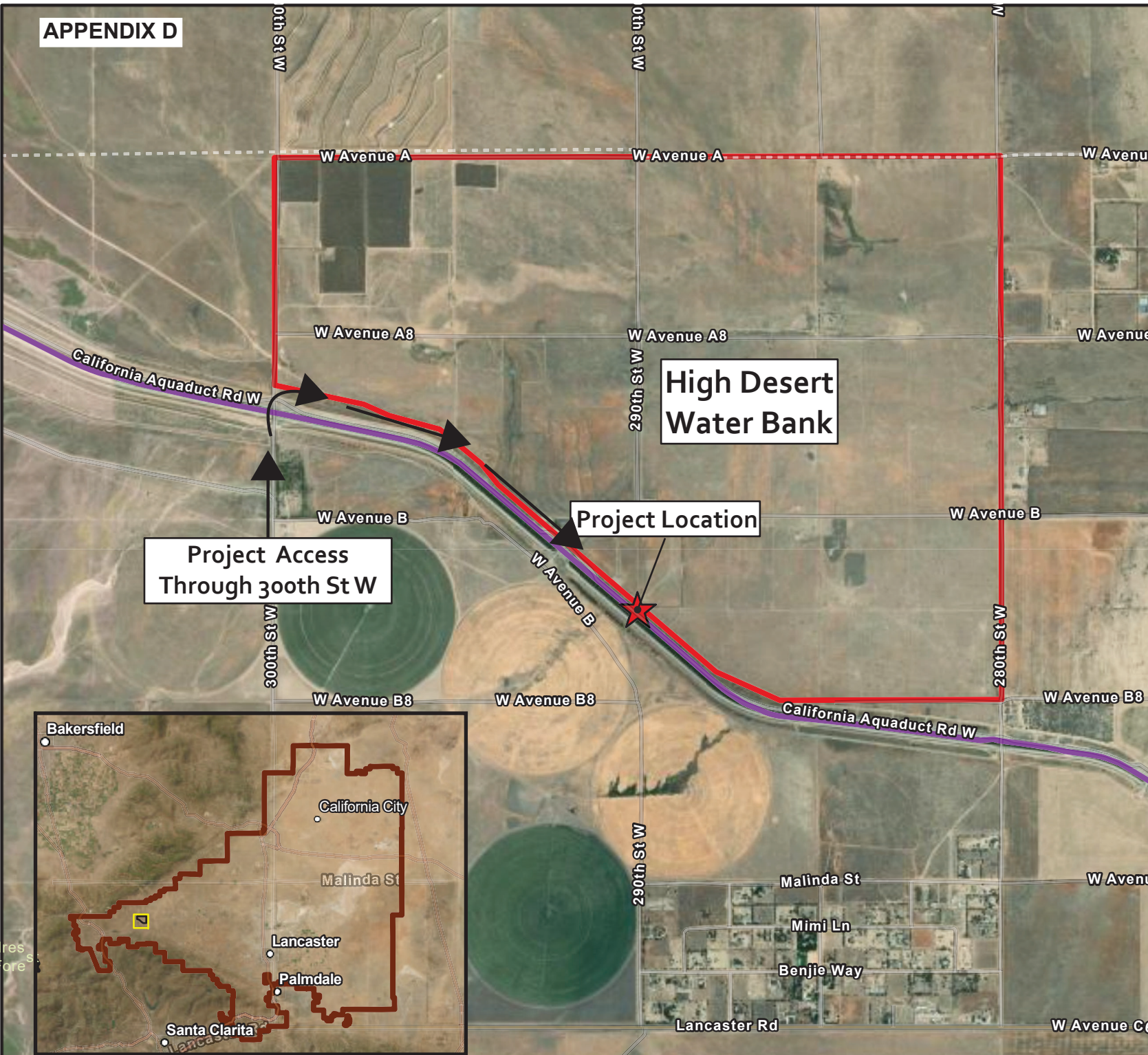
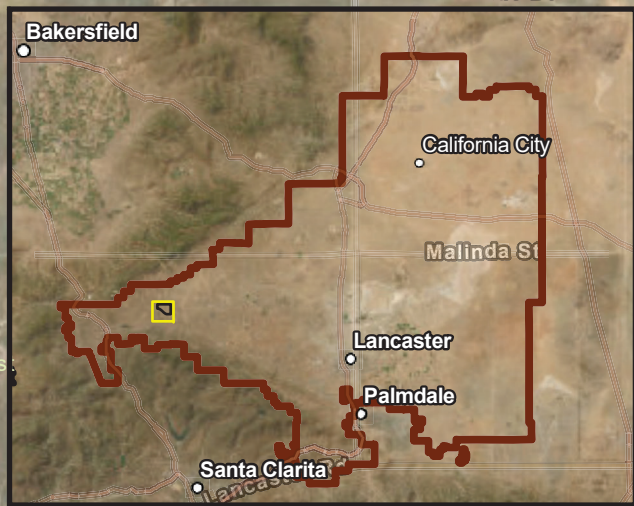
08/06/2024



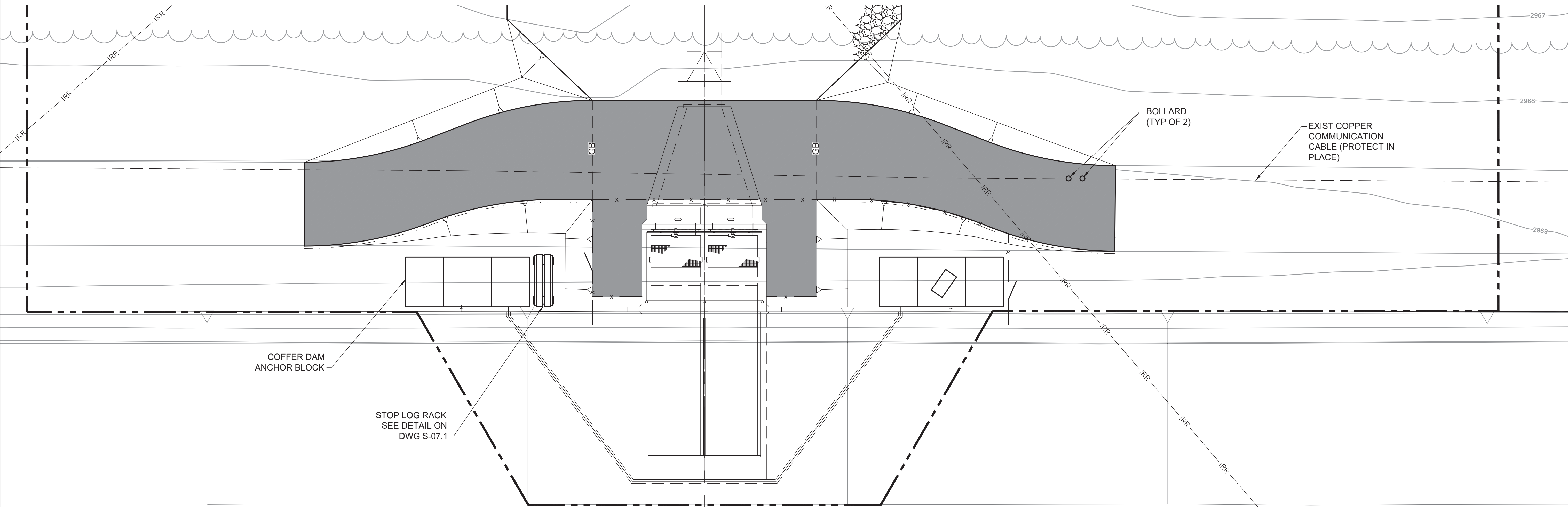
High Desert
Water Bank

Project Location

Project Access
Through 300th St W

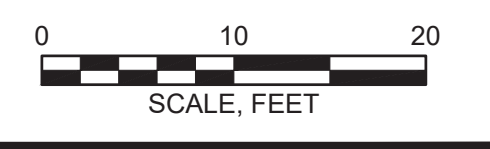


DRAWING: c:\users\kchung\onedrive - gei consultants, inc\documents\working projects\avek-stantec\high desert water bank\turn in_out\sheet_files\c-01_02.dwg PLOTTED: 3/22/2024 9:35 AM
By: Chung, K



APPENDIX D

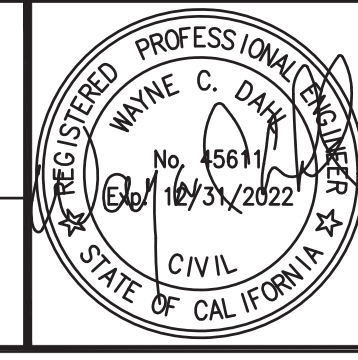
TURNOUT/TURN-IN SITE PLAN
SCALE: 1"=10'



NO.	DATE	REVISIONS	APPROVED
1	2/10/24	DWR REVIEW	

Stantec
38 TECHNOLOGY DRIVE, SUITE 100
IRVINE, CA 92618
949.923.6000
stantec.com

DAHL
consultants

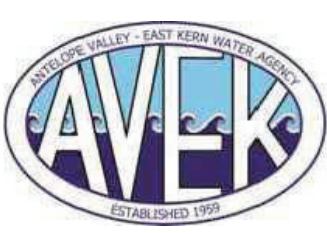


WAYNE C. DAHL
NAME

DESIGN TEAM LEAD
R.C.E. 45611

11/10/21
DATE

The Contractor shall verify and be responsible for all dimensions. DO NOT scale the drawing - any errors or omissions shall be reported to Stantec without delay. The Copyrights to all designs and drawings are the property of Stantec. Reproduction or use for any purpose other than that authorized by Stantec is forbidden.



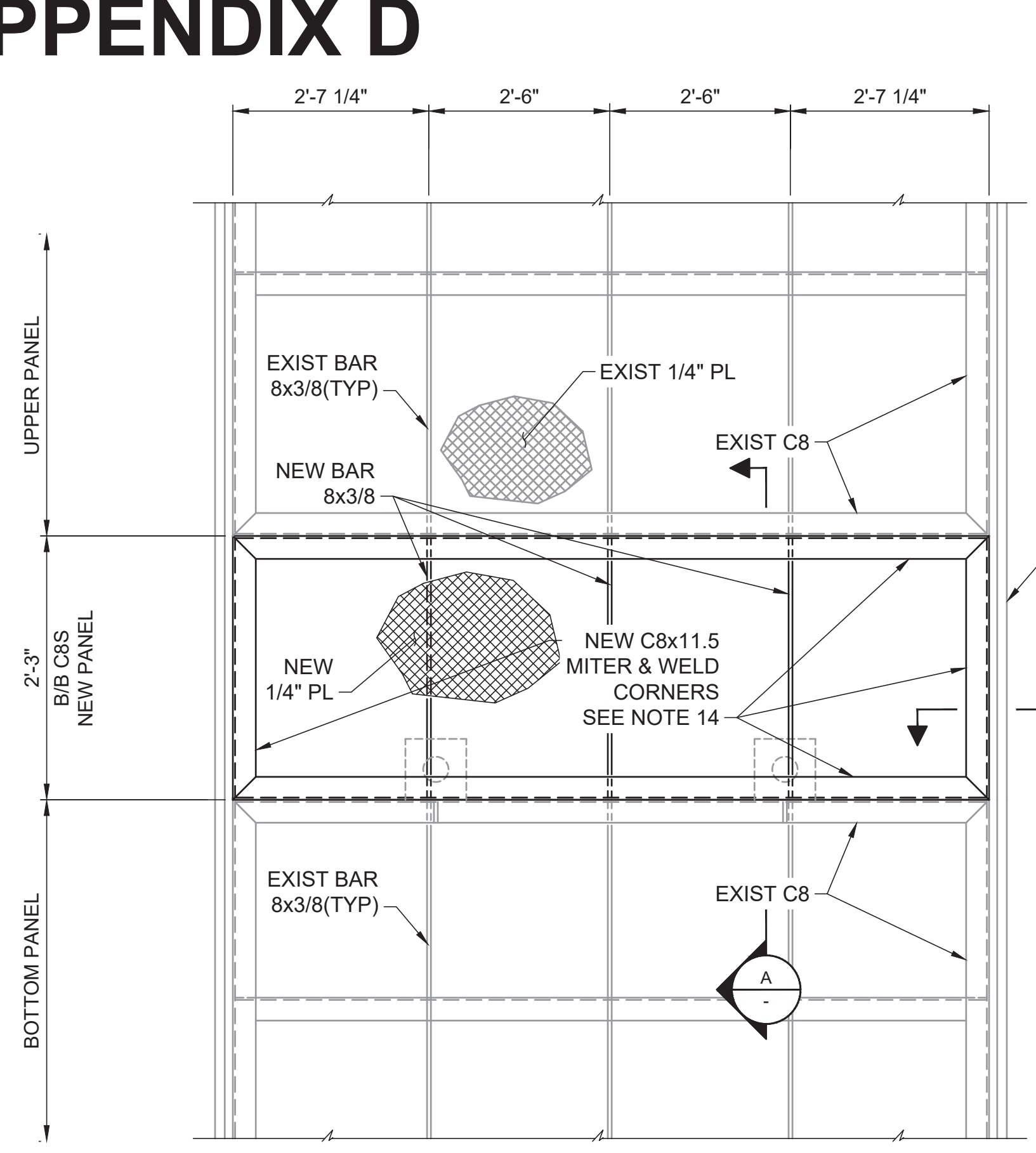
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

CIVIL
AQUEDUCT TURNOUT/TURN-IN
SITE PLAN AND PHOTO

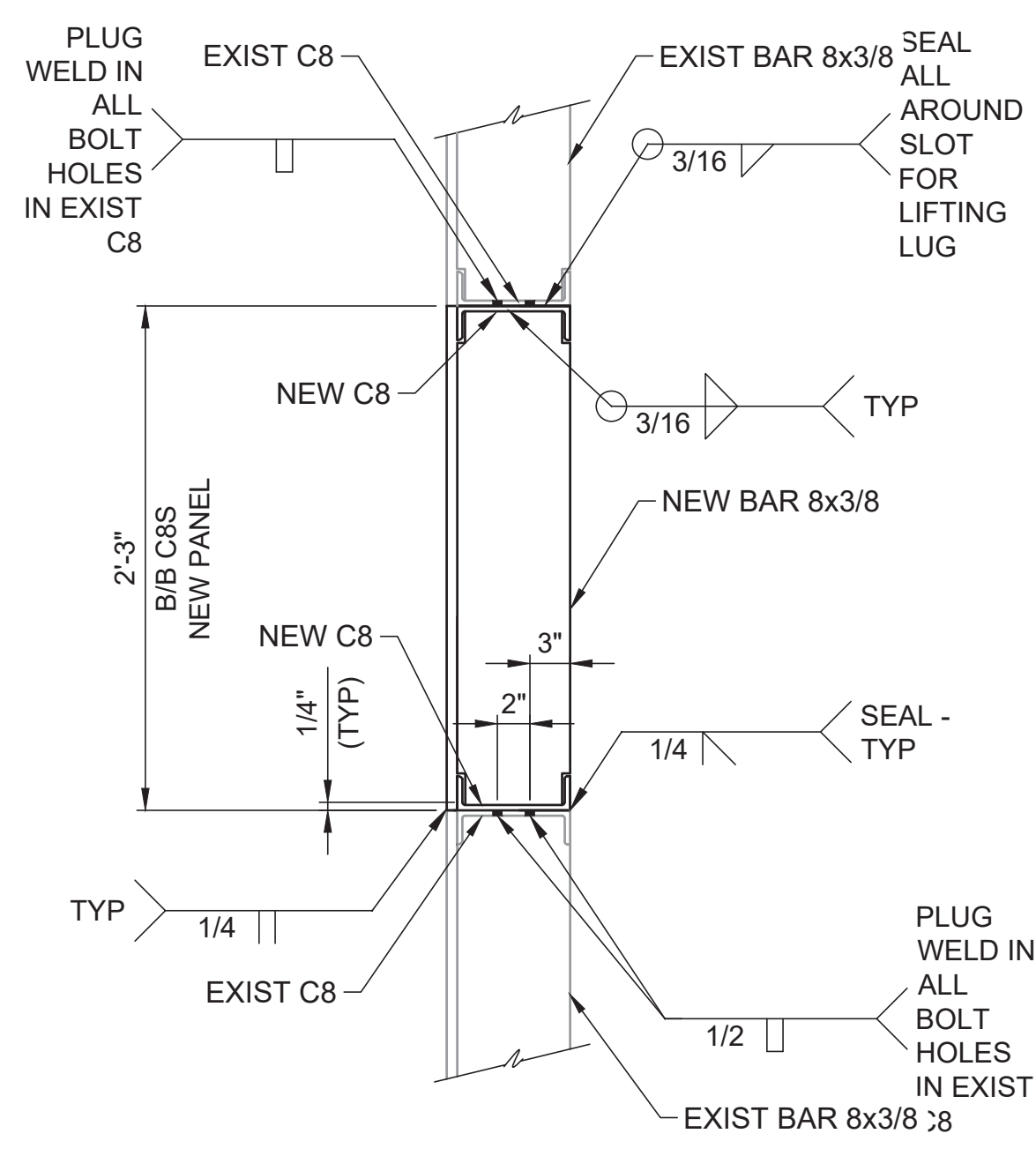
SHEET
C-02.1
10 of 60
SHEETS

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN
NOVEMBER 2021

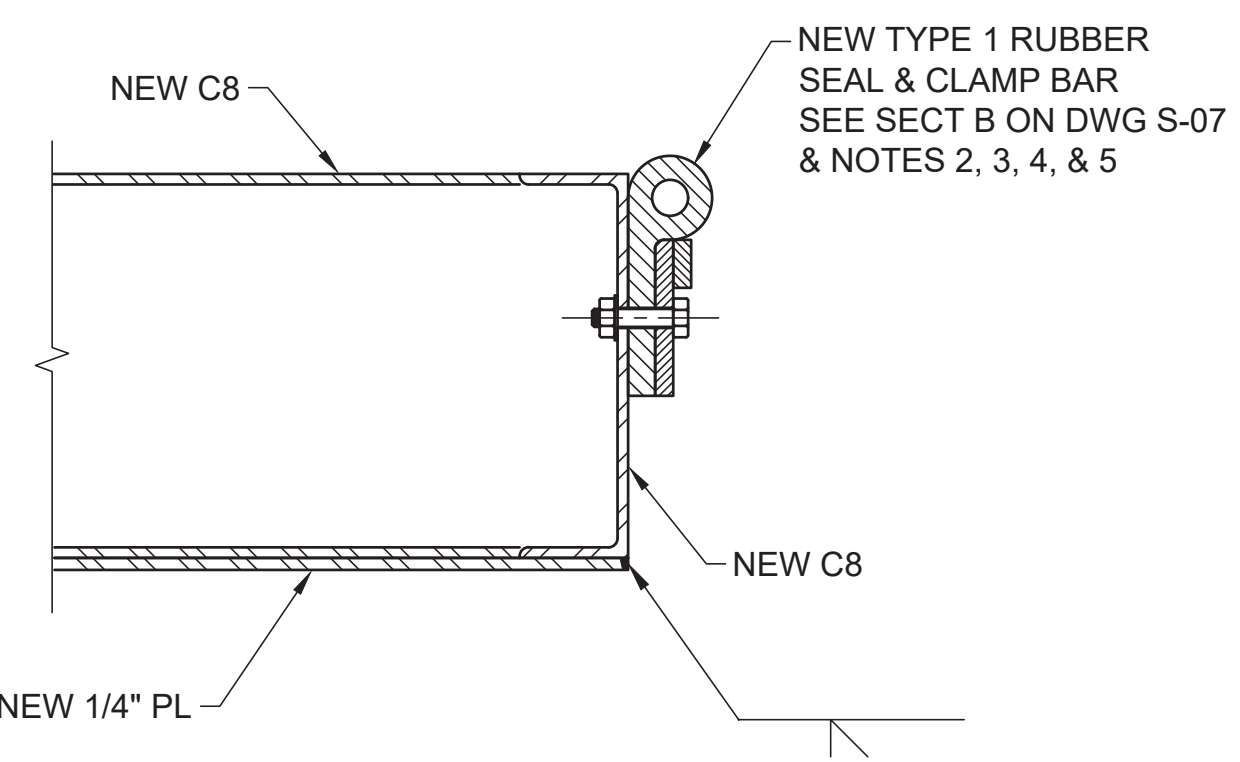
APPENDIX D



STOP LOG PARTIAL ELEVATION
NO SCALE



SECTION A
NO SCALE



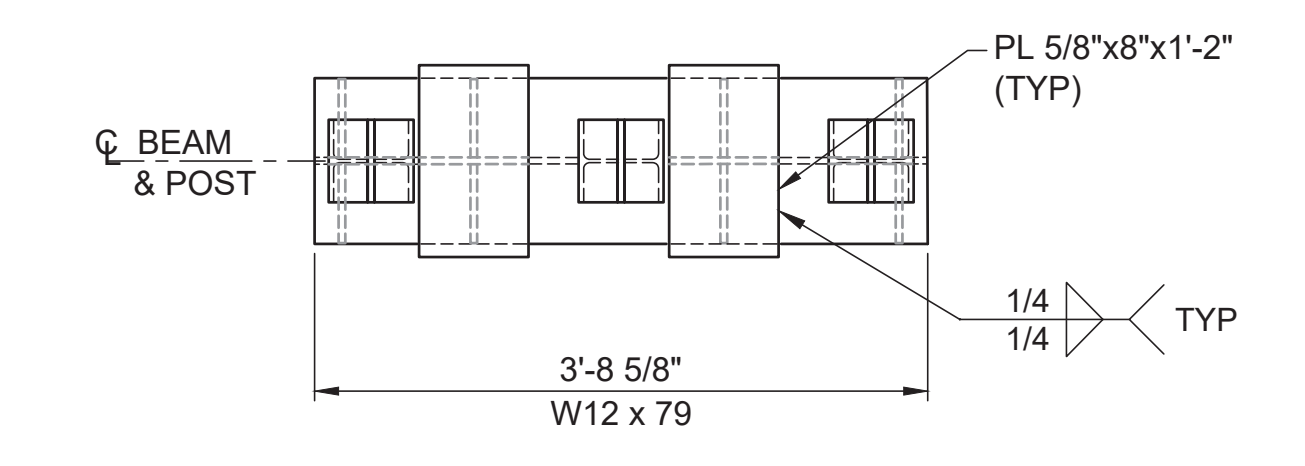
SECTION B
NO SCALE

- NOTES:**
- THIS DWG MODIFIES DWG S-07. SEE DWG S-07 FOR REFERENCE, FOR TOP AND BOTTOM PANEL DETAILS.
 - REMOVE BOTH LIFTING LUGS FROM BOTTOM PANEL OF STOP LOG & GRIND FLAT.
 - PROVIDE TYPE 1 RUBBER SEAL AND CLAMP BAR PER SECTION B AND DETAILS ON S-07.
 - REMOVE ALL RUBBER SEALS AND CLAMP BARS. INSTALL NEW, CONTINUOUS SEALS AND CLAMP BARS FULL HEIGHT EACH SIDE OF STOP LOG ASSEMBLY AND ACROSS BOTTOM.
 - RUBBER SEAL CORNER JOINTS SHALL BE MITERED AND VULCANIZED.
 - WELD SHALL BE GROUND FLUSH WHERE IN CONTACT W/ SEALS.
 - ALL PLATES AND SHAPES SHALL BE ASTM A36 STEEL.
 - NEW PANEL SHALL BE HOT DIP GALVANIZED AFTER FABRICATION AND PRIOR TO FINAL ASSEMBLY AND WELDING OF THE FULL STOP LOG.
 - WELDS AND OTHER AREAS WHERE THE GALVANIZING IS DAMAGED SHALL BE COATED WITH GALVANOX OR EQUAL AFTER FINAL ASSEMBLY.
 - SKIN PLATE JOINTS SHALL BE WATER TIGHT WITH FULL PENETRATION BUTT WELDS.
 - SEAL CLAMP BARS SHALL HAVE CONTINUOUS WATER TIGHT JOINTS WITH FULL PENETRATION BUTT WELDS.
 - ALL BOLTS, NUTS, AND WASHERS SHALL BE TYPE 316 STAINLESS STEEL, CLASS 2, CONFORMING TO ASTM A193 FOR BOLTS AND ASTM A194 FOR NUTS. ALL WELDS TO BE CONTINUOUS, WITH E70XX WELD ELECTRODE.

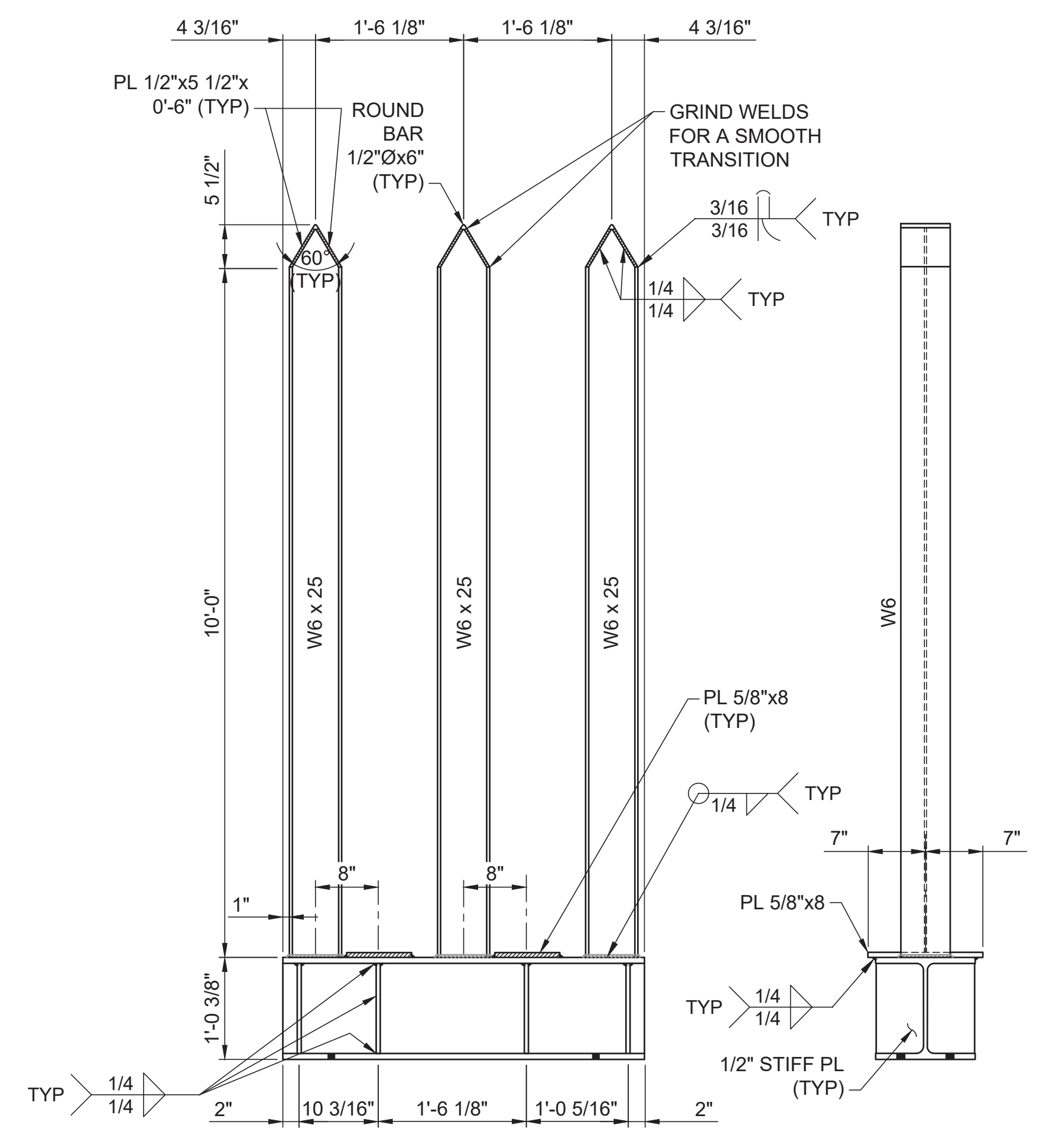
- NON-DESTRUCTIVE TESTING (NDT) IS REQUIRED FOR ALL WELDS ON THE STOP LOG ASSEMBLIES. NDT IS NOT REQUIRED FOR THE WELDS ON THE STORAGE RACK ASSEMBLIES. WELD TEST ACCEPTANCE CRITERIA SHALL BE IN ACCORDANCE WITH AWS STRUCTURAL WELDING CODE, D1.1 AND D1.8. THE NDT SCHEDULE SHALL BE AS FOLLOW:

Weld Test Acceptance Criteria: AWS D1.1 and D1.8 NONDESTRUCTIVE TEST SCHEDULE			
Portion of Work	Type of Weld	NDT Method	Frequency
Shop Welds	Fillet Welds	None	n/a
	PJP	Ultrasonic (UT)	25%
	CJP	Ultrasonic (UT) or Radiographic (RT)	100%
Field Welds	Fillet Welds	None	n/a
	PJP	Ultrasonic (UT)	25%
	CJP	Ultrasonic (UT) or Radiographic (RT)	100%

- CONNECTION CALLED OUT AS MITER AND WELD SHALL CONSIST OF FULL PENETRATION GROOVE WELDS ON FLANGES AND A SQUARE BUTT WELD ON THE WEBS. SURFACES IN CONTACT WITH SEALS OR THE FACE PLATE SHALL BE GROUND SMOOTH.

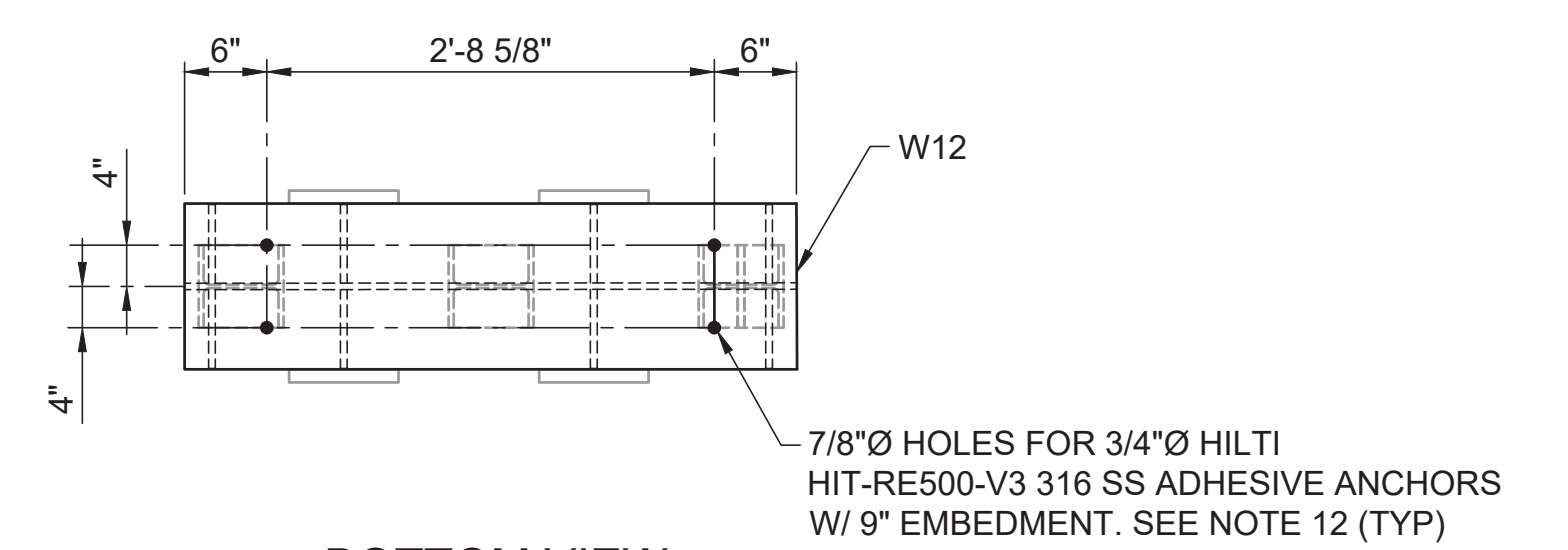


PLAN VIEW



ELEVATION

END VIEW



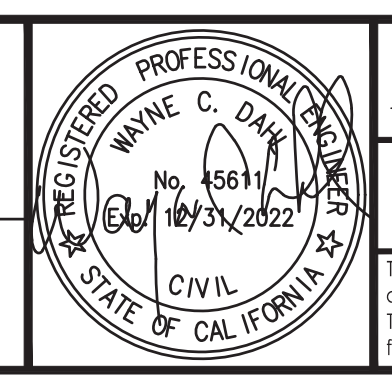
BOTTOM VIEW

STOP LOG RACK DETAIL (2 RACK ASSEMBLIES REQD)
NO SCALE

NO.	DATE	REVISIONS	APPROVED
2	4/30/24	DWR REVIEW	
1	2/10/24	DWR REVIEW	

Stantec
38 TECHNOLOGY DRIVE, SUITE 100
IRVINE, CA 92618
949-923-6000
stantec.com

DAHL
consultants



WAYNE C. DAHL
NAME

DESIGN TEAM LEAD
R.C.E. 45611

11/10/21
DATE

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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL

STOP LOG MODIFICATIONS
PARTIAL ELEVATION AND SECTIONS

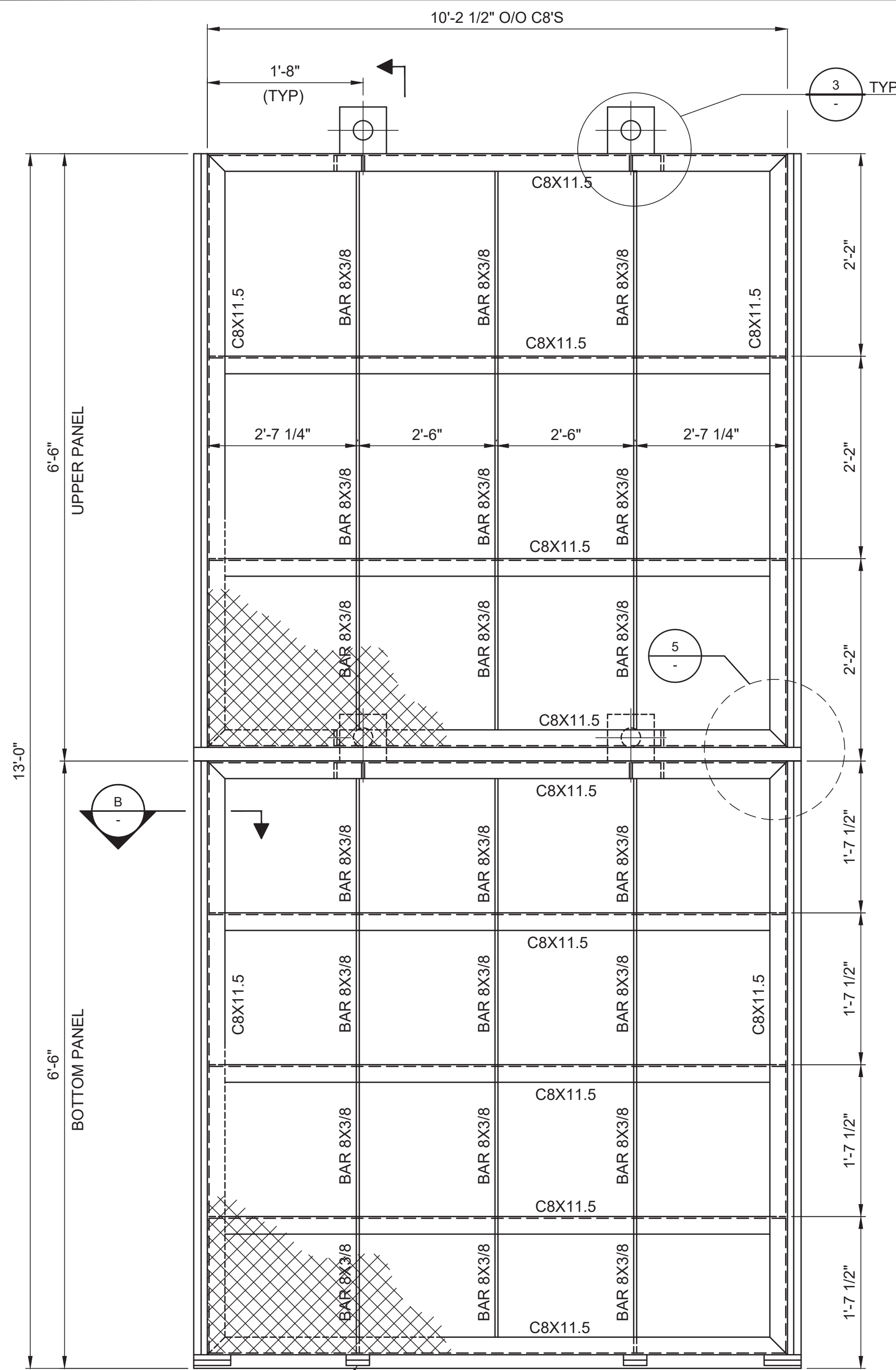
SHEET
S-07.1

27 of 60
SHEETS

DRAWING: c:\users\kchung\onedrive - gei consultants, inc\documents\working projects\ahli projects\avek-stantec\high desert water bank\turn in_out\sheet_files\s-07_1.dwg PLOTTED: 5/3/2024 8:29 AM BY: Chung, K

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

DRAWING: d:\working_projects\dahl_projects\working\avek-stantec\high_desert_water_bank\turn_in_out\sheet_files\s-07.dwg PLOTTED: 2/8/2022 6:32 PM BY: Chung, KI

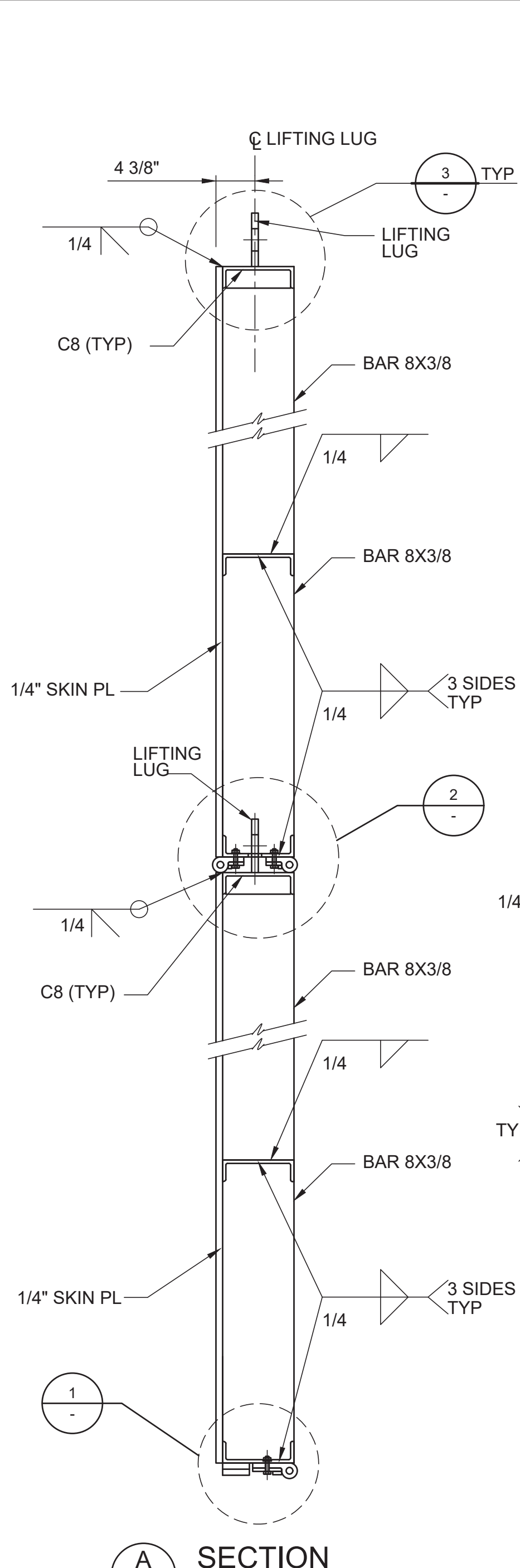


2 PL 11/16 X 3 X 0'-6"
(TYP 4 PLACES)

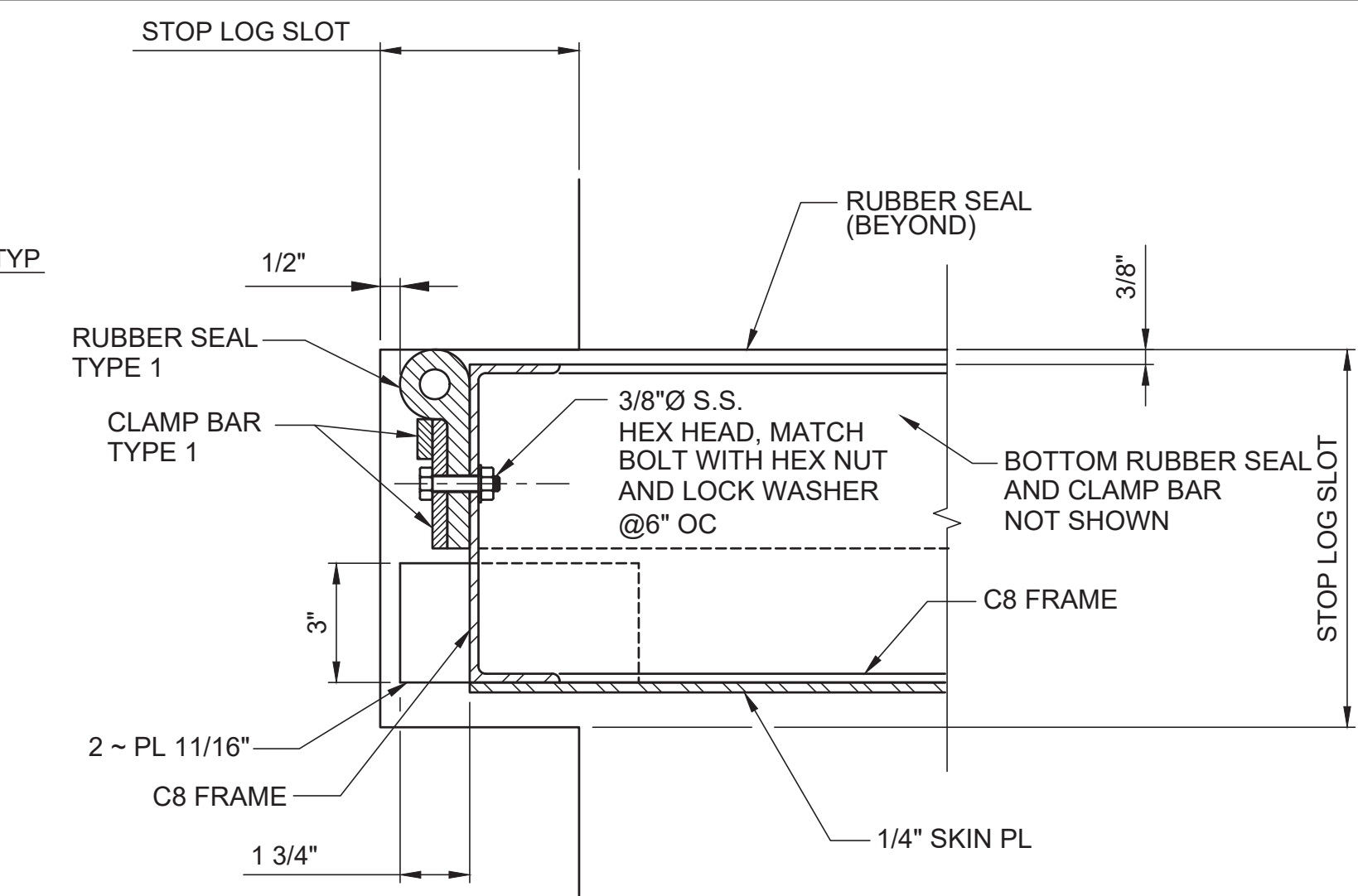
STOP LOG ELEVATION
NO SCALE

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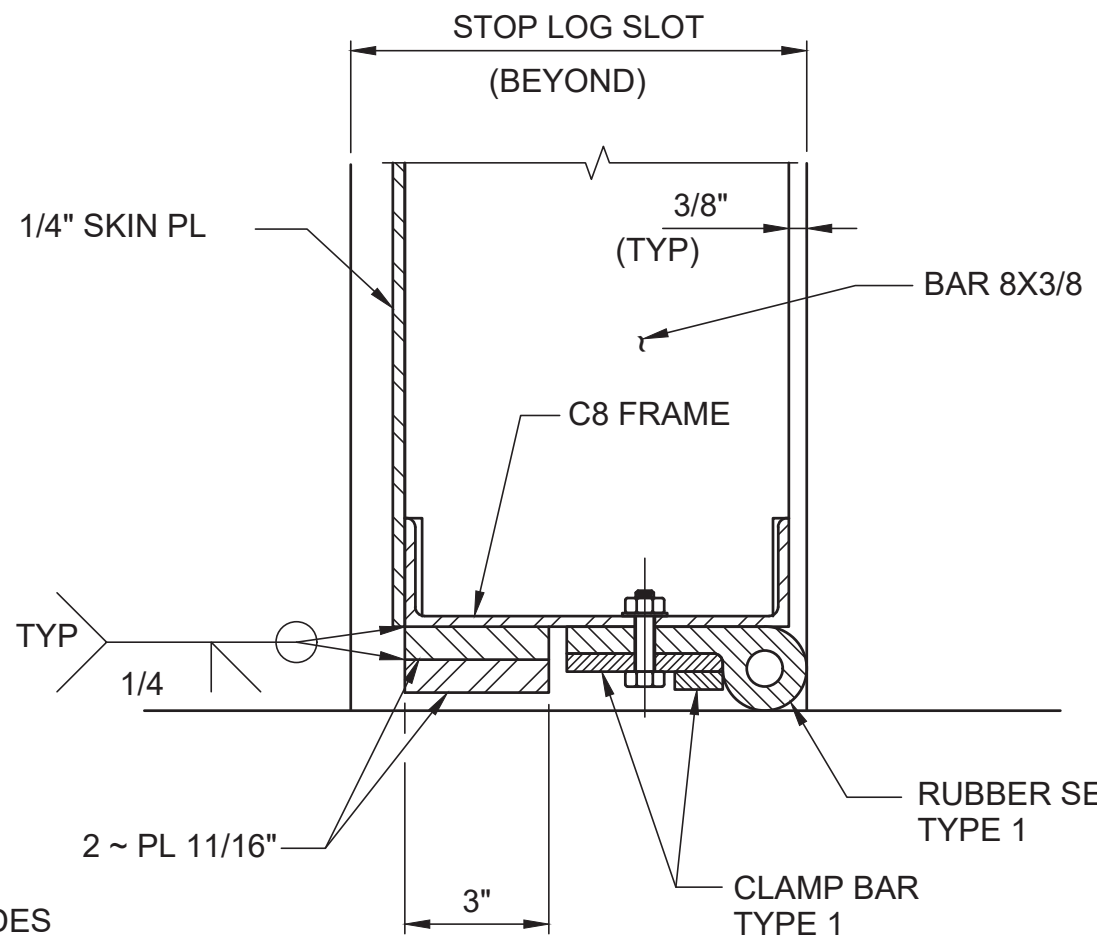
1. ALL PLATES AND SHAPES SHALL BE ASTM A36 STEEL AND SHALL BE HOT DIP GALVANIZED AFTER FABRICATION UNLESS NOTED OTHERWISE.
2. SKIN PLATE JOINTS SHALL BE WATER TIGHT WITH FULL PENETRATION BUTT WELDS.
3. WELDS SHALL BE GROUND FLUSH WHERE IN CONTACT WITH SEALS.
4. RUBBER SEAL SHALL HAVE CONTINUOUS WATER TIGHT JOINTS. JOINTS SHALL BE VULCANIZED.
5. SEAL CLAMP BARS SHALL HAVE CONTINUOUS WATER TIGHT JOINTS WITH FULL PENETRATION BUTT WELDS.
6. ALL BOLTS, NUTS, AND WASHERS SHALL BE TYPE 316 STAINLESS STEEL, CLASS 2, CONFORMING TO ASTM A193 FOR BOLTS AND TO ASTM A194 FOR NUTS. ALL WELDS TO BE CONTINUOUS, WITH E70XX WELD ELECTRODE.



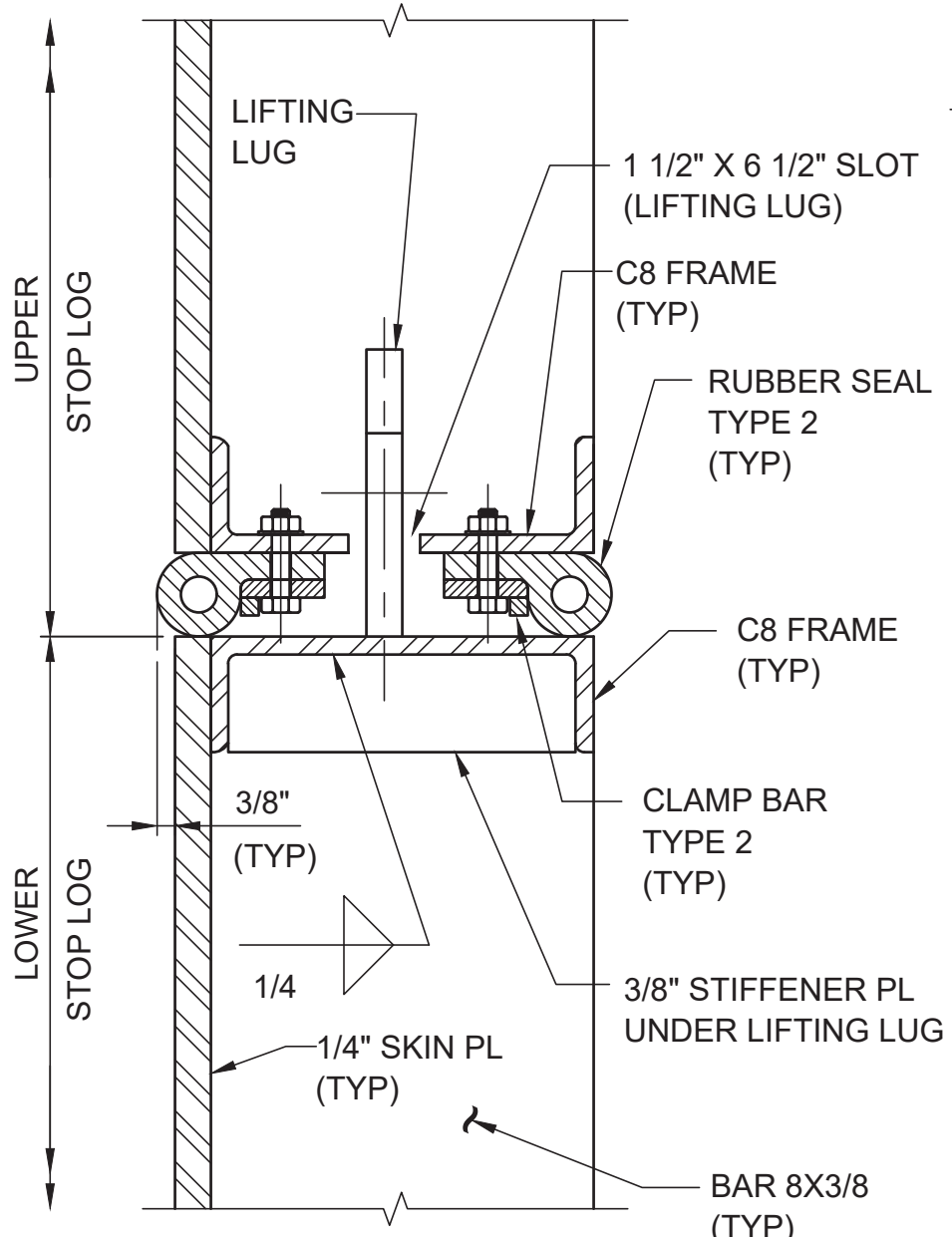
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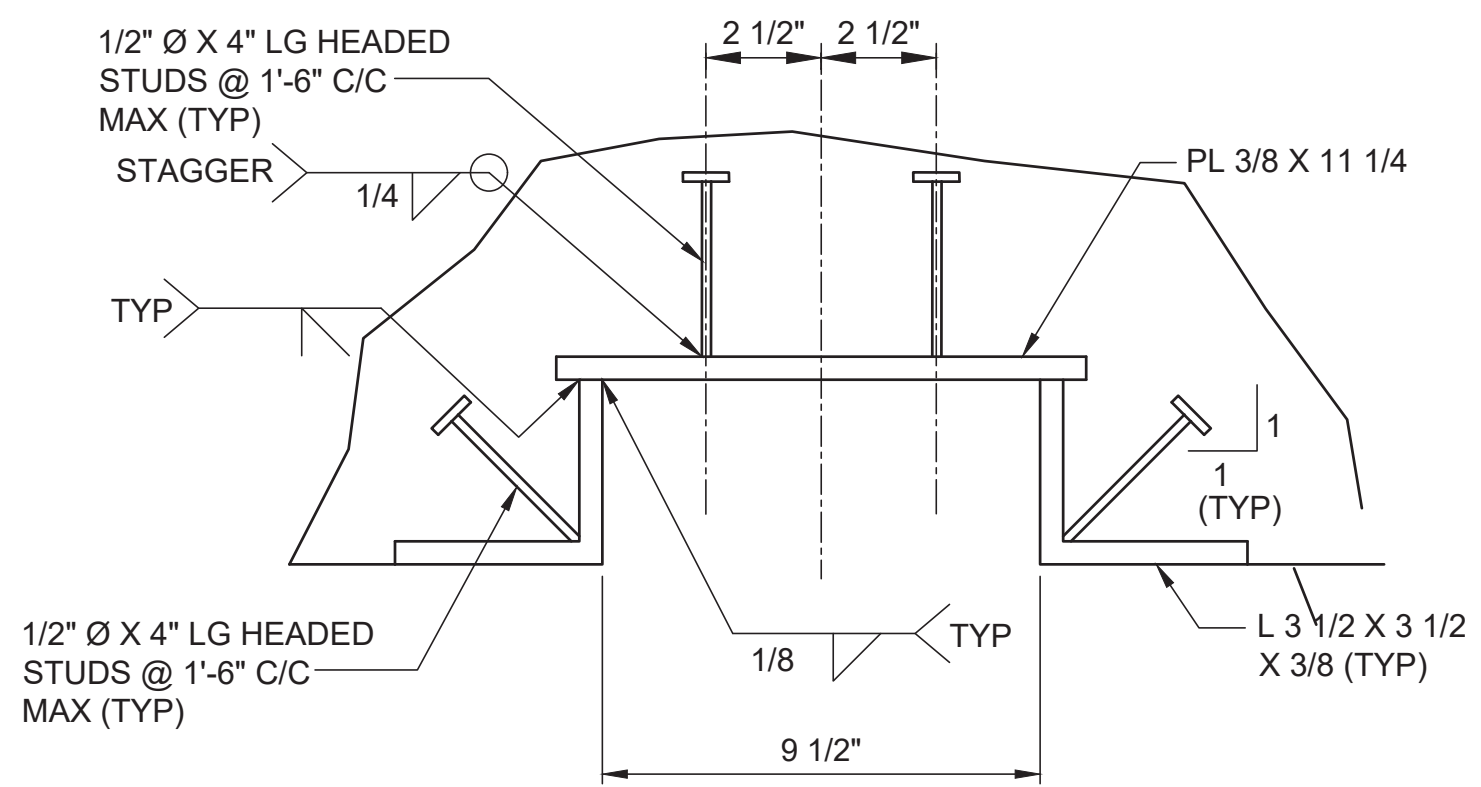
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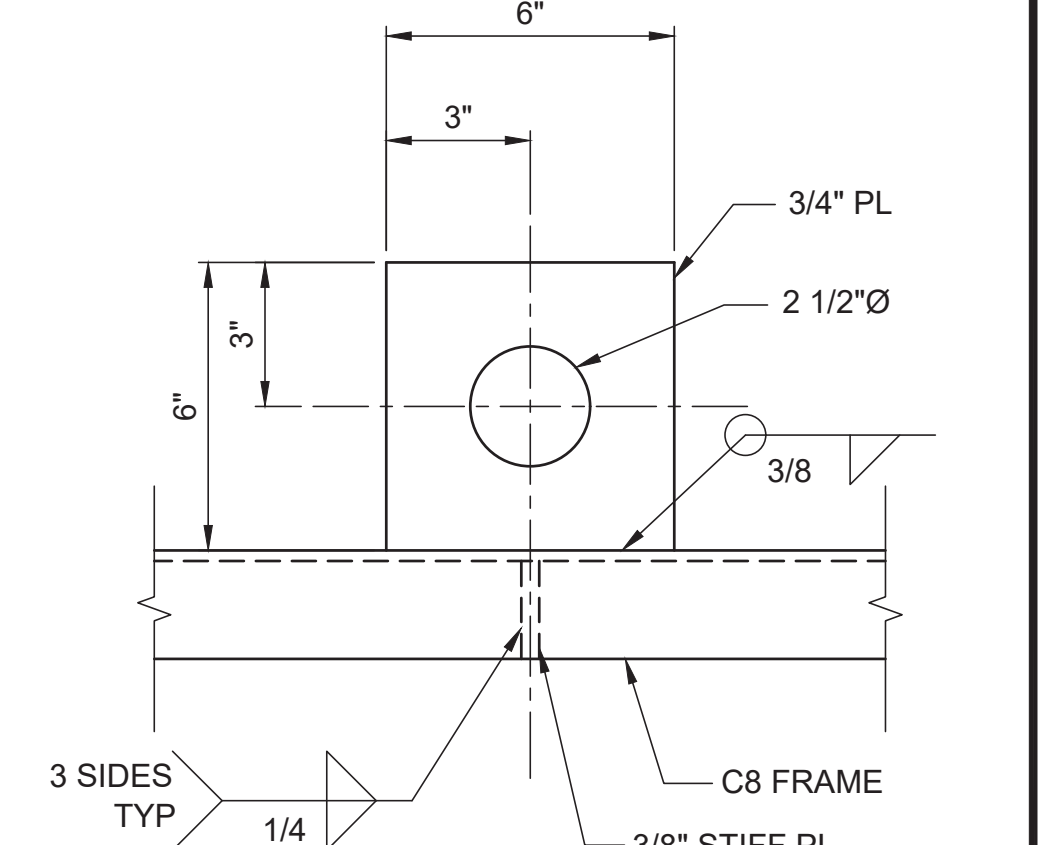
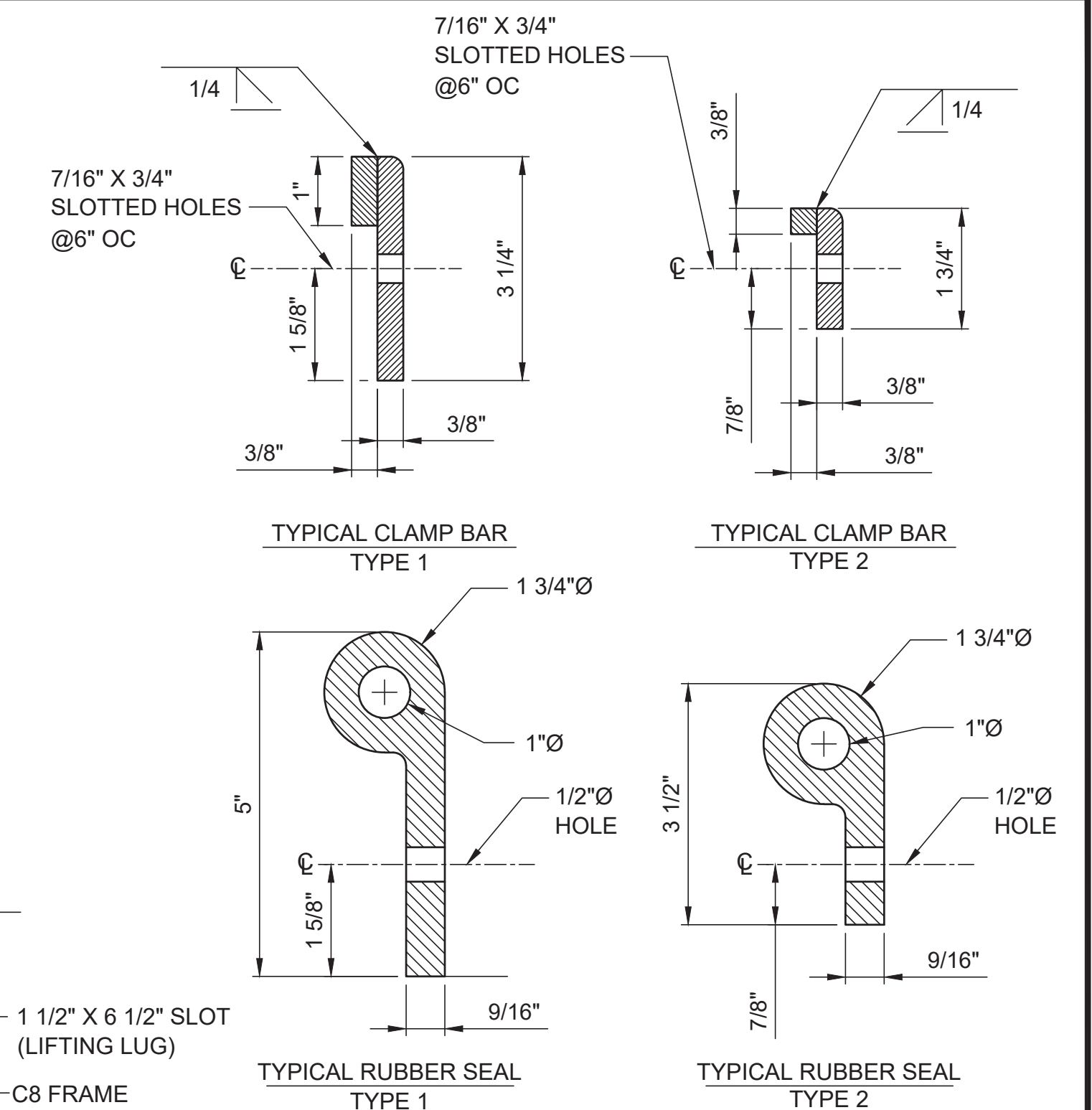
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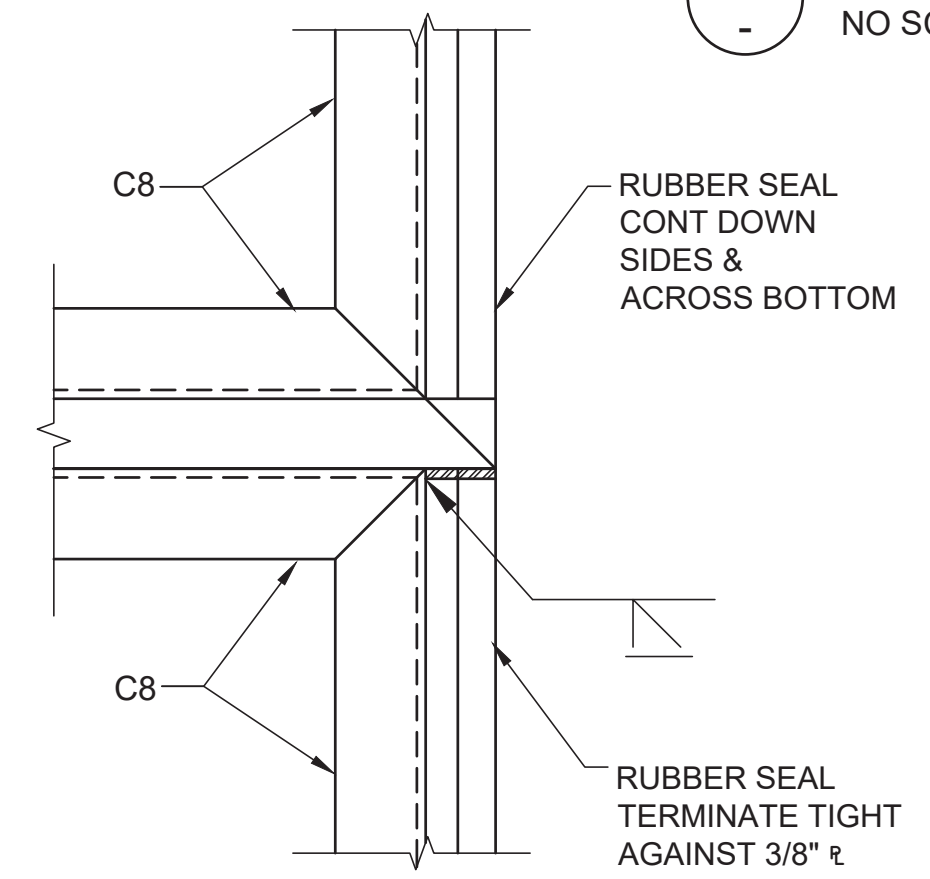
DETAIL 2
NO SCALE



DETAIL 4
NO SCALE



DETAIL 3
NO SCALE



DETAIL 4
NO SCALE

APPENDIX D

NO.	DATE	REVISIONS	APPROVED

Stantec
38 TECHNOLOGY DRIVE, SUITE 100
IRVINE, CA 92618
949.923.6000
stantec.com

DAHL
consultants

REGISTERED PROFESSIONAL ENGINEER
WAYNE C. DAHL
No. 45611
Exp. 10/31/2022
CIVIL
STATE OF CALIFORNIA

WAYNE C. DAHL
NAME
DESIGN TEAM LEAD
R.C.E. 45611
11/10/21
DATE

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ANTHELOPE VALLEY - EAST KERN WATER AGENCY

ANTHELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

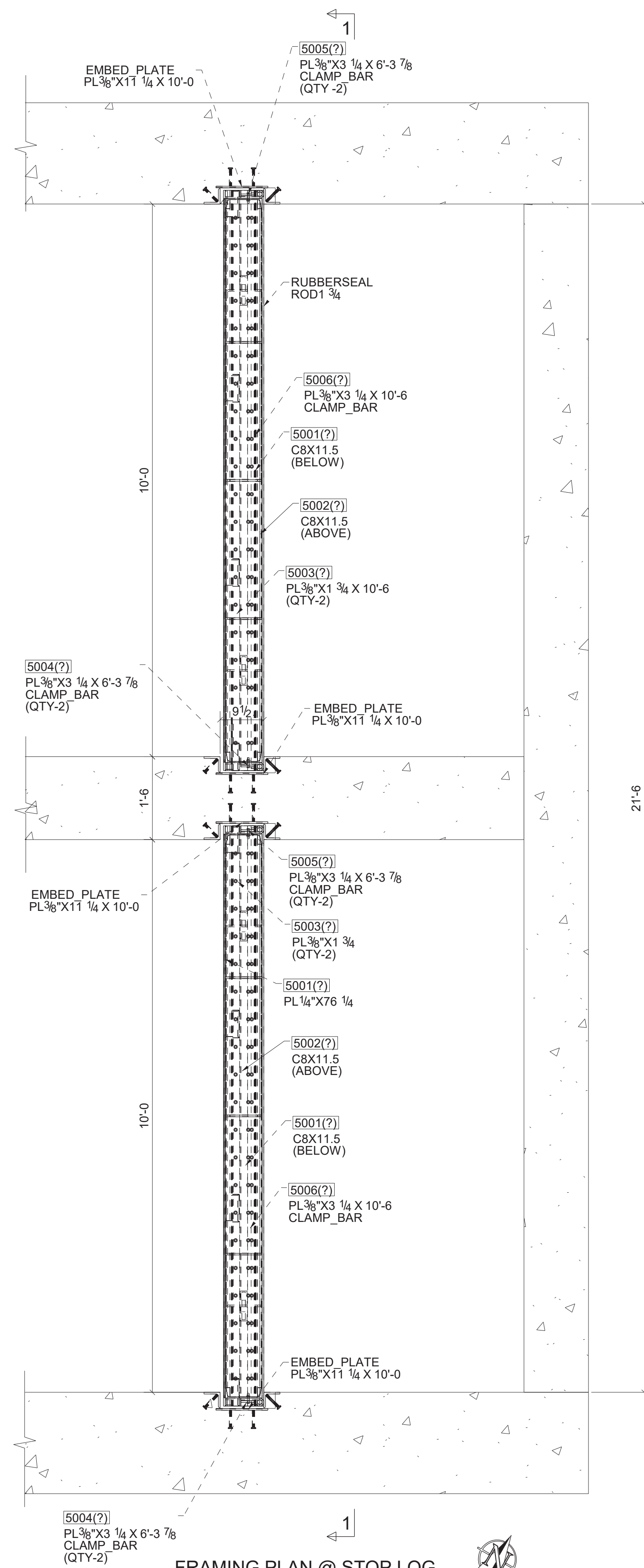
STRUCTURAL
STOP LOG ELEVATION, SECTIONS
AND DETAILS

SHEET
S-07
24 of 54
SHEETS

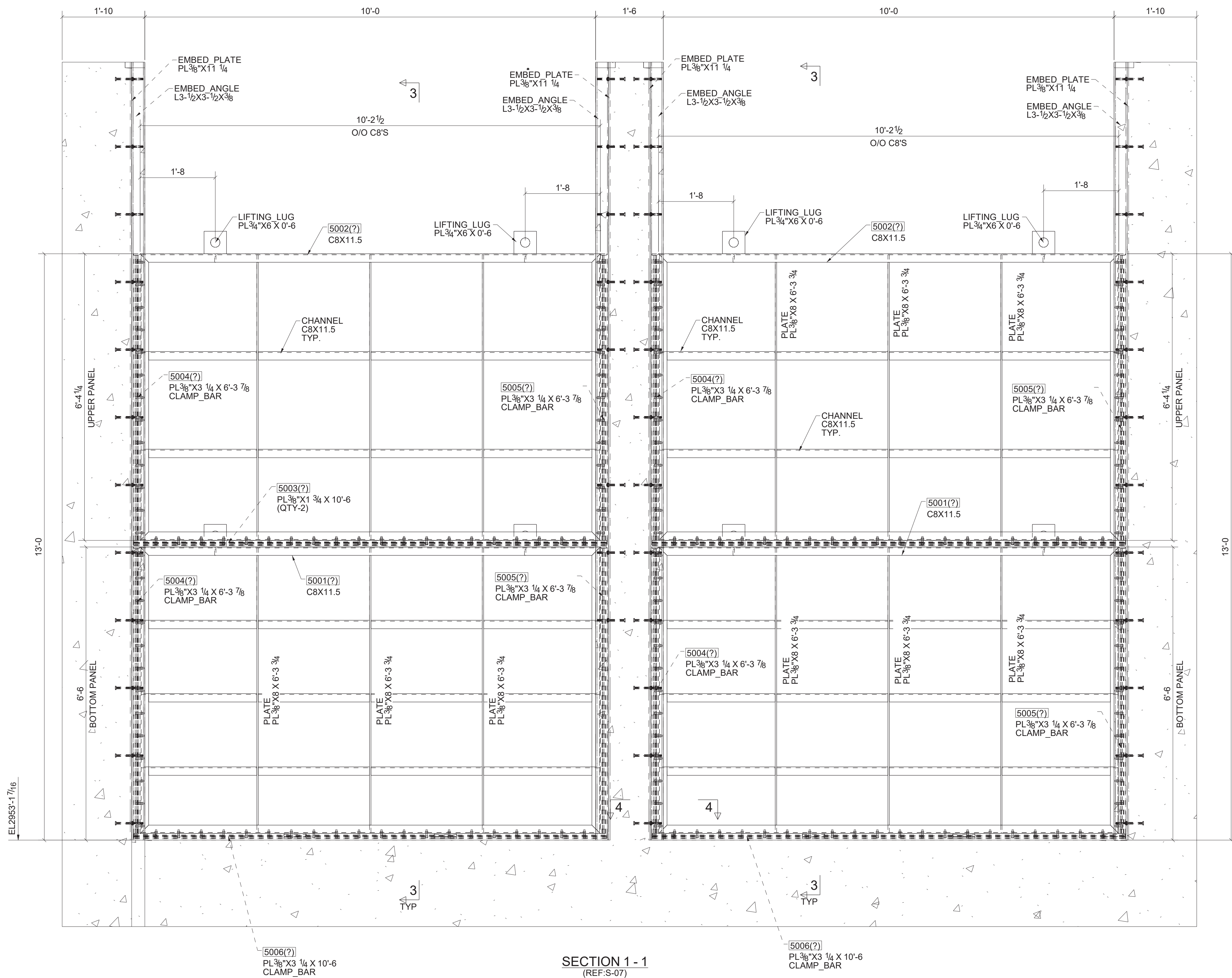
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

APPENDIX E

Existing Stoplog Shop Drawings



FRAMING PLAN @ STOP LOG
REFER EM 2 FOR EMBED PLAN



SECTION 1 - 1
(REF: S-07)

ALL STEEL IN THIS SHEET ARE GALVANIZED.



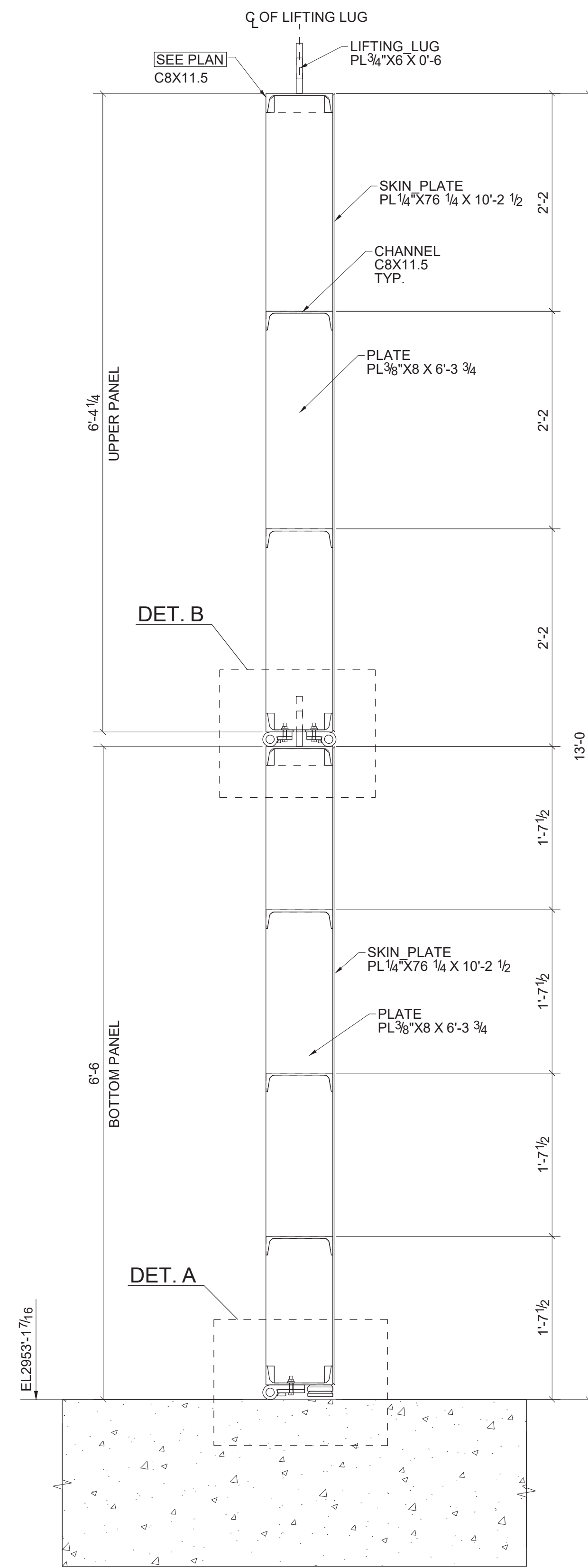
ANTELOPE VALLEY-EAST KERN WATER AGENCY
PALMDALE, CA

DATE:	04/13/2022				
DRAWN:	MAV				
CHK'D:	DVS	A	04/13/2022	MAV	ISSUED FOR APPROVAL
APP'VD:		B	10/13/2022	TVK	ISSUED FOR RE-APPROVAL
		REV.	DATE	BY	REMARKS

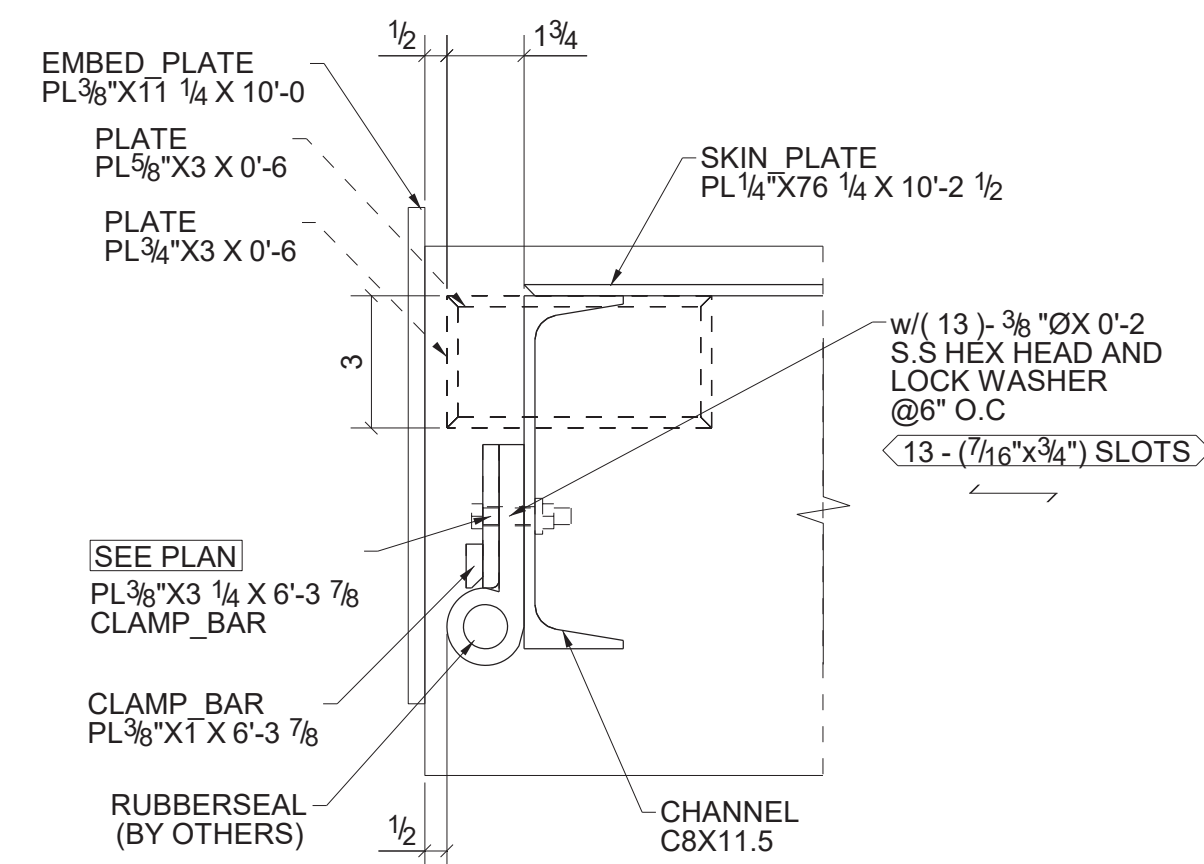
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NOTES:

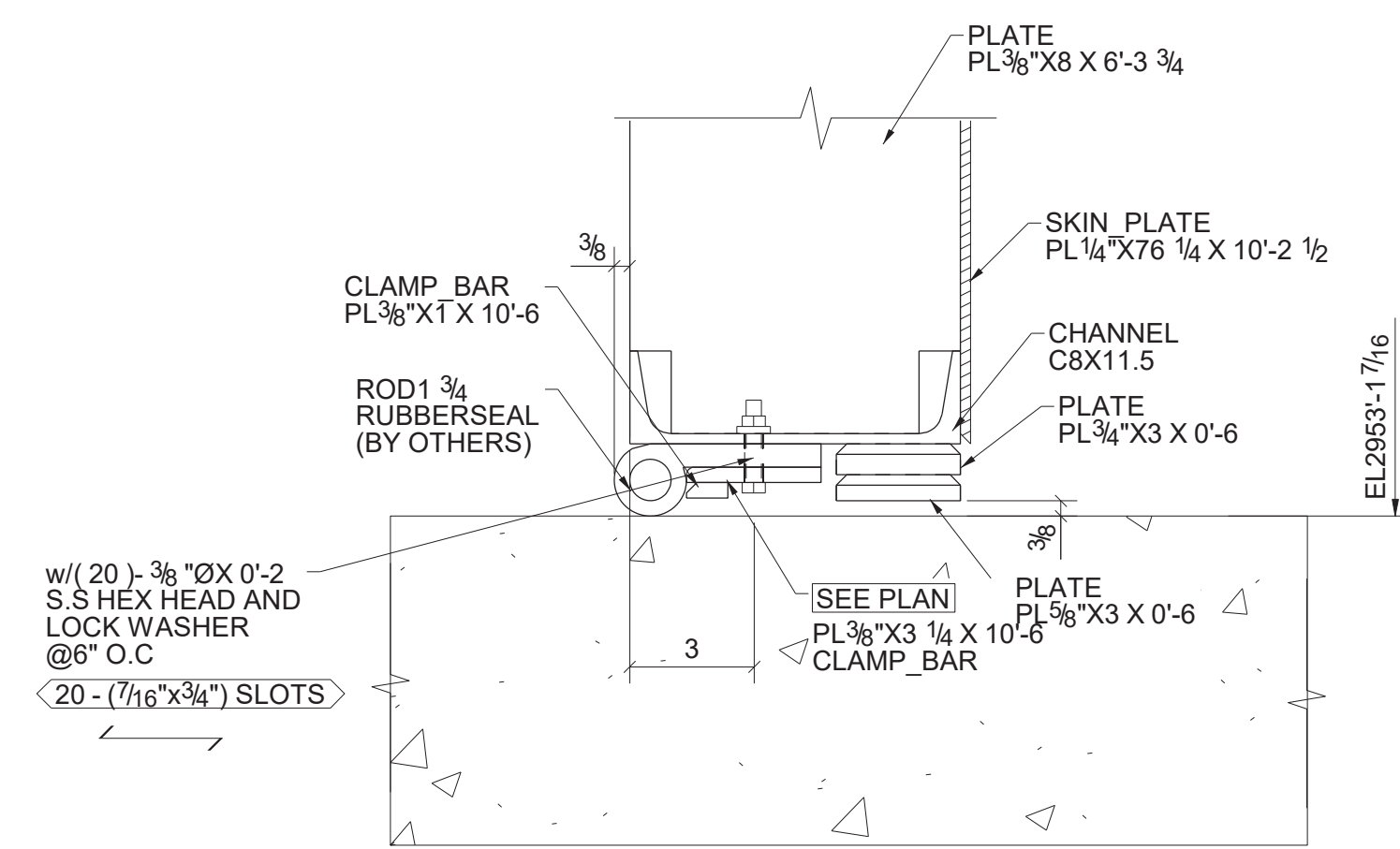
PREPARATION :		
PAINT :		
JOB NUMBER	DRAWING NO.	REVISION
22-040	E5	B



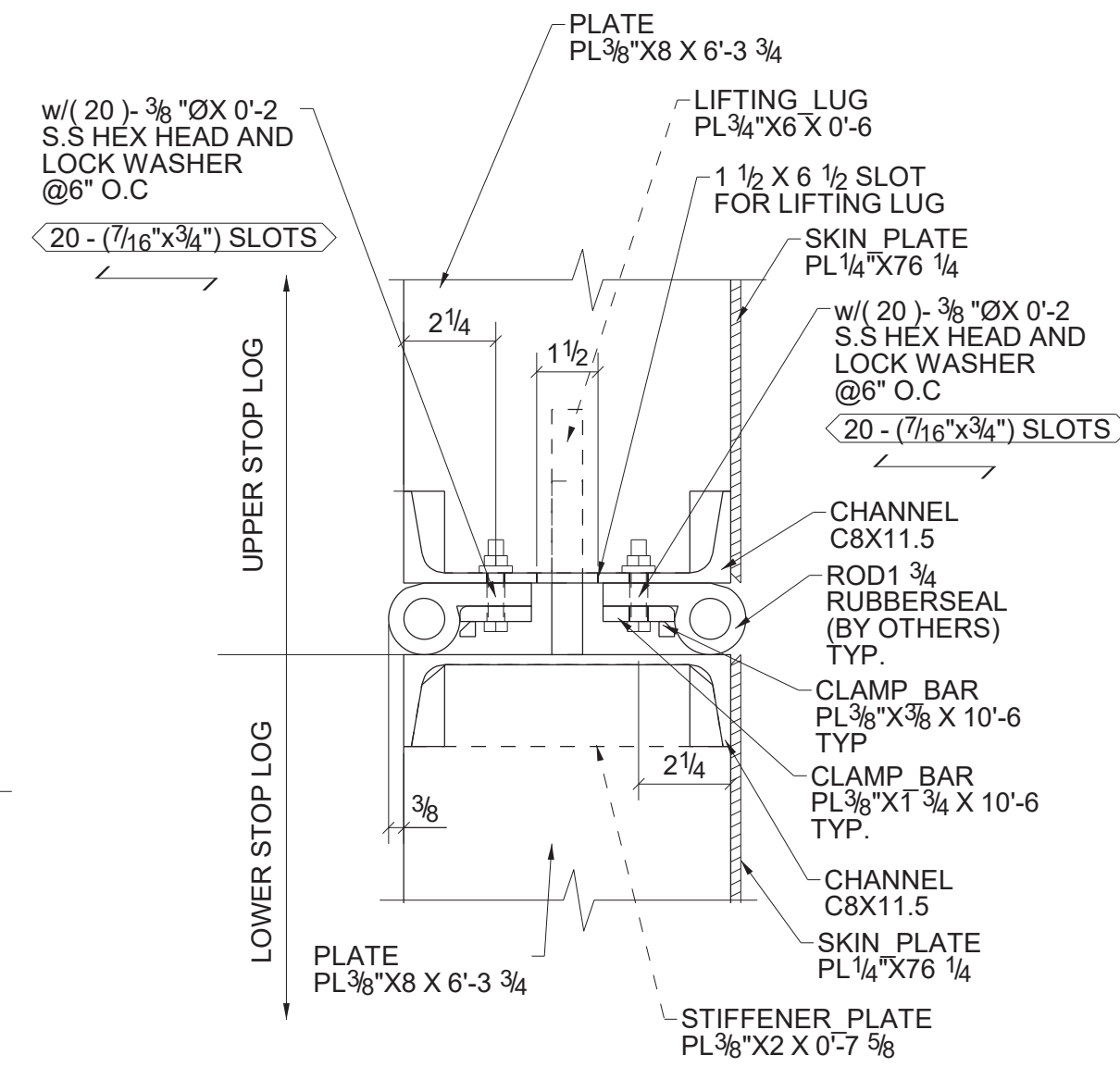
SECTION 3-3
(REF: A/S-07)
E5



SECTION 4-4
(REF: B/S-07)
E5



DETAIL A
(REF: 1/S-07)



DETAIL B
(REF: 2/S-07)



ACCELERATED CONSTRUCTION AND METAL PALMDALE, CA

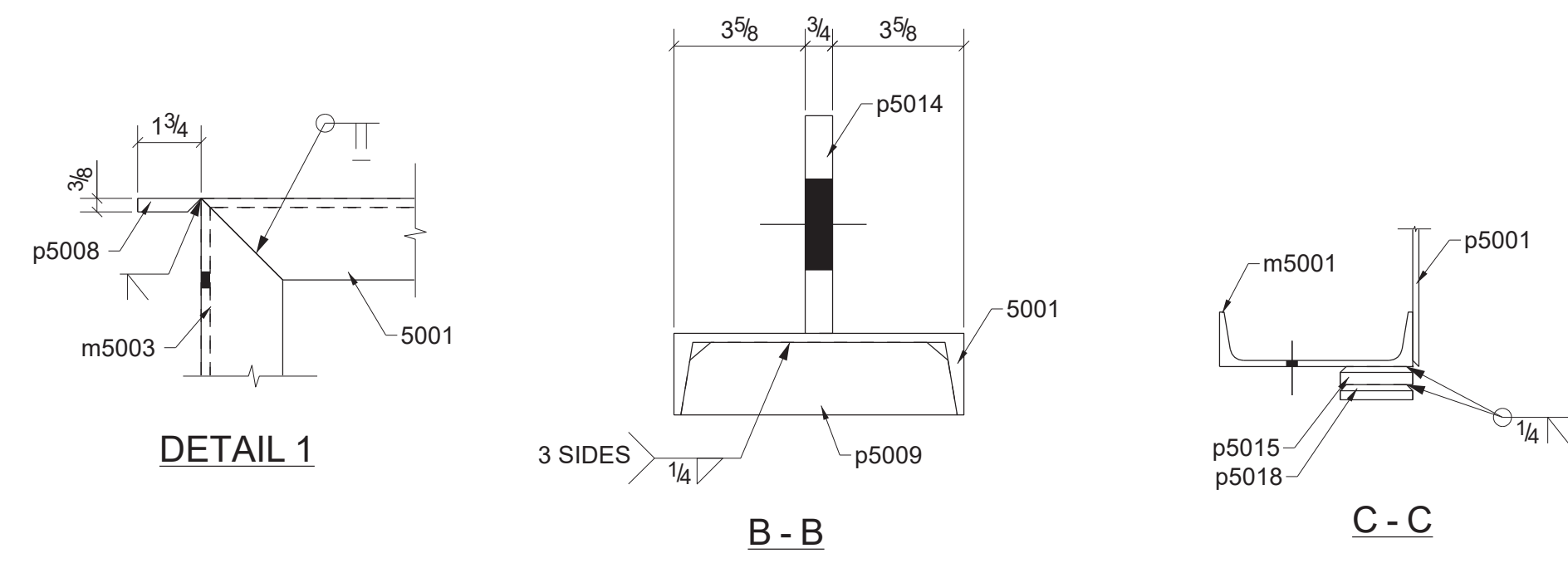
ANTELOPE VALLEY-EAST KERN WATER AGENCY

DATE:	04/13/2022				
DRAWN:	MAV				
CHK'D:	DVS	A	04/13/2022	MAV	ISSUED FOR APPROVAL
APP'VD:		B	10/13/2022	TVK	ISSUED FOR RE-APPROVAL
		REV.	DATE	BY	REMARKS

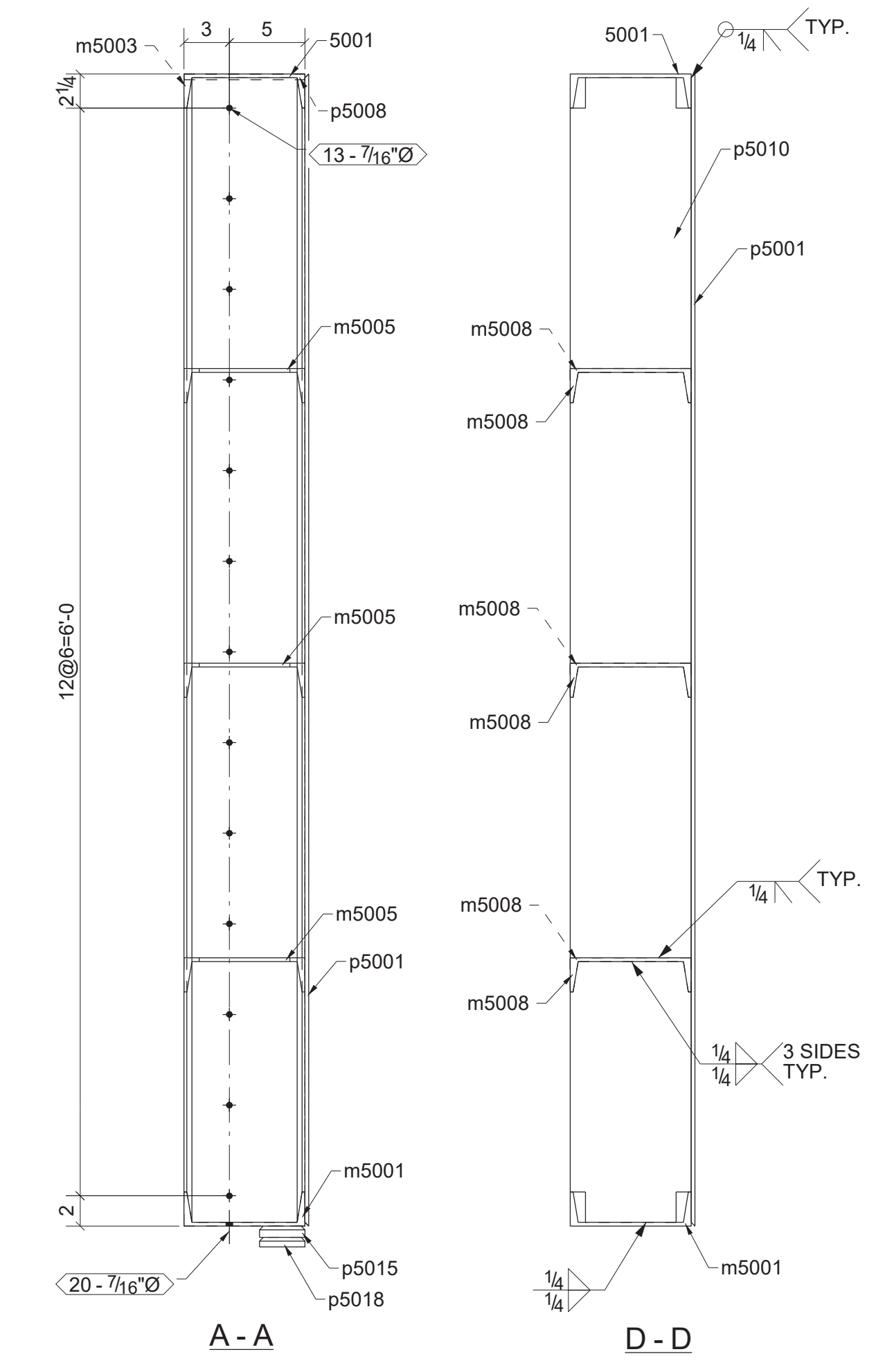
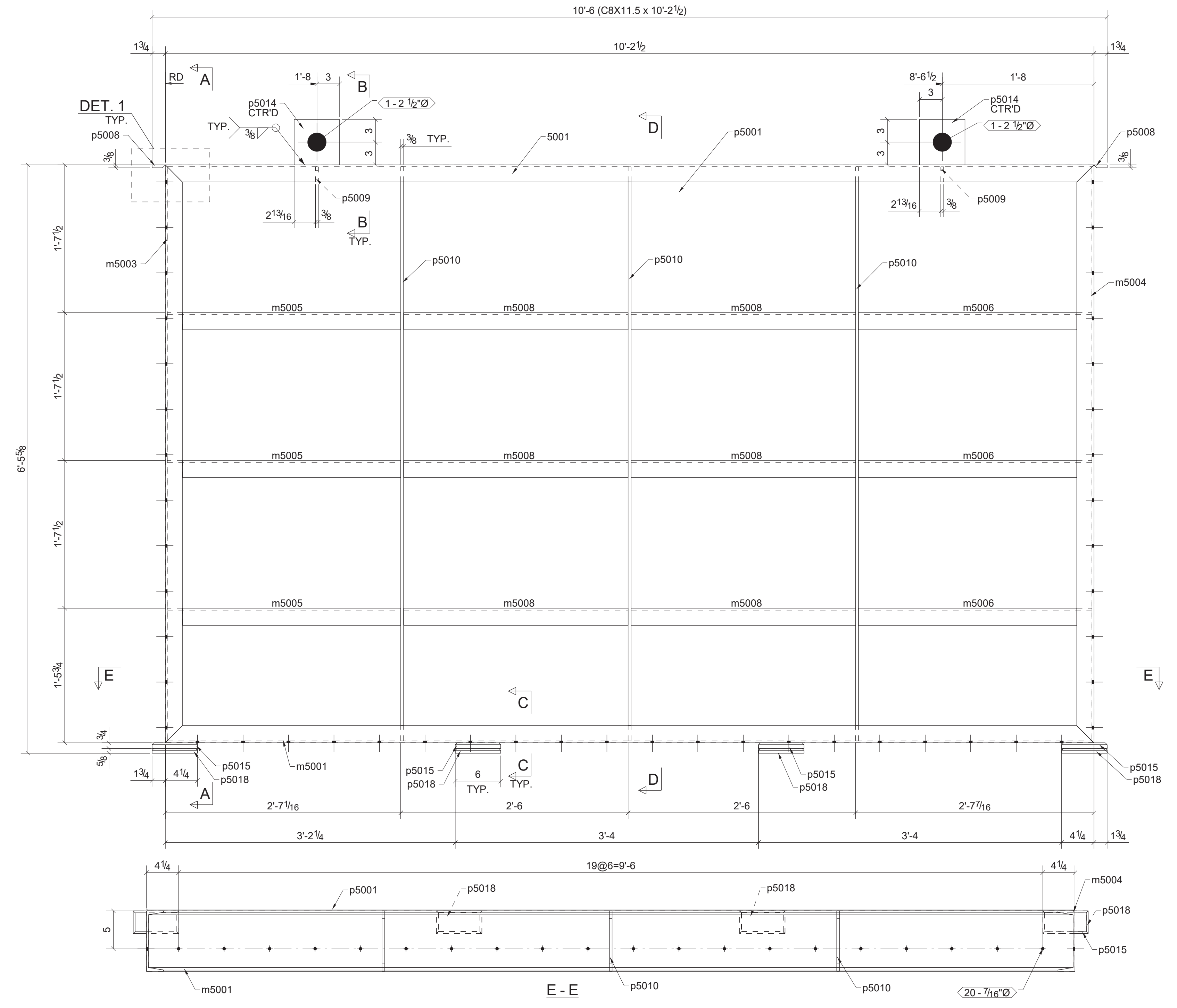
NOTES:

NOTES:

PREPARATION :		
PAINT :		
JOB NUMBER	DRAWING NO.	REVISION
22-040	E6	B



BILL OF MATERIAL					
SHIP MARK	PIECE MARK	QTY	DESCRIPTION	LENGTH	REMARKS
5001		2	C8X11.5	10'-2 1/2"	BEV-2 A36 GALV.
	m5001	2	C8X11.5	10'-2 1/2"	A36
	m5003	2	C8X11.5	6'-4 1/4"	A36
	m5004	2	C8X11.5	6'-4 1/4"	A36
	m5005	6	C8X11.5	2'-6 13/16"	A36
	m5006	6	C8X11.5	2'-6 13/16"	A36
	m5008	12	C8X11.5	2'-5 5/8"	A36
	p5001	2	PL1/4"X76 1/4"	10'-2 1/2"	A36
	p5008	4	PL3/8"X1 3/4"	0'-8"	A36
	p5009	4	PL3/8"X2"	0'-7 5/8"	A36
	p5010	6	PL3/8"X8"	6'-3 3/4"	A36
	p5014	4	PL3/4"X6"	0'-6"	A36
	p5015	8	PL3/4"X3"	0'-6"	A36
	p5018	8	PL5/8"X3"	0'-6"	A36



2 - CHANNELS - 5001
GALVANIZED

ACM ANTELOPE VALLEY-EAST KERN WATER AGENCY
ACCELERATED CONSTRUCTION AND METAL

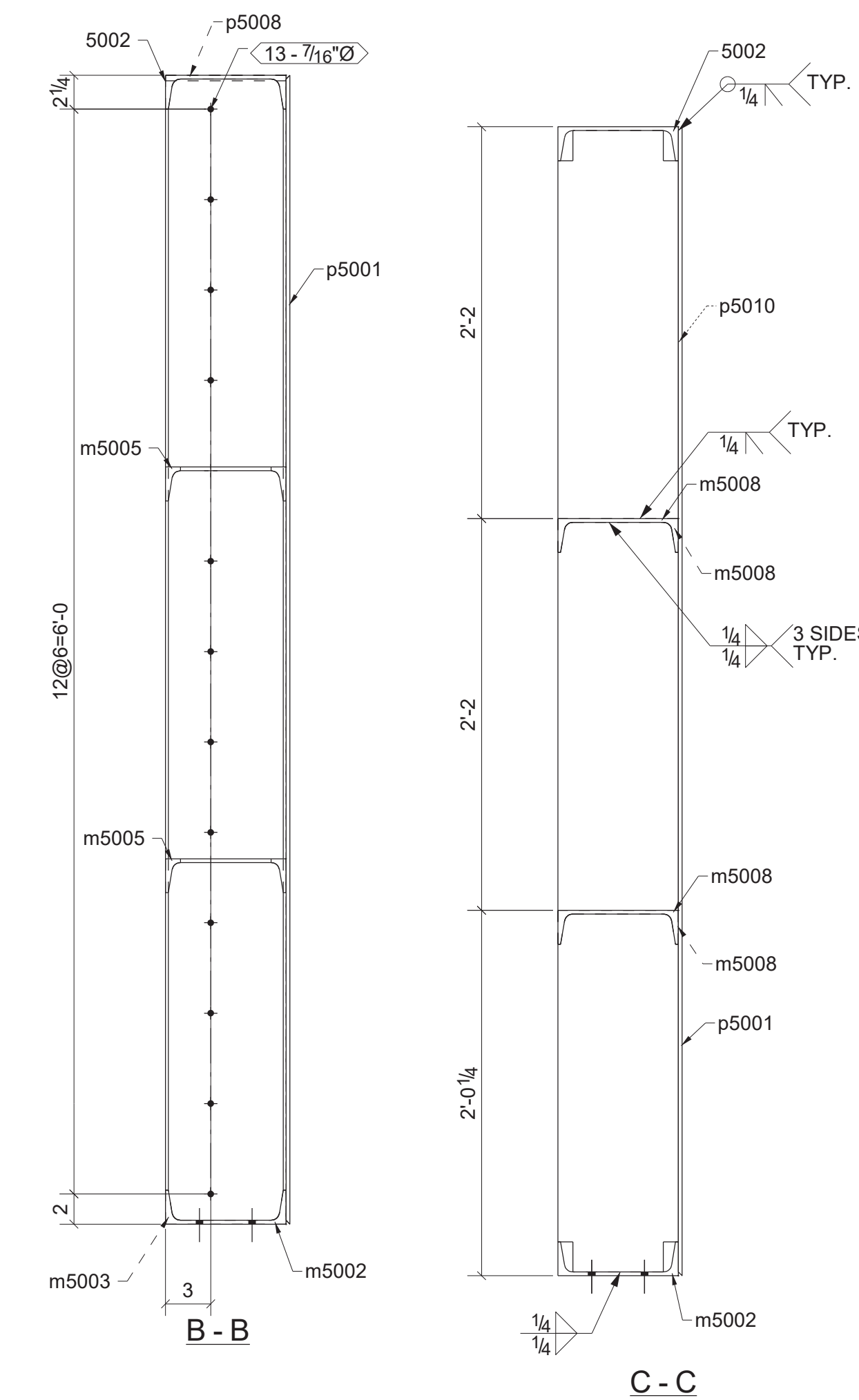
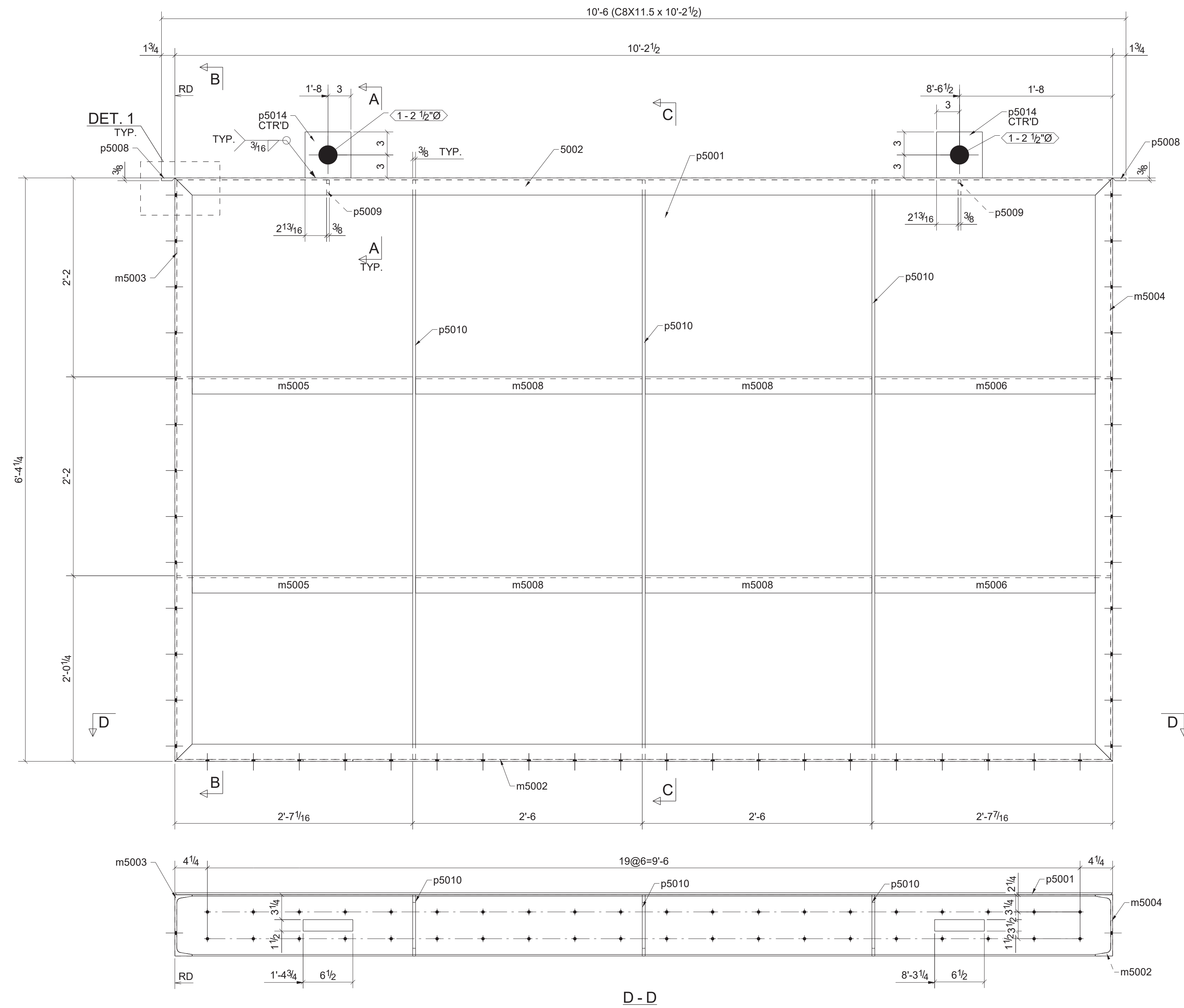
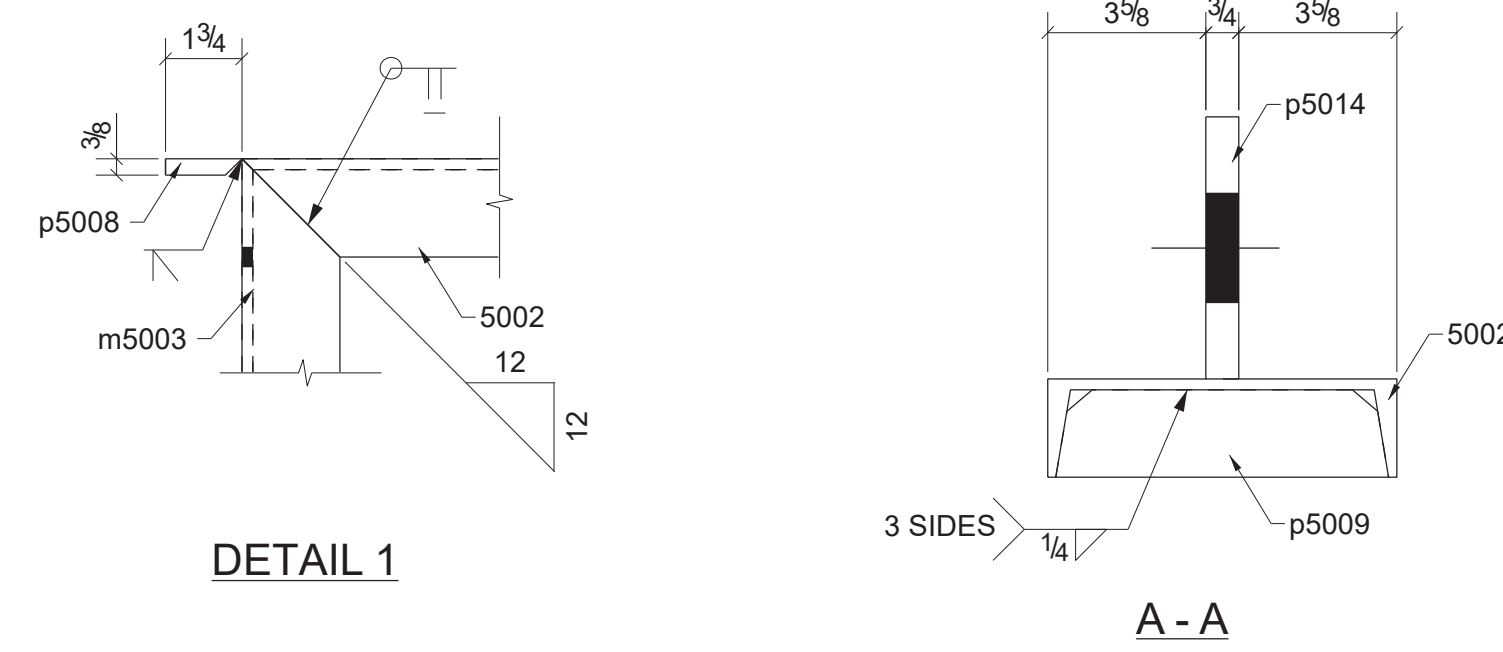
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APP'VD:		B	10/13/2022	NVR	ISSUED FOR RE-APPROVAL
		REV.	DATE	BY	REMARKS

NOTES:	
NOTES:	

PREPARATION :		
SSPC - SP6		
PAINT :		
GALVANIZED		
JOB NUMBER	DRAWING NO.	REVISION
22-040	5001	B

BILL OF MATERIAL

SHIP MARK	PIECE MARK	QTY	DESCRIPTION	LENGTH	REMARKS
5002		2	C8X11.5	10'-2 1/2"	BEV-2 A36 GALV.
	m5002	2	C8X11.5	10'-2 1/2"	A36
	m5003	2	C8X11.5	6'-4 1/4"	A36
	m5004	2	C8X11.5	6'-4 1/4"	A36
	m5005	4	C8X11.5	2'-6 13/16"	A36
	m5006	4	C8X11.5	2'-6 13/16"	A36
	m5008	8	C8X11.5	2'-5 5/8"	A36
	p5001	2	PL1/4"X76 1/4"	10'-2 1/2"	A36
	p5008	4	PL3/8"X1 3/4"	0'-8"	A36
	p5009	4	PL3/8"X2"	0'-7 5/8"	A36
	p5010	6	PL3/8"X8"	6'-3 3/4"	A36
	p5014	4	PL3/4"X6"	0'-6"	A36



2 - CHANNELS - 5002 GALVANIZED

ACM ANTELOPE VALLEY-EAST KERN WATER AGENCY
ACCELERATED CONSTRUCTION AND METAL

DATE:	04.13.2022				
DRAWN:	NVR				
CHK'D:	MAV	A	04/13/2022	NVR	ISSUED FOR APPROVAL
APPV'D:		B	10/13/2022	NVR	ISSUED FOR RE-APPROVAL
		REV.	DATE	BY	REMARKS

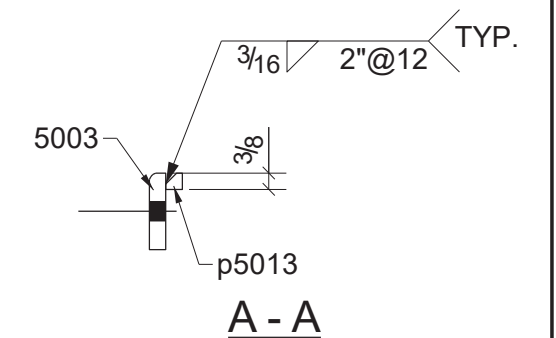
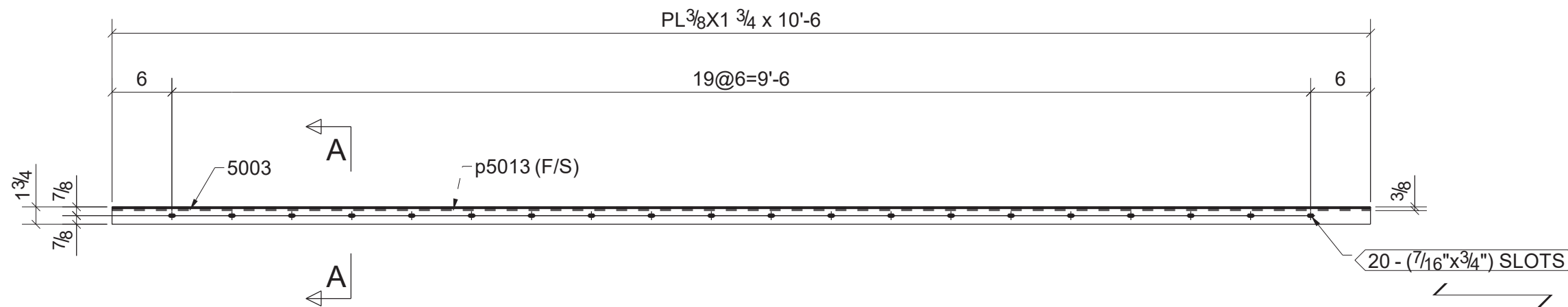
NOTES:

NOTES:

PREPARATION :		
SSPC - SP6		
PAINT :		
GALVANIZED		
JOB NUMBER	DRAWING NO.	REVISION
22-040	5002	B

BILL OF MATERIAL

SHIP MARK	PIECE MARK	QTY	DESCRIPTION	LENGTH	REMARKS
5003		4	PL3/8"X1 3/4"	10'-6"	SQ-2 A36 GALV.
	p5013	4	PL3/8"X3/8"	10'-6"	A36



4 - CLAMP_BARS - 5003

GALVANIZED



ANTELOPE VALLEY-EAST KERN WATER AGENCY

DATE:	04.13.2022				
DRAWN:	NVR				
CHK'D:	MAV	A	04/13/2022	NVR	ISSUED FOR APPROVAL
APPV'D:		B	10/13/2022	NVR	ISSUED FOR RE-APPROVAL
REV.	DATE	BY			REMARKS

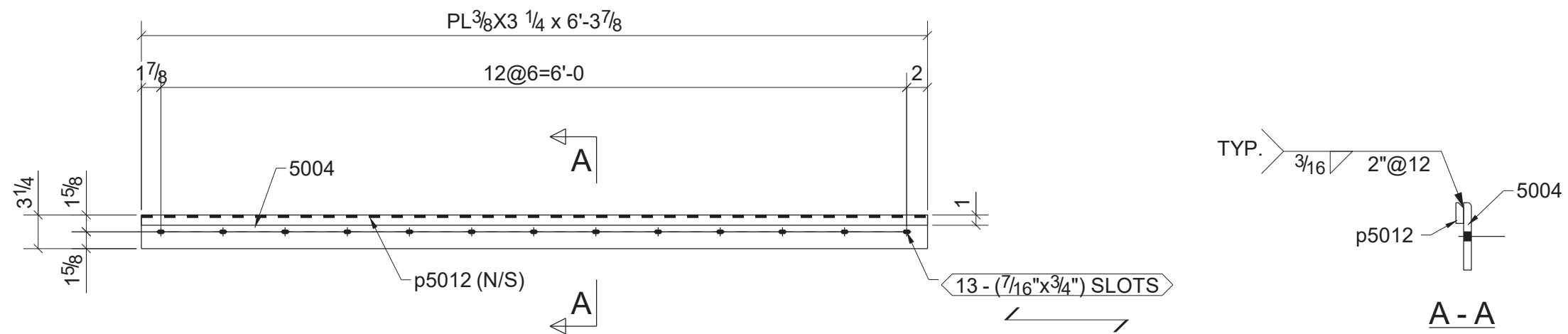
NOTES:

NOTES:

PREPARATION :		
SSPC - SP6		
PAINT :		
GALVANIZED		
JOB NUMBER	DRAWING NO.	REVISION
22-040	5003	B

BILL OF MATERIAL

SHIP MARK	PIECE MARK	QTY	DESCRIPTION	LENGTH	REMARKS
5004		4	PL3/8"X3 1/4"	6'-3 7/8"	SQ-2 A36 GALV.
	p5012	4	PL3/8"X1"	6'-3 7/8"	A36



4 - CLAMP_BARS - 5004

GALVANIZED



ANTELOPE VALLEY-EAST KERN WATER AGENCY

DATE:	04.13.2022				
DRAWN:	NVR				
CHK'D:	MAV	A	04/13/2022	NVR	ISSUED FOR APPROVAL
APPV'D:		B	10/13/2022	NVR	ISSUED FOR RE-APPROVAL
REV.	DATE	BY			REMARKS

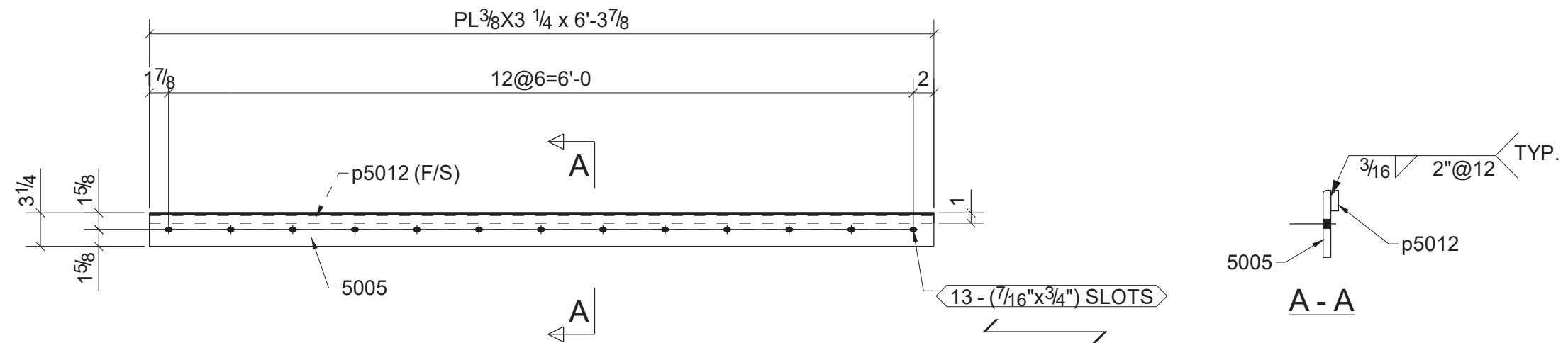
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NOTES:

PREPARATION :		
SSPC - SP6		
PAINT :		
GALVANIZED		
JOB NUMBER	DRAWING NO.	REVISION
22-040	5004	B

BILL OF MATERIAL

SHIP MARK	PIECE MARK	QTY	DESCRIPTION	LENGTH	REMARKS
5005		4	PL3/8"X3 1/4"	6'-3 7/8"	SQ-2 A36 GALV.
	p5012	4	PL3/8"X1"	6'-3 7/8"	A36



4 - CLAMP_BARS - 5005

GALVANIZED



ANTELOPE VALLEY-EAST KERN WATER AGENCY

DATE:	04.13.2022				
DRAWN:	NVR				
CHK'D:	MAV	A	04/13/2022	NVR	ISSUED FOR APPROVAL
APP'VD:		B	10/13/2022	NVR	ISSUED FOR RE-APPROVAL
REV.	DATE	BY			REMARKS

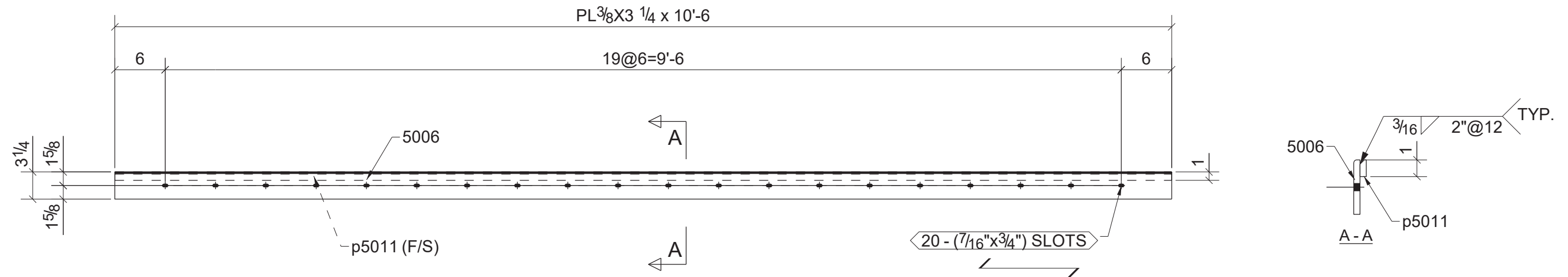
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NOTES:

PREPARATION :		
SSPC - SP6		
PAINT :		
GALVANIZED		
JOB NUMBER	DRAWING NO.	REVISION
22-040	5005	B

BILL OF MATERIAL

SHIP MARK	PIECE MARK	QTY	DESCRIPTION	LENGTH	REMARKS
5006		2	PL3/8"X3 1/4"	10'-6"	SQ-2 A36 GALV.
	p5011	2	PL3/8"X1"	10'-6"	A36



2 - CLAMP_BARS - 5006
GALVANIZED



ANTELOPE VALLEY-EAST KERN WATER AGENCY

DATE:	04.13.2022				
DRAWN:	NVR				
CHK'D:	MAV	A	04/13/2022	NVR	ISSUED FOR APPROVAL
APPV'D:		B	10/13/2022	NVR	ISSUED FOR RE-APPROVAL
REV.	DATE	BY			REMARKS

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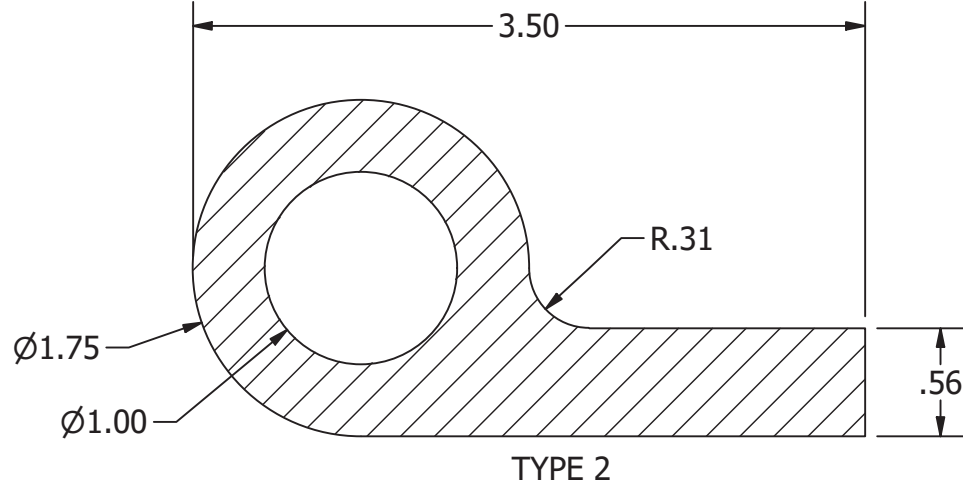
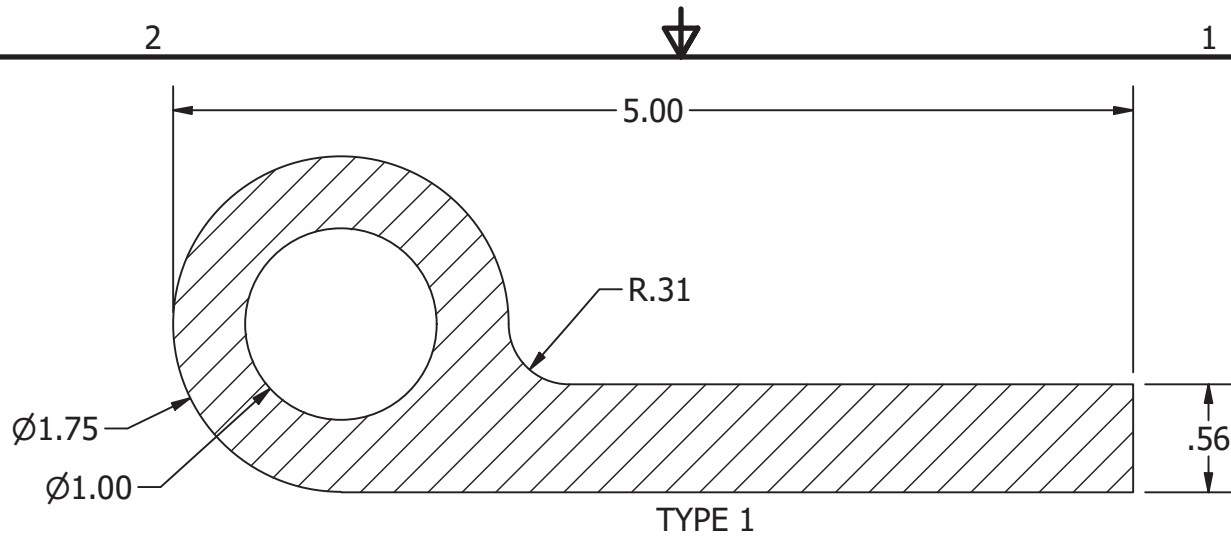
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PAINT :		
GALVANIZED		
JOB NUMBER	DRAWING NO.	REVISION
22-040	5006	B

APPENDIX F

Existing J-Seal Submittal

APPENDIX F



NOTES:

1. MATERIAL TO BE SU13366
2. TYPE 1 SEAL TO BE FACTORY HOT SPLICED TO 74FT LONG
3. TYPE 2 SEAL TO BE FACTORY HOT SPLICED TO 42FT LONG

DRAWN N. MOORMAN		1/10/2023		SEALS UNLIMITED 503-690-6644 WWW.SEALSUNLIMITED.COM	
MFG					
APPROVED				PROJECT/CUSTOMER NAME	
				BLOIS CONSTRUCTION INC HOLLOW J-BULB SEALS	
		SIZE A	PART DESC MOLD 200102		REV 0
		SCALE 1:1			SHEET 1 OF 1

TYPICAL PROPERTIES

SU13366

Seals Unlimited natural rubber compound SU13366 containing carbon black, zinc-oxide, accelerators, vulcanizing agents, antioxidants, and plasticizers. The physical characteristics of the rubber compound meet or exceed the following specifications:

Physical Test	Test Value	Test Method Standard
Durometer Hardness, Shore 'A', Range	60 – 70	ASTM D2240
Tensile Strength (Ultimate)	3000 PSI min	ASTM D412
Elongation (Ultimate)	450% min	ASTM D412
300% Modulus	900 PSI	ASTM D412
Compression Set (% Maximum of Original Deflection) Method B, 22hrs. @ 70°C (158°F), 25% deflection, 1/2 hr. recovery	30%	ASTM D395
Water Absorption (Maximum Change in Weight) Age the specimen first at 70 +/- 2°C for 22, +.25/-0 hrs. in an air oven, use this weight as W1, then perform the water absorption test. 166 hrs. @70°C (158°F), distilled water	5%	ASTM D471
Tensile Strength, After Accelerated Aging 48 Hrs. @ 70°C (158°F) @ 300 PSI O ₂ in pressure vessel	80% of min tensile requirement	ASTM D572
Low Temperature Brittleness Method A, Para. 9.3.2; 5 modified T-50 specimens, 3 min. @ -40°C (-40°F)	All Pass w/ no cracks	ASTM D2137
Specific Gravity	1.118 – 1.158	ASTM D297

APPENDIX G

Conformed Turnout Plans and Specifications

APPENDIX G

TECHNICAL CONDITIONS

01 14 01	SPECIAL SITE CONDITIONS AND CONSTRUCTION SEQUENCING
01 14 19	PROTECTION OF WORK AND EXISTING FACILITIES
01 14 20	PROTECTION OF EXISTING UTILITIES AND IRRIGATION FACILITIES
01 20 00	MEASUREMENT AND PAYMENT
01 22 00	BID ITEM DESCRIPTIONS
01 32 01	WIRELESS CELLUAR CONSTRUCTION CAMERA
01 32 23	SUPPLEMENTAL SURVEYING REQUIREMENTS
01 33 23	SUPPLEMENTAL SUBMITTAL REQUIREMENTS
01 35 23	SUPPLEMENTAL SAFETY REQUIREMENTS
01 35 53	SITE SECURITY
01 52 13	TEMPORARY FIELD OFFICE BUILDING
01 71 13	MOBILIZATION AND DEMOBILIZATION
02 41 00	DEMOLITION
03 11 10	CONCRETE FORM WORK
03 15 10	CONCRETE JOINTS, WATERSTOP, AND SEALANTS
03 21 00	CONCRETE REINFORCEMENT
03 30 00	CONCRETE
03 35 00	CONCRETE FINISHING AND CURING
03 37 19	SHOTCRETE
03 60 00	GROUT
05 05 20	BOLTS, WASHERS, ANCHORS, AND EYEBOLTS
05 12 10	MISCELLANEOUS METALWORK
09 90 00	PAINTING AND COATING
13 34 40	CONTROL BUILDING
22 14 29	SUBMERSIBLE SUMP PUMP
23 34 16	CENTRIFUGAL FAN
26 05 00	ELECTRICAL WORK, GENERAL
26 05 19	WIRES AND CABLES
26 05 26	GROUNDING
26 05 33	ELECTRICAL RACEWAY SYSTEMS
26 05 43	UNDERGROUND RACEWAY SYSTEMS
26 05 73	PROTECTIVE DEVICE STUDIES
26 05 83	ELECTRIC MOTORS
26 08 00	ELECTRICAL TESTS
26 24 16	PANELBOARD
26 27 00	LOW VOLTAGE DISTRIBUTION EQUIPMENT
26 27 26	WIRING DEVICES
26 50 00	LIGHTING
31 11 00	CLEARING AND GRUBBING
31 23 15	DEWATERING
31 23 16	EXCAVATION
31 23 23	FILL AND COMPACTION
31 23 24	CONTROLLED LOW STRENGTH MATERIAL

APPENDIX G

32 12 16	ASPHALT PAVING
32 31 13	CHAIN LINK FENCING AND GATES
33 11 00	GENERAL PIPING REQUIREMENTS
33 11 06	PIPE COUPLINGS AND EXPANSION JOINTS
33 11 10	WELDED STEEL PIPE (AWWA C200)
33 12 16	ELECTRICAL MOTOR ACTUATORS
35 20 17	HEAVY DUTY SLUICE GATES
40 90 00	PROCESS CONTROL AND INSTRUMENTATION SYSTEMS
40 91 00	PRIMARY PROCESS MEASUREMENT DEVICES
40 95 13	PROCESS CONTROL PANELS AND HARDWARE
46 21 51	TRAVELING WATER SCREEN
APPENDIX A	GEOTECHNICAL REPORT
APPENDIX B	HISTORICAL WATER SURFACE LEVELS
APPENDIX C	KERN COUNTY WATER AGENCY COFFERDAM
APPENDIX D	COFFERDAM LEASE AGREEMENT

APPENDIX G

SECTION 01 14 01 SPECIAL SITE CONDITIONS AND CONSTRUCTION SEQUENCING

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section provides special site requirements and a suggested sequencing plan for construction of the Aqueduct Turnout/Turn-in (Turnout/Turn-in).

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Milestones: Contract
- B. Liquidated Damages: Special Condition
- C. Section 31 23 15 - Dewatering
- D. Section 01 32 01 – Wireless Cellular Construction Camera

PART 2 -- PRODUCT (NOT USED)

PART 3 -- EXECUTION

3.1 SPECIAL TIMING FOR CONSTRUCTION OF THE TURNOUT/TURN-IN SUBMITTALS

- A. Contract work must be completed within the period allowed. Failure to perform and complete the construction work within said time period, shall subject the CONTRACTOR to the liquidated damages provisions stated in the Contract.
 - 1. **February 1, 2022 – Award**
 - 2. **February 15, 2022 – Notice to Proceed (NTP)**
 - 3. **September 1, 2022 – Milestone 1: Completion of all work except installation of the sluice gates, installation of the 84-inch diameter steel pipeline, construction of the meter vault and meter, and construction of the control building. Removal of cofferdam and all temporary works. This milestone includes installation of the stop logs and securing the site if the Contractor plans to demobilize prior to completion of the remaining work. Securing the site includes installation of a bulkhead at the end of the 84-inch diameter pipe stub and backfill.**
 - 4. **December 12, 2022 – Turnout/Turn-in complete and operable**
 - 5. **The Contractor shall submit a complete submittal addressing all of the DWR requirements (listed in Section 3.2 below) within two weeks of the Contract Award date. Special attention is required as the level of completeness of the submittal will impact timing for DWR review and acceptance. If the encroachment permit cannot be secured by April 15,**

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2022, the contract time will be extended day for day until the permit is secured. However, the time extension will be at no additional cost to the Agency.

3.2 CONSTRUCTION SEQUENCING AND SPECIAL REQUIREMENTS

A. General

1. Construction of the WORK shall be accomplished without interruption to Department of Water Resources' (DWR) water deliveries, except that DWR normally experiences reductions in water levels during the winter periods as shown on the graphs included in Appendix B.
2. A construction sequencing concept was developed during design and is included herein. The CONTRACTOR may elect to adopt this concept for further development or develop its own concept for completing the required WORK without interruption to water deliveries; and, either way, shall submit a detailed plan for development and implementation. If the CONTRACTOR proposes a different scheme, it must meet all the core requirements described above and as further described below. The critical milestones, listed above, must be met for successful completion of the WORK.

(a) Special Requirements

- (i) The East Branch of the California Aqueduct (Aqueduct) will remain in operation during the period of construction.
- (ii) The CONTRACTOR's operations must not interfere with DWR's operations of the canal.
- (iii) The CONTRACTOR shall exercise all caution and care to protect the Aqueduct from breaching.
- (iv) The CONTRACTOR's attention is directed to the critical coordination of work items required to secure the encroachment permit from DWR.

(b) DWR Requirements

- (i) A seven (7) day advance notification is required prior to starting work within the Department of Water Resources right-of-way. Contact the Department of Water Resources, Division of Engineering, Encroachment Permit Section, Sacramento, California at (800) 600-4397. The Southern Field Division shall be simultaneously notified at (661) 944-8600.
- (ii) Construction procedures, excavation plans, schedules, type and weight of the construction equipment to be used. The construction procedures shall include cofferdam placement showing the concrete anchor block size and locations for anchoring the cofferdam.
- (iii) Measures shall be taken by the CONTRACTOR to protect in place all SWP facilities and appurtenances, including but not limited to communication and control cables and cathodic protection test stations. The CONTRACTOR will be liable for all damages to SWP facilities and appurtenances as a result of the construction, and for any other damages or losses suffered by DWR or its SWP

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contractors, including power, irrigation, municipal and industrial water supply, and communication losses.

- (iv) Communication and control cables connected with the operation of the SWP are buried along either or both sides of the aqueduct/pipeline within DWR right of way, as approximately depicted on the drawings. Prior to any excavation in this area, the cable(s) shall be located and exposed by potholing in the presence of a DWR field division representative. Call DWR Southern Field Division at (661) 944-8600 at least seven (7) days in advance for an appointment. All excavations within three (3) feet of the cable(s) shall be done using hand-held tools only.
- (v) Prior to DWR issuing an Encroachment Permit, the cable(s) shall be located and exposed by potholing. All work within 3 feet of the cable(s) shall be done using hand-held tools only. The CONTRACTOR shall contact Underground Service Alert (USA) at (800) 422-4133 for Southern California and MCI Telecommunications Corporation at (800) 624-9675 for information regarding the location of the communication and control cables. The presence of a DWR inspector will be required throughout the exposure process. Please call the Southern Field Division at (661) 944-8600 for a Temporary Permit and appointment to perform the exposure of the cable(s).

The resultant elevation information shall be delineated on the CONTRACTOR's submittal and labeled as:

CABLE POTHOLED ELEVATION XX.X

Surface Elevation XX.X

Where xx.x is the elevation in feet to the nearest tenth

(c) Engineer's Sequencing Plan

(i) Turnout/Turn-in in the Aqueduct

1. Step 1 – Initiate site work – **February 2022**

- a. Initiate required environmental clearances
- b. Install temporary or permanent power supply (coordinate with SCE)
- c. Install ground level monitoring system
- d. Perform inspection of the canal lining (divers)
- e. Install construction monitoring cameras
- f. Within two weeks following award of the contract, submit all items required by DWR that are necessary to obtain the DWR encroachment permit.**
- g. Initiate all submittals, but specifically early submittals for rebar, trash racks, stop logs, and required embeds needed to complete the turnout/turn-in and secure the canal.

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2. Step 2 – Install temporary cofferdam
 - a. Coordinate with DWR for short suspension of flow
 - b. Dewater the cofferdam and seal base at any leak locations (divers may be required)
3. Step 3 - Turnout/Turn-in excavation
 - a. Sawcut and remove canal lining to required limits
 - b. Over excavate and place CLSM subgrade
 - c. Limit extent of excavation to provide breach protection from any potential cofferdam failure
4. Step 4 – Turnout/Turn-in – minimum construction required prior to removal of temporary cofferdam
 - a. Place concrete base slab, walls, and deck
 - b. Backfill structure and replace canal lining
 - c. Install trash rack and stop logs
 - d. Install bulkhead at the end of 84-inch diameter pipe stub and backfill
5. Step 5 – Remove cofferdam and all temporary works
 - a. Coordinate with DWR for short suspension of flow
6. Step 6 – Excavate for installation of 84-inch diameter steel pipeline and concrete meter vault
 - a. Construct concrete meter vault
 - b. Complete the installation and backfill of the 84-inch diameter pipelines and meter vault
7. Step 7 – Sitework
 - a. Construct sitework to required subgrade elevations
 - b. Construct electrical control building
 - c. Install conduits to turnout/turn-in
 - d. Place aggregate base for site surfacing and construct roadway pavement section for O&M road
8. Step 8 – Install equipment, startup, and testing – Complete by **December 12, 2022**
 - a. Install electrical equipment and tie-in to DWR’s SCADA

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- b. Install flow meter
- c. Install sluice gates
- d. Install traveling water screens

(d) Temporary Facilities During Construction

- (i) The CONTRACTOR shall construct and maintain all necessary temporary structures required therefor; and shall furnish, install, maintain, and operate all necessary dewatering equipment for maintaining the foundations and other parts of the work free from water. After having served their purpose, all equipment, cofferdams, or other protective works shall be removed from the work area so as not to interfere in any way with the operation of the new facilities.
- (ii) During construction of the new turnout/turn-in only, the CONTRACTOR shall install a temporary structure in the Aqueduct for the purpose of isolating the area of construction for the new turnout/turn-in structure while maintaining the required flow in the canal. Such a structure might include but is not limited to a cofferdam, or box, or crib. The cofferdam structure may be temporarily anchored to concrete thrust blocks that can be temporarily installed outside the top of the canal lining.
- (iii) The AGENCY has leased a large cofferdam owned by the Kern County Water Agency (KCWA). This large cofferdam is adequately sized and shall be used for this Work. The CONTRACTOR shall be responsible for the design of the anchor blocks and overall stability of the cofferdam placement.

Specifications for KCWA's cofferdam are included as an appendix to the Specifications.

1. A copy of the lease agreement is included herein Appendix D. The AGENCY is responsible for (will pay) the \$50,000 fee for the three-month term as well as the \$12,500 deposit which will be returned to the AGENCY if unused. The AGENCY'S three-month lease period for the cofferdam will commence at the time the CONTRACTOR takes possession (commences loading of the cofferdam for transport). The CONTRACTOR shall take possession of the cofferdam on or before April 15, 2022.

The CONTRACTOR is responsible for lease costs beyond the three-month term at a rental rate of \$12,500 per month. The CONTRACTOR is also responsible for all other terms of the agreement and specifically the items under Paragraph 1 COFFERDAM. The CONTRACTOR shall load and transport the cofferdam to the Project site; and return and off load the cofferdam at the KCWA storage facility located west of Bakersfield, CA at Pumping Plant 2 of the Cross Valley Canal.

2. The Aqueduct design invert at the location of the turnout/turn-in structure is Elevation 2948.87.
3. The approximate existing canal slope (gradient) is 0.00006.
4. The Aqueduct canal side slope is 2 Horizontal to 1 Vertical, bottom width is 16 feet.

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5. The Aqueduct canal lining thickness is 4 inches.
 6. To facilitate the CONTRACTOR's operations related to installation and removal of the cofferdam, water levels in the canal may be lowered for a period of up to 24 hours. This must be coordinated with DWR well in advance and should be shown on the CONTRACTOR's schedule. Changes related to lowering the water surface elevation require 24 hours per one foot of lowering.
- (e) The CONTRACTOR shall be responsible for and shall repair at its expense any damage to the foundations, structures, or any other part of the work caused by floods, water, or failure of any part of the turnout/turn-in or protective works.
- (f) Submittals
- (i) At least 20 days prior to commencing with construction, the CONTRACTOR shall submit a detailed plan for the proposed methods of construction. The plan shall be prepared and stamped by a California PE with experience in the design of cofferdams for construction of "river-type" work.
 - (ii) Portions of this submittal must be approved by DWR such that this submittal is a condition precedent to receiving the encroachment permit.
 - (iii) The submittal shall include, at a minimum, the following items:
 1. Dimensioned drawings and narrative that provides details regarding the anticipated types, sizes, capacities, and locations of the cofferdam and dewatering facilities including calculations to substantiate the designs of the selected facilities. The drawings shall show the area of the canal lining to be removed and replaced, the relationship to the temporary structure, and excavation limits.
 2. Procedures shall include an excavation plan (in accordance with CAL-OSHA requirements), schedules, and type and weight of the construction equipment to be used.
 3. Schedule and sequencing plan(s) including a schedule showing when installation will begin, when removal of the cofferdam will be complete, requested periods of reduced level and flow (not exceeding 24 hours) and other significant activities.
 4. A detailed description of the installation and removal procedures.
 5. Describe the proposed method for sealing the cofferdam against leakage and the proposed method for pumping or otherwise removing any manageable leakages or seepage behind the cofferdam.
 6. Describe, in detail, a comprehensive safety program of inspection, maintenance, and repair that the contractor will implement to maintain the soundness and effectiveness of the cofferdam throughout the period of construction. The safety program shall include full-time surveillance cameras accessible to the AGENCY and the AGENCY's representatives at all times.

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7. Full containment - provide limits of excavation including construction of any temporary berms that will fully contain the canal water following a failure of the cofferdam system.
 8. Details for installation of inclinometers for the CONTRACTOR's ground-surface monitoring program.
 9. Water removal methods (dewatering methods).
 10. Arrangement, location, and depths of the components.
 11. Power supply and standby power systems.
- (iv) Review by DWR and/or the ENGINEER of the plan proposed by the CONTRACTOR will only be with respect to the basic principles the CONTRACTOR intends to employ. Review by DWR and/or the ENGINEER does not relieve the CONTRACTOR of the full responsibility for the adequacy of its methods for constructing the turnout/turn-in.

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SECTION 01 14 19 PROTECTION OF WORK AND EXISTING FACILITIES

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall coordinate closely with DWR to minimize interruption to DWR's operations including maintaining the integrity of the DWR's security fencing and access gates during performance of the Work.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 PROTECTION OF THE WORK SITE, EXISTING STRUCTURES, ROADWAYS, UTILITIES, VEGETATION, AND PRIVATE PROPERTY

- A. The CONTRACTOR shall effectively secure and protect adjacent property and structures.
- B. The CONTRACTOR shall open fences on or crossing the right of way and install temporary gates of sound construction thereon so as to maintain the existing level of property security. Adjacent fence posts shall be adequately braced to prevent the sagging or slackening of the wire. Before such fences are opened, the CONTRACTOR shall notify the owner or tenant of the property and, where practicable, the opening of the fences shall be in accordance with the wishes of said owner or tenant. The CONTRACTOR shall be responsible that no loss or inconvenience shall accrue to the owner or tenant by virtue of its fences having been opened or the gate not having been either shut or attended at all times. Where special types of fences are encountered, the CONTRACTOR shall install temporary gates made of similar materials and of suitable quality to serve the purposes of the original fences. In all cases where the CONTRACTOR removes fences to obtain work room, it shall provide and install temporary fencing as required, and on completion of construction shall restore the original fence to the satisfaction of the AGENCY'S REPRESENTATIVE. All cost of providing, maintaining and restoring gates and fencing shall be borne by the CONTRACTOR.
- C. The CONTRACTOR shall use extreme care during construction to prevent damage from dust to adjacent property. The CONTRACTOR, at its own expense, shall provide adequate dust control for the right of way and take other preventive measures as directed by the AGENCY'S REPRESENTATIVE.
- D. The CONTRACTOR shall be responsible for all damage to any property resulting from trespass by the CONTRACTOR or its employees in the course of their employment, whether such trespass was committed with or without the consent or knowledge of the CONTRACTOR.
- E. The CONTRACTOR shall see that the work site is kept drained and free of all ground water.
- F. The CONTRACTOR shall be responsible for any damage caused by drainage or water runoff from construction areas and from construction plant areas.

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- G. In the event of an emergency or unusual conditions endangering life, the work, or adjacent property, the CONTRACTOR may, without special instructions or authorization, act at its discretion to prevent or eliminate such danger. Should the AGENCY'S REPRESENTATIVE deem an emergency condition to exist, the CONTRACTOR shall immediately do those things and take those steps ordered by the AGENCY'S REPRESENTATIVE. The decision of the AGENCY'S REPRESENTATIVE in this respect shall be final. Any claims for compensation made by the CONTRACTOR on account of emergency work shall be determined by agreement.
- H. Crossing of Existing Creeks, Reservoirs, and Ponds
1. The CONTRACTOR shall repair and replace all existing embankments, dikes, and/or levees for existing creeks, sumps, reservoirs, and ponds that are disturbed by pipeline crossings or other Contract construction.
 2. Suitable earth materials for affected dikes and levees shall be placed and compacted in conformance with requirements of Section 31 23 23 – Fill and Compaction for embankment construction.
 3. No separate payment will be made for repair and replacement of existing dikes and levees, including compaction thereof. The cost of all such work and materials specified under this paragraph shall be borne by the CONTRACTOR.

END OF SECTION

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SECTION 01 14 20 PROTECTION OF EXISTING UTILITIES AND IRRIGATION FACILITIES

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR is required to locate, record, and submit the data for all utilities shown on the plans prior to final approval of shop drawings for the manufacture of the project pipelines. This section provides information related to procedures for addressing utility conflicts that may exist.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Survey Requirements: 01 32 23

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 DESCRIPTION

- A. The CONTRACTOR shall be responsible for locating, removal, relocation, and protection of all public and private utility facilities, including irrigation facilities in the nature of utilities, located on the site of the construction project and the CONTRACTOR shall not be entitled to any extension of time or claim for damages or extra compensation in connection therewith. Provided however, if and to the extent that existing main or trunkline public utility facilities as defined by Government Code Section 4215 ("Public Utility Facilities") are not identified in the Contract Documents, as between the CONTRACTOR and the AGENCY. The AGENCY will be responsible for the costs of locating, repairing damage not due to the failure of the CONTRACTOR to exercise reasonable care, and removing or relocating Public Utility Facilities not indicated in the plans and specifications with reasonable accuracy, and for equipment on the project necessarily idled during such work regarding said Public Utility Facilities, as the case may be, but the CONTRACTOR shall perform any such work in conformance with applicable provisions of the General Provisions if so directed by the AGENCY'S REPRESENTATIVE. The CONTRACTOR will not be assessed liquidated damages for delay in completion of the project, when such delay was caused by the failure of the public agency or the owner of the Public Utility Facilities to provide for removal or relocation of any Public Utility Facilities. If the CONTRACTOR, while performing the Contract work, discovers utility facilities not identified by the AGENCY in the Contract Documents, CONTRACTOR shall immediately notify the AGENCY'S REPRESENTATIVE in writing.
- B. Subject to the provisions of paragraph 1.1A of this section, where the work to be performed under the Contract crosses or otherwise interferes with existing streams, water courses, canals, farm ditches, pipelines, drainage channels, or water supplies, the CONTRACTOR shall provide for such water courses or pipelines and shall perform such construction during the progress of work so that no damage will result to either public or private interests, and the CONTRACTOR shall be liable for all damage that may result from failure to so provide during the progress of the work.

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- C. Utilities—The facilities to be constructed under this Contract cross existing underground features and the AGENCY has made a determined effort to gather and incorporate into these Specifications and Drawings all available information regarding existing underground features. The AGENCY’s investigation included utility-owner contacts and solicitation of available maps. The CONTRACTOR shall proceed with caution and make every effort to further identify underground features during pipeline trenching and excavation procedures in order to minimize the hazard of damaging any unidentified underground feature. The responsibility for locating, removal, relocation, and protection of all public and private underground utilities, including petroleum facilities in the nature of utilities, shall be as specified under this paragraph and in paragraph 1.1A of this section. Within thirty (30) days of the Notice to Proceed, the CONTRACTOR shall confirm, mark, and determine the depth of all underground utilities that are crossed by pipelines to be constructed under this Contract. The information obtained shall be provided to the AGENCY’s REPRESENTATIVE for review prior to any construction, including the manufacture of pipe specials. Unless otherwise specified or directed, all utilities shall be maintained in continuous service during all Contract operations. The CONTRACTOR shall not interfere with any roadway or utility system without the approval of the AGENCY’s REPRESENTATIVE. At all times adequate access shall be provided for use of the utility owner or operating entity.
- D. Utility or Irrigation Facility Relocation Work—Any movement or relocation of utilities or irrigation facilities selected by the CONTRACTOR to facilitate its operations shall be arranged by the CONTRACTOR, and all cost of such movement or relocation shall be borne by CONTRACTOR except as otherwise provided by paragraph 1.1A of this section. The CONTRACTOR shall extend full cooperation to all others performing utility or irrigation facility relocation work within or adjacent to Contract work areas. Exact method of coordination of work involving the CONTRACTOR and others will be as determined by the AGENCY’s REPRESENTATIVE, whose decision will be final. In no case shall the CONTRACTOR perform any relocation work except with the approval of the AGENCY’S REPRESENTATIVE and authorized representatives of utility companies, or owners of irrigation facilities, or other operating entities affected.
- E. Protection of Existing Irrigation Pipelines - At all locations where pipelines or other facilities to be constructed pursuant to this Contract cross or run parallel to existing irrigation pipelines, including structures of any nature, CONTRACTOR shall not interfere in any way with the proper functioning or use of the existing irrigation pipelines for the purpose for which they were intended, or CONTRACTOR may, at its option and with the approval of the ENGINEER and the owner, relocate said existing structures or pipelines, all at CONTRACTOR’s expense. The CONTRACTOR shall be responsible for all costs associated with repair of irrigation pipelines within the work area that are damaged by the CONTRACTOR during performance of the Contract work.

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SECTION 01 20 00 MEASUREMENT AND PAYMENT

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section provides the basis for payment of Work performed under the Contract.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 WORK LISTED IN THE SCHEDULE OF WORK ITEMS

- A. Work under this contract will be paid on a unit price or lump-sum basis as outlined on the Bid Form for the quantity of work installed.
- B. The unit prices and lump-sum prices include full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work included in the contract documents.
- C. The application for payment will be for a specific item based on the percentage completed or quantity installed. The percentage complete will be based on the value of the partially completed work relative to the value of the item when entirely completed and ready for service.

3.2 WORK NOT LISTED IN THE SCHEDULE OF WORK ITEMS

- A. The General Conditions and items in the Special Conditions, General Requirements, and specifications which are not listed in the schedule of work items of the Bid Form are, in general, applicable to more than one listed work item, and no separate work item is provided therefor. Include the cost of work not listed but necessary to complete the project designated in the contract documents in the various listed work items of the Bid Form.
- B. The bids for the work are intended to establish a total cost for the work in its entirety. Should the CONTRACTOR feel that the cost for the work has not been established by specific items in the Bid Form, include the cost for that work in some related bid item so that the Proposal for the project reflects the total cost for completing the work in its entirety.

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SECTION 01 22 00 BID ITEM DESCRIPTIONS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. Work under this Contract will be paid on a unit price or lump sum basis as outlined on the Schedule of Pay Items for the quantity of work installed.
- B. The unit prices and lump sum prices include full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work included in the Contract documents.
- C. The bids for the work are intended to establish a total cost for the work in its entirety. Should the Contractor feel that the cost for the work has not been established by specific items in the Schedule of Pay Items, include the cost for that work in some related bid item so that the Proposal for the project reflects the total cost for completing the work in its entirety.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Measurement and Payment: 01 20 00
- B. Mobilization and Demobilization: 01 71 13

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 BID ITEMS IDENTIFIED ON THE CONTRACT DRAWINGS

- A. **Bid Item No. 1 – Mobilization and Demobilization.** This is a lump sum bid item for mobilization and demobilization work required for the project. Mobilization work shall include, but not be limited to, that necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of the CONTRACTOR's and AGENCY's REPRESENTATIVE field office facilities necessary for work on the project; for establishment of staging/lay down areas; for obtaining permits, bonds and insurance; preparation of surveys and videos of existing access roads and facilities; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site. Demobilization work shall include, but not be limited to, the removal from the project at the end of construction of all equipment, supplies, field office facilities, personnel and incidentals, and shall include restoration of all staging/lay down areas. The amount bid for mobilization and demobilization shall not exceed shall not exceed 5% of Items 2 through 20. Payment for mobilization and demobilization will be made on the following basis:

- 1. When a total of 5 percent of the original Contract Price is earned for other schedule items, 50 percent of the Contract lump sum price for mobilization and demobilization will be paid.

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2. When a total of 10 percent of the original Contract Price is earned for other schedule items, 45 percent of the Contract lump sum price for mobilization and demobilization will be paid.
 3. When the Contract work is accepted as complete, the balance of the Contract lump sum price for mobilization and demobilization will be paid.
 4. Progress payments for mobilization and demobilization will be subject to retention as provided in Section 7 of the General Provisions.
- B. **Bid Item No. 2 – Sheeting Shoring and Bracing.** This is a lump sum bid item for providing sheeting, shoring and bracing to protect personnel and property in accordance with Cal/OSHA regulations, all safety plans, and these Contract Documents.
- C. **Bid Item No. 3 – Storm Water Pollution Prevention Plan (SWPPP).** This is a lump sum bid item for preparation, submittal, and implementation of the SWPPP. The price paid shall include all work associated with preparing and implementing the SWPPP.
- D. **Bid Item No. 4 – Premium for Installation Floater Insurance (including coverage for Acts of God), See Section 5-4 of General Conditions.** This is a lump sum bid item for providing Premium for Installation Floater Insurance (including coverage for Acts of God) for the project, see Section 5.4 of General Conditions.
- E. **Bid Item No. 5 - Construction Surveillance Cameras.** This is a lump sum bid item for furnishing all materials and equipment specified under the Contract, and for providing all labor and equipment necessary to provide 24-hour video surveillance at the Project site.
- F. **Bid Item No. 6 – Temporary Cofferdam.** This is a lump sum bid item for providing all labor, materials, and equipment and perform all operations necessary to install and seal the KCWA temporary cofferdam (leased for a three-month term by the AGENCY), including furnishing, installing, and maintaining a dewatering system for the cofferdam. This bid item shall include all costs associated with loading, unloading, and transporting the KCWA cofferdam to the project site and back to Bakersfield, CA upon completion of the work, as well as any anticipated costs for use of the KCWA cofferdam beyond the three-month term. Upon completion of the Work, the cofferdam and all related appurtenances shall be removed from the site.
- G. **Bid Item No. 7 – Aqueduct Turnout/Turn-in Structure.** This is a lump sum bid item for constructing the reinforced concrete turnout/turn-in structure, including the access platform concrete landing and canal lining tie-in. Work includes, but is not limited to, demolition, dewatering, excavation, backfill, 12 inches of over-excavation and refill, forming, furnishing and installing reinforcing steel, furnishing and placing concrete, finishing, curing, stripping, patching and all other materials, equipment and work incidental to construction of the items in accordance with the Drawings.
- H. **Bid Item No. 8 – Meter Vault Structure.** This is a lump sum bid item for constructing the meter vault, including sidewalks located adjacent to the structure. Work includes, but is not limited to, dewatering, excavation, backfill, 12 inches of over-excavation and refill, forming, furnishing and installing reinforcing steel, furnishing and placing concrete, finishing, curing, stripping, patching and all other materials, equipment and work incidental to construction of the items in

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accordance with the Drawings. Work also includes furnishing and installing steel piping and fan for the vault ventilation system, and sump pump with discharge piping.

- I. **Bid Item No. 9 – Additional Over-Excavation and Refill for Aqueduct Turnout/Turn-in Structure and Meter Vault Structure.** This is a unit price bid item for additional over-excavation and refill, as directed by the Geotechnical Engineer, excluding the initial 12 inches of over-excavation and refill. Work includes, but is not limited to, excavation and stockpile of over-excavated material; filling excavated area with native material, aggregate base material, or CLSM; moisture conditioning fill material; and compaction as required. Measurement for payment for the additional over-excavation and refill will be made in cubic yards to the neat lines of the over-excavated volume. Payment for excavating and refilling the area will be made at the unit price per cubic yard bid in the Schedule of Pay Items.
- J. **Bid Item No. 10 – Miscellaneous Metalwork.** This is a lump sum bid item for furnishing and installing trash racks, stop logs, meter vault cover, access platform, grating, handrail, and ladders, including all embeds, in accordance with the Drawings.
- K. **Bid Item No. 11 – 96-inch Wide by 72-inch High Electrically Operated Sluice Gates.** This is a lump sum bid item for furnishing all materials and equipment specified under the Contract, and for providing all labor and equipment necessary to perform all operations required to furnish, deliver, install, and test two 96" x 72" sluice gates.
- L. **Bid Item No. 12 – Traveling Water Screens.** This is a lump sum bid item for furnishing all materials and equipment specified under the Contract, and for providing all labor and equipment necessary to perform all operations required to furnish, deliver, install, and test two traveling water screens.
- M. **Bid item No. 13 – 84-inch Diameter Steel Pipe.** This is a lump sum bid item for furnishing and installing the 84-inch diameter steel piping, including steel vent piping, couplings, steel sleeves, link seals, and pipe bulkhead. Work includes, but is not limited to, clearing and grubbing; dewatering; excavation; hauling excess trench spoil to spoil area; furnishing and installing pipeline and appurtenances; backfill and compaction of backfill; and hydrostatic testing.
- N. **Bid Item No. 14 – 84-inch Diameter Multi-Path Ultrasonic Flow Meter.** This is a lump sum bid item for furnishing all materials and equipment specified under the Contract, and for providing all labor and equipment necessary to perform all operations required to furnish, deliver, install, and test the 84-inch diameter multi-path ultrasonic flow meter.
- O. **Bid Item No. 15 – Site Work.** This is a lump sum bid item for performing all site grading work. Work includes, but is not limited to, clearing and grubbing, placing materials in layers, removing rocks and indurated material larger than 5 inches, furnishing water, moisture conditioning, compacting, and trimming finished grades and subgrades to the lines and grades shown on the Drawings. Work also includes removal and reinstallation of the DWR right of way fence, including furnishing and installing a steel pipe gate in the fence.
- P. **Bid Item No. 16 – A.C. Pavement.** This is a lump sum bid item for furnishing and placing asphalt concrete pavement to the lines and grades shown on the Drawings. Work includes preparation of subgrade, and furnishing, placing, and compacting aggregate base course.

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- Q. **Bid Item No. 17 – Aggregate Base Surfacing.** This is a lump sum bid item for furnishing all materials specified under the Contract, and for providing all labor and equipment necessary to perform all operations required to furnish, moisture condition, place, and compact aggregate base to the lines and grades shown on the Drawings.
- R. **Bid Item No. 18 – Chain Link Fence with Gate.** This is a lump sum bid item for furnishing all materials specified under the Contract, and for providing all labor and equipment necessary to perform all operations required to furnish, deliver, and install chain link fencing, including chain link fabric, barbed wire, posts, concrete, gate, ground rods, grounding cable, and all accessories.
- S. **Bid Item No. 19 – Control Building.** This is a lump sum bid item for furnishing all materials specified under the Contract, and for providing all labor and equipment necessary to construct the control building, including HVAC system, reinforced concrete floor slab, sidewalk, and curb and gutter.
- T. **Bid Item No. 20 – Electrical and Controls.** This is a lump sum bid item for furnishing all materials and equipment specified under the Contract, and for providing all labor and equipment necessary to perform all operations required to furnish, deliver, install, and test all electrical, instrumentation, and control equipment at the control building, turnout/turn-in structure, and meter vault. Included in the lump sum bid item shall be costs for concrete work, start-up services, tools, and spare parts.

END OF SECTION

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SECTION 01 32 01 - WIRELESS CELLULAR CONSTRUCTION CAMERA

PART 1 -- GENERAL

1.1 SUMMARY

- A. Section includes a professional-grade 12-megapixel (4000 x 3000) construction camera. All hardware, software and time-lapse movie production services to be provided by a proven construction camera System Vendor. The system is to include a mounting pole and solar panel system for power.

1.2 MANUFACTURER (OR APPROVED EQUAL)

- A. OxBlue Corporation
Brett Catalano
Account Executive
(T) 404-554-1467
BCatalano@OxBlue.com
814 Bellemeade Ave NW
Atlanta, GA 30318
(404) 917-0200
www.OxBlue.com

1.3 CLOSEOUT SUBMITTALS

- A. Submit all original digital still images without alteration, manipulation, editing, or modifications using Image-editing software.
- B. Submit a professionally produced high-definition (1080) time-lapse movie of the project. Editing shall include image stabilization, color correction, removal of inclement weather footage and images outside the desired daily time range to be determined by the AGENCY.

1.4 WARRANTY

- A. Manufacturer Warranty: MANUFACTURER agrees to repair or replace components of system that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Camera shall have a Lifetime Warranty including parts, labor, and shipping.

1.5 SHIPPING

- A. All domestic shipping fees shall be included in the equipment price.

1.6 OWNERSHIP DOCUMENTS

- A. All images and time-lapse footage shall be the property of the AGENCY.

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PART 2 -- PRODUCTS

2.1 CAMERA

- A. Resolution: 12 megapixel (4000 x 3000)
- B. Wide angle lens standard
- C. Minimum 78 degree horizontal field of view
- D. Remotely adjustable optical zoom

2.2 DATA CONNECTIVITY AND STORAGE

- A. Wireless (Cellular GPRS or CDMA) services provided by System Vendor
- B. Camera Memory: 48 hour minimum image buffer capacity for lost data connections
- C. Remote Storage: Unlimited storage of webcam images provided by System Vendor

2.3 POWER CONNECTION

- A. 120 I 240 VAC (optional 12 VDC version for compatible OxBlue Solar Power station available)

2.4 DIMENSION AND WEIGHT

- A. Camera Dimensions: 21" L (53.34 cm) X 5.5" W (13.97 cm) X 4.25" H (10.795 cm)
- B. Mount Dimensions: 5.43" L (13.8 cm) X 6.71" W (17 cm) X F.7.78" H (19.8 cm)
- C. Weight: 17.5 lb (4.42 kg) installed

2.5 MOUNT

- A. Pole or wall mount provided by System Vendor
- B. Optional mounts (parapet mount, non-penetrating roof mount, etc.) available.

2.6 OPERATING ENVIRONMENT AND CONTROLS

- A. 10 to 120 degrees F (-23 to 49 degrees C)
- B. 90% non-condensing
- C. 120 I 240 VAC units come standard with heater, blower and defroster; 12 VDC units come standard with blower.

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2.7 SOFTWARE INTERFACES

A. DESKTOP PC VERSION

1. Display AVEK or Project logo on desktop software interface
2. Dashboard displaying each camera the user has access to and its status
3. Digital PTZ (pan-tilt-zoom) capabilities within a high-resolution image
4. Visual calendar showing actual photos from each day of the project
5. Access to each individual photo archived
6. Ability to schedule the automated delivery of images to users via email
7. Automatic daily generation of high-definition (1024x768) quality time-lapse movie
8. Display weather data with each image (temperature, condition, heat index, visibility, pressure, wind, dew point and humidity)
9. Ability to compare images from two cameras or two specific times simultaneously
10. Ability to review the last 4 days, 4 weeks, or 4 months simultaneously
11. Ability to overlay and compare images from different times

B. MOBILE VERSIONS

1. Provide HTML mobile version with ability to access current image, archived images, weather data and time-lapse footage.
2. Provide iPhone/iPad app with ability to access current image, archived images, weather data and time-lapse footage.

2.8 HOSTING AND WEBSITE INTERGRATION

- A. Provide links to thumbnails of latest image at low, medium, and high resolutions.
- B. Provide API access for use in software and website integration.

2.9 DATA SECURITY AND INFRASTRUCTURE

- A. Multiple access options including publicly available links, username authentication, IP restrictions and HTTPS communication protocols shall be available.
- B. Actual access method used shall be specified by the AGENCY.
- C. Data shall be stored on redundant servers owned and managed by the System Vendor.

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2.10 SOLAR POWER STATION FOR CAMERA

- A. Turnkey system designed specifically for use with the camera
- B. 99.5% minimum reliability based on weather and insulation data specific to the region
- C. 5-day minimum solar autonomy based on average low temperature for the region
- D. Charge control with easy-to-read digital display meter showing system status
- E. Powder coated lockable unit
- F. Marine-quality components
- G. Lightning protection
- H. 1-year minimum system warranty with up to 25 year solar module warranty
- I. Domestic freight included in Solar Power Station cost

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. It is the contractor 's responsibility to meet all code requirements and to obtain any and all permits necessary.
- B. Testing the camera for data connectivity at the jobsite prior to installation is recommended.

3.2 TESTING INSTRUCTIONS

- A. Connect the camera to an appropriate power source at the jobsite, and verify that the blue light, located on the bottom of the camera, is on.
- B. After 20 minutes, contact OxBlue Technical Support at (888) 849-2583 to confirm image transmission.
- C. OxBlue Technical Support is available, Monday through Friday, from 9:00 AM to 5:00 PM ET. Please have the 5-digit camera ID available when calling.

PART 4 -- TIME LAPSE MOVIE PRODUCTION

4.1 AUTOMATED ONLINE TIME LAPSE MOVIES

- A. System shall automatically generate up to date (1080) high definition time-lapse movies throughout the duration of the project.
- B. Automatically generated time-lapse movies shall be available for download at any time.

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- C. The online system shall intelligently select frames in order to produce time-lapse.
- D. Movies of an appropriate duration for viewing on the web, typically 30-60 seconds.

4.2 PROFESSIONALLY PRODUCED TIME-LAPSE MOVIE

- A. At the completion of the project the System Vendor shall produce one time-lapse movie of the project.
- B. The time-lapse movie shall be prepared based on the AGENCY'S instructions for resolution, duration, date range, time range and audio as part of the service.

END OF SECTION

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SECTION 01 32 23 SURVEYING REQUIREMENTS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section provides surveying requirements for the Contract Work.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Section 01 14 20, Protection of Utilities

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 WORK AREA

- A. The AGENCY will provide the right-of-way for construction of the facilities covered by these Specifications. Prior to commencing any work within a given area, the CONTRACTOR shall stake the right-of-way limits with lath at 300-foot intervals (maximum), and shall maintain same until all work within the given area is complete.

3.2 SURVEYING AND FIELD VERIFICATION OF EXISTING DIMENSIONS AND GROUND PROFILES

- A. General — The horizontal and vertical control information used by the AGENCY for design purposes is included in the Drawings. The CONTRACTOR is advised that alignments must be established with sufficient accuracy to ensure that all contract work is constructed within the rights-of-way acquired by the AGENCY. Based upon the above-specified information, the CONTRACTOR shall develop and make all other detailed surveys as required for Contract construction, including but not limited to field staking for structures, pipelines, and site grading. At all times the CONTRACTOR shall be responsible for the preservation or resetting of all existing survey monuments. No separate payment will be made for survey work and the cost of all such work shall be borne by the CONTRACTOR.

- B. Survey Control Points

1. The CONTRACTOR shall perform all layout surveys required for the control and completion of the work, and all necessary surveys to compute quantities of work performed. The AGENCY has established primary control to be used by the CONTRACTOR for establishing lines and grades required for the work.
2. Primary control consists of benchmarks and horizontal control points in the vicinity of the work. A listing and identification of the primary control is provided on the drawings. Before beginning any layout work or construction activity, the CONTRACTOR shall check and verify primary control, and shall advise the ENGINEER in writing that the points are acceptable or, if they are not acceptable, the reasons therefor. Any discrepancies shall be resolved before proceeding.

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3. All survey work performed by the CONTRACTOR shall be subject to field and office review by the ENGINEER. Any significant discrepancies found by the CONTRACTOR shall be immediately reported to the ENGINEER. The CONTRACTOR shall perform any additional surveys necessary to determine the cause of the discrepancy and shall submit their recommendations for correction. Corrective action shall be taken only with the written approval of the ENGINEER.
- C. Submittals. Submittals shall be in accordance with this paragraph and Section 01 33 23 Submittal Requirements.
1. At least 15 days prior to beginning surveying work, the CONTRACTOR shall submit, a complete plan for the surveying required to layout the work, including methods and time tables for establishing lines and grades.
 2. At least 15 days prior to performing layout or quantity survey work, the CONTRACTOR shall submit, for review and resolution as required, results of the CONTRACTOR's check on the accuracy of the primary control.
 3. Within 2 days of completing and reducing notes for a survey or portion of survey, the CONTRACTOR shall submit, for review and filing, a copy of such notes. Within 2 days of completing a field survey book, the CONTRACTOR shall submit, for review and filing, the original field survey book. If requested by the ENGINEER, the CONTRACTOR shall submit, for review and filing, a copy of the workday's survey notes at the conclusion of that workday.
- D. Layout of work. From the primary control points, the CONTRACTOR shall establish all lines and grades necessary to control the work, and shall be responsible for all measurements that may be required for execution of the work to the tolerances prescribed in these specifications or on the drawings. **An AutoCad file containing line work for the centerline and the work area limits will be provided to the CONTRACTOR for use to layout the work once the primary horizontal control has been verified.**
1. The CONTRACTOR shall establish, place, and replace as required, such additional stakes, markers, and other controls as may be necessary for control, intermediate checks, and guidance of construction operations.
 2. Records. - Survey data shall be recorded in accordance with recognized professional surveying standards. Original field notes, computations, and other surveying data shall be recorded on electronic data collectors or in standard field books. Notes or data not in accordance with standard formats will be rejected. Illegible notes or data, or erasures on any page of a field book will be considered sufficient cause for rejection of part or all of the field book. Copied notes or data will not be permitted; therefore, rejection of part or all of a field book may necessitate resurveying. Corrections by ruling or lining out errors will be satisfactory.

The CONTRACTOR shall also provide the ground profile data to the AGENCY. The data shall be delivered as a text file, either comma or space delimited with a format that includes the point number, northing, easting, elevation, and description for each point shot in the field.

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- E. Quantity Surveys – The following requirements are in addition to the requirements for quantity surveys included in 01 00 00.
1. All bid items are lump sum therefore quantity surveys are not required. Pipeline related bid items are lump sum. The vertical alignments are set to maintain the pipe cover shown on the plan and profile drawings. Once the CONTRACTOR has surveyed and delivered the centerline ground profile to the AGENCY's REPRESENTATIVE, the AGENCY may direct changes to the pipeline vertical alignment. Adjustment of the vertical alignment of the pipelines to maintain the cover shown on the drawings shall not be a basis for additional cost.
- F. Surveying
1. Surveys required.
 - (a) Work limit staking at 500-foot intervals (maximum spacing).
 - (b) Alignment staking. - Each 100 feet on tangent; each 25 feet on curves.
 - (c) Slope staking. - Each 100 feet on tangent, except each 50 feet on tangent for trimming and lining operations and each 25 feet on curves.
 - (d) Structure. - Stake out structures; checkouts prior to and during construction.
 - (e) Road. - Blue tops each 100 feet on tangent and each 25 feet on curves.
 - (f) Information for Record drawings. - As required for structures and other features of work.
 - (g) Centerline profile for the length of the entire length of the pipeline alignments. Spacing of the ground shots shall be at a maximum interval of 100 feet and at all grade breaks. All survey shall be recorded on Horizontal Datum and Vertical Datum used for the work. The data shall be delivered as a text file, either comma or space delimited with a format that includes the point number, northing, easting, elevation, and description for each point shot in the field.
 2. Accuracy. - Degree of accuracy shall be an order high enough to satisfy tolerances specified for the work and the following:
 - (a) Work limits and alignment of tangents and curves shall be within 0.1 foot.
 - (b) Structure points shall be set within 0.01 foot, except where operational function of the special features or installation of metalwork and equipment require closer tolerances. When formwork has been placed and is ready for concrete, the CONTRACTOR shall check the formwork for conformance with the drawings and to ensure that the forms are sufficiently within the tolerance limits for the completed work.
 - (c) Blue tops shall be set within 0.01 foot.
 - (d) Cross-section points shall be located within 0.10 foot, horizontally and vertically.
 - (e) Aerial Mapping shall meet National Mapping Standards for 2-foot contour intervals

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3. Materials and equipment. - The CONTRACTOR shall provide all materials and equipment required for surveying work, including but not limited to, instruments, stakes, steel pins, templates, platforms, standard field books, and tools, and except as required to be incorporated in the work or left in place, all such materials and equipment shall remain the property of the CONTRACTOR.

Instruments shall be accurate and shall be subject to rigid inspection for proper operations at least every two weeks of use. Defective instruments, as determined by the ENGINEER, shall be promptly replaced, repaired, or adjusted to the satisfaction of the ENGINEER.

G. Field Verification of Existing Dimensions and Ground Profiles

1. Layout dimensions shown on the Drawings are subject to change to meet field conditions and/or based upon the final in-place location of CONTRACTOR-furnished and installed facilities, as determined by ENGINEER. It shall be the responsibility of the CONTRACTOR to verify all pertinent dimensions, to effect satisfactory fitting of all existing facilities with new Contract materials and equipment, and to insure that the proper earth cover is provided over all new and existing buried pipe. Depth of existing buried utilities shall be verified prior to construction and fabrication of pipe and specials.
2. Prior to development of pipeline lay sheets, the CONTRACTOR shall develop and deliver surveyed centerline profile for the length of the entire length of the pipeline alignments. Spacing of the ground shots shall be at a maximum interval of 100 feet and at all grade breaks. Once the District receives the data, the ENGINEER will evaluate the CONTRACTOR's profile by comparing it to the design profile and adjustments (if any), to raise or lower the vertical alignment, will be made and transmitted to the CONTRACTOR.
3. Potholing Existing Utilities and Irrigation Facilities— Within sixty (60) days of the Notice to Proceed, the CONTRACTOR shall confirm, mark and determine the depth of all utilities and irrigation pipelines that are crossed by pipelines to be constructed under this Contract. The CONTRACTOR shall also confirm and determine the depth of existing irrigation pipelines that are parallel to the pipelines to be constructed under this Contract, if they are within or immediately adjacent to the CONTRACTOR's planned pipeline trench excavation. The information obtained shall be provided to the ENGINEER for review prior to any construction, including the manufacture of farm turnout pipe and/or pipe specials. At crossings where there is not a minimum clearance of 12 inches, the ENGINEER will either adjust the grade of the existing pipeline (a maximum of 2 feet) by means of "pulling" pipe joints, adding an air release valve; or the AGENCY will make arrangements to have the CONTRACTOR raise or lower the irrigation pipeline.
4. Cost. –The cost of all material, equipment, and labor required for surveys for the layout of work and quantity surveys required shall be included in the prices bid in the schedule for items of work requiring the surveys, except that the cost for surveying and providing the centerline profile and the cost for potholing shall be paid for under the respective bid item in the Bidding Schedule.

END OF SECTION

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SECTION 01 33 23 SUBMITTAL REQUIREMENTS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section provides submittal requirements.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 SUBMITTALS

A. General

1. Drawings furnished to the CONTRACTOR by the AGENCY shall not be construed as shop or fabrication drawings. Prior to the fabrication or placement of any or all items, the CONTRACTOR shall furnish to the ENGINEER all required shop drawings.
2. Catalog cuts or generic drawings will not be accepted.
3. Any drawings submitted without the CONTRACTOR's signed approval required under Paragraph 3.1.C will not be considered and will be returned to the CONTRACTOR for proper resubmission.

B. Schedule of Submittals

1. Within ten (10) Days after the Effective Date of the Contract (unless otherwise specified in the Contract Documents), CONTRACTOR will prepare and deliver a Schedule of Submittals to the ENGINEER that has been fully integrated with the Cost-Loaded CPM Progress Schedule and identifies each Submittal required by the Contract Documents as well as the date on which CONTRACTOR will deliver each Submittal to the ENGINEER. Each Submittal must be delivered to the ENGINEER at least thirty (30) Days prior to the date the material or equipment is scheduled to be incorporated into the Work. The CONTRACTOR is responsible for any schedule delays resulting from the Submittal process.

C. Submittal Procedures

1. CONTRACTOR will follow the following procedures for each Submittal, Shop Drawing and Sample required by the Contract Documents:
 - (a) Transmit three (3) copies of each.
 - (b) Transmittals will be sequentially numbered. CONTRACTOR to mark revised submittals with original number and sequential alphabetic suffix.

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- (c) Each submittal will identify the Project, Contractor, Subcontractor and supplier, pertinent Drawing and detail number, and Specification Section number appropriate to submittal.
- (d) CONTRACTOR shall sign each submittal, certifying that it has reviewed and approved the submittal, verified products required, field dimensions, adjacent construction Work, and that coordination of information is according to requirements of the Work and Contract Documents.
- (e) Identify variations in Contract Documents and product or system limitations that may differ and/or be detrimental to successful performance of completed Work.
- (f) When Submittal is revised for resubmission, CONTRACTOR shall promptly address the ENGINEER's comments and resubmit. CONTRACTOR shall identify changes made since previous submission.
- (g) The ENGINEER's review of shop drawings shall not relieve CONTRACTOR from responsibility for deviations from the Contract Documents unless CONTRACTOR has, in writing, called the ENGINEER's attention to such deviations at time of submission and the ENGINEER has taken no exception to the deviation. The ENGINEER's review of shop drawings shall not relieve CONTRACTOR from responsibility for errors in shop drawings.
- (h) Submittals not required by the Contract Documents or requested by the ENGINEER will not be acknowledged or processed.
- (i) Incomplete Submittals will not be reviewed by the ENGINEER. Delays resulting from incomplete submittals are not the responsibility of the AGENCY.
- (j) CONTRACTOR shall not be entitled to any extension of the Contract Times as a result of the Submittal process.
- (k) Where a Submittal, Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to the ENGINEER's review and approval of the pertinent submittal will be at the sole expense and responsibility of CONTRACTOR.
- (l) Schedule Milestone for Submittals. CONTRACTOR shall submit all submittals required by the Contract Documents in accordance with the Schedule of Submittals. If CONTRACTOR fails to submit the submittals in accordance with the Schedule of Submittals, CONTRACTOR shall be solely liable for any delays or impacts caused by the delayed submittal, whether direct or indirect. CONTRACTOR shall be liable for the time calculated from the date the submittal is due until the date a compliant submittal is made. A compliant submittal will be one that is complete and satisfies the requirements of the Contract Documents.

3.2 SHOP DRAWING AND SAMPLE SUBMITTAL PROCEDURES

A. Before submitting each Shop Drawing or Sample, CONTRACTOR shall have:

1. Reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

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2. Determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 3. Determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 4. Determined and verified all information relative to CONTRACTOR's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- B. With each submittal, CONTRACTOR shall give the ENGINEER specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal and, in addition, a specific notation made on each Shop Drawing or Sample submitted to the ENGINEER for review and approval of each such variation.
- C. Shop Drawings
1. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show the ENGINEER the services, materials, and equipment. CONTRACTOR proposes to provide and to enable the ENGINEER to review the information for assessing conformance with information given and design concept expressed in Contract Documents.
 2. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional ENGINEER responsible for designing components shown on Shop Drawings. Shop Drawings must include signed and sealed calculations to support design in a form suitable for submission to and approval by authorities having jurisdiction.
 3. CONTRACTOR shall make revisions and provide additional information when required by authorities having jurisdiction
- D. Samples
1. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as required to enable the ENGINEER to review the submittal for assessing conformance with information given and design concept expressed in Contract Documents.
 2. Samples should be of appropriate size and detail to assess functional, aesthetic, color, texture, patterns and finish selection.
- E. Engineer's Review
1. The ENGINEER will review of Shop Drawings and Samples in accordance with the Schedule of Submittals. The ENGINEER's review and acceptance will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design

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concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Within thirty (30) calendar days after receipt of shop or fabrication drawings, the ENGINEER will return one copy of the drawings to the CONTRACTOR appropriately marked. The CONTRACTOR shall then revise the shop or fabrication drawings if requested by the ENGINEER or submit an alternative to the revision, and perform the work in accordance with the revision or approved alternative therefor. The AGENCY reserves the right to require, at no additional cost over the prices stated in the Bidding Schedule, such modifications or alterations as deemed necessary by the ENGINEER. Notwithstanding the above provisions, the CONTRACTOR shall be responsible for obtaining proper fit and dimensions, and adequate strength to withstand specified dynamic and static loadings on the materials and equipment furnished; the ENGINEER's review will apply only to the general arrangement of the materials or equipment.
3. The ENGINEER's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
4. The ENGINEER's review and acceptance shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless the ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample.

F. Resubmittal Procedures

1. CONTRACTOR shall make corrections required by the ENGINEER and shall return three (3) corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by the ENGINEER on previous submittals.

END OF SECTION

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SECTION 01 35 23 SUPPLEMENTAL SAFETY REQUIREMENTS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section supplements safety requirements outlined in the General Conditions.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Safety: Section 5.7 of the General Provisions

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 WORK SITE SAFETY

- A. General - In addition to all other safety requirements specified in the Contract Documents, CONTRACTOR shall comply with the requirements of this section.
- B. CONTRACTOR shall comply with the latest edition of the Bureau of Reclamation's "Safety and Health Standards" at all times during performance of the Work.
- C. The AGENCY has considered these Safety Programs when determining the Contract Times and no additional time or compensation will be added to the Contract due to these Programs.
- D. The facilities to be constructed under this Contract cross existing underground features and the AGENCY has made a determined effort to gather and incorporate, into these Specifications and Drawings, all available information regarding existing underground features. The AGENCY's investigation included utility-owner contacts and solicitation of available maps.
 - 1. Even though the effort has been made to identify the utilities as described above, the risk exists that not all utilities (especially private irrigation pipelines due to lack of public records) are known and identified. An extremely hazardous condition could occur if an irrigation pipeline is ruptured during trench excavation operations that could trap workers that are inside the pipeline.
 - 2. For this reason, except during jointing of each section of pipe, the CONTRACTOR shall not have workers inside the pipeline while trench excavation operations are in progress for the respective pipeline.
- E. Excavation Safety Plan
 - 1. Not less than thirty (30) days before beginning excavation required under this Contract, the CONTRACTOR shall furnish to the AGENCY's REPRESENTATIVE for review working

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Drawings of its excavation safety plan. CONTRACTOR shall not begin excavation until said plan has been reviewed by the AGENCY's REPRESENTATIVE.

2. The excavation safety plan shall include all of the CONTRACTOR's excavation operations, and working Drawings shall be a detailed plan showing the design or shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground. Plans varying from the shoring system standards established by the Construction Safety Orders of the Cal-OSHA or the Federal Safety Standards of the Department of Health, Education and Welfare, must be prepared by a registered civil or structural engineer. In no event shall the CONTRACTOR use a shoring, sloping, or protective system less effective than that required by said Construction Safety Orders, or less effective than that required by said Federal Safety Standards.

END OF SECTION

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SECTION 01 35 53 SITE SECURITY

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section provides site security requirements for the project.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 SITE SECURITY

- A. Security Program - The CONTRACTOR shall protect the work, and operations areas from theft, vandalism, and unauthorized entry. The CONTRACTOR shall initiate a security program at the job mobilization and shall maintain the program throughout construction until final acceptance of the work by the AGENCY. Security of the CONTRACTOR's work and storage areas is the sole responsibility of the CONTRACTOR. At a minimum, the CONTRACTOR shall place a chain link fence around the storage areas. If the CONTRACTOR elects to install security lighting, design and installation of the lighting system shall be the responsibility of the CONTRACTOR. All security fences and other security measures shall be removed at the completion of construction.
- B. Engineer's Field Office Security - The CONTRACTOR is responsible for the AGENCY's field office security. The AGENCY's field office shall be equipped with a wireless cellular type security alarm system that includes intrusion alarms, motion detectors, and central station monitoring. In lieu of providing security alarm and central station monitoring, the CONTRACTOR may provide a uniformed security guard during non-working hours for the entire construction period. If used, the uniformed security guard shall remain on-site and provide constant surveillance. Construction workers living on-site, or guard dogs shall not be considered to provide the function of a uniformed security guard.
- C. The CONTRACTOR will reimburse the AGENCY the full replacement values (including installation costs) of any equipment, instruments, and tools that are stolen or damaged from the AGENCY's field office. Any equipment, instruments, and tools provided by the CONTRACTOR that are stolen or damaged by intruders or other unwanted incident shall be replaced within one (1) week from the date of occurrence. For each day thereafter that the AGENCY's field office is not equipped nor ready for resuming normal work, the CONTRACTOR will be assessed liquidated damages in the amount of Five Hundred Dollars (\$500.00) per working day.

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SECTION 01 52 13 TEMPORARY FIELD OFFICE BUILDING

PART 1 -- PART

1.1 DESCRIPTION

- A. The field office, equipped as specified herein, shall be provided by the CONTRACTOR at the CONTRACTOR's camp, ready for use by the AGENCY within 14 days after the commencement date stated in the Notice to Proceed. The CONTRACTOR's attention is directed to the condition that no payment for mobilization, or any part thereof, will be approved for payment under the Contract until all field office facilities specified herein, have been provided.
- B. Unless released earlier by the AGENCY in writing, said field office shall be maintained in full operation at the site with all utilities connected and operable until the Notice of Completion has been executed. Upon execution of the Notice of Completion, or upon early release of the field office by the AGENCY, the CONTRACTOR shall remove the field office within 14 days from said date, and shall restore the site occupied by said field office to the condition indicated.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 BUILDING CONSTRUCTION

- A. Provide a trailer or construct a separate field office building for the AGENCY's REPRESENTATIVE. The field office and its appurtenances or accessories shall remain the property of the CONTRACTOR. Remove the field office from the site after completion of the project.
- B. Building shall be of weathertight construction and contain a minimum of 500 square feet of floor space. Provide 8-foot-minimum ceiling height. Provide one office (minimum 120 square feet), workroom, a conference room, and rest room. A portable toilet and hand washing station shall be provided if no sewer connection is available. Provide floor-to-ceiling walls to separate the rooms; do not use temporary partitions. Provide floor tiles in each room. Provide interconnecting lockable doors.
- C. Line walls and ceiling with insulation.
- D. Each office shall have at least one door. Provide the window area with screens, window shades, and security bars.
- E. Provide at least six windows in the building, with at least one window for each room. Provide blinds for windows. Provide two entrance doors to the building, one at each end. Provide cylinder lock and key on each door. Provide four sets of keys to the AGENCY's REPRESENTATIVE.
- F. Trailer shall not be less than 5 years old.

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3.2 BUILDING CONVENIENCES

- A. Provide refrigerated air conditioning. Provide heating system. HVAC system shall maintain a temperature indoors of 65°F to 80°F regardless of outdoor conditions at the site.
- B. Provide electricity, telephone and internet service. Telephone service shall consist of two phone lines, one of which shall be a high speed internet connection (highest speed offered by service provider).
- C. Provide continuous bottled drinking water service with hot and cold dispenser and continuous supply of paper cups. Provide a refrigerator, minimum 15-cubic-foot size. Provide microwave oven, minimum 1-cubic-foot size.
- D. Provide rest room with toilet, washbasin, and mirror. Provide towel rack, and exhaust fan. A flush-type chemical toilet with a holding tank may be substituted. Contractor is responsible for regular removal of sanitary waste material and the recharging of chemicals. Provide continuous supply of toilet paper and paper towels for the toilet facility. Equip with one soap dispenser, one toilet paper holder, one paper towel cabinet, and one waste paper receptacle. The field office and these facilities shall be serviced and provided with necessary sanitary supplies by a janitorial/cleaning service retained by the Contractor on a daily basis. The AGENCY shall be credited a sum of \$50 per day that the janitorial service is not provided.

3.3 BUILDING SERVICES

- A. Provide janitorial service with two cleanings per week.
- B. Pay the costs for electricity service.
- C. Pay the costs of all telephone and internet service.

3.4 ACCESSORY EQUIPMENT

- A. Provide the following accessory equipment for each office:
 - 1. One 3-foot by 6-foot desk with drawers and locks.
 - 2. One cushioned office swivel desk chair.
 - 3. Two cushioned chairs for visitors.
 - 4. One metal filing cabinet, 18 inches wide by 30 inches deep by 52 inches high, four drawers with locks.
 - 5. One bookcase, 12 inches deep by 48 inches long, with one 12-inch-high shelf and one 18-inch-high shelf. Provide seismic restraint attachment to wall.
 - 6. One wastebasket.
- B. Provide the following accessory equipment for the workroom:

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1. One 3-foot by 6-foot desk with drawers and locks and one cushioned swivel office desk chair.
 2. Two wastebaskets.
 3. One flat table, 4 feet by 8 feet.
 4. Eight office chairs, stiff-leg type, no armrests, folding optional.
 5. One metal filing cabinet, 18 inches wide by 30 inches deep by 52 inches high, four drawers with locks.
 6. One bookcase, 12 inches deep by 48 inches long, with five 12-inch-high adjustable shelves. Provide seismic attachment to wall.
 7. Two cushioned chairs for visitors.
 8. One wall-mounted erasable white markerboard, 4 feet by 8 feet minimum, with three markers each in colors red, green, blue, and black.
 9. One wall-mounted corkboard for thumbtacks, 4 feet by 8 feet minimum.
- C. Provide the following accessory equipment for the conference room:
1. One bookcase, 12 inches deep by 48 inches long, with one 12-inch-high shelf and one 18-inch-high shelf. Provide seismic attachment to wall.
 2. One wastebasket.
 3. One flat conference table, 4 feet by 8 feet.
 4. Eight office chairs, stiff-leg type, no armrests, folding optional.
 5. Two cushioned chairs for visitors.
 6. One wall-mounted erasable white markerboard, 4 feet by 4 feet minimum, with three markers each in colors red, green, blue, and black.
- D. Provide and maintain commercial grade color photocopier, dry toner type, to copy to 8-1/2-inch by 11-inch, 8-1/2-inch by 14-inch, and 11-inch by 17-inch paper. Provide toner, paper, and service required for machines' operation.

3.5 ELECTRICAL OUTLETS AND LIGHTING

- A. Provide LED light fixtures to evenly illuminate the rooms to a minimum of 50 foot-candles and an average of 70 foot-candles measured at desk height. Provide a two-lamp LED fixture in the rest room. Provide light switch in each room.
- B. Provide three duplex 120-volt grounding type outlets in each office and the workroom and the conference room and one ground fault circuit interrupter type outlet in the rest room. Provide one duplex outlet for each refrigerator and microwave.

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3.6 COMPUTER EQUIPMENT

- A. Provide and maintain the following computer equipment, computer software, and networking connections:
1. Router: Cable/DSL router with firewall, wireless N router speed.
 2. Printer: HP Officejet 6500 Laser Format 11"x17" All in One Printer or approved equal.
 3. DSL: DSL service with at least 1.5 mbps speed. Provide DSL modem, installation, and monthly service.
 4. Wiring and Connections: Provide hook and all necessary network cabling from router to three workstations, copier, and printer. Provide wiring for telephones, fax line, and modem line. Provide minimum of five-outlet surge protectors.
 5. The CONTRACTOR shall retain and remove the computer equipment upon completion of the project.

3.7 TELEPHONE AND DSL SERVICE

- A. Within 14 days after the commencement date stated in the Notice to Proceed, provide in each of the field offices one telephone, in good working order, at each desk, one telephone in the workroom and one telephone in the conference room. Provide one telephone line for each two phones, minimum of two lines, and one telephone line for each computer and for each facsimile for voice or data transmissions. The number of lines shall be rounded up to the nearest whole number.
- B. Provide monthly service for telephone lines and DSL service as noted previously.

END OF SECTION

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SECTION 01 71 13 MOBILIZATION AND DEMOBILIZATION

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. Mobilization work shall include, but not be limited to, that necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of CONTRACTOR's and the AGENCY's REPRESENTATIVE field office facilities necessary for work on the project; for establishment of staging/lay down areas; for obtaining permits, bonds and insurance; preparation of surveys and videos of existing access roads and facilities; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site. Demobilization work shall include, but not be limited to, the removal from the project at the end of construction of all equipment, supplies, field office facilities, personnel and incidentals, and shall include restoration of all staging/lay down areas.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A. Bid Item Descriptions: 01 22 00

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 MOBILIZATION AND DEMOBILIZATION

- A. Mobilization and demobilization will be paid at the Contract lump sum price stated in the Schedule of Pay Items for the item listed below:
 - 1. Item No. 001 – Mobilization and Demobilization
- B. Progress payments for mobilization and demobilization will be made as follows:
 - 1. When a total of 5 percent of the original Contract Price is earned for other schedule items, 50 percent of the Contract lump sum price for mobilization and demobilization will be paid.
 - 2. When a total of 10 percent of the original Contract Price is earned for other schedule items, 45 percent of the Contract lump sum price for mobilization and demobilization will be paid.
 - 3. When the Contract work is accepted as complete, the balance of the Contract lump sum price for mobilization and demobilization will be paid.
 - 4. Progress payments for mobilization and demobilization will be subject to retention as provided in Section 7 of the General Provisions.

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SECTION 02 41 00 DEMOLITION

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials, and equipment to perform demolition and abandoning-in-place of existing equipment and piping.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Fill and Compaction: 31 23 23.

PART 2 -- PRODUCTS

2.1 MATERIALS

- A. Refer to other sections of these specifications for material to be used as replacements for removal or abandoned equipment.

PART 3 -- EXECUTION

3.1 GENERAL

- A. Perform demolition and abandonment work specified and indicated in the drawings.

3.2 EXISTING PIPING AND ELECTRICAL UTILITIES

- A. Refer to Section 01 14 01 - Special Site Conditions for construction requirements and constraints, and scheduling activities with the AGENCY or affected utility agency that are required to perform the work. The AGENCY or affected utility agency will open/close valves on piping, slide and sluice gates in channels, and schedule electrical disconnects required for the shutdowns.
- B. Where demolition is specified or indicated on the Drawings, disconnect all associated electrical equipment, and render the equipment safe.
- C. Remove and dispose of all conduit, wire, electrical equipment, controls, etc. associated with the items and/or areas to be demolished as indicated on the Drawings unless otherwise indicated. For each piece of equipment to be removed, remove all ancillary components (e.g. instruments, solenoid valves, disconnect switches, etc. Remove all wire back to the source for all conduits to be removed or abandoned in place.
- D. Where salvaged equipment is noted on Drawings to be provided to the AGENCY, CONTRACTOR shall remove equipment, package, label and deliver to the AGENCY's yard.

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- E. Provide new nameplates for modified electrical distribution equipment, motor control centers, etc. to identify equipment and circuits that are no longer used as spares. Provide new typewritten schedules for all modified panelboards.
- F. Portions of this Project involve installation in existing facilities and interfaces to existing circuits, power systems, controls, and equipment:
 - 1. Perform and document comprehensive and detailed field investigations of existing conditions (circuits, power systems, controls, equipment, etc.) before starting any WORK. Determine all information necessary to document, interface with, modify, upgrade, or replace existing circuits, power systems, controls, and equipment.
 - 2. Provide and document interface with, modifications to, upgrades, or replacement of existing circuits, power systems, controls, and equipment.
 - 3. Provide new nameplates for modified electrical distribution equipment, motor control centers, etc. to identify equipment and circuits that are no longer used as spares.
 - 4. Set of complete, final, as-reviewed and accepted manufacturer's or vendor's descriptive information.
- G. Utility coordination: Coordinate with the electric utilities as required.

3.3 ABANDONMENT OF PIPING IN-PLACE

- A. Plug buried pipes 6 inches and larger to be abandoned as shown on the Drawings. Plug pipes of all sizes to be abandoned under structures with sand and cement slurry.

3.4 FENCING REMOVAL

- A. Where existing fencing is shown on the Drawings to be removed and replaced, CONTRACTOR shall coordinate the removal and replacement work with the respective landowner.

3.5 PAVEMENT REMOVAL

- A. Initially cut asphalt concrete pavement with pneumatic pavement cutter or other equipment at the limits of the excavation and remove the pavement. After backfilling the excavation, saw cut asphalt concrete pavement to a minimum depth of 2 inches at a point not less than 9 inches outside the limits of the excavation or the previous pavement cut, whichever is greater, and remove the additional pavement.
- B. Final pavement saw cuts shall be straight along both sides of trenches, parallel to the pipeline alignment, and provide clean, solid, vertical faces free from loose material. Saw cut and remove damaged or disturbed adjoining pavement. Saw cuts shall be parallel to the pipeline alignment or the roadway centerline or perpendicular to same, or as directed by County inspector.

3.6 DEMOLITION

- A. Existing buildings, structures, boxes, pipes, pavements, curbs, fencing, and other items are to be removed, altered, salvaged, and disposed of as specified herein or indicated on the

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Drawings. Remove and dispose of all portions of these items that interfere with project construction.

- B. Remove and dispose offsite facilities to be demolished in their entirety including below ground footings, foundations, and other associated appurtenances, as shown on the Drawings or as specified herein. Backfill and compact all site areas disturbed by demolition work with earth backfill material in accordance with Section 31 23 23 – Fill and Compaction.
- C. Perform the work in a manner that will not damage parts of the structure not intended to be removed or to be salvaged for the AGENCY. If, in the opinion of the AGENCY's REPRESENTATIVE, the method of demolition used may endanger or damage parts of the structure or affect the satisfactory operation of the facilities, promptly change the method when so notified by the AGENCY's REPRESENTATIVE. No blasting will be permitted.
- D. Equipment, material, and piping, except as specified to be salvaged for the AGENCY, or removed by others, within the limits of the demolition, excavations, and backfills, will become the property of the CONTRACTOR and shall be removed from the project site. The salvage value of this equipment, materials, and piping shall be reflected in the contract price of the demolition work.
- E. Material specified to be salvaged for the AGENCY shall be removed and salvaged in accordance with Section 02 42 00 – Removal and Salvage.
- F. All pavement and road material removed during demolition activities shall be disposed of by the CONTRACTOR.
- G. Do not reuse material salvaged from demolition work on this project, except as specifically shown.
- H. Materials and wastes, defined as hazardous by 40 CFR 261.3, or by other Federal, State, or Local laws or regulations, shall be containerized, labeled, and disposed of in accordance with applicable Federal, State, and Local laws and regulations.

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SECTION 03 11 10 CONCRETE FORM WORK

PART 1 -- GENERAL

1.1 DESCRIPTION

This section describes materials and installation of concrete forms.

- A. Related Work Specified Elsewhere
 - 1. Concrete Joints, Water Stops, and Sealants: 03 15 10.
 - 2. Concrete Reinforcement: 03 21 00.
 - 3. Concrete: 03 30 00.
 - 4. Concrete Finishing and Curing: 03 35 00.

1.2 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit manufacturer's literature for form ties, spreaders, corner formers, form and coatings.
- C. Falsework Calculations and Drawings: The CONTRACTOR's attention is directed to the provisions of Section 1717 of the California Department of Industrial Relations, Division of Industrial Safety, Construction Safety Orders, which require that all falsework or vertical shoring installations where the height of the falsework or vertical shoring, as measured from the top of the sills to the soffit of the superstructure, exceeds 14 feet, or where individual horizontal span lengths exceed 16 feet, or provision for vehicular or railroad traffic through falsework or vertical shoring is made, shall be approved and signed by a civil or structural engineer, registered in the State of California; provided further, that a copy of the falsework plan or shoring layout shall be available on the job site at all times.
- D. Detailed drawings shall be provided of all falsework proposed to be used. Such drawings shall be in sufficient detail to indicate the general layout, sizes of members, anticipated stresses, grades of materials to be used in the falsework, and typical soil conditions.

PART 2 -- PRODUCTS

2.1 FORM CONSTRUCTION AND DESIGN

- A. Design forms according to the applicable portions of ACI 347. Form all concrete, except as specified otherwise.
- B. Provide form windows or stage forms to allow visual observation at all times of the concrete being placed and vibrated. Provide a formwork design and placement schedule that will limit free fall of concrete in walls 8 inches or less in thickness to 4 feet and for walls thicker than 8

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inches, limit this fall to 6 feet. Total vertical lift made in a single pass shall not exceed 2 feet in height.

- C. Notify the AGENCY's REPRESENTATIVE prior to concrete placement (48 hours minimum).
- D. Steel forms shall be minimum 24 gauge, with tongue-and-groove joints, complete with steel stakes and splice plates.
- E. Concrete placed on sloping surfaces shall be contained for vibration and shaped to the lines shown by means of a weighted, steel-faced, unvibrated moving slip form screed of suitable depth and width, which shall be drawn up the slope by suitable means. Roller screeds will not be allowed.

2.2 FORM MATERIAL

- A. Except as otherwise expressly accepted by the ENGINEER, lumber brought on the Site for use as forms, shoring, or bracing shall be new material.
- B. Form materials shall be metal, wood, plywood, or other materials that will not adversely affect the concrete and will facilitate placement of the concrete to the shape, form, line, and grade required. Metal forms shall be an approved type that will accomplish such results.
- C. Lumber used in form construction shall be Douglas fir, No. 2 grade, S4S, Standard Grading and Dressing Rules No. 16, West Coast Lumber Inspection Bureau. Boards shall be 6 inches or more in width.
- D. Plywood used in form construction shall be Grade B-B, Class 1 plyform, mill-oiled, and sanded on both sides in conformance with U.S. Product Standard PS-1. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Exterior Grade.

2.3 FORM TIES

- A. Locate form ties on exposed surfaces in a uniform pattern or as indicated in the drawings. Place form ties so they remain embedded in the concrete except for a removable portion at each end and do not leave an open hole through the concrete. Form ties shall have conical or spherical type inserts with a maximum diameter of 1 inch. Construct form ties so that no metal is within 1 inch of the concrete surface when the forms, inserts, and tie ends are removed. Do not use wire ties. Ties shall withstand all pressures and maintain forms within acceptable deflection limits.
- B. Ties for water-holding structures or dry structures with access, such as basements or pipe galleries, that are below finish grade shall have an integral steel water stop that is tightly and continuously welded to the tie. The water stop shall be at least two times larger in area than the tie cross-sectional area and shall be oriented perpendicular to the tie and symmetrical about the center of the tie. Construct the ties to provide a positive means of preventing rotation or disturbance of the center portion of the tie during removal of the ends.
- C. Removable tapered form ties may be used when approved by the ENGINEER. Removable tapered form ties shall be tapered through-bolts at least 1 inch in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of the same minimum size.

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2.4 FORM RELEASE AGENT

- A. Form release agent shall effectively prevent absorption of moisture by the form and prevent bond with the concrete. Agent shall be nonstaining, California V.O.C.- compliant, leave concrete with a coatable surface, and be nontoxic after 30 days.
- B. For steel forms, release agent shall prevent discoloration of the concrete due to rust.

PART 3 -- EXECUTION

3.1 FORM TOLERANCES

- A. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum Tolerance (inch)
Sleeves and inserts	+1/4 -1/4
Projected ends of anchors	+1/4 -0.0
Anchor bolt setting	+1/4 -1/4
Finished concrete, all locations	+1/4 -1/4 in 10 feet
	Max ±1-inch in total length

- B. The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and inserts:	Centerline of sleeve or insert.
Projected ends of anchors:	Plane perpendicular to the end of the anchor as located in the drawings.
Anchor bolt setting:	Centerline of anchor bolt.
Finish concrete:	The concrete surface as defined in the drawings.

- C. Where equipment is to be installed, comply with manufacturer's tolerances if more restrictive than above.
- D. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the AGENCY.

3.2 FORM SURFACE PREPARATION

- A. Clean form surfaces to be in contact with concrete of foreign material prior to installation. Tape, gasket, plug, and/or caulk joints, gaps, and apertures in forms so that the joint will remain watertight and withstand placing pressures without bulging outward or creating surface irregularities.
- B. Coat form surfaces in contact with concrete with a form release agent prior to form installation.

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- C. Keep form coatings off steel reinforcement, items to be embedded, and the previously placed concrete.

3.3 BEVELED EDGES (CHAMFER)

Form 3/4-inch beveled edges on all exposed concrete edges and corners, beam soffit corners, and where indicated in the drawings. Reentrant corners in concrete members shall not have fillets, unless otherwise shown in the drawings. The top edges of slabs, walkways, beams, and walls may be beveled with an edging trowel in lieu of using chamfer strips.

3.4 FORM PLACEMENT

- A. Provide means for holding adjacent edges and ends of form panels tight and in accurate alignment to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete. Forms shall be tight and shall prevent the loss of mortar and fines during placing and vibration of concrete.
- B. Provide one cleanout and inspection opening (12 inches wide by 18 inches high) every 7 feet at the bottom of each lift of forms.
- C. Provide exterior corners in concrete members with bevels as specified.
- D. Provide means for removing forms without injury to the surface of finished concrete.
- E. Do not embed any form-tying device or part thereof other than metal in the concrete.
- F. Locate large end of taper tie on the "wet" side of the wall.
- G. Use only form or form-tying methods that do not cause spalling of the concrete upon form stripping or tie removal.
- H. Form surfaces of concrete members except where placement of the concrete against the ground is shown in the drawings or as indicated below. The dimensions of concrete members shown in the drawings apply to formed surfaces, except where otherwise indicated. Add 2 inches of concrete where concrete is placed against trimmed undisturbed ground in lieu of forms. Placement of concrete against the ground shall be limited to footings and other nonexposed concrete and only where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing.

3.5 FORM REUSE

Reuse only forms that provide a uniform surface texture on exposed concrete surfaces. Apply light sanding or other surface treatment between uses for uniform texture. Plug unused tie rod holes with corks, shave flush, and sand the concrete surface side. Do not patch forms other than filling tie rod holes, except in the case of Class II forms. Do not use metal patching discs on Class I forms.

3.6 REMOVAL OF FORMS

- A. Forms and shoring for elevated structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and reshore. The following table

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indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed:

Sides of footings and encasements	24 hours
Walls, vertical sides of beams, girders, columns, and similar members not supporting loads	48 hours
Slabs, beams, and girders	10 days (forms only)
Shoring for slabs, beams, and girders	Until concrete strength reaches specified 28-day strength
Wall bracing	Until top or roof slab concrete reaches specified 28-day strength

- B. Do not remove forms from concrete that has been placed with outside air temperature below 50°F without first determining if the concrete has properly set without regard for time. Do not apply heavy loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

3.7 FORMED OPENINGS

Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure watertightness. Provide openings with continuous keyways and water stops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.

3.8 EMBEDDED ITEMS

Set anchor bolts and other embedded items accurately before placing concrete and hold securely in position until the concrete is placed and set. Check special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after placing concrete. Check nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to placing concrete.

3.9 ALUMINUM SURFACES IN CONTACT WITH CONCRETE

Coat aluminum surfaces that will be in contact with concrete per Section 09 90 00, System 21.

3.10 PIPES AND WALL SPOOLS CAST IN CONCRETE

- A. Install wall spools, wall flanges, and wall anchors before placing concrete. Do not weld, tie, or otherwise connect the wall spools or anchors to the reinforcing steel.
- B. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will occur during construction.

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- C. Pipes or spools located below operating water level shall have water stop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast. Pipes fitted with thrust rings shall be cast in place.

END OF SECTION

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SECTION 03 15 10 CONCRETE JOINTS, WATER STOPS, AND SEALANTS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section describes materials, testing, and installation of construction and expansion joints, PVC water stops, premolded joint filler, joint sealant, bond breaker tape, preformed control joints, backing rod, and steel expansion joint dowels.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Formwork: 03 11 10.
- B. Concrete Reinforcement: 03 21 00.
- C. Concrete: 03 30 00.
- D. Concrete Finishing and Curing: 03 35 00.

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit manufacturer's literature, catalog data, and statement of compliance with referenced standards and specifications for materials specified herein.
- C. Submit material samples of PVC water stops.
- D. Provide technical data sheets for the CONTRACTOR's personnel and the AGENCY covering joint preparation, priming, and sealant materials application.
- E. Submit layouts for construction joints.

1.4 MANUFACTURER'S SERVICES

- A. Prior to joint preparation for joints receiving sealant materials, the CONTRACTOR shall require joint manufacturer's technical representative to demonstrate at the site joint preparation, priming, and sealant materials application for the CONTRACTOR's personnel performing joint work.

PART 2 -- PRODUCTS

2.1 PVC WATER STOP

- A. Water stop shall be:
 - 1. Extruded from a virgin elastomeric PVC compound and shall be lock-rib, center- bulb or flat-strip type as manufactured by Greenstreak, A. C. Horn, Kirkhill Rubber Company, Vinylex,

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or approved equal. Water stop shall comply with Corps of Engineers Specification CRD-C-572.

2. Of the dimensions and profile shown in the drawings.
3. Resistant to chemical action with portland cement, alkalies, acids, and not affected by mildew or fungi. It shall show no effect when immersed for 10 days in a 10% solution of sulfuric or hydrochloric acid, saturated lime solution or salt water. Water stops shall be such that any cross section will be dense, homogeneous, and free from porosity and other imperfections. They shall be symmetrical in shape. When tested in accordance with Federal Standard No. 601, the material shall meet the following minimum requirements:

Requirement	ASTM Spec.
Tensile strength, minimum, 2,000 psi	D638
Hardness, Shore durometer, 60-70	D2240
Elongation, ultimate, minimum, 350%	D638
Water absorption, dry weight, maximum (48 hours) 0.32%	D570
Specific gravity, 1.3	D792
Stiffness in flexure, minimum, 600 psi	D747
Cold brittleness, maximum, -35°F	D746
Tear resistance, minimum, 225 lbs/inch	D624

2.2 PRE-FORMED HYDROPHILIC WATER STOP

- A. Hydrophilic water stops shall only be used where shown on the drawings or expressly approved by the ENGINEER.
- B. Hydrophilic, bentonite-free water stops shall be Hydrotite CJ-1020-2K as manufactured by Greenstreak, Ultraseal MC2010 as manufactured by Asahi Denka, or approved equal.
- C. Water stops shall be manufactured from chloroprene rubber and modified chloroprene rubber with hydrophilic properties. Water stop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete. The minimum expansion ratio of modified chloroprene shall not be less than 2 to 1 volumetric change in distilled water at 70 degrees F (21 degrees C).
- D. The bonding agent for hydrophilic water stops shall be the manufacturer's adhesive for wet, rough concrete.
- E. When tested in accordance with Federal Standard No. 601, the material shall meet the following minimum requirements:

Physical Properties, Chloroprene	
Requirement	ASTM Spec.
Tensile strength, minimum, 1,275 psi	D412

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Elongation, ultimate, minimum, 350%	D412
Hardness, Shore A, 55 plus and minus 5	D2240
Physical Properties, Modified Chloroprene	
Requirement	ASTM Spec.
Tensile strength, minimum, 300 psi	D412
Elongation, ultimate, minimum, 600%	D412
Hardness, Shore A, 55 plus and minus 5	D2240

2.3 OTHER TYPES OF WATER STOPS

- A. When other types of water stops, not listed above, are indicated in the design drawings, they shall meet the same requirements as those listed herein.

2.4 JOINT SEALANT FOR CONCRETE STRUCTURES

- A. Joint sealant shall be a multipart, gray, nonstaining, nonsagging, gun grade polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant rubber. Sealant shall comply with ASTM C920, Type M, Grade P, Class 25 for horizontal joints and Grade NS, Class 25 for vertical joints and be recommended by the manufacturer for continuous immersion in water.

Characteristic or Parameter	Technical Requirements
Pot life	1 to 3 hours
Hardness	35 Shore A, ± 5
Elongation	650%, ASTM D412
Tensile strength	200 psi, ASTM D412
Peel strength on concrete	No adhesion loss at 25 pounds
Temperature service range	40°F to 167°F
Immersion in water	Continuous

- B. Sealant shall be Tremco Vulkem 227 or Sikaflex-2CNS (for Grade NS, Class 25), Sikaflex-2CSL of Sika Corporation or Vulkem 245 (for Type M, Grade P, Class 25), or equal. Troweling of sealants into joints will not be permitted.

2.5 BACKING ROD FOR EXPANSION JOINTS

- A. Backing rod shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware, or equal. The rod shall be 1/8 inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint. Where possible, provide full-length sections for the joint; minimize splices. Apply backup rod and bond breaker tape in expansion joints.

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2.6 BOND BREAKER TAPE

- A. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape that will adhere to the premolded joint material or concrete surface. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.

2.7 PREFORMED CONTROL JOINT

- A. Preformed control joints shall only be used where indicated on the drawings or expressly approved by the ENGINEER. They shall not be used as a substitute for construction joints.
- B. Preformed control joints shall be a one-piece, flexible, PVC joint former, such as Kold-Seal Zip-Per Strip KSF-150-50-50, manufactured by Vinylex Corp., Knoxville, Tennessee, or a one-piece steel strip with preformed groove, such as Keyed Kold Retained Kap, manufactured by Burke Concrete Accessories, Inc., San Mateo, California, or equal. Provide the preformed control joint material in full-length unspliced pieces.

2.8 PREMOLDED JOINT FILLER FOR PAVEMENT AND SLABS

- A. Joint filler shall be preformed, nonextruded type constructed of closed-cell neoprene conforming to ASTM D1752, Type I, as manufactured by W.R. Grace Company of Cambridge, Massachusetts; W.R. Meadows, Inc., Elgin, Illinois; or equal.

2.9 PREMOLDED JOINT FILLER FOR HYDRAULIC STRUCTURES

- A. Sponge rubber per ASTM D1752, Type I.

2.10 STEEL EXPANSION JOINT DOWELS

- A. Steel expansion joint dowels shall conform to one of the following:
 - 1. Steel bar dowels with a 12-mil-thick epoxy coating. Steel bar dowels shall conform to ASTM A36 or ASTM A615, plain rounds, Grade 40. Epoxy coating shall be in conformance with ASTM A775; or
 - 2. Stainless steel bar dowels conforming to ASTM A276, Type 316.
- B. Thoroughly grease expansion joint prior to placing adjoining wall or slab concrete.

2.11 PVC TUBING FOR EXPANSION JOINTS

- A. PVC tubing in expansion joints shall be schedule SDR 13.5, conforming to ASTM D2241.

2.12 STYROFOAM FILLER BLOCK

- A. Styrofoam filler blocks for future construction and expansion joints shall be Styrofoam
- B. SM brand as manufactured by Dow Chemical Company or equal.

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PART 3 -- EXECUTION

3.1 PVC WATER STOPS

- A. Water stops shall be heat spliced at ends and intersections to ensure continuity. Bend water stops up from footing and slab joints and splice to wall water stop to result in a watertight structure. Construct forms for construction joints in such a manner as to prevent injury to water stops. Hold water stops securely in position in the construction joints by wire ties, continuous bars, and rings as indicated. Install water stops in construction and expansion joints in hydraulic structures or where shown in the drawings.
- B. Make field splices with a thermostatically controlled heating iron in conformance with the manufacturer's current recommendations. Allow at least 10 minutes before pulling or straining the new splice in any way. The finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80% of the unspliced materials.
- C. All joints in water stops involving more than 2 ends to be joined together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar water stop sections shall be prefabricated (shop made fitting) prior to placement in the forms. The shop made fittings shall allow at least 24-inch long strips of water stop material beyond the joint in each direction.
- D. Water stops shall be stored so as to permit free circulation of air around the water stop material.
- E. When any water stop is installed in the concrete on one side of a joint while the other half or portion of the water stop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed water stop from direct rays of the sun during the entire exposure.

3.2 CONSTRUCTION JOINTS

- A. Layout of construction joints shall be as shown in the drawings and according to the following guidelines:
 - 1. Provide horizontal construction joints at top of foundation members and slabs on grade and at the soffit of supported slabs and beams.
 - 2. Space the construction joints at a maximum horizontal distance of 40 feet and a maximum vertical distance of 20 feet.
 - 3. Space the corner vertical construction joints between 4 and 8 feet from the corner of walls or wall intersections.
 - 4. Space horizontal construction joints at least 8 inches below bottom of slabs.
- B. After the pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material, and expose clean aggregate by sandblasting the surface of construction joints before placing the new concrete. Cover horizontal construction joints with mortar. Spread uniformly and work thoroughly into all irregularities of the surface. The water-cement ratio of

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the mortar in place shall not exceed that of the concrete to be placed, and the consistency of the mortar shall be suitable for placing and working.

- C. In case of emergency, place additional construction joints. (An interval of 45 minutes between two consecutive batches of concrete shall constitute cause for an emergency construction joint.)

3.3 EXPANSION JOINTS

- A. Provide expansion joints with continuous edge reservoirs, which shall be filled with a joint sealant. Leave the material used for forming the reservoirs in place until immediately before cleaning the grooves and filling them with joint sealant. After removing edge forms from the reservoir, remove grout, loose concrete, and fins; then sandblast the slots. Allow the reservoirs to become thoroughly dry; then blow out the reservoirs and immediately prime and fill with the expansion joint sealant and backup materials. The joint sealant manufacturer shall supply the primer used.

3.4 INSTALLATION OF PREMOLDED JOINT FILLER

- A. Install in joint accurately as shown. Attach to concrete with a bonding agent recommended by the joint sealant and joint filler manufacturer for compatibility.

3.5 INSTALLATION OF JOINT SEALANTS

- A. Immediately before installing the joint sealant, clean the joint cavity by sandblasting or power wire brushing. Install bond breaker tape per manufacturer's instructions.
- B. Apply masking tape along the edges of the exposed surface of the exposed joints.
- C. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.
- D. After the joints have been prepared as described above, apply the joint sealant.
- E. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer.
- F. Trowel the joints smooth with a tuck pointing tool wiped with a solvent recommended by the sealant manufacturer.
- G. After applying the sealant, remove the masking tape and any sealant spillage.

3.6 INSTALLATION OF STEEL EXPANSION JOINT DOWELS

- A. Install parallel to wall or slab face, perpendicular to the joint face, and in true horizontal position. Secure tightly in forms with rigid ties. Orient dowels to permit joint movement.

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3.7 CRACKING

- A. Saw joints in slabs before the formation of uncontrolled cracking (i.e., cracking that occurs at locations other than construction, control, or contraction joints) and as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing. Saw joints both during the day and night as required.
- B. If concrete cracks at locations other than construction, control, or contraction joints, the CONTRACTOR may be required to remove and replace the defective work (cracked concrete) in accordance with the provisions of this section, at no additional cost to the AGENCY.

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SECTION 03 21 00 CONCRETE REINFORCEMENT

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section describes materials, testing, and installation of reinforcing steel in concrete.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Form Work: 03 11 10.
- B. Concrete Joints, Water Stops, and Sealants: 03 15 10.
- C. Concrete: 03 30 00.
- D. Concrete Finishing and Curing: 03 35 00.

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove conformance with the specified ASTM standard.
- C. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings (mechanical, electrical, equipment, and architectural) including additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings indicated in the typical detail and structural drawings. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, deck, floor, or roof slabs) including dowels and corner bars. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown in the drawings and as specified. Placing drawings shall be prepared by the CONTRACTOR and shall not incorporate photocopies of the contract drawings.

PART 2 -- PRODUCTS

2.1 REINFORCING STEEL

- A. Reinforcement shall conform to ASTM A615 or A706, Grade 60.
- B. Reinforcing steel shall be detailed and fabricated in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Bend reinforcing steel cold.

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- C. Deliver reinforcing steel to the site bundled and with identifying tags.

2.2 WELDED WIRE REINFORCEMENT

- A. Welded wire reinforcement shall conform to ASTM A185.

2.3 TIE WIRE

- A. Tie wire shall be 16-gauge minimum, black, soft annealed.

2.4 BAR SUPPORTS

- A. Bar supports in beams and slabs exposed to view after form stripping shall be galvanized and plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

2.5 MECHANICAL REINFORCING BAR COUPLERS

- A. Mechanical reinforcing bar couplers shall only be used where indicated on the drawings or otherwise approved in writing by the ENGINEER.
- B. Mechanical reinforcing bar couplers shall be as manufactured by Dayton Barsplice Inc., DYWIDAG, or equal. Couplers shall develop a minimum of 125% of the specified yield strength of the reinforcing bars.

2.6 EPOXY COATING

- A. Epoxy coating for reinforcing steel and accessories, where indicated, shall conform to ASTM A775.

PART 3 -- EXECUTION

3.1 PLACING

- A. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.
- B. Place reinforcing in accordance with the following, unless otherwise indicated:
 - 1. Reinforcement indicated in the drawings is continuous through the structure to the farthest extent possible. Terminate bars 2 inches clear from faces of concrete.
 - 2. Splices may be used to provide continuity due to bar length limitations.
- C. Reinforcing steel, before being positioned and just prior to placing concrete, shall be free from loose mill and rust scale and from any coatings that may destroy or reduce the bond. Clean reinforcing steel by sandblasting or wire brushing and remove mortar, oil, paint, or dirt to remove materials that may reduce the bond.
- D. Do not straighten or rebend reinforcing steel in the field. Do not use reinforcing with bends not shown in the drawings. Bars partially embedded in concrete shall not be field bent except as specifically permitted by the ENGINEER.

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- E. Position reinforcing steel in accordance with the drawings and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms to provide the specified concrete coverage. Bars additional to those shown in the drawings, which may be found necessary or desirable by the CONTRACTOR for the purpose of securing reinforcement in position, shall be provided by the CONTRACTOR at its own expense.
- F. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.
- G. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.
- H. Roll wire mesh used for reinforcement flat before placing concrete. Support and tie wire mesh to prevent movement during concrete placement.
- I. Position dowels for masonry walls to occur at reinforced block cells.

3.2 SPLICES

- A. Splices shall be as indicated in the drawings. Unless otherwise shown, stagger splices in adjacent horizontal bars 48 bar diameters.

3.3 ADDITIONAL REINFORCEMENT AROUND OPENINGS

- A. Place additional reinforcement around pipe or openings as indicated in the drawings.

3.4 WELDING REINFORCEMENT

- A. Reinforcing shall only be welded where specifically permitted by the ENGINEER. Welding of reinforcing steel shall be in accordance with AWS D1.4.

3.5 PLACING WELDED WIRE FABRIC

- A. Extend fabric to within 2 inches of the edges of the slab and lap splices at least 1 1/2 courses of the fabric and a minimum of 6 inches. Tie laps and splices securely at ends and at least every 24 inches with 16-gauge black annealed steel wire. Pull fabric into position as the concrete is placed by means of hooks, and work concrete under the steel to ensure that it is placed at the proper distance above the bottom of the slab.

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SECTION 03 30 00 CONCRETE

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section describes materials, mixing, testing, and placing of concrete and grout.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Formwork: 03 11 10.
- B. Concrete Joints, Water Stops, and Sealants: 03 15 10.
- C. Concrete Reinforcement: 03 21 00.
- D. Concrete Finishing and Curing: 03 35 00.
- E. Grout: 03 60 00.

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Prepare concrete and mortar mix designs and laboratory 7-day and 28-day compressive tests, or submit test reports of 7- and 28-day compressive tests of the mix where the same mix has been used on two previous projects. Tests shall not be more than two years old. Prepare mix designs in accordance with ACI 318, Chapters 4 and 5, except as modified herein. Submit mix design in writing for review by the ENGINEER at least 30 days before placing of any concrete.
- C. Provide certificate that cement used complies with ASTM C150 and these specifications.
- D. Provide certificates that aggregates comply with ASTM C33 and contain less than
- E. 1% asbestos by weight or volume. State weathering region limits of coarse aggregates: severe, moderate, or negligible. State basis of determining that potential reactivity is negligible. Identify certifications and tests to actual materials to be used in the work. Provide additional tests and certifications for each change in material source. Provide an alternate material source of aggregate if tests indicate that aggregates are reactive or possess severe weathering potential. Submit gradation analysis with concrete mix designs.
- F. Provide delivery tickets for ready-mix concrete or weighmasters certificate per ASTM C94, including weights of cement and each size aggregate and amount of water added at the plant and record of pours. Record the amount of water added on the job on the delivery ticket. Water added at the plant shall account for moisture in both coarse and fine aggregate.
- G. Provide certificate of compliance with these specifications from the manufacturer of the concrete admixtures.

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- H. Provide epoxy bonding compound manufacturer's specific instructions for use.
- I. Provide manufacturer's certifications as to suitability of product to meet job requirements with regard to surface, pot life, set time, vertical or horizontal application, and forming restrictions.
- J. Provide nonshrink grout manufacturer's certificate of compliance with these specifications and specific instructions for use.
- K. Submit six copies of a report from a testing laboratory verifying that aggregate and gravel material conforms to the specified gradations and characteristics.
- L. Plant Qualification: Submit certification from the National Ready Mixed Concrete
- M. Association indicating compliance with the specified qualification requirements.
- N. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F.

1.4 PLANT QUALIFICATION

- A. Meet requirements of the Check List for Certification of Ready Mixed Concrete.
- B. Production facilities of the National Ready Mixed Concrete Association and ASTM C94.

1.5 STANDARDS

- A. Unless otherwise indicated, materials, workmanship, and practices shall conform to the following standards:
 - 1. CBC California Building Code.
 - 2. ACI 301, "Structural Concrete for Buildings."
 - 3. ACI 318, "Building Code Requirements for Reinforced Concrete."
- B. Where provisions of pertinent codes and standards conflict with this specification, the more stringent provisions govern.

PART 2 -- PRODUCTS

2.1 NONDOMESTIC CEMENT AND ADDITIVES

- A. The use of nondomestic cement and additives in concrete may be permitted only after review of a written request to use such materials. The request to use nondomestic materials shall include a chemical analysis that indicates the material meets the project specifications. Certifications that state the nondomestic materials meet the project requirements will not be accepted.
- B. Test reports for concrete materials shall be current to within three months of inclusion into the project and shall be identifiable to the materials supplied.

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2.2 CEMENT

- A. Cement shall be in accordance with one of the following options: (1) Type II or Type V cement plus a Class N or F pozzolan or (2) Type V Portland cement only.
- B. Use only one brand of cement in any individual structure. Use no cement that has become damaged, partially set, lumpy, or caked. Reject the entire contents of the sack or container that contains such cement. Use no salvaged or reclaimed cement.
- C. Maximum tricalcium aluminate shall not exceed 8%. The maximum percent alkalis shall not exceed 0.6%.

2.3 POZZOLAN

- A. Pozzolan shall meet the requirements of ASTM C618 for Class N or F with the following additional requirements:
 - 1. The percentage of sulfur trioxide shall be 4.0 or less.
 - 2. The maximum percentage loss on ignition shall be 8.0 for Class N and 2.5 for Class F.
 - 3. The pozzolanic activity index with lime shall be determined using 2-inch cubes and the minimum strength at seven days shall be 900 psi.
 - 4. Unless the aggregates used are not potentially alkali-reactive and test results are submitted to support that, the pozzolan shall be tested for reduction of mortar expansion at 14 days as specified for Class N pozzolan under the optional physical requirements in Table 2A of ASTM C618. The cement used in the test shall be low-alkali. For pozzolan to be acceptable it shall result in an expansion reduction of zero percent or greater when compared to the control test.
 - 5. Pozzolan shall not reduce the sulfate resistance of concrete. A Class N pozzolan shall be shown by test and experience not to detract from the sulfate resistance prior to use. A Class F pozzolan shall be shown to have an "R" factor of less than 2.5 determined in accordance with ASTM C114 prior to use.

2.4 AGGREGATES

- A. Aggregates shall be natural rock, sand, or crushed natural rock and shall comply with ASTM C33, and shall contain less than 1% asbestos by weight or volume. Aggregates shall be free from any substances that will react with the cement alkalis, as determined by Appendix X-1 of ASTM C33. Lightweight sand for fine aggregate will not be permitted.

2.5 WATER AND ICE

- A. Use water and ice that is clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities that might reduce the strength, durability, or otherwise adversely affect the quality of the concrete. Water shall not contain more than 500 mg/L of chlorides or more than 500 mg/L of sulfate. Agricultural water with high total dissolved solids, over 1000 mg/L TDS, shall not be used.

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2.6 COLOR ADDITIVE FOR EXTERIOR ELECTRICAL DUCT ENCASUREMENT

- A. For exterior electrical duct concrete encasements, use a color additive for identification purposes: brick red "Colorfull" as manufactured by Owl Manufacturing Company, Arcadia, California; coral red "Chromix C-22" as manufactured by L. M. Scofield Company, Los Angeles, California; or equal. Add the color additive while the concrete is being mixed using the quantity per cubic yard of concrete recommended by the manufacturer for the class of concrete indicated.

2.7 CONCRETE ADMIXTURES

- A. Class A concrete shall contain an air-entraining admixture conforming to ASTM C260. Admixtures shall be Master Builders MasterAir AE 200, Sika AEA-15, or equal.
- B. Class A concrete shall contain a water-reducing admixture conforming to ASTM C494, Type A. It shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Admixtures shall be Master Builders Pozzolith polymer-type normal setting, Plastocrete 161 or Plastiment, Sika Chemical Corporation, or equal.
- C. Concrete shall not contain more than one water-reducing admixture.
- D. Do not use any admixture that contains chlorides or other corrosive elements in any concrete. Admixtures shall be nontoxic after 30 days.
- E. Accelerating admixtures shall not be used.

2.8 EPOXY BONDING COMPOUND

- A. Bonding compound shall be Sikadur 32 Hi-Mod, Sika Chemical Corporation, Lyndhurst, New Jersey; Concesive by BASF; Euco Epoxy 452 by Euclid Chemical Company; or equal.

2.9 NONEPOXY BONDING COMPOUND

- A. Use Weldcrete by Larsen Products Corporation, Link by Sta-Dry Manufacturing Corporation, Euco Weld by Euclid Chemical Company, or equivalent. The compound shall be rewettable for up to two weeks.

2.10 CONCRETE MIX DESIGN

- A. Conform to ASTM C94, except as modified by these specifications.
- B. Air content as determined by ASTM C231 shall be 4% \pm 1%.
- C. Maximum water-cement ratio for Class A concrete = 0.45 by weight. Maximum water-cement ratio for Class B and Class C concrete = 0.53 by weight.
- D. Where pozzolan is used in Class A concrete it shall not constitute or replace more than 15% of the cement material required without the pozzolan by weight.

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- E. Provide concrete with the following compressive strengths at 28 days and proportion it for strength and quality requirements in accordance with ACI 318, "Proportioning on the Basis of Field Experience," to achieve 28-day compressive strength as follows:

Class	Type of Work	28-Day Minimum Compressive Strength (in psi)	Minimum Cement Content (in lbs per C.Y.)
A	Concrete for all structures and concrete not otherwise specified. Concrete fill at structure foundations, cradle, supports across pipe trenches, and reinforced pipe encasement.	4,000	564
B	Concrete lining	3,000	500
C	Miscellaneous unreinforced concrete, including thrust blocks.	2,500	425
D	Electrical Duct Encasement	2,000	

- F. Measure slump in accordance with ASTM C143. Slump shall be as follows:

1. Slab on grade or heavy sections wider (in plan view) than 3 feet: 2-inches, plus or minus 1-inch.
2. Footings, walls, suspended slabs, beams, and columns: 3-inches, plus or minus 1-inch.
3. Proportion and produce the concrete to have a maximum slump as shown.
4. A tolerance of up to 1 inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

- G. Maximum coarse aggregate size and grading shall be as shown in the following table.

	Maximum Aggregate Size	Aggregate Grade per ASTM C33
Class A and C	1 1/2"	467
Class B	1"	57

- H. The amount of sand used for the composition of the concrete shall be no more than 40% (by weight) of the sand and coarse aggregates.

2.11 TEMPERATURE CONTROL

- A. For concrete sections with a minimum specified dimension that is equal to or greater than 2 feet 0 inches, and unless otherwise permitted:

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1. Provide documentation that maximum concrete temperature in the structure will not exceed 158 degrees F, and the maximum temperature differential between the center of the section and external surfaces of the concrete will not exceed 35 degrees F.
2. Temperature difference between exterior surface of concrete and adjacent air temperature shall not exceed 35 degrees F.

2.12 TRIAL BATCH AND LABORATORY TESTS

- A. Before placing any concrete, a testing laboratory designated by the CONTRACTOR and approved by the ENGINEER, shall prepare a trial batch of Class A concrete, based on the preliminary concrete mixes submitted. The concrete shall conform to the requirements of this section. The trial batch shall be prepared using the aggregates, cement, and admixture(s) proposed for the project. The cost of laboratory trial batch tests will be borne by the CONTRACTOR. The trial batch testing shall be performed at no additional cost to the AGENCY.

2.13 WORKABILITY

- A. Concrete shall be of such consistency and composition that it can be worked readily into the forms and around the reinforcement without excessive vibrating and without permitting the materials to segregate or free water to collect on the surface.
- B. CONTRACTOR shall adjust the proportions to secure a plastic, cohesive mixture, and one that is within the specified slump range.
- C. To avoid unnecessary changes in consistency, the CONTRACTOR shall obtain the aggregate from a source with uniform quality, moisture content, and grading. The CONTRACTOR shall handle materials to minimize variations in moisture content that would interfere with production of concrete of the established degree of uniformity and slump.

PART 3 -- EXECUTION

3.1 READY-MIXED CONCRETE

- A. At the CONTRACTOR's option, ready mixed concrete may be used if it meets the requirements of ASTM C94 as modified by these specifications.
- B. Concrete shall be conveyed from the truck to the place of final deposit as rapidly as practicable by methods that will prevent segregation or loss of ingredients to maintain the quality of the concrete. No concrete shall be placed more than 90 minutes after mixing has begun for that particular batch. If it is necessary to add water to obtain the specified slump, water shall be added per ASTM C94, but the water content of the reviewed design mix shall not be exceeded.
- C. Dry-batched concrete or jobsite mix shall only be used when haul time is excessive. Do not retemper partially hardened concrete.
- D. The CONTRACTOR shall keep a record showing time and place of each pour of concrete, together with transit-mix delivery slips certifying the contents of the pour.

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3.2 PRIOR TO PLACING CONCRETE

- A. Subgrade: Compact the subgrade and/or bedding. Saturate the subgrade approximately eight hours before placement and sprinkle ahead of the placement of concrete in areas where vapor barrier is not used. Remove all standing water, mud, and foreign matter before concrete is deposited.
- B. Granular Base: When indicated in the drawings, install a granular base beneath the slab on grade or a structural foundation. Place the granular material on a compacted subgrade.
- C. Vapor Barrier: Place under structural slabs and buildings where indicated in the drawings. Stretch and weight edges and laps to maintain their positions until concrete is placed.

3.3 PLACING CONCRETE

- A. Placement shall conform to ACI 304 as modified by these specifications.
- B. Coordinate in advance of concrete placement the sequence of placement to assure that construction joints will occur only as designed. Provide AGENCY's REPRESENTATIVE with a copy of the sequence of placement in advance of placement.
- C. Alternate sections of concrete walls and slabs may be cast simultaneously. Do not place adjacent sections of walls and slabs until seven days after placement of first placed concrete.
- D. Notify the AGENCY's REPRESENTATIVE of readiness, not just intention, to place concrete in any portion of the WORK. This notification shall be such time in advance of the operation as the AGENCY's REPRESENTATIVE deems necessary to allow observation of the WORK at the location of the proposed concrete placing. Failure of sufficient advance notification will be cause for delay in placing until observations can be completed. Forms, steel, screeds, anchors, ties, inserts, and other embedded items shall be in place before the CONTRACTOR's notification of readiness is given.
- E. Schedule sufficient equipment for continuous concrete placing. Provide for backup equipment and procedures to be taken in case of an interruption in placing. Provide backup concrete vibrators at the project site. Test concrete vibrators the day before placing concrete.
- F. Do not place concrete until all free water has been removed or has been diverted by pipes or other means and carried out of the forms, clear of the work. Do not deposit concrete underwater, and do not allow free water to rise on any concrete until the concrete has attained its initial set. Do not permit free or storm water to flow over surfaces of concrete so as to injure the quality or surface finish.
- G. Where a vapor barrier is installed, do not puncture the vapor barrier by stakes or any other concrete accessory. Repair any holes in the vapor barrier by patching before placing concrete.
- H. Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing. Do not deposit concrete in large quantities in one place to be worked along the forms with a vibrator.

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- I. Use mechanical vibration in placing concrete to eliminate rock pockets and voids, to consolidate each layer with that previously placed, to completely embed reinforcing bars and fixtures, and to bring just enough fine material to exposed surfaces to produce a smooth, dense, and even texture. Vibrators shall be of the high-frequency internal type, and the number in use shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. In all cases, at least two vibrators shall be available at the site. Use external vibrators for consolidating concrete when the concrete is otherwise inaccessible for adequate consolidating. Construct forms with sufficient strength to resist displacement or damage when external vibrators are used.
 - 1. For liner concrete placed on a slope, vibrate concrete along the leading edge of the slip form screed.
- J. Do not place concrete during rainstorms. Protect concrete placed immediately before rainstorms to prevent rainwater from coming in contact with freshly placed or uncured concrete. Keep sufficient protective covering ready at all times for this purpose.
- K. Elephant Trunks: Use hoppers and elephant trunks or drop chutes to prevent the free fall of concrete that results in separation of coarse particles.
- L. Chutes: Use metal or metal-lined chutes with a slope not exceeding one vertical to two horizontal and not less than one vertical to three horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirement may be used only if they discharge into a hopper before distribution.
- M. Deposit concrete continuously and in level layers of such thickness (not exceeding 2 feet in depth) so that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams, planes of weakness, or cold joints.
- N. Casting new concrete against old: Where concrete is to be cast against old concrete (defined as any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting (exposing aggregate) prior to the application of an epoxy bonding agent. Application shall be in accordance with the bonding agent manufacturer's instructions and recommendations.
- O. Corrosion protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in the concrete shall be positioned and supported prior to placement of the concrete. Placement shall be such that a minimum clearance of 2-inches is maintained between the embedded item(s) and any part of the concrete reinforcement. Embedded items shall not be secured by wiring or welding them to the concrete reinforcement.
- P. Anchor bolts shall be accurately set and shall be maintained in position by templates during placement of the concrete.

3.4 TIME BETWEEN PLACEMENTS

- A. At least two hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system, unless otherwise indicated in the drawings.

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3.5 MAXIMUM HEIGHT OF CONCRETE POURS AND FREE FALL

- A. Do not drop concrete freely into place from a height greater than 6 feet in unexposed work and 4 feet in exposed work. Use tremies or pumps where the drop exceeds these limits. See Section 03 11 10 also.

3.6 PUMPING CONCRETE

- A. Conform to the recommendations of ACI 304.2R except as modified herein.
- B. Base pump size on rate of concrete placement, length of delivery pipe or hose, aggregate size, mix proportions, vertical lift, and slump of concrete.
- C. Minimum inside diameter of pipe or hose shall be based on the maximum aggregate size as follows:
 - 1. 1-inch-maximum aggregate: 4 inches minimum inside diameter.
 - 2. 1-1/2-inch-maximum aggregate: 5 inches minimum inside diameter.
- D. Do not use aluminum pipes for delivery of concrete to the forms.
- E. Before pumping is started, prime the delivery pipe or hose by pumping mortar through the line using 5 gallons of mortar for each 50 feet of delivery line. Do not deposit mortar in the forms.

3.7 HOT WEATHER REQUIREMENTS

- A. During hot weather, give proper attention to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation in accordance with ACI 305 and the following.
- B. All concrete shall be placed at a temperature between 50° and 90° F, except Class B Concrete for reservoir lining shall have a maximum temperature of 80° F at the placement if the ambient air temperature in the canal prism is 90° F or above. The temperature will be determined by placing a thermometer in the concrete immediately after sampling at the placement site. Then the temperature of the concrete at the batch plant shall be adjusted to ensure that the specified concrete temperature is attained at the placement. The CONTRACTOR shall employ effective means, such as precooling of aggregates and mixing water and placing at night, as necessary to maintain the temperature of the concrete below the specified maximum. The CONTRACTOR shall be entitled to no additional compensation due to the foregoing requirements.
- C. Take precautions when placing concrete during hot, dry weather to eliminate early setting of concrete. This includes protection of reinforcing from direct sunlight to prevent heating of reinforcing, placing concrete during cooler hours of the day, and the proper and timely application of specified curing methods.
- D. There will be no additional reimbursement to the CONTRACTOR for costs incurred for placing concrete in hot weather.

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3.8 COLD WEATHER REQUIREMENTS

- A. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather in accordance with ACI 306 and the following.
- B. When the temperature of the surrounding atmosphere is 40°F or is likely to fall below this temperature, use heated mixing water not to exceed 140°F. Do not allow the heated water to come in contact with the cement before the cement is added to the batch.
- C. When placed in the forms during cold weather, maintain concrete temperature at not less than 55°F. All materials shall be free from ice, snow, and frozen lumps before entering the mixer.
- D. Maintain the air and the forms in contact with the concrete at temperatures above
- E. 40°F for the first five days after placing, and above 35°F for the remainder of the curing period. Provide thermometers to indicate the ambient temperature and the temperature 2 inches
- F. There will be no additional reimbursement made to the CONTRACTOR for costs incurred for placing concrete during cold weather.

3.9 BACKFILL AGAINST WALLS

- A. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.
- B. Do not backfill the walls of structures that will be laterally restrained or supported by suspended slabs or slabs on grade until the slab is poured and the concrete has reached the specified compressive strength.

3.10 CONCRETE TESTS

- A. Concrete quality testing will be performed on the concrete by the AGENCY as follows:
 - 1. Frequency of Sampling: Compression test specimens shall be taken during construction from the first placement of each class of concrete herein and at intervals thereafter as selected by the AGENCY's REPRESENTATIVE, but not less than one set of four from each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day. Sampling and curing of cylinders shall conform to ASTM C31.
 - 2. Strength Testing: Tests will be performed in accordance with ASTM C39. One test cylinder shall be tested at 7 days for information and two cylinders shall be tested at 28 days for acceptance. The remaining cylinder shall be held to verify test results, if necessary. Strength acceptance will be based on the average of the strengths of the two cylinders tested at 28 days. If one cylinder of a 28-day test manifests evidence of improper sampling, molding, or testing, other than low strength, it shall be discarded and the fourth cylinder shall be used for the test result.
 - 3. Concrete slump shall be determined by ASTM C143 with each strength test sampling and as required to establish consistency.

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4. Air content of the concrete shall be determined using ASTM C231 to verify the percentage of air in the concrete immediately prior to depositing in forms.
 5. The average value of concrete strength tests shall be equal to or greater than the specified 28-day strength. No test shall be less than 90% of the specified 28-day strength.
 6. If the 28-day strength tests fail to meet the specified minimum compressive strength, the concrete will be assumed to be defective and one set of three cores from each area may be taken as selected by the AGENCY and in accordance with ASTM C42. If the average compressive strength of the set of three concrete cores fails to equal 95% of the specified minimum compressive strength or if any single core is less than 75% of the minimum compressive strength, the concrete will be considered defective. The AGENCY may require additional coring, nondestructive load testing, or repair of defective concrete. Costs of coring, testing of cores, load testing, and required repairing pertaining thereto shall be paid by the CONTRACTOR at no extra cost to the AGENCY.
- B. To facilitate concrete sampling and testing, the CONTRACTOR shall:
1. Provide and maintain facilities for safe storage and proper curing of concrete test specimens on the project site, as required by ASTM C31.

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SECTION 03 35 00 CONCRETE FINISHING AND CURING

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section describes materials and methods of concrete finishes, curing, repair of defects, and surface protection.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Formwork: 03 11 10.
- B. Concrete Joints, Water Stops, and Sealants: 03 15 10.
- C. Concrete Reinforcement: 03 21 00.
- D. Concrete: 03 30 00.

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit curing compound manufacturer's statement of compliance with these specifications and recommended coverage to meet or exceed the specified tests. Submit manufacturer's application instructions.

PART 2 -- PRODUCTS

2.1 EPOXY BONDING COMPOUND

- A. See Section 03 30 00 – Concrete.

2.2 CURING COMPOUND

- A. Curing compound shall conform to ASTM C309, Type 2, Class A.
- B. Curing compound shall be white-pigmented and resin-based. Sodium silicate compounds shall not be allowed.
- C. Curing compound shall be compatible with required finishes and coatings and shall meet the State of California Clean Air Quality Standards which limit the quantity of volatile organic compounds.

2.3 MORTAR FOR REPAIR OF CONCRETE

- A. Mortar used for repair of concrete shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than

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one part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.

2.4 BURLAP MATS

A. Conform to AASHTO M182.

2.5 SISAL-KRAFT PAPER AND POLYETHYLENE SHEETS FOR CURING

A. Conform to ASTM C171.

PART 3 -- EXECUTION

3.1 CONCRETE FINISHES

A. Finish concrete surfaces in accordance with the following schedule:

Finish Designation	Area Applied
F-1	Beams, columns, and exterior walls not exposed to water or view.
F-2	Exterior and interior walls, beams, and columns exposed to water, unless such items are to be coated.
F-3	Exterior walls, beams, and columns of structures or buildings exposed to view and to 1 foot below water level or finished grade.
S-1	Canal lining
S-2	Slabs and floors not water bearing.
S-4	Slabs and floors of structures or buildings exposed to view, which are water bearing.
S-5	Slabs and floors at slopes greater than 10% and stairs.
E-1	Exposed edges. EXCEPTION: edges normally covered with earth.
E-2	Top of walls, beams, and similar unformed surfaces.

1. **Finish F-1:** Repair defective concrete, fill depressions deeper than 1/2 inch, and fill tie holes.
2. **Finish F-2:** Repair defective concrete, remove fins, fill depressions 1/4 inch or deeper, and fill tie holes.
3. **Finish F-3:** In addition to Finish F-2, fill depressions and airholes with mortar. Dampen surfaces and then spread a slurry consisting of one part cement and one and one-half parts sand by damp loose volume, over the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.
4. **Finish S-1:** The finished surface shall be equivalent in evenness, smoothness, and free from rock pockets and surface voids to that obtainable by effective use of a long-handled steel trowel. Light surface pitting and light trowel marks will not be considered objectionable.
5. **Finish S-2:** Smooth steel trowel finish.

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6. **Finish S-4:** Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.
 7. **Finish S-5:** Steel trowel finish without local depressions or high points. Apply a stiff bristle broom finish. Leave broom lines parallel to the direction of slope drainage.
 8. **Finish E-1:** Provide chamfer or beveled edges per Section 03 11 10 – Concrete Form Work.
 9. **Finish E-2:** Strike smooth and float to an F-3.
- B. Plastic shrinkage cracks which occur before the concrete hardens shall be closed. Shrinkage cracks shall be closed by working; cracks shall not be sealed by troweling only.

3.2 FINISHING OF FORMED SURFACES

- A. Water cure surfaces until finishing and repairing are completed.
- B. Perform finish work as soon as possible after forms are removed. Remove fins and irregularities by grinding or rubbing, fill depressions deeper than specified with mortar, and fill tie holes.
- C. Ream tie holes with toothed reamers until surface of hole is rough and clean. Coat surface with epoxy bonding compound and fill with mortar.
- D. Finish tapered tie holes as follows:
 1. Sandblast tie rod hole and blow clean prior to filling.
 2. Drive rubber plug, with one end open, to the center of the hole. Plug size shall be larger in diameter than the diameter of the hole at the center of the wall.
 3. Coat entire annular surface of the hole with epoxy prior to filling with mortar.
 4. Apply epoxy in accordance with manufacturer's instructions.
 5. Fill each side of hole with mortar. Apply mortar to the "wet" side of the wall first. Consolidate mortar solidly into the hole.
 6. Notify AGENCY's REPRESENTATIVE of tie rod filling schedule.

3.3 REPAIR OF DEFECTS

- A. Do not repair defects until concrete has been reviewed by the AGENCY's REPRESENTATIVE.
- B. Surface Defects:
 1. Repair surface defects that are smaller than 1 foot across in any direction and are less than 1/2 inch in depth.
 2. Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges perpendicular to the surface and at least 3/8 inch deep,

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thoroughly dampen the surface, work into the surface a bonding grout (one part cement to one part fine sand), fill the hole with mortar, match the finish on the adjacent concrete, and cure as specified.

C. Severe Defects:

1. The CONTRACTOR shall repair severe defects that are larger than surface defects but do not appear to affect the structural integrity of the structure. The ENGINEER shall determine if the defects affect the integrity of the structure.
2. Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges of the hole perpendicular to the surface, sandblast the surface, coat the sandblasted surface with epoxy bonding compound, place nonshrink grout as specified in Section 03 60 00, match the finish on the adjacent concrete, and cure as specified.
3. Major Defects: If the defects are serious or affect the integrity of the structure, as determined by the ENGINEER, or if patching does not satisfactorily restore the quality and appearance to the surface, the ENGINEER may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section.

3.4 REPAIR OF CRACKS IN CONCRETE

- A. Repair concrete cracks in water containment structures that are greater than 0.01 inch and less than 0.1 inch in width by epoxy pressure injection.
1. Preparation: Insert and anchor a one-way polyethylene valve or pipe nipple in holes drilled into crack. Position them every 6 inches or 18 inches on center depending on the width of the crack. The injecting operation for vertical cracks shall consist of pumping the epoxy grout into the lowest position first and working vertically up in the cracks. Maintain a slow, steady pressure rather than a rapid buildup of pressure. When grouting material reaches the next tube, stop off the present position and follow the same procedure on the next position.
 2. Upon completion of the epoxy grouting, remove the epoxy gel used to hold the valve or nipple by applying a direct flame to the epoxy and scraping it off. Fill the holes with the same material as used for patching the surface.
 3. While the valves or nipples are installed first, the grouting operation shall not commence until after the patchwork has been completed and has sufficiently cured.
- B. Repair cracks in concrete structures that are wider than 1/10 inch by cutting out a square edged and uniformly aligned joint 3/8 inch wide by 3/4 inch deep, preparing exposed surfaces of the joint, priming the joint, and applying polyurethane joint sealant in accordance with Section 03 15 10.
- C. If the cracks are serious or affect the structural integrity or function of the element, the ENGINEER may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section.

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3.5 CURING AND PROTECTION

- A. Water cure cast-in-place concrete for water containment walls, slabs, channels, and footings by Method 1, 2, or 3 for a period of five days (minimum) prior to applying other curing methods. Do not submerge concrete placed in the dry until it has attained sufficient strength to adequately sustain the stress involved and do not subject it to flowing water across its surface until it has cured four days. Start curing of concrete as soon as possible without damaging surface and not later than two hours after placing.
- B. Cure concrete surfaces in accordance with the methods specified herein for the different parts of the WORK and described in the following paragraphs. These methods are considered to be minimum for curing. The conditions that exist in the field during placement and curing may require additional curing procedures and efforts to ensure proper protection and curing of the concrete. Select and implement the appropriate method commensurate with climatic conditions.

Curing Method	Area Permitted
1	All surfaces minimum 72 hours.
2	All surfaces minimum 72 hours.
3	Slabs and floors minimum 72 hours.
4	All surfaces when maximum ambient temperature will not exceed 80°F and humidity will not drop below 40% on the day of concrete placement and for the three days following.

- C. Where wooden forms are used, wet forms immediately before concreting and keep moist by sprinkling until removed. Keep exposed surfaces of formed concrete moist until commencement of curing.
- D. Use proper concrete placing and curing methods at all times to limit the amount of crazing and cracking of the structures during initial setting and shrinking of the concrete.
- E. Cure concrete for not less than 14 days after placing in accordance with one of the following methods.
1. Method 1, Water Spray Method:
 - (a) Tightly close off concrete surfaces to be cured by bulkheads or other means or entirely surround by tight enclosures, and keep the concrete surfaces moist by sprinkling, spraying, or other means.
 2. Method 2, Wet-Burlap-Mat Method:
 - (a) Thoroughly wet and cover concrete surfaces to be cured with wet burlap mats as soon as the forms have been stripped or as soon as the concrete has set sufficiently to avoid marring the surface. Keep entire concrete surface and burlap continuously and completely wet during the entire curing period.

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3. Method 3, Curing Blanket Method:

- (a) Thoroughly wet concrete surfaces to be cured and cover with curing blankets as soon as the concrete has set sufficiently to avoid marring the surface. The curing blankets shall be weighted to maintain close contact with the concrete surface during entire curing period. Should the curing blankets become torn or otherwise ineffective, keep surfaces moist and replace damaged sections. The curing blankets shall consist of one of the following two types:
 - (i) Sheets of heavy waterproof sisal-kraft paper laid with the edges butted together and with the joints between strips sealed with 2-inch-wide strips of sealing tape or with the edges lapped not less than 3 inches and fastened together with waterproof cement to form continuous watertight joints; or
 - (ii) Sheets of clean polyethylene, having a minimum thickness of 4 mils, laid with edges butted together, and with the joints between sheets sealed with 1-inch-wide strips of acetate tape.
- (b) During the curing period, do not permit traffic of any nature or depositing of objects, temporary or otherwise, on the curing blankets.

4. Method 4, Curing Compound Method:

- (a) Do not use curing compound on surfaces that are to be coated.
- (b) Thoroughly mix compound and apply at a rate of not less than one gallon per 200 square feet. Increase rate as necessary to provide a continuous film of curing compound.
- (c) Spray the surface with two coats of liquid curing compound. Apply in accordance with the manufacturer's instructions to cover the surface with a uniform film that will seal thoroughly. Apply second coat at 90 degrees from the first coat.
- (d) Apply curing compound immediately after completion of the finish on unformed surfaces and within two hours after removal of forms on formed surfaces. Repair formed surfaces within the said two-hour period; provided, however, that any such repairs which cannot be made within the said two-hour period shall be delayed until after Method 1, 2, or 3 has been applied. When repairs are to be made to an area on which curing compound has been applied, first sandblast the area to remove the compound, then repair.
- (e) Wherever curing compound may have been applied to surfaces against which concrete subsequently is to be placed and to which it is to adhere, remove the curing compound entirely by sandblasting prior to the placing of new concrete.
- (f) Where the curing compound method is used, exercise care to avoid damage to the seal during the curing period. Should the seal be damaged or broken before the expiration of the curing period, repair the damaged portions immediately by the application additional curing compound.

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5. It is the responsibility of the CONTRACTOR to select the appropriate curing method in response to climatical and/or site conditions occurring at the time of concrete placement. Take appropriate measures as described in ACI 305 and 306 for protecting and curing concrete during hot and cold weather.

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SECTION 03 37 19 SHOTCRETE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The application of shotcrete may be used in areas for concrete lining and concrete lining transitions only where permitted and is subject to locations approved by the ENGINEER. Shotcrete is defined as pneumatically applied concrete or mortar placed directly onto a surface. Shotcrete shall be composed of water, cementitious materials, sand, coarse aggregate, fiber mesh, and admixtures, and shall be placed by the wet-mix process as specified herein.
- B. The wet-mix process shall consist of thoroughly mixing all the ingredients, feeding the mixture into the delivery equipment, delivering the mixture by positive displacement or compressed air to the nozzle; and then jetting the mixture from the nozzle at high velocity onto the surface to receive the shotcrete.
- C. Shotcrete shall be placed by nozzlemen that are ACI certified in accordance with ACI 506.3R. The CONTRACTOR shall submit nozzlemen certificates to the ENGINEER for approval. Shotcrete shall conform to the requirements of ACI 506.2 Standard Specifications for Shotcrete, except as modified herein.
- D. Prior to start of construction, the CONTRACTOR shall demonstrate that its equipment, materials and operators are capable of providing a finished product in accordance with the Specifications. For this demonstration, the CONTRACTOR shall provide test panels, 30 inches by 30 inches, with a depth the same as the lining. A separate panel shall be provided for each shooting position to be used (invert and slope) and one half of each panel shall contain reinforcement as used in the lining. Cores will be taken by the CONTRACTOR for visual inspection and compressive strength tests. The ENGINEER has the authority to accept or reject equipment, materials and/or operators based on its evaluation and its decision will be final.
- E. If the CONTRACTOR can present valid, factual documentation to the satisfaction of the ENGINEER that its equipment, materials and operators have produced satisfactory results on similar work within the past six months, the ENGINEER may eliminate the test panel procedure.

1.2 RELATED WORK SPECIFIED ELESWHERE

- A. Concrete: 03 30 00
- B. Concrete Finishing and Curing: 03 35 00

1.3 SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 23 Submittal Requirements.
- B. The CONTRACTOR shall submit to the ENGINEER for review a proposed specific operating procedure including a hazard analysis for all shotcrete operations. The specific operating procedure shall include such things as engineering controls, protective clothing, eye protection,

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respiratory protection, and air sampling as necessary to check the effectiveness of the control program.

- C. The CONTRACTOR shall submit test specimens of fresh and hardened shotcrete from locations directed by the ENGINEER.
- D. The CONTRACTOR shall submit certification of compliance for materials in accordance with Part 2 (Products) below.

1.4 SAFETY

- A. All work shall be performed in accordance with the applicable safety and health standards, the requirements of Reclamation's publication "Reclamation Safety and Health Standards," the contract, and these Specifications. Certain additional safety precautions shall be employed to prevent skin and eye contact during shotcreting. If necessary, respirators that filter dusts and caustic mists shall be worn by nozzle men and others in the immediate area of shotcreting.

1.5 QUALITY ASSURANCE

- A. Quality assurance shall be in accordance with the requirements of the contract entitled "Quality Assurance," and with the requirements of these Specifications.
- B. If, in the opinion of the ENGINEER, the results of shotcreting indicate that proper quality control procedures are not being consistently utilized, further shotcrete work may be suspended in whole or in part at the discretion of the ENGINEER. Such suspension will be effective until the CONTRACTOR demonstrates substantial improvement in quality control procedures.
 - 1. **Contractor's quality control** – In accordance with Section 01400, the CONTRACTOR shall be responsible for providing quality control measures to ensure compliance of the shotcrete with these Specifications. The CONTRACTOR shall implement necessary and appropriate quality control procedures to ensure that all shotcrete conforms to the requirements of these Specifications.
 - 2. **Engineer inspection and tests** – Engineer inspection and tests will be in accordance with these Specifications.
 - 3. Not less than 24 hours in advance of any shotcrete application the CONTRACTOR shall inform the AGENCY's REPRESENTATIVE when the work will be performed and, unless inspection is specifically waived, the shotcreting shall be performed only in the presence of an authorized representative of the AGENCY.
 - 4. **Testing** – Except as specified, the CONTRACTOR shall perform all tests. The CONTRACTOR shall provide all materials, equipment, and labor necessary for performing the tests at no additional cost to the AGENCY.
 - 5. **Approval** – Approval of the shotcrete will be based on the inspection and testing requirements of these Specifications.
 - 6. **Rejection** – Shotcrete that fails to meet the requirements of these Specifications will be rejected.

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- C. The CONTRACTOR will perform all testing of fresh and hardened shotcrete. The CONTRACTOR shall obtain specimens from locations specified by the ENGINEER. The compressive strength of the shotcrete will be determined through tests of 3-inch-diameter cores. The average compressive strength of cores taken from a shotcrete application shall not be less than 3,000 pounds per square inch at 28-days' age. Eighty percent of the cores shall have a compressive strength greater than 3,000 pounds per square inch at 28-days' age. Adjustments shall be made as directed by the ENGINEER to obtain shotcrete having suitable impermeability, strength, density, and durability.
- D. A minimum of two companion panels shall be shotcreted at the completion of each 100 cubic yards of shotcrete applied. These panels shall be shotcreted during the normal course of the work by having the nozzleman turn the nozzle from the work to the panels and then return to his/her normal application to the lining. The panels shall be prepared and sampled as designated above for pre-application testing. Required compressive strengths are given above.
- E. If, in the opinion of the ENGINEER, the CONTRACTOR's shotcrete application far exceeds requirements, the frequency of fabricating companion panels may be reduced.
- F. If, in the opinion of the ENGINEER, proper quality control procedures are not being used consistently, the frequency of fabricating companion panels may be increased and cores from the lining may be required for evaluation of the quality of shotcrete.
- G. It may be necessary for the ENGINEER to occasionally cut into the fresh shotcrete lining to confirm uniformity and thickness. Such areas shall be immediately filled with new shotcrete by the CONTRACTOR.
- H. No shotcrete shall be applied to the work until pre-application testing indicates that the nozzleman is qualified and the proposed shotcrete mixture meets the compressive strength specified above. The CONTRACTOR shall allow adequate lead time for fabricating of test panels and testing shotcrete specimens. Furthermore, the CONTRACTOR is encouraged to fabricate panels for several mixtures since failure of a single mixture to meet specified strength requirements could delay accomplishment of other work.

PART 2 -- PRODUCTS

2.1 MATERIALS

- A. All shotcrete materials shall be furnished by the CONTRACTOR and shall be obtained from previously tested and approved sources. Materials will be accepted on certification of compliance with the following standards:
 - 1. **Portland cement** – Portland cement shall be as specified in Section 03 30 00 - Concrete.
 - 2. **Pozzolan** – Pozzolan, if used, shall be as specified in Section 03 30 00 - Concrete.
 - 3. **Water** – The water used in making shotcrete shall be as specified in Section 03 30 00 - Concrete.
 - 4. **Admixtures** – The CONTRACTOR shall furnish air-entraining and chemical admixtures for use in wet-mix shotcrete. The amount of air-entraining admixture used shall be that

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amount necessary to effect a total air content in the shotcrete, prior to application, of 7 percent plus or minus 1 percent by volume of shotcrete. Set accelerating admixtures shall not be used.

5. Air-entraining admixture shall be used in all shotcrete and shall conform to ASTM C 260.
6. When use of type A, D, F, or G chemical admixtures is approved by the ENGINEER, they shall conform to ASTM C 494.
7. **Curing compounds** – Curing compounds shall be as specified in Section 03 35 00 – Concrete Finishing and Curing.
8. **Sand and coarse aggregate** – The term "sand" is used to designate aggregate in which the maximum size particle will pass a 4.75-mm (No. 4) sieve. The term "coarse aggregate" is used to designate all aggregate that can be retained on a 4.75-mm (No. 4) sieve. Sand and coarse aggregate meeting the requirements of ASTM C 33 shall be used in all shotcrete. At least 30 percent (by mass) of the aggregate in the shotcrete mix (before gunning) shall be coarse aggregate.
9. The maximum nominal size coarse aggregate shall be no larger than 1/2 inch. Only 3 percent significant undersize coarse aggregate material that will pass a 4.75-mm (No. 4) U.S. Standard sieve will be permitted. Any oversize material must pass a 5/8-inch sieve. No material retained on the 5/8-inch sieve will be permitted.

PART 3 -- EXECUTION

3.1 PREPARATIONS FOR PLACING

- A. Soil, hardened shotcrete, and other porous surfaces that are to receive fresh shotcrete shall be dampened with a water spray immediately prior to shotcreting. Dampening shall be sufficient to prevent loss of excessive amounts of water from the back side of the fresh shotcrete during the curing period. There shall be no free or ponded water on surfaces to receive shotcrete. Dampening of soil shall not be to the point of causing erosion or slope stability problems.

3.2 APPLICATION

- A. **Mixture proportions** – The proportions of water, cementitious materials, sand, coarse aggregate, and admixture shall be determined by the CONTRACTOR and submitted to the ENGINEER for review. Engineer to obtain the specified compressive strength and workability. The shotcrete shall have a minimum cementitious materials content of 658 pounds per cubic yard, as discharged from the nozzle. Furthermore, the amount of cementitious materials will be increased by the CONTRACTOR as necessary to obtain the specified compressive strengths.
- B. **Consistency** – The consistency of the shotcrete at the delivery point shall not exceed a 3-inch slump. Slumps of 1 inch or less may be necessary for the side slopes.
- C. **Batching** – Concrete mixtures for wet mix shotcrete shall include a maximum sized aggregate of 1/2 inch, with 85 to 100 percent passing the 3/8-inch screen. The water-cement ratio of the concrete (exclusive of water absorbed by the aggregates) shall not exceed 0.47 by weight. Slump of the concrete, when placed, shall not exceed 3 inches. Concrete with less slump should

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be used when it is necessary to do so. The concrete ingredients shall be thoroughly mixed in a batch mixer. The concrete, as discharged from the mixer, shall be uniform in composition and consistency from batch to batch.

- D. **Mixing** – Cementitious materials, sand, coarse aggregate, and admixtures shall be uniformly added and thoroughly mixed in a concrete mixer before being fed into the delivery equipment.
- E. **Placing Welded-Wire Fabric**
1. Before the shotcrete is placed, the surfaces of the fabric and the surfaces of any supports shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances.
 2. Fabric shall be secured in position so that it will not be displaced or vibrate excessively during the placing of the shotcrete. The final position of the fabric shall not deviate more than 1/4 inch from being centered in the shotcrete lining.
- F. **Placing**
1. Placing of shotcrete shall be performed only in the presence of an authorized representative of the AGENCY. Placement shall not begin until all preparations are complete and the authorized representative of the AGENCY has approved the preparations. Shotcrete shall not be placed in standing or running water.
 2. Placing shotcrete shall be performed only by a nozzleman certified in accordance with paragraph 1.01D above during preapplication testing.
 3. An air compressor with ample capacity to provide clean, dry air and maintain a uniform nozzle velocity shall be used.
 4. The shotcrete shall be applied by pneumatic pressure from a discharge nozzle held about 2 to 5 feet from the surface and in a stream as nearly normal as possible to the surface being covered. The nozzle shall also be gyrated while applying the shotcrete.
 5. The shotcrete shall be applied in layers having a thickness that will ensure complete adherence of the shotcrete to the surface. Any shotcrete that shows evidence of sloughing or separation shall be removed and replaced by and at the expense of the CONTRACTOR and to the satisfaction of the ENGINEER.
 6. Care shall be taken to prevent the formation of sand or rock pockets in the shotcrete. Any pockets formed shall be removed immediately and replaced with suitable shotcrete at the expense of the CONTRACTOR.
 7. Use of rebound as shotcrete aggregate is not permitted, and rebound accumulations shall be removed and disposed of at the expense of the CONTRACTOR as approved by the ENGINEER.
 8. The temperature of shotcrete, as placed, shall be between 50° and 90° F. The applied shotcrete shall be kept at a temperature of at least 50° F for a minimum of 3 days immediately following application. When cold weather conditions prevail at the jobsite and

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the temperature of aggregates and water is below 50° F, it may be necessary to obtain shotcrete meeting the specified 28-day compressive strength.

9. The CONTRACTOR shall provide and maintain sufficient standby equipment to ensure continuous production and application of shotcrete to prevent delays in shotcreting operations.
 10. Forms shall be used for shotcrete whenever necessary to confine the shotcrete and shape it to the required lines. The forms shall be clean and free from encrustations of mortar, grout, or other foreign material. Before shotcrete is placed, the surfaces of the forms shall be coated with a form oil that will effectively prevent sticking and will not soften or stain the shotcrete surfaces or cause the surfaces to become chalky or dust producing.
 11. If, in the ENGINEER'S opinion, the shotcreting system selected by the CONTRACTOR fails to provide satisfactory in-place shotcrete in accordance with these Specifications, the CONTRACTOR shall change to another system, provide a redemonstration of the nozzleman's proficiency, or provide a new qualified nozzleman.
- G. **Deviations and tolerances** – Structural deviations and surface tolerances for shotcrete shall be in accordance with the requirements specified in Section 03 11 00 – Concrete Form Work.
- H. **Finishes and finishing** – Finishes and finishing for shotcrete shall be in accordance with the requirements for concrete lining as specified in Section 03 35 00 – Concrete Finishing and Curing.
- I. **Curing** – Curing for shotcrete shall be in accordance with the requirements for concrete canal lining as specified in Section 03 35 00 – Concrete Finishing and Curing.

END OF SECTION

APPENDIX G

SECTION 03 60 00 GROUT

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section describes materials, mixing, testing, and placing of grout. The following types of grout are covered in this Section:
 - 1. Cement Grout
 - 2. Non-Shrink Grout – Class I (cement based)
 - 3. Non-Shrink Grout – Class II (cement based)
 - 4. Non-Shrink Epoxy Grout
 - 5. Epoxy Anchor Grout for Adhesive Anchors
 - 6. Topping Grout and Concrete/Grout Fill

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete: 03 30 00
- B. Concrete Finishing and Curing: 03 35 00

1.3 SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 23 Submittal Requirements.
- B. Provide certified testing lab reports for tests indicated herein.
- C. Provide certification that the grouts used on the project contain no chlorides or other chemicals that cause corrosion.
- D. Provide manufacturer's literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the work and location of use. An ICC-ES Evaluation report shall be submitted for epoxy anchor grout for adhesive anchors.
- E. Provide manufacturer's certification that non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.
- F. Provide the name and contact information of the grout manufacturer's representative who will provide on-site service. The representative shall have a minimum of one year of experience with the chosen grouts.

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1.4 STANDARDS

- A. Unless otherwise indicated, materials, workmanship, and practices shall conform to the following standards:
1. CBC California Building Code.
- B. Where provisions of pertinent codes and standards conflict with this specification, the more stringent provisions govern.

PART 2 -- PRODUCTS

2.1 APPLICATION

- A. Unless indicated otherwise, grouts shall be provided as listed below whether indicated on the Drawings or not.

Application	Type of Grout
Anchor bolts and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F, or in high fire risk areas.	Non-Shrink - Class I
Anchor bolts and reinforcing steel required to be set in grout that is not in high temperature or high fire risk areas.	Epoxy Anchor Grout
Beam and column (1 or 2 story) base plates less than 16-inches in the least dimension.	Non-Shrink - Class I
Column base plates (greater than 2 story or larger than 16-inches in the least dimension)	Non-Shrink - Class II
Storage tanks and other non-motorized equipment and machinery under 30 horsepower	Non-Shrink - Class I
Machinery over 30 horsepower and equipment under 30 horsepower but subject to severe shock loads and high vibration	Non-Shrink Epoxy
Filling blockout spaces for embedded items such as railing posts, gate guide frames, etc.	Non-Shrink - Class I (Class II where placement time exceeds 20 min.)
Under precast concrete elements	Non-Shrink - Class II
Toppings and concrete/grout fill less than 3-inches thick	Topping Grout
Toppings and concrete/grout fill greater than 3-inches thick	Structural Concrete per 03310
Surface repairs	Cement Grout
Repair of holes and defects in concrete members which are not water bearing and not in contact with soil or other fill material	Non-Shrink - Class I
Repair of holes and defects in concrete members which are water bearing or in contact with soil or other fill materials	Non-Shrink - Class II
Any application not listed above, where grout is called for on the Drawings	Non-Shrink Class I, unless noted otherwise

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2.2 CEMENT GROUT

- A. Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 Days shall be 4000 psi.
- B. Cement grout materials shall be as indicated in Section 03 30 00 – Concrete.

2.3 NON-SHRINK GROUTS (CEMENT BASED)

A. General

- 1. Cement-based non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas-liberating, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used.
- 2. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout indicated herein shall be that recommended by the manufacturer for the particular application.
- 3. Grout shall not contain chlorides or additives that may contribute to corrosion.
- 4. Grout shall be formulated to be used at any consistency from fluid to plastic.
- 5. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:
 - (a) Minimum tensile splitting strength of 500 psi per ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - (b) Minimum flexural strength of 1000 psi per ASTM C 580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - (c) Minimum bond strength (concrete to grout) of 1900 psi per modified ASTM C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

B. Class I Non-Shrink Grout

- 1. Class I non-shrink grout shall have a minimum 28 Day compressive strength of 5000 psi when mixed at a fluid consistency.
- 2. Class I non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable and plastic consistencies.
- 3. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827 – Test Method for Early

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Volume Change of Cementitious Mixtures. The grout when tested shall not bleed or segregate at maximum allowed water.

4. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090 - Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.
5. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.
6. Class I Non-Shrink Grout shall be Masterflow 713 Plus by MBT-Chemrex; Five Star Grout by Five Star Products; Sikagrout 212 by Sika Corporation; Premier by L&M Construction Chemicals; High-Flow Grout by Euclid Chemical Company; CG 200 PC by Hilti, or equal.

C. Class II Non-Shrink Grout

1. Class II non-shrink grout shall be a high precision, fluid, extended working time grout. The minimum 28-Day compressive strength shall be 7500 psi, when mixed at a fluid consistency.
2. Grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827.
3. Grout shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090.
4. Class II non-shrink grout shall have an extended working time of 30 minutes minimum when mixed to a fluid consistency as defined in ASTM C 827 at temperature extremes of 45 to 90 degrees F in accordance with ASTM C 1107.
5. Class II non-shrink grout shall meet the requirements of ASTM C 1107, Grade B or C when tested using the amount of water needed to achieve fluid consistency per ASTM C 939.
6. The grout when tested shall not bleed or segregate at maximum allowed water content.
7. Provide certification that its non-shrink property is not based on gas production or gypsum expansion.
8. Class II non-shrink grout shall be Masterflow 928 by MBT-Chemrex; Five Star Fluid Grout 100 by Five Star Products; Crystex by L&M Construction Chemicals; or equal.

2.4 NON-SHRINK EPOXY GROUT

- A. Non-shrink epoxy grout shall be a flowable, non-shrink, 100 percent solids system. The epoxy grout system shall have 3 components: resin, hardener, and specially blended aggregate, each premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.

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- B. Epoxy grout shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827, (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1).
- C. Epoxy grout shall have a negligible (less than 0.0006 in/in) length change after hardening, and a coefficient of thermal expansion less than 0.00003 in/in F when tested according to ASTM C 531 - Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing.
- D. The epoxy grout shall develop a minimum compressive strength of 9000 psi in 24 hours and 13,000 psi in seven days when tested in accordance with ASTM C 579, method B.
- E. The mixed epoxy grout shall have a minimum working life of 90 to 120 minutes at 70 degrees F.
- F. The effective bearing area shall be a minimum of 95 percent EBA in accordance with ASTM C 1339 – Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts, for bearing area and flow.
- G. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application. Do not reduce aggregate loading or add solvents to increase flowability.
- H. Non-shrink epoxy grout shall have the following minimum properties when tested at 7 Days:
 - 1. Minimum bond strength to concrete of 3000 psi per ASTM C 882 modified.
 - 2. Minimum bond strength to steel of 1700 psi per ASTM C 882 modified.
 - 3. Minimum flexural strength of 2500 psi per ASTM C 580.
 - 4. Minimum tensile strength of 2000 psi per ASTM C 307 -- Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
- I. Non-shrink epoxy grout shall be Five Star DP Epoxy Grout by Five Star Products, Inc.; Masterflow 648 CP Plus by MBT-Chemrex; Sikadur 42 Grout-Pak by Sika Corporation; or equal.

2.5 EPOXY ANCHOR GROUT

- A. Epoxy anchor grout shall conform to ASTM C 881 - Epoxy-Resin-Base Bonding Systems for Concrete, Type IV, Class B & C, Grade 3 with the exception of gel time.
- B. Heat deflection temperature per ASTM D 648 -- Test Method for Deflection Temperature of Plastics Under Flexural Load shall be a minimum 120 degrees F.
- C. Manufacturer shall certify that the epoxy anchor grout will maintain 90 percent of its strength up to a temperature of 125 degrees F.
- D. Grout shall come in a 2 chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.

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- E. Epoxy anchor grout shall be capable of being used in submersed applications once cured.
- F. Compressive strength per ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics shall be 10,000 psi minimum.
- G. If the average working or operating temperature will be over 100 deg F or in a high fire risk area, use cement based non-shrink grout and oversized holes.
- H. Overhead anchors and anchors in fire-resistive construction shall be cast-in anchors.
- I. Embedment of adhesive anchors/rebar shall be deep enough to develop the anchor/rebar. Embedment shall not exceed 67 percent of the member depth.
- J. Epoxy anchor grout shall be Epcon C6 by ITW Ramset/Red Head; Power-Fast Epoxy Injection Gel by Powers Fasteners; RE 500 by Hilti, Sikadur AnchorFix-4, or equal.

2.6 TOPPING GROUT AND CONCRETE/GROUT FILL

- A. Where fill is thicker than 3-inches, structural concrete, as indicated in Section 03 30 00 - Concrete, may be used when accepted by the ENGINEER.
- B. Grout for topping of slabs and concrete/grout fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and be mixed as indicated herein. Materials and procedures indicated for normal concrete in Section 03 30 00 - Concrete, shall apply unless indicated otherwise.
- C. Topping grout and concrete/grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45.
- D. Coarse aggregate shall be graded as follows:

U.S. STANDARD SIEVE SIZE	PERCENT BY WEIGHT PASSING
1/2 in	100
3/8 in	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

- E. Final mix design shall be as determined by trial mix design as indicated in Section 03 30 00 - Concrete, except that drying shrinkage tests are not required.
- F. **Strength:** Minimum compressive strength of topping grout and concrete/grout fill at 28 Days shall be 4000 psi.

2.7 CURING MATERIALS

- A. Curing materials shall be in accordance with Section 03 35 00 - Concrete Finishing and Curing and as recommended by the manufacturer of prepackaged grouts.

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2.8 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.
- B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed 4-inches.

2.9 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurements shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 -- EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Grout shall be stored in accordance with manufacturer's recommendations.

3.2 GENERAL

- A. CONTRACTOR shall arrange for the manufacturer of prepackaged grouts to provide on-Site technical assistance within 72 hours of request, as part of the WORK.
- B. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by the ENGINEER.
- C. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of the saturation period, excess water shall be removed with clean, oil free compressed air prior to grouting. Concrete substrate shall not be wet prior to placement of epoxy grouts.
- D. Surface preparation, curing, and protection of cement grout shall be in accordance with Section 03 30 00, Concrete. The finish of the grout surface shall match that of the adjacent concrete unless otherwise indicated.
- E. Surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete, and other deleterious materials.
- F. Shade the WORK from sunlight for at least 24 hours before and 48 hours after grouting.
- G. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

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3.3 GROUTING PROCEDURES

- A. **General:** Mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Structural, equipment, tank, and piping support bases shall be grouted, unless indicated otherwise.
 - 1. The original concrete shall be blocked out or finished off a sufficient distance below the plate to provide for a minimum one-inch thickness of grout, or a thickness as indicated.
 - 2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout through a headbox of appropriate size. The mixture shall be of a fluid consistency and poured continuously into the space between the plate and the base concrete. Forms for grout shall be tight against retaining surfaces, and joints shall be sealed as recommended by the grout manufacturer to be liquid-tight. Forms shall be coated as recommended by the grout manufacturer for easy form release. Where this method of placement is not practical or where required by the ENGINEER, alternate grouting methods shall be submitted for acceptance by the ENGINEER.
- C. Drilled anchors and Reinforcing Bars
 - 1. General
 - (a) Drilled anchors and reinforcing bars shall be installed in strict accordance with the manufacturer's instructions. Holes shall be roughened with a brush on a power drill, and cleaned. Drilled anchors shall not be installed until the concrete has reached the required 28 Day compressive strength. Anchors shall not be loaded until the grout has reached its indicated strength in accordance with the manufacturer's instructions.
 - (b) The CONTRACTOR shall identify position of reinforcing steel and other embedded items prior to drilling holes. Care shall be exercised in coring and drilling to avoid damaging existing reinforcing or embedded items. Notify the ENGINEER if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging prestressing tendons, electrical and communications conduit, and piping.
 - 2. Epoxy Adhesive Anchors
 - (a) Grout shall be proportioned and mixed with automatic equipment.
 - (b) Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO report, but shall not be less than 8 diameters for threaded rod, or 12 diameters for reinforcing or smooth bars.
 - (c) Holes shall be dry.

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3. Cement Based Non-Shrink Grout

- (a) In places of high temperature or fire hazard, anchor bolts shall be grouted in using cement based non-shrink grout, Class I.
- (b) Unless otherwise indicated, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar per the manufacturer's ICBO report, but shall not be less than 16 diameters for threaded rod or 24 diameters for reinforcing or smooth bars.
- (c) When the bolt diameter is one-inch or less, the hole diameter should be a minimum of 2-inches. When the bolt diameter is greater than one-inch, the hole diameter should be at least twice the bolt diameter.
- (d) Drilled holes shall be saturated with water for not less than 24 hours before installation of anchor/rod/rebar.
- (e) The non-shrink grout should be placed in the holes in a non-sag (trowelable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.

D. Topping Grout and Concrete/Grout Fill

- 1. Mechanical, electrical, and finish WORK shall be completed prior to placement of topping or concrete/grout fill. To ensure bonding to the base slab, the base slab shall be given an exposed aggregate finish. Alternatively where accepted by the ENGINEER, the base slab shall be given a roughened textured surface by a close-spaced rake while the surface is green. After curing, high pressure washing shall expose the aggregates and produce not less than a 3/16-inch amplitude roughness. Jackhammers or chipping hammers shall not be used.
- 2. The minimum thickness of grout topping and concrete/grout fill shall be one-inch. Where the finished surface of concrete/grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.
- 3. The base slab shall be thoroughly cleaned and wetted to saturated surface dry (SSD) condition per the International Concrete Repair Institute (ICRI) -- Technical Guide for Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays, prior to placing topping and fill. No topping concrete shall be placed until the slab is completely free from standing pools or ponds of water. A thin coat of neat cement grout shall be broomed into the surface of the slab just before topping or fill placement. The neat cement grout shall not be allowed to dry before topping placement. If it does dry, it must be immediately removed using wet stiff brooms and reapplied. The topping and fill shall be compacted by rolling or thorough tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade. Coat surface with evaporation retardant as needed to prevent plastic shrinkage cracks.

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4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping or fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.
6. As soon as topping or fill finishing is completed, coat surface with curing compound. After the topping is set and sufficiently hard in clarifiers and where required by the ENGINEER, the tank shall be filled with sufficient water to cover the entire floor for 14 days.

3.4 CONSOLIDATION

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, to assure that the space to be grouted is completely filled.

3.5 QUALITY ASSURANCE

A. Field Tests

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the ENGINEER to ensure continued compliance with these specifications. The specimens will be made by the AGENCY's REPRESENTATIVE or its representative.
2. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C 1107 - Packaged Dry, Hydraulic-Cement Grout (Nonshrink), at intervals during construction selected by the ENGINEER. A set of 3 specimens will be made for testing at 7 Days, 28 Days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for topping grout, and concrete/grout fill will be performed in accordance with Section 03 30 00 - Concrete, at intervals during construction as selected by the ENGINEER.
4. Compression tests and fabrication of specimens for epoxy grouts will be performed in accordance with ASTM C 579 - Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacing and Polymer Concretes, Method B, at intervals during construction as selected by the ENGINEER. A set of 3 specimens will be made for testing at 7 Days, and each earlier time period as appropriate.
5. The cost of laboratory tests on grout will be paid by the AGENCY except where test results show the grout to be defective. In such case, the CONTRACTOR shall pay for the tests, removal and replacement of Defective Work, and re-testing, all as part of the WORK.
6. The CONTRACTOR shall assist the AGENCY's REPRESENTATIVE in obtaining specimens for testing and shall furnish materials necessary for fabricating the test specimens.

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- B. **Construction Tolerances:** Construction tolerances shall be as indicated in Section 03 30 00 – Concrete unless indicated otherwise.
- C. Pre-Installation Demonstration and Training
1. Cement and Epoxy-Based Non-Shrink Grouts
 - (a) The grout manufacturer shall give a demonstration and training session for the cement based non-shrink and epoxy grouts to be used on the project, before any installation of grout is allowed.
 - (b) Training session shall use a minimum of 5 bags of cement-based non-shrink class I grout mixed to fluid consistency. Tests shall be conducted for flow cone and bleed tests. Six cubes for testing at 1, 3, and 28 Days shall be made. The remaining grout shall be placed, and curing may be initiated on actual project placements such as baseplates and tie holes to provide on-the-job training for the CONTRACTOR and the AGENCY's REPRESENTATIVE. The CONTRACTOR employees who will be doing the grouting participate in this training and demonstration session. The training session shall include methods for curing the grout.
 - (c) The manufacturer shall mix enough cement-based non-shrink class II grout for a minimum of 15 tie holes and shall train the CONTRACTOR'S employees in how to perform the work and cure the grout. The CONTRACTOR shall have the employees assisting in the mixing and sealing of the tie holes.
 - (d) If the project includes patching, throughbolt holes, epoxy anchors, and/or blockouts, the manufacturer shall also train the CONTRACTOR'S employees in the mixing and curing of the epoxy grouts for each of these applications.
 - (e) The CONTRACTOR shall transport the test cubes to an independent test laboratory, obtain the test reports, and report these demonstration and training test cube strengths to the ENGINEER.
 2. Epoxy Anchor Grout for Adhesive Anchors
 - (a) Before installing adhesive anchors in the WORK, adhesive anchor installers shall be trained and qualified at the Site by the manufacturer's representative.
 - (i) Training and qualification for each installer shall include, but not be limited to: Hole drilling procedure, hole preparation and cleaning techniques, adhesive injection technique and dispenser training/maintenance, rebar dowel preparation and installation, and proof loading/torqueing.
 - (ii) Anchors installed in both the vertical and horizontal positions in a mock-up concrete panel of adequate size and thickness. Anchors shall be tested in tension and shear loading. A minimum of 3 anchors shall be tested for each installation position.
 - (iii) Anchors shall be tested at 2 times the published allowable load in tension and in shear as indicated in the ICC-ES report.
 - (iv) If any of the 3 test bolts in any installation position fail to reach the test loads, the installer shall be re-tested with the same procedure. Re-testing is required only for the failed installation position.

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- (v) An installer who has 3 consecutive successful bolt tests in the first or second trial is considered qualified for adhesive anchor installation for this project. The manufacturer's representative shall issue a certificate to the qualified installer, and a copy of the certificate shall be filed with the CONTRACTOR and be submitted to the AGENCY's REPRESENTATIVE.
- (vi) The test anchor size shall be the maximum size adhesive anchor used on the project. The embedment length shall be long enough to develop the allowable steel strength per AISC Manual of Steel Construction.
- (vii) Each installer shall be re-qualified every 6 months for the duration of the project by the same qualifying procedure.
- (viii) The certification of each qualified installer shall be available for verification at the Special Inspector's request.
- (ix) Defective anchors noted by the Special Inspector shall be replaced and re-installed by the CONTRACTOR without any additional compensation.

3.6 SPECIAL CORRECTION OF DEFECTS PROVISIONS

A. Manufacturer's Warranty

1. Furnish one year warranty for WORK provided under this section.
2. Manufacturer's warranty shall not contain a disclaimer limiting responsibility to the purchase price of products or materials furnished.

END OF SECTION

APPENDIX G

SECTION 05 05 20 BOLTS, WASHERS, ANCHORS, AND EYEBOLTS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section describes materials and installation of anchor bolts, connecting bolts, washers, drilled anchors, epoxy anchors, screw anchors, eyebolts, and stainless steel fasteners.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete: 03 30 00.
- B. Miscellaneous Metalwork: 05 12 10.
- C. General Piping Requirements: 33 11 00.

1.3 DESIGN CRITERIA

- A. Structural Connections: AISC Specification for Structural Steel Buildings, Latest Edition, except connection details that are shown in the contract drawings.

1.4 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit manufacturer's catalog data and ICC reports for bolts, washers, and concrete anchors. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 -- PRODUCTS

2.1 ANCHOR BOLTS

- A. Steel anchor bolts shall conform to ASTM A307, Grade A, B, or C.

2.2 CONNECTION BOLTS

- A. Steel connection bolts shall conform to ASTM A325, Type 3. Connection type shall be X per the AISC handbook.
- B. Provide galvanized bolts where shown in drawings. Galvanizing of bolts, nuts, and washers shall be in accordance with ASTM F2329.

2.3 STAINLESS STEEL BOLTS

- A. Stainless steel bolts shall be ASTM F593, Type 304. Nuts shall be ASTM F594, Type 304. Provide washer for each nut and bolthead. Washers shall be of the same material as the nuts.

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2.4 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

- A. Lubricant shall be chloride free and shall be RAMCO TG-50, Anti-Seize by RAMCO, Specialty Lubricants Corporation Husky™ Lube O'Seal, or equal.

2.5 PLAIN UNHARDENED STEEL AND STAINLESS STEEL WASHERS

- A. Washers shall comply with ASTM F844. Stainless steel washers shall be Type 304. Provide clipped washers where space limitations necessitate.

2.6 MECHANICAL ANCHORS

- A. Unless otherwise indicated in the drawings, mechanical anchors shall be hot-dipped galvanized steel wedge anchors as manufactured by ITW Ramset/Redhead, Kwik Bolt TZ by Hilti, or equal.

2.7 ADHESIVE ANCHORS

- A. Unless otherwise indicated, all drilled concrete or masonry anchors shall be stainless steel epoxy adhesive anchors. Adhesive anchors shall be Hilti HIT HY-RE 500 Adhesive Anchor System, or approved equal. An ICC-ES Evaluation Report shall be submitted for a proposed system.

PART 3 -- EXECUTION

3.1 STORAGE OF MATERIALS

- A. Store material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.2 GALVANIZING

- A. Zinc coating for bolts, anchor bolts, and threaded parts shall be in accordance with ASTM F2329.

3.3 INSTALLING CONNECTION BOLTS

- A. Use steel bolts to connect structural steel members. Use stainless steel bolts to connect structural aluminum members.
- B. Install ASTM A325 bolts per the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
- C. Install washers per AISC Specification for ASD.
- D. Bolt holes in structural members shall be 1/16 inch in diameter larger than bolt size. Measure cast-in-place bolt locations in the field before drilling companion holes in structural steel beam or assembly.
- E. Slotted holes, if required in the drawings, shall conform to AISC Specifications, Chapter J, Section J3, Table J3.1.

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3.4 INSTALLING ANCHOR BOLTS

- A. Preset bolts and anchors by the use of templates. All anchor bolts shall be preset (embedded in the concrete) unless otherwise indicated on the drawings or approved by the ENGINEER.
- B. After anchor bolts have been embedded, protect projecting threads by applying grease and having the nuts installed until the time of installation of the equipment or metalwork.
- C. Minimum depth of embedment of mechanical anchors and adhesive anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.
- D. Prepare holes for mechanical anchors and adhesive anchors in accordance with the anchor manufacturer's recommendations prior to installation.
- E. Install mechanical anchors and adhesive anchors per the manufacturer's recommendations and instructions.

3.5 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

- A. Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

END OF SECTION

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SECTION 05 12 10 MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section describes materials, fabrication, and installation of structural steel, structural plate and members, steel tubing, handrails, grating, expanded metal items and access hatches.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete: 03 30 00.
- B. Bolts, Washers, Anchors, and Eyebolts: 05 05 20.
- C. Painting and Coating: 09 90 00.

1.3 DESIGN CRITERIA

- A. Structural Connections and Framing: AISC Specification for Structural Steel Buildings, Latest Edition, except connection details that are shown in the contract drawings.

1.4 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit placing or erection drawings that indicate locations of fabricated items.
- C. Reproductions of contract documents will not be accepted for this purpose.

PART 2 -- PRODUCTS

2.1 STRUCTURAL STEEL

- A. Material for all-purpose bolted or welded construction shall conform to the following:
 - 1. ASTM A992: W shapes (rolled wide flange shapes).
 - 2. ASTM A36 or A572, Grade 50: S, M, HP, and channels.
 - 3. ASTM A36: Angles and plates.
 - 4. ASTM A53: Steel pipe used as structural members, handrails, and posts.

2.2 BOLTS AND WASHERS

- A. See Section 05 05 20 – Bolts, Washers, Anchors, and Eyebolts.

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2.3 HOLLOW STRUCTURAL STEEL (HSS) TUBING

- A. Steel: Conform to ASTM A500, Grade A

2.4 GRATING

- A. Grating shall be as detailed on the Drawings.
- B. Field measure grating for proper cutouts and sizing.
- C. Grating shall be completely banded. For pipe and conduits (including electrical conduit) larger than 1 inch in diameter penetrating grating, cut and band grating before galvanizing.

2.5 EXPANDED METAL SHEETING

- A. Expanded metal sheet shall comply with ASTM F1267, Type II, Class 2, Grade A Style designation shall be as shown on the Drawings.

2.6 ACCESS HATCHES

- A. Access hatches shall be U.S.F. fabrications, Inc. Type A or Bilco Type J steel or aluminum of the size and configuration shown on the Drawings. Steel doors and frames shall be hot dipped galvanized. Latch and lifting mechanism assemblies, hold open arms and guides, and brackets, hinges, pins and fasteners shall be Type 316 stainless steel.
- B. Locking and Latching Devices: Recessed hasp covered by a hinged lid flush with the exterior surface.

2.7 WELDING ELECTRODES

- A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.
- B. Welding electrodes for stainless steel shall conform to AWS A5.4. Use electrodes as follows:

Stainless Steel Material	Welding Electrode Material
Type 304	E 308
Type 304L	E 347
Type 316	E 316
Type 316L	E 318

PART 3 -- EXECUTION

3.1 STORAGE OF MATERIALS

- A. Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

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3.2 FABRICATION AND ERECTION

- A. Fabricate miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Continuously weld permanent connections along the entire area of contact. Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated in the drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded.
- B. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.
- C. Set embedded metalwork accurately in position when concrete is placed and support rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 03 60 00 – Grout.
- D. Set seat angles for grating and expanded metal covers so that the grating or cover will be flush with the floor or top of structures.

3.3 GALVANIZING

- A. All miscellaneous steel shall be hot dip galvanized in accordance with ASTM A123 unless otherwise indicated on the design drawings.

3.4 WELDING

- A. Perform welding on steel by the SMAW process. Welding shall conform to the AWS D1.1-2008, except as modified in AISC Section J2.
- B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to the AWS D1.2-2003.
- C. Perform welding on stainless steel by the TIG process. All welds shall be full penetration and smooth unless otherwise indicated in the drawings. Provide inert gas on the inside of pipe during welding to reduce oxidation.
- D. Provide a minimum of two passes for metal in excess of 5/16-inch thickness.
- E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

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3.5 BOLTING

- A. See Section 05 05 20 – Bolts, Washers, Anchors, and Eyebolts.

3.6 CONTROL OF FLAME CUTTING

- A. Do not use a gas-cutting torch in the field for correcting fabrication errors on any member in structural framing. Use a gas-cutting torch only on minor members when the member is not under stress.

3.7 REPAIR OF GALVANIZED SURFACES

- A. Repair or replace metal with damaged galvanized surfaces at no additional cost to the AGENCY. Repair galvanized surfaces per Section 09 90 00 – Painting and Coating, System No. 55.

END OF SECTION

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SECTION 09 90 00 PAINTING AND COATING

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials, and equipment for the application of painting and coating systems for the following surfaces:
 - 1. Submerged metal.
 - 2. Exposed metal.
 - 3. Concrete
 - 4. Metal in contact with concrete.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Finishing and Curing: Section 03 35 00

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit manufacturer's data sheets showing the following information:
 - 1. Percent solids by volume.
 - 2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
 - 3. Recommended surface preparation.
 - 4. Recommended thinners.
 - 5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
 - 6. Application instructions including recommended equipment and temperature limitations.
 - 7. Curing requirements and instructions.
- C. Submit color swatches.
- D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.
- E. Submit material safety data sheets for each coating.

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PART 2 -- PRODUCTS

2.1 MATERIALS

- A. Conform to the coating specifications and standards referenced in PART 3.
- B. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.
- C. The volatile organic content (VOC) of the applied coatings, as determined in accordance with ASTM D3960, shall comply with prevailing air pollution regulations.
- D. If the specified products are not available in formulations that meet applicable regulations on VOC levels at time of application, the CONTRACTOR shall submit for review products of equivalent quality and function that comply with the regulations in effect at that time.
- E. No request for substitution of an “equal” will be considered which decreases the film thickness designated, the number of coats to be applied, solids content by volume, the general type of coating, paint, or primer, or the quantity, quality and type of ingredients in the coatings specified. Paints not listed in the specifications shall be submitted with certified ingredients analysis so that a complete comparison between specified and proposed paint may be made.

PART 3 -- EXECUTION

3.1 PAINTING AND COATING SYSTEMS

- A. Painting and coating systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

3.2 SUBMERGED METAL COATING SYSTEMS

- A. System No. 1--Submerged Metal—(Nonpotable water) Type: Epoxy having a minimum volume solids of 80%.
 - 1. **Service Conditions:** For use with metal pipes, pumps, or structures submerged in raw water (nonpotable).
 - 2. **Surface Preparation:** SSPC SP-10.
 - 3. **Coating System:** Devoe Bar-Rust 233H; Amerlock 400; Tnemec 104; or equal, 16 mils.
- B. System No. 2--Immersed Metal—(Nonpotable water) Type: Polyamide Epoxy
 - 1. **Service Conditions:** Surge tank interior.
 - 2. **Surface Preparation:** SSPC SP-10.

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3. **Coating System:** Tnemec 66; or equal, 16 mils.

3.3 EXPOSED METAL COATING SYSTEMS

- A. System No. 10--Exposed Metal Type: High-build epoxy intermediate coat having a minimum volume solids of 60%, with an inorganic zinc prime coat and a pigmented polyurethane finish coat having a minimum volume solids of 52%.
 1. **Service Conditions:** For use with metal structures, pumps, motors, piping, valves, and couplings subjected to water condensation.
 2. **Surface Preparation:** SSPC SP-10.
 3. **Prime Coat:** Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 12 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec 90E-92, Devoe Catha-Coat 304 or 304V, International Interzinc 22HS, PPG Dimetcote 9HS, Carboline Carbozinc 11HS, Sherwin-Williams Zinc-Clad II Plus, PPG METALHIDE® 28 Inorganic Zinc-Rich Primer 97-672, or equal.
 4. **Intermediate Coat:** Tnemec 104, ICI Devoe Devran 224HS or 231, International Interseal 670HS, PPG Amercoat 385, Carboline Carboguard 890, Sherwin-Williams Macropoxy 646 B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or equal; 5 mils.
 5. **Finish Coat:** Two-component pigmented acrylic or aliphatic polyurethane recommended by the manufacturer for overcoating a high-build epoxy coating. Apply to a thickness of at least 2 mils. Products: Tnemec Series 1075, ICI Devoe Devthane 379, International Interline 990HS, PPG Amercoat 450HS, Carboline 134HG, Sherwin-Williams Hi-Solids Polyurethane B65-300, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or equal.
- B. System No. 18--Organic Zinc Primer for Shop Coating and Field Touch-Up: Type: Organic zinc primer having a minimum zinc content of 14 pounds per gallon. Service Conditions: For use as a shop-applied primer or field touch-up primer over inorganic zinc prime coatings on exposed metal. Surface Preparation: SSPC SP-10.
- C. Products: Tnemec 90-97, International Interzinc 308, PPG Amercoat 68HS, ICI Devoe 313, Carboline 859, Sherwin-Williams Zinc-Clad III HS, PPG DURETHANE™ MCZ 97-679, or equal; applied to a minimum dry- film thickness of 3 mils. Organic zinc primer shall be manufactured by the prime coat manufacturer.

3.4 BURIED METAL COATING SYSTEMS

- A. System No. 21--Buried Metal: Type: High solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697).
 1. **Service Conditions:** Buried metal, such as valves, flanges, couplings, bolts, nuts, structural steel, and fittings.

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2. **Surface Preparation:** SSPC SP-10.
 3. **Coating System:** Apply three or more coats of PPG Amerlock 400 or 400VOC, Tnemec 104HS or 80, ICI Devoe Bar-Rust 233H, Carboline 890LT, Sherwin-Williams Tank Clad HS B62-80 series, or equal; 16 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.
- B. System No. 22--Buried Metal: Type: Polyamide Epoxy-Coal Tar.
1. **Service Conditions:** Pump suction barrel exterior and ductile iron pipe exterior.
 2. **Surface Preparation:** SSPC SP-10.
 3. **Coating System:** Apply two coats of Tnemec 46HS-413, 20 mils; or equal.
- C. System No. 24--Buried Metal: Type: Corrosion-resisting grease.
1. **Service Conditions:** Buried metal, such as bolts, bolt threads, tie rods, and nuts. Surface Preparation: SSPC SP-3 or SP-6.
 2. **Coating:** NO-OX-ID GG-2 as manufactured by Sanchem, Inc. Apply to a minimum thickness of 1/4 inch.

3.5 COATING SYSTEMS FOR NONFERROUS METALS

- A. System No. 55--Repair of Galvanized Steel Surfaces: Type: Cold galvanizing compound consisting of paint containing oils, solvents, and zinc dust and complying with MIL-P-21035. Minimum metallic zinc content in the cured coating shall be 90%.
1. **Service Conditions:** Repair of damaged galvanized coatings on steel surfaces. Surface Preparation: Clean damaged surfaces per SSPC SP-1 and SP-11.
 2. **Coating System:** Apply R.C. Galvanizing Compound, RAMCO Specialty Products "Zinckit," NuWave "Galv-Match-Plus," Devcon "Cold Galvanizing," Clearco "Cold Galvanizing Spray," or equal to a minimum dry-film thickness of 3 mils. Apply per ASTM A780, Annex A2.

3.6 WEATHER CONDITIONS

- A. Do not paint in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5°F above the dew point.
- B. Do not apply paint when the relative humidity is above 85%.
- C. Do not paint when temperature of metal to be painted is above 120°F.
- D. Do not apply alkyd, inorganic zinc, silicone aluminum, or silicone acrylic paints if air or surface temperature is below 40°F or expected to be below 40°F within 24 hours.
- E. Do not apply epoxy, acrylic latex, and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60°F or expected to drop below 60°F in 24 hours.

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3.7 SURFACE PREPARATION PROCEDURES

- A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting.
- B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on ipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.
- C. Do not abrasive blast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove sharp edges, burrs, and weld spatter.
- D. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Apply coatings within two hours of blasting or before any rust bloom forms.
- E. Surface preparation shall conform with the SSPC specifications as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Pickling	SP-8
Near-White Blast Cleaning	SP-10
Power Tool Cleaning to Bare Metal	SP-11
Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating	SP-12
Surface Preparation of Concrete	SP-13

- F. Wherever the words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” or “blast cleaning” or similar words are used in these specifications or in paint manufacturer’s specifications, they shall be understood to refer to the applicable SSPC, surface preparation specifications listed above.
- G. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be 2 to 3 mils. Verify the surface profile by measuring with an impresser tape acceptable to the ENGINEER. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the AGENCY’s REPRESENTATIVE. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the ENGINEER.

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3.8 ABRASIVE BLAST CLEANING

- A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.
- B. After abrasive blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast cleaned surface not coated within said eight-hour period.
- C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.
- D. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.9 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

- A. After application of primer to surfaces, allow coating to cure for a minimum of two hours before handling to minimize damage.
- B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.
- C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.
- D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.10 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

- A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.
- B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisodium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.

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- C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.
- D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be prepared per SSPC SP-11. Remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.
- E. Use repair procedures on damaged primer that protects adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles, and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.
- F. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

3.11 PAINT STORAGE AND MIXING

- A. Deliver paints to the jobsite in the original, unopened containers.
- B. Store and mix materials only in areas designated for that purpose by the AGENCY's REPRESENTATIVE. The area shall be well-ventilated, with precautionary measures taken to prevent fire hazards. Post "No Smoking" signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use. Store paint at an ambient temperature from 50°F to 100°F.
- C. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.12 PROCEDURES FOR THE APPLICATION OF COATINGS

- A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.
- B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

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- C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.
- D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.
- E. Apply coating systems to the specified minimum dry-film thicknesses as determined per SSPC PA-2.
- F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.
- G. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. Apply the brush coat prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.
- H. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.
- I. Each coat shall cover the surface of the preceding coat completely, and there shall be a visually perceptible difference in applied shade or tint of colors.
- J. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the ENGINEER.
- K. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

3.13 DRY-FILM THICKNESS TESTING

- A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Provide certification that the gauge has been calibrated by a certified laboratory within the past six months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.
- B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past six months. Provide detector as manufactured by Tinker and Razor or K-D Bird Dog.

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- C. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.
- D. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80%, nor more than 120%, of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.
- E. Perform tests in the presence of the AGENCY's REPRESENTATIVE.

3.14 SURFACES TO BE COATED

- A. Coat surfaces with the specific coating systems as described below. Color of finish coat will be selected by the AGENCY.

COATING SCHEDULE

Surface or Item	Coating System No.
1. All metalwork submerged or subjected to excessive moisture from spray or condensation including stop log guides, ladders, and trash racks, unless other protective coating is specified or shown on the Drawings.	All surfaces shall be hot-dip galvanized.
2. Operating platforms, including structural steel, grating, checkered plate, and all nuts, bolts, and fasteners.	All surfaces shall be hot-dip galvanized.
3. Handrails, ladders and ladder rungs, minor steel pipe, safety cable, and all nuts, bolts, and fasteners including anchor bolts.	All surfaces shall be hot-dip galvanized.
4. Exclusive of Items 2 and 3 above, all other field fabricated structural work and miscellaneous metal work exposed to ordinary atmospheric exposure, including pipe supports, flange supports, pipe tie down straps and marker posts, unless galvanizing or other protective coating is specified or shown on the Drawings.	10
5. Above ground valves, fittings, couplings and castings, not including brass.	10
6. Below ground valves, fittings, couplings and castings, not including brass.	21
7. Exterior of steel pipe above ground and in vaults.	10

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Surface or Item	Coating System No.
8. Interior of steel pipe above ground and in vaults.	1
9. Heavy duty sluice gates.	1

3.15 REPAIR OF IMPROPERLY COATED SURFACES

- A. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.16 CLEANING

- A. During the progress of the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.
- B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.
- C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION

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SECTION 13 34 40 CONTROL BUILDING

PART 1 -- GENERAL

1.1 DESCRIPTION OF WORK

A. This section covers construction of the control building, which includes the following items as specified herein:

1. Concrete Unit Masonry
2. Roof Deck
3. Roofing
4. Sheet Metal
5. Doors, Frames, and Hardware
6. Interior Finish
7. HVAC Equipment
8. Building Sealant

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete: 03 30 00.
- B. Concrete Reinforcement: 03 21 00

1.3 SUBMITTALS

A. The CONTRACTOR shall submit the following for review in accordance with Section 01 33 23 Submittal Requirements:

1. Manufacturer's specifications, product data, installation, instructions, and recommendations for the following:
 - (a) Anchorage device information
 - (b) Metal studs, joists, furring channels, and accessories
 - (c) Access doors
 - (d) Sealant and accessories
 - (e) Metal doors, frames, and accessories
 - (f) Finish hardware
 - (g) Glass and glazing
 - (h) Concrete block sample; C90, Type I, Grade N certification

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- B. Sample of roofing guarantee form
- C. HVAC equipment

1.4 QUALITY CONTROL

- A. **Applicable Standards:** Unless otherwise indicated on the drawings all concrete masonry shall conform to the following codes and standards:
 - 1. 2019 CBC – California Building Code
 - 2. 2018 IBC – International Building Code
 - 3. ACI 350, American Concrete Institute “Building Code Requirements for Masonry Structures”
- B. All WORK shall conform the standard of quality established by the approved free-standing sample panel.
- C. Concrete block masonry units shall be sampled and tested in accordance with ASTM C140.
- D. **Testing of Mortar and Grout:** The CONTRACTOR shall have the mortar and grout tested to assure compliance with these Specifications and the governing codes by a recognized testing laboratory approved by the ENGINEER.
 - 1. Tests shall be taken at the following times:
 - (a) At commencement of masonry work a minimum of 2 test samples each of mortar and grout shall be taken on 3 successive working days.
 - (b) At any change in materials or job conditions a minimum of 2 samples of each modified material, grout, and mortar shall be tested.
 - (c) Four random tests each of mortar and grout shall be made. The random test samples shall be taken when requested by the AGENCY or the AGENCY’s DESIGNATED REPRESENTATIVE.
 - (d) Additional samples shall be taken and tested whenever, in the judgement of the AGENCY or the AGENCY’s DESIGNATED REPRESENTATIVE, additional tests (beyond random tests) are necessary to determine the quality of the work.
 - (e) The costs of tests and test reports, except for any additional tests requested by the AGENCY or the AGENCY’s DESIGNATED REPRESENTATIVE, shall be paid for by the CONTRACTOR. The costs of additional tests requested shall be paid for by the AGENCY.
- E. When the ambient air temperature is below 40 degrees F concrete masonry units shall not be placed. When the ambient air temperature is above 100 degrees F or exceeds 90 degrees F with a wind velocity greater than 8 mph the CONTRACTOR shall implement hot weather procedures approved by the ENGINEER. The hot weather procedures shall comply with the requirements of ACI 350, Section 1.8D.

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PART 2 -- MATERIALS

2.1 CONCRETE MASONRY UNITS

A. Concrete Blocks

1. Concrete blocks shall be of the size and finish as shown and shall be the product of one manufacturer.
2. Blocks shall be hollow load-bearing units of the designated types and sizes and shall conform to ASTM Designation: C 90, Type I, Grade N.
3. Aggregate shall conform to ASTM Designation: C 33 or C 331.

B. Cement

1. Cement shall be as specified Section 03 30 00.

C. Steel Reinforcement

1. Steel reinforcement shall be as specified in Section 03 21 00.

D. Mortar

1. Mortar shall be natural gray colored and shall conform to ASTM Designation: C 270, Mortar Type M.

E. Grout

1. Grout for filling cells in blocks shall conform to ASTM Designation: C 476 for coarse grout except cement shall conform to Section 03 30 00. Grout shall be mixed in drum-type batch mixer. Lime putty shall be made as specified in the appendix to ASTM Designation: C-5.
2. Grout shall attain a compressive strength of 2,000 psi at 28 days.

F. Bonding Agent

1. Bonding agent shall be factory prepared product, Larsen Products Corporation, "Weld-Crete"; "Concresive No. 1001 LPL"; Marine Concrete Bonder No. 5; or equal, and applied in accordance with the manufacturer's printed directions.

2.2 ROOF DECK

- A. Steel joists and decking shall be formed steel strips with structural properties as shown. Cover plates shall be 16 gauge minimum thickness.
- B. Zinc coatings shall be continuous and unbroken, and free from cracking, flaking, and other damage.

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- C. Decking shall be one pattern and shall be the product of one manufacturer. Exposed cutting shall be done by a metal cutting saw or wheel. Decking shall be adjusted and fitted in place before welding to the structure. Decking shall be installed square, parallel and with ends aligned even and straight, with a solid fit at bearings, free from warp. Decking shall be at least 12 inches wide by full length in one piece, except where cutting is necessary.
- D. Parts shall be installed as shown and in accordance with the manufacturer's instructions. Joint welding shall conform to AWS D1.3 and have no bum through the base metal.
- E. Materials shall conform to the following:
 - 1. Structural steel shapes, plates, and bars shall conform to ASTM Designation: A 36.
 - 2. Steel for decking and cover plates shall conform to ASTM Designation: A 446, Grade A, Coating Designation G60.

2.3 ROOFING

A. General

- 1. This paragraph covers built-up roofing and roof insulation, and wood perimeter nailers.
- 2. Surfaces shall be dry, clean, smooth, and free from dirt, grease, oil, and other foreign or deleterious material.
- 3. Built-up roofing system shall consist of base sheet, two interply sheets, and a cap sheet conforming to Shuller Specifications with Premier Felt Products, Type VI; Firestone, with premium plysheet, Type VI; MB Technology System 1, hot asphalt application; or equal, UL Class A rating.

B. Insulation

- 1. Base Layer
 - (a) 2-inch perlite, same as below.
- 2. Tapered Insulation and Top Layer Recover Board
 - (a) ½-inch thick perlite recover board and tapered insulation with coated surface conforming to Firestone; Shuller; Fesco Board; International Permalite; or equal.
- 3. Fasteners
 - (a) Insulation plates and screws as recommended by the insulation manufacturer and approved by FM and UL listed adhesive products.

C. Base Sheet

- 1. Suitable base sheet may be fiberglass or as recommended by the manufacturer. Base sheet shall contain a minimum weight of 25 pounds per square.

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D. Ply Sheets

1. SBS modified ply sheet shall contain polyester reinforcement or a combination of polyester and other fiber reinforcing material. Ply sheet shall contain a minimum weight of 65 pounds per square.

E. Cap Sheet (Mineral Surface)

1. SBS modified cap sheet constructed of polyester mat in a base material of SBS rubber with white granule surface, Class A, UL approved. Cap sheet shall contain a minimum weight of 95 pounds per square.

F. Base Flashing

1. Reinforced roof flashing shall be fiberglass felts, Schuller, Glassply Premier; Firestone, Premier Plysheet Type VI; or equal.

G. Roof Deck Underlayment

1. Roof deck underlayment shall be 5/8-inch Type X glass mat-faced, silicon treated gypsum core panel. Board to meet FM Class 1, UL 1256 and UL Class assemblies. Georgia-Pacific, Dens-Deck; USG, Weatherock; or equal.

H. Walk Pads

1. Provide manufacturer's standard pads as required.

I. Roof Perimeter Nailer

1. Roof perimeter nailers shall be Construction grade Douglas fir conforming to Paragraph 123 of the West Coast Lumber Inspection Bureau Association.
2. Roof perimeter nailers for roof openings shall be pressure-treated with a waterborne preservative conforming to AWPA P-5 and shall be Koppers Co., Inc., Wolmanized; or equal. Pressure treatment shall conform to AWPA C-2.
3. Roof perimeter nailers shall be of the same thickness as the insulation and shall be solid wood. The nailers shall be secured to the steel decking by 1/4-inch, self-tapping, flat head, countersunk, noncorrosive machine screws at 3'-0" centers maximum, with heads countersunk flush with the wood surface. The members shall be butted at comers and abutting sections except where necessary to provide bearing for both joining members.

2.4 SHEET METAL

A. General

1. Sheet metal includes the gutters, downspouts, flashing, and extruded wall louvers as shown secured in place.

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B. Gutters, Downspouts, and Flashing

1. Gutters, downspouts, and flashings shall be fabricated from 24 gauge galvanized sheets to the shapes as shown.
2. Gutters shall be installed dead level with joints lapped 1 inch riveted and soldered watertight; outer edges shall be stiffened. Outlet tubes and gutter opening flanges shall be soldered in place watertight. Outlets shall be furnished with wire globe strainers of galvanized, stainless steel or aluminum wire, as applicable. Fabricate comers in shop. Expansion joints shall be provided as shown.
3. Longitudinal joints on downspouts shall be crimped and only one intermediate joint will be allowed other than the inlet and outlet joints. Transverse joints shall be lapped, riveted, and soldered. Downspouts shall be installed plumb and true, connected to gutter outlets and securely attached to the building with factory fabricated brackets and expansion anchors.
4. Precast concrete splash blocks shall be set in a sand bed at each downspout.

C. Extruded Wall Louvers

1. Louvers shall be extruded aluminum and shall be the 4-inches thick, exterior nonoperable wall types, and the modular block size type, Construction Specialties, Inc., Model 4110; Airlite, Type AC 505; Airline ACG150; or equal.
2. Screens, No. 4 mesh, shall be provided for exterior wall type louvers and shall be aluminum woven wire set in an extruded aluminum frame. Frames shall have mitered comers and shall be heliarc welded and dressed smooth. The aluminum woven wire shall be attached to the frame. Screens shall be removable.
3. Exposed surfaces of louvers shall receive finish A41, medium bronze.

2.5 DOORS, FRAMES, AND HARDWARE

A. Structural Steel Door Frames

1. Structural steel door frames shall be fabricated from structural steel conforming to ASTM Designation: A 36; shall have comers mitered; welded continuously; and shall be ground smooth. Each frame shall be secured to the structure as shown. Flat bar stops shall be plug welded to the frame from the blind side at 9-inch centers. Hardware cutouts for striker plates shall be reinforced with 3/16-inch-thick steel backing plates.

B. Door Louvers

1. Louvers for doors shall be USS No. 16 gauge 1-inch to 1-3/4-inch-thick, factory fabricated and primed, fixed blade, inverted Vee type for interior doors, and Zee type for exterior doors complete with Zee type molding on both sides. Edges of metal shall be finished smooth. Louvers shall be of one manufacturer and may be the door manufacturer's standard, providing the required shape and area are provided. Louvers shall be secured in place in accordance with the manufacturer's standard method.

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C. Standards

1. Hollow metal doors shall comply with commercial Standard 242.
2. Hardware of the same type shall be the product of one manufacturer. Hardware shall be appropriate for the intended use and complete with screws, nuts, washers, grommets, and other fastening devices of matching metal and finish, necessary for proper installation. Screws shall have phillips heads.
3. Door trim, unless otherwise specified, shall conform to the requirements of Federal Specification FF-H-106. Hinges shall conform with the requirements of ANSI A156.1. Other hardware, unless otherwise specified, shall conform with the requirement of Federal Specification FF-H-111.

D. Templates

1. Templates shall be provided for hardware.

E. Locks

1. General

- (a) Locks shall conform to the Department 's locking system. Locks shall be manufactured by Best Lock Corporation. Locks, including padlocks, requiring cylinders, shall be furnished with construction master key cylinders.

2. Door Locks

- (a) Locksets for doors shall be Best Lock Corporation, heavy duty cylindrical lockset, 83K Series, Van Buren 4D Knob satin chrome 626 finish. Lock strikes shall have a wrought brass type box.

3. Key and Function Requirements

- (a) Exit doors shall be operable with a single action. Construction master keys only shall be shipped to the CONTRACTOR. Permanent keys hereinafter specified shall be shipped by the supplier via registered mail to Department of Water Resources, Lancaster Project Headquarters, 3121 East Avenue I, Lancaster, CA 93534, Attention: Project Engineer, with an accompanying letter identifying the project, specification number, and contract to which they belong. The Department will install permanent cylinders and then deliver the construction keys and cylinders to the CONTRACTOR.
- (b) Keys, keying and cylinders shall be provided for Control, Grand Master, Master, Sub-Master, and operating levels as directed. Mark keys and cylinder plugs to depict operating level and key group. Stamp opposite of key "State of California, do not duplicate."

4. Keys

- (a) Keys shall be coded as directed. Two keys shall be provided per door, and cut for codes selected.

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F. Hollow Metal Doors

1. Hollow metal doors shall be the product of one manufacturer. The doors shall be full flush, hollow construction, formed with 16 gauge first quality cold rolled, stretcher leveled steel face sheets. Door parts shall be welded together and internally stiffened with 16 gauge steel along edges and ends and vertically for full height of the door at 6 inches on centers. Face sheets shall be turned over and fully cover vertical edges. The interior of doors shall be completely filled with closely packed fiberglass insulation or 3-1/2-pound density mineral wool.

G. Finish

1. Hardware finish for exposed surfaces shall be US26D, satin chrome, first quality heavy plating.

H. Hinges

1. Hinges for doors shall be full mortised into the door and surface on frame. Hinges shall be nonrising loose pin, stainless steel, 5 knuckle, with button tip, size 4-1/2 inches by 4 inches, nonremovable pin (NRP) type at exterior doors, except that door leaves of widths over 36 inches shall have 5 inches by 4 inches. Doors without closers shall have 1-1/2 pair of regular bearing butts, Type A5112.

I. Door Stops

1. Door stops shall be placed at doors where doors will strike a wall or other obstruction. Stops shall be Glynn-Johnson Corp., GJF20; Builders Brass Works, BS-9076X; or equal. Stops shall be anchored to the top of concrete slab or floor covering. Stops at exterior doors shall be placed where they will not be hazard to travel.
2. Hold-open door stops (bolted to bottom of doors) shall be provided.

J. Door Bottom

1. Neoprene seals shall be installed on all doors. Seals shall be Pemko, No. 315AN; Zero, No. 39; or equal, with aluminum finish.

K. Thresholds

1. Aluminum thresholds and sill drip shall be Pemko Manufacturing Co.; Zero Weather Stripping Co., Inc.; or equal to match type shown. Thresholds shall be set in sealant and fastened in place with concrete anchor fasteners conforming to Federal Specification: FF-S-325. Thresholds shall run full width of the opening, shall be fitted snug to jambs, and shall be square and true in the opening.

L. Latch Guards

1. Latch guards shall be provided at exterior doors.

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M. Rain Drips and Weather Stripping

1. Rain drips shall be extruded aluminum flashing installed at exterior doors and shall be National Guard Products, Inc.; Pemko Manufacturing Co., No. 345A; or equal. Weather stripping shall be provided at exterior doors.

2.6 INTERIOR FINISH

A. Insulated Walls

1. Insulated walls shall have 1-1/2-inch rigid insulation with Z bar furring covered by 1/2-inch plywood.

B. Insulated Ceiling

1. Insulated ceiling shall be insulated with unfaced batt insulation between metal joists and covered with 1/2-inch plywood as shown.

C. Materials

1. Materials shall conform to the following:
 - (a) Rigid insulation shall be polystyrene conforming to U. C. Industries, Inc., Formula 250; Dow Chemical Co., Styrofoam; or equal.
 - (b) Z bars shall be 18 gauge sheet steel devices manufactured as furring studs which, with rigid insulation, form a furring/insulation assembly attached to concrete block as recommended by manufacturer and as approved.
 - (c) Batt insulation shall be unfaced glass fiber conforming to Federal Specification HH-1-521F, Type I, 6 inch, R = 19.
 - (d) Plywood shall be medium density overlay, Group 1, exterior grade, smooth surface. Plywood shall be attached to structure with bugle-head, self-tapping screws at 12-inch centers to members 16 inch on center.

2.7 HVAC EQUIPMENT

A. Air Conditioning Equipment

1. The air conditioning equipment shall include one 1-½ ton, self-contained, floor-mounted, ductless, split system heat pump and an integrated control system to operate the unit. System shall include one wall-mounted evaporator fan coil unit designed to be located inside the Control Building, and a remote air-cooled propeller fan condenser designed to be installed outside. The evaporator fan coil unit, condenser, and control shall be located as shown.
2. The evaporator unit shall be completely assembled and wired. The fans shall be statically and dynamically balanced and run on permanently lubricated bearings. A condensate and drain pan shall be provided under the coil, and a condensate drain line shall be provided to the exterior of the building. The minimum sensible capacity of the evaporator section shall

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be 12,500 Btu/Hr at 72°F at a relative humidity of 50 percent. The evaporator section shall include:

- (a) Copper tube, aluminum finned evaporator coil
 - (b) 800 CFM double inlet direct drive centrifugal fan
 - (c) 9000 Btu/hr electric resistance heater
 - (d) Integrated control system
 - (e) Insulated floor-mounted cabinet
3. The condenser unit shall be completely factory assembled, piped, and wired. The casing shall be fabricated out of galvanized steel, bonderized, and finished with baked enamel. The fan shall be a direct drive propeller type, and provided with a raised wire guard. The condenser shall be a horizontal flow, side discharge, self-contained unit sized to operate at 110 °F ambient. The condenser section shall include:
- (a) Copper tube, aluminum finned condenser coil
 - (b) 1000 CFM propeller fan
 - (c) Hermetically sealed compressor
4. Both condenser and evaporator units shall be rated for operation on 240 volt, single phase power, 60 Hz. The control system shall be capable of controlling from a single control panel. A single temperature control knob shall be provided for set point adjustment. Units shall be started and stopped with switches on the control panel. The control system shall be enclosed in a wall mountable panel; mounting holes and electrical knockouts shall be provided. The control panel shall be wired directly to the units and shall operate using 120 volt, single phase power, 60 Hz.
5. The air conditioning equipment shall be Liebert Datamate, DME series with a Liebert, PFC propeller Fan Condensing Unit

B. Exhaust Fan

1. The exhaust air fan shall be installed in the Control Room as shown. Exhaust air fan shall be a centrifugal in-line with an integral back draft damper. The fan shall have an AMCA Certified Ratings Seal and the U.L. Label. The fan shall have a centrifugal wheel. The manufacturer shall submit vibration amplitudes and magnetic motor hum in decibels. The fan shall be provided with cord, plug, and receptacle inside the housing. The entire fan, motor, and wheel assembly shall be removable without disturbing the housing. Motor speed shall not exceed 1100 RPM. The fan motor shall be designed for continuous operation and shall be grounded and mounted on vibration isolators. The Control Room exhaust air fan shall have a capacity of 225 CFM with the back draft damper installed. Fan speed controllers shall be used to maintain the fan to within plus or minus 5 percent of the specified capacity. The back draft damper shall be spring loaded and chatter proof.

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2.8 BUILDING SEALANT

A. Building Sealant

1. Building sealant for caulking shall be two-component elastomeric sealant conforming to Federal Specification TT-S-227, Type I for horizontal surfaces and Type II for vertical surfaces, or a one-component elastomeric sealant conforming to Federal Specification TT-S-230A for horizontal and vertical surfaces.
2. Sealant shall be integrally colored to be in harmony with the finish color or adjacent surfaces. Colors shall be submitted for selection.
3. Sealant primer shall be manufactured by the manufacturer of the sealant surfaces to promote proper adhesion as recommended by the sealant manufacturer.
4. Resilient backing material shall be used to control the depth of the sealant and serve as a bond breaker where required. Resilient backing materials shall be solid foam, circular in cross-section, and shall be compatible with the sealant, resulting in no bond with and no staining of the sealant. Resilient backing material shall be 25 to 50 percent larger in diameter than the width of the joint and shall be rolled into place without twisting or longitudinal stretching.

PART 3 -- EXECUTION

3.1 CONCRETE MASONRY UNITS

A. Product Delivery, Storage, And Handling

1. Store masonry units above ground on level platforms that allow air circulation under stacked units. Cover and protect against wetting prior to use.
2. Deliver units on pallets or flatbed barrows. Do not permit free discharge from conveyor or mortar trays.
3. Cement, lime, and other cementitious materials shall be delivered and stored in dry, weather tight sheds or enclosures in unbroken bags, barrels, or other approved containers, plainly marked and labeled with the manufacturers' names and brands.
4. Mortar and grout shall be stored and handled in a manner which will prevent the inclusion of foreign materials and damage by water or dampness.

B. General

1. General requirements for construction shall be as follows:
 - (a) Reinforced hollow unit masonry shall be built to preserve the unobstructed vertical continuity of the cells to be filled. Head joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.

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- (b) Walls and cross webs forming such cells to be filled shall be full-bedded in mortar to prevent leakage of grout.
- (c) Where stack bond is used, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches on center.
- (d) Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell measuring not less than 3 inches x 3 inches.
- (e) Grout shall be a workable mix suitable for placing without segregation and shall be thoroughly mixed. Grout shall be placed by pumping or an approved alternate method and shall be placed before initial set or hardening occurs. Grout shall be consolidated by puddling or mechanical vibration during placing and reconsolidated after excess moisture has been absorbed but before workability is lost. Grouting of any section of a wall shall be completed in one day with no interruptions greater than one hour.
- (f) Reinforcing except tie wires shall be embedded in the grout. Spacing between masonry units and reinforcing shall be a minimum of one bar diameter.
- (g) Horizontal reinforcement shall be placed in bond beam units. Openings through webs for horizontal reinforcement shall be a minimum of 3 inches x 3 inches.
- (h) Unless otherwise shown or specified, cells and voids shall be filled with grout. Blocks shall be laid to the lines and dimensions shown. WORK shall be laid to reduce the cutting of blocks to a minimum.

C. Concrete Block

1. Concrete surfaces upon which blocks will be placed shall be roughened to expose the aggregate, cleaned, dampened and slushed with neat cement paste or binding agent. Cells of the first course shall be grouted full and rodded immediately after laying in a full bed of mortar. Blocks shall not be dampened before laying. Blocks shall be laid plumb, true to line with level courses accurately spaced. Bond shall be stacked unless shown otherwise, shall be kept plumb throughout and shall align vertically and horizontally. Any block which is disturbed after the mortar has stiffened shall be removed and relaid with fresh mortar. Corner and reveals shall be plumb and true.
2. Mortar joints shall be 3/8-inch maximum, uniform thickness and shall be fully bedded at both faces of the blocks, vertically and horizontally. Excess mortar shall be struck off to the depth of the irregularities. Vertical and horizontal joints shall have tooled concave surface and mortar compacted against the edges of the block to produce a dense surface.

D. Placing Reinforcement

1. Steel reinforcement shall be placed where shown.
2. Vertical reinforcement shall be continuous without splices. Vertical reinforcement shall be secured in place at top and bottom as shown, and at intermediate intervals not exceeding 48 inches.

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E. Grouting

1. Grouting shall be consolidated so as to completely fill voids and embed reinforcing steel in 4-foot maximum lifts. Horizontal steel shall be fully embedded in grout in an uninterrupted pour. An approved admixture that reduces early water loss and produces an expansive action shall be used in the grout.

F. Cleaning

1. After the mortar has set and hardened at least 30 days, but prior to the application of paint or waterproofing, block surfaces shall be light sandblasted to remove dirt, grease, excess mortar, stains, or resinous material. Unsound mortar exposed by sandblasting shall be removed and new mortar placed.

3.2 ROOFING

A. General

1. Review climatic conditions and dryness of substrate; do not install roofing unless conditions are favorable.
2. Do not exceed the temperature limitation recommended by the roofing materials manufacturer for the heating of bitumen. Remove overheated materials from the work site without delay. Provide a clearly visible thermometer on each kettle or delivery truck used to heat bitumen.
3. Lay multiple-ply courses of plysheet and hot bitumen in shingle fashion and comply with the recommendation of the roofing materials manufacturer. Avoid lapping felts against the direction of drainage. Start installation of roofing at lowest line across roof.
4. Comply with details, recommendations, and procedures of the manufacturer, National Roofing Contractors Association Roofing and Waterproofing Manual and these specifications.
5. No gasoline powered equipment shall be placed or operated on completed roof sections. Gasoline and solvents shall not be stored on new roof sections and shall not be left on any part of work area overnight.

B. Roof Insulation

1. Secure Perimeter
 - (a) Secure outside perimeter 4 feet of insulation to decking using mechanical fasteners recommended by insulation manufacturer and approved for FM 1-90 rating.
2. Tapered Insulation and Perlite Layer
 - (a) Stagger end and side joints from base layer. Imbed in a full mopping of 18-20 pounds per square.

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C. Application of Roofing

1. Apply layers of felt in a shingle fashion, lapping each felt over the preceding one. Starter sheets required. Mop the full width under each felt with asphalt at a minimum rate in pounds per square as per manufacturer's recommendations. Broom each felt so that it shall be firmly and uniformly set without voids into the hot asphalt.
2. Provide composition base flashing at cant strips and other sloping and vertical surfaces, and at the roof edges.

D. Surfacing

1. Broadcast granule surfacing over bitumen spill/run over new cap sheet. Place cap sheet to achieve a continuous compact overlay with a minimum of 50 percent embedment into bitumen.

3.3 DOORS, FRAMES, AND HARDWARE

A. Fabrication And Workmanship

1. General

- (a) Parts shall fit together and shall have clearances to operate smoothly, free from bind. Metal doors and frames shall be weathertight and watertight. Welding shall be neat and free from weld splatter, slag, warp, deformation, and other defects. Exposed welds shall be ground smooth and finished flush to match adjacent surfaces. Metal doors and frames shall be free from warp, buckle, dents, and other defects. Members shall be well formed, straight, and true. Joints shall be tight, neat, filled, and finished flush to ensure that seams will be invisible after painting. Screws, bolts, and other fasteners shall be inserted square and true and drawn up to a tight flat seat with full bearing.

2. Preparation for Finish Hardware

- (a) Doors and frames shall be machined and reinforced as necessary to accommodate the finish hardware. Preparation shall include cutting, applying reinforcement, and drilling and tapping for machine screws. Frames shall be "boxes" at hardware openings. Reinforcement shall be steel at least 3/16 inch thick in place. Heads of doors shall be similarly reinforced for hardware. Reinforcement and machining shall conform to templates of the hardware items to be attached.

B. Prime Coat Painting

1. Hollow metal doors and metal frames shall be thoroughly cleaned and treated by "Bonderizing" or by phosphoric acid or other equivalent surface preparation and then primed with one shop coat of protective, rust- inhibitive metal primer, thoroughly bonded to the metal and dried to a flat finish. Irregularities in surface shall be made smooth with an approved metal putty.

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C. Installation

1. Install hardware per manufacturer's instructions. The installed hardware shall be free from paint, corrosion and damage.
2. Adjust hardware so that moving parts operate freely without bind or excessive play.
3. Adjust door and floor closers for closing speed, latching speed, back checking, and adjust hold open devices for full control of door.
4. Upon completion of installation and adjustment, confirm keying performance and turn over to the ENGINEER dogging keys and closer valve keys with attached tags identifying their door and location, temporary keyboard with hooks, lock spanner wrenches, and other factory-furnished installation aids, instructions, and maintenance guides.

3.4 INTERIOR FINISH

- A. Insulation and furring system shall be installed as recommended by the manufacturer.

3.5 HVAC EQUIPMENT

- A. The HVAC equipment shall be piped, wired, installed, and tested by factory-trained technicians or authorized manufacturers' representatives.

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SECTION 22 14 29 SUBMERSIBLE SUMP PUMP

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section provides requirements for a packaged submersible sump pump.

1.2 REFERENCES

- A. ASTM International (ASTM):
 1. A 48 - Standard Specification for Gray Iron Castings.
 2. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 3. D 2000 - Standard Classification System for Rubber Products in Automotive Applications.

1.3 SYSTEM DESCRIPTION

- A. Design requirements:
 1. The sump pump shall have a capacity of not less than 15 gpm when operating against a head of 20 feet.
 2. Suitable for pumping raw sewage.

1.4 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit dimensional drawings.
- C. Submit manufacturer's catalog data and detail drawings showing all pump parts and described by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Show linings and coatings.

PART 2 -- PRODUCTS

2.1 MATERIALS

- A. Cast Iron: ASTM A 48, Class 30 minimum
- B. Stainless Steel: ASTM A 276 or equal.
- C. Buna N: ASTM D 2000.

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2.2 PUMP CASING

- A. Material: Cast iron.
- B. Design Working Pressure: 1.5 times the shut off pressure.
- C. Provide support legs on sump bottom and clearance for suction entrance.
- D. External fasteners shall be 300 series stainless steel.
- E. The discharge connection shall be a 2 -inch NPT vertical connection.

2.3 IMPELLER

- A. Material: Cast iron.
- B. Non-clog type.

2.4 DRIVERS

- A. Motor:
 - 1. The motor shall be a minimum of 1/3 hp, 120 volt, single phase, 60 Hz.
 - 2. The pump motor shall be submersible, constructed with open windings and designed to operate in clean dielectric oil for cooling windings and lubricating motor bearings. Motors shall be thermally protected by an automatic reset overload protector.

2.5 PVC PIPING AND FITTINGS

- A. PVC Piping and Fittings - PVC pipe shall conform to ASTM Designation: D 1785, Schedule 40. PVC fittings shall be socket type conforming to ASTM Designation: D 2466.

2.6 PVC VALVES

- A. General - Valves shall include the valve, valve operator, mounting hardware and connections to adjacent piping.
- B. Sump Pump Check Valve - Sump pump check valve shall be ball type, PVC, as manufactured by Asahi/America Inc.; Chemtrol/Louisville Division, Nibco Inc.; or equal.

2.7 FINISHES

- A. CONTRACTOR to provide field coatings as specified in Section 09 90 00.

2.8 LEVEL SENSORS

- A. The pump shall be controlled by an automatic pressure diaphragm activated control switch, set to on and off positions as shown.

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PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Install submersible sump pumps as specified by the manufacturer.

3.2 FIELD QUALITY CONTROL

- A. Inspection and checkout
 - 1. Operate, rotate, or otherwise functionally test for 15 minutes minimum after components reach normal operating temperatures.
 - 2. Operate at rated design load conditions.
 - 3. Confirm that equipment is properly assembled, equipment moves or rotates in the proper direction, shafting, drive elements and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual power consumption, lubrication temperatures, bearing temperatures, or other conditions are observed.
- B. Testing - Sump pump system shall be hydrostatically tested to a pressure equal to 1-1/2 times the maximum operating head of system pump.

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SECTION 23 34 16 CENTRIFUGAL FAN

PART 1 -- GENERAL

1.1 SUMMARY

- A. This Section includes furnishing all materials and equipment, and performing all operations necessary to install a ventilating system for the meter vault, all as shown on the Drawings and specified herein. The work shall include all steel pipe assemblies for both the intake and exhaust vent pipes, a direct-drive centrifugal fan, and all electrical work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Painting and Coating: 09 90 00
- B. Electrical Work: 26 05 00
- C. Welded Steel Pipe: 33 11 10

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Product Data: Include rated capacities, performance curves with operating point clearly indicated, dimensions, weights, furnished specialties, accessories, and installation instructions for each type of product indicated.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- D. Operation and maintenance manual and spare parts list.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. OWNENEMA Compliance: Motors and electrical accessories shall comply with NEMA 1.

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PART 2 -- PRODUCTS

2.1 DIRECT-DRIVE CENTRIFUGAL FAN

- A. The centrifugal fan shall be the direct-drive, single-width, single-inlet type furnished complete with fan housing, fan, motor, support frame, discharge screen, and all accessories required for installation and operation. The centrifugal fan shall prove 1300 cubic feet per minute (CFM) at a static pressure of 0.25 inch W.G. The centrifugal fan shall be furnished with the manufacturer's standard finish
- B. Fan - The fan wheel shall operate at 900 revolutions per minute (RPM), shall have fabricated steel blades, and the housing shall be fabricated steel. Each fan shall have a mounting frame suitable to support the housing and motor and shall be adjustable for various fan discharge positions.
- C. Motor - The fan motor shall be the across-the-line, full-voltage-starting, constant-speed-induction type. The motors shall be rated 115 volts, single phase, 60 Hz.
 - 1. The motor shall be provided with internal thermal protection and shall conform to the applicable standards of IEEE, NEMA, and ANSI. The nameplate horsepower rating shall be a minimum of 115 percent of the BHP required at the specified performance.
- D. Control Equipment - Control equipment related to the operation of the centrifugal fan shall be furnished as shown on the Drawings.
- E. Flexible Connector - The flexible connector shall be made of neoprene-coated glass fabric weighing approximately 30 ounces per square yard. The flexible connector shall be not over 4 inches long and shall be complete with devices suitable for attaching to equipment and ductwork. The flexible connector shall be installed with sufficient slack to prevent the transmission of vibrations. Connecting equipment and ductwork shall be self-supporting and shall not impart any twisting forces to the flexible connector.
- F. Sheet Metalwork - Exposed duct and duct transitions between the pipe assemblies and the flexible connector shall be constructed from minimum No. 18-gage galvanized steel sheets in accordance with ASTM designation: A 526.
- G. Miscellaneous Materials - For materials shown on the Drawings but not covered herein by detailed Specifications, the CONTRACTOR shall furnish standard commercial grades of materials that are satisfactory to the ENGINEER.

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. The CONTRACTOR shall install the centrifugal fan where shown on the Drawings. The miscellaneous metalwork shall be fabricated and installed in accordance with the Contract Drawings. The centrifugal fan shall be aligned and fastened securely to the support bracket

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where shown. A flexible connector shall be installed between the fan and the inlet air duct. Damaged surfaces of the centrifugal fan shall be repaired.

- B. Servicing, Adjusting, and Testing - The CONTRACTOR shall service, adjust, and test the ventilating equipment. In servicing the equipment, all equipment shall be checked for correct installation, lubrication, electrical connections, and any other conditions that may require corrective measures. All equipment including dampers, propeller fans, and control, safety, and overload devices shall be adjusted so that operation of the systems meets the specified requirements.
1. The CONTRACTOR shall test these systems to prove to the satisfaction of the ENGINEER that they meet the requirements of these Specifications.
 2. The CONTRACTOR shall furnish all equipment required for servicing, adjusting, and testing the ventilating equipment. The CONTRACTOR shall retain ownership to all servicing, adjusting, and testing equipment.

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SECTION 26 05 00 ELECTRICAL WORK, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide electrical WORK, complete and operable, in accordance with the Contract Documents.
- B. CONTRACTOR to provide electrical work for future electrical utility service connection, Control Building, slide gates with actuators and remote controls, Meter Vault with flow meter transducers and remote transmitter, Traveling Screen System, all complete and operable. CONTRACTOR to provide Control Building complete with combination Meter and Main Disconnect with service rated main breaker, Manual Transfer Switch, Portable Generator Receptacle, Lighting Panelboard, and conduits with cables. Control Building electrical work to include lighting, receptacles, HVAC system, Exhaust Fan, PLC Panel, Terminal Cabinet (TCP), Slide Gate Control Panel (SGCP), Sonic Flow Transmitter console, communication backboard, and antenna mast with antenna cable. Meter Vault electrical work to include lighting, receptacles, sump pump, meter transducers, flood switch, and intake fan. Provide all configuration and programming of equipment. Provide all work and materials for complete and operational systems.
- C. The electrical service, to be provided by Southern California Edison in the future, is not part of the Contract. CONTRACTOR is responsible to provide and install all trenching, backfill, service conduit with pull tape, and Metering Panel with main disconnect, equipment and materials per SCE requirements. Bid to include 150' of underground service conduit, routed from Metering Panel to location provided by AGENCY. CONTRACTOR to supply a temporary portable generator, connected to Portable Generator Receptacle, to test, start-up, and demonstrate new systems for up to 7 days. CONTRACTOR is responsible for all fuel and maintenance on supplied portable generator.
- D. The provisions of this Section apply to all sections in Division 26, except as indicated otherwise.
- E. CONTRACTOR shall provide all conduit and wiring for HVAC equipment, thermostats, and interconnecting conduits and cables, even if not shown on Contract Drawings. Conduit and wiring shall meet requirements of Division 26. HVAC thermostat to be provided and installed and wired by HVAC equipment installer.
- F. CONTRACTOR shall provide all conduits and wiring for Traveling Screen System, even if not shown on Contract Drawings, for a complete and operable system. Conduit and wiring shall meet requirements of Division 26.
- G. The WORK of this Section is required for operation of electrically-driven equipment provided under specifications in other Divisions. The CONTRACTOR's attention is directed to the requirement for proper coordination of the WORK of this Section with the WORK of equipment specifications, the WORK of instrumentation sections.

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- H. Concrete, excavation, backfill, and steel reinforcement required for encasement, installation, or construction of the WORK of the various sections of Division 26 is included as a part of the WORK under the respective sections, including equipment housekeeping pads, and equipment stanchions.

1.2 REFERENCE STANDARDS

NEC (NFPA 70)	National Electrical Code
CEC	California Electrical Code
NETA	International Electrical Testing Association
NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)

- A. Electrical equipment shall be listed by and shall bear the label of Underwriters' Laboratories, Inc. (UL) or an independent testing laboratory acceptable to the local code enforcement agency having jurisdiction.
- B. Installation of electrical equipment and materials shall comply with OSHA Safety and Health Standards, state building standards, and applicable local codes and regulations.
- C. Where the requirements of the specifications conflict with UL, NEMA, NFPA, or other applicable standards, the more stringent requirements shall govern.

1.3 SIGNAGE AND MARKINGS

- A. **Identification:** Provide danger, caution, and warning signs and equipment identification markings in accordance with applicable federal and state OSHA and NEC requirements.
- B. Local Disconnect Switches
 - 1. Each local disconnect switch for electrical equipment shall be legibly marked to indicate its purpose. Provide nameplate with inscription of connected equipment name and tag number, voltage, number of phases.
- C. Light Switches and Receptacles
 - 1. Each light switch shall be legibly marked to indicate its purpose and panelboard circuit number.
 - 2. Each receptacle shall be legibly marked with panelboard circuit number.
- D. Warning Signs
 - 1. Provide warning signs on Control Building door and electrical panels. Warning signs shall state electrical hazards.
 - 2. Electrical equipment and control panels shall include electrical hazard signs and arc flash labels, per contract documents and NEC. Provide arc flash labels with personal protective equipment (PPE) levels on Manual Transfer Switch, Panelboard LP-1, Traveling Screen

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control panel, and disconnect switches at the gate actuators. Provide arc flash label with calculated values and date, and PPE level, per NEC, on service entrance equipment Metering Panel with Main Disconnect.

3. Equipment Nameplates – Provide engraved phenolic equipment nameplates on all electrical and instrumentation equipment and devices on panel doors and back panel. Nameplate to be inscribed with equipment name and corresponding tag per Schematic Diagram.
- E. Provide a sign for mounting near gate actuators. Warning signs shall be 7 inches high by 10 inches wide, colored yellow and black, on not less than 18-gauge vitreous enameling stock. Sign shall read: “CAUTION THIS EQUIPMENT STARTS AUTOMATICALLY BY REMOTE CONTROL”.
- F. Provide a minimum of two (2) signs for site within this project for mounting on Control Building door, and man-gate on fenced area around gate actuators. Warning signs shall be 7 inches high by 10 inches wide, colored red and white, on not less than 18-gauge vitreous enameling stock. Sign shall read: “WARNING HIGH VOLTAGE KEEP OUT”.

1.4 PERMITS AND INSPECTION

- A. Permits shall be obtained and inspection fees shall be paid according to the General Conditions.

1.5 RESPONSIBILITY

- A. The CONTRACTOR shall be responsible for:
 1. Complete systems that are functionally operational in accordance with the intent of these Contract Documents.
 2. Coordinating the details of facility and process equipment layouts and construction for all Specification Divisions which affect the WORK covered under Division 26.
 3. Furnishing and installing all incidental items not actually shown or specified, but which are required by good practice and to provide complete functional systems.
 4. Coordination with all other Specification Divisions for wiring and cable requirements.
 5. CONTRACTOR shall submit to the AGENCY a complete copy of red line as-builts every month after Notice to Proceed date for AGENCY information and review.

1.6 INTENT OF DRAWINGS

- A. The Contract Drawings indicate the extent, general location, and arrangement of equipment. Duct bank, conduit runs, and handhole locations are diagrammatic and may not show the exact routing or location for installation. The CONTRACTOR shall verify the locations of conduit stub-ups based upon conduit entry space of equipment furnished from the manufacturer's certified shop drawings and by inspection of the actual equipment to be installed.
- B. In general, where the background on Contract Drawings has been screened, the area screened is WORK other than electrical, unless otherwise noted. WORK under Division 26 is shown heavier for contrast.

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- C. Standard details are typical for all locations which apply regardless of whether a callout is shown on the individual plan drawing or not.
- D. Electrical design is based on minimum horsepower or current ratings. If the CONTRACTOR provides equipment with a larger horsepower or current rating, the CONTRACTOR shall be responsible for making all necessary changes to accommodate the larger unit, with the approval of the ENGINEER. CONTRACTOR shall pay for all such changes including engineering design by a Professional Electrical Engineer currently registered in the State of California.
- E. Number and size of wires which shall be installed in runs of conduit where not shown on the Contract Drawings shall be determined from the one-line, schematics, connection, interconnection, and control diagrams of actual equipment approved and furnished.

1.7 CONTRACTOR SUBMITTALS

A. General

1. Provide manufacturers' descriptive information and shop drawings for all equipment, material, and devices furnished under Division 26, Electrical, including certified outline and arrangement drawings, schematic (elementary) diagrams, and interconnection diagrams. Device designations and symbols for schematic (elementary) diagrams and interconnection diagrams shall conform to the latest edition of NEMA ICS 1.
2. Submit complete schematic drawings for all equipment furnished in accordance with other Divisions that interface with electrical equipment. These drawings shall contain diagrams, terminal numbers, device names, tag numbers, conductor colors, wire labels, conductor size, etc., to provide complete identification of the circuits and provide coordination between the equipment.
3. If the equipment installed during construction is not the exact same equipment that was approved by the ENGINEER before construction, then the CONTRACTOR shall resubmit all documentation related to the installed equipment as required herein for the ENGINEER's approval.
4. Review of submittal information by the ENGINEER shall not relieve the CONTRACTOR from responsibility for deviations from Contract Drawings and/or Specifications, unless he has in writing at time of submission requested and received written approval from the ENGINEER for specific deviations. Review of submittal information shall not relieve the CONTRACTOR from responsibility for errors and omissions in shop drawings or literature.
5. Manufacturer's standardized elementary diagrams will not be acceptable unless applicable portions of the diagram have been clearly identified and non-applicable portions deleted or crossed out.
6. Shop Drawings shall be custom prepared. Drawings or data indicating "optional" or "as required" equipment are not acceptable. Options not proposed shall be crossed out or deleted from Shop Drawings.

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7. Submit catalog cuts or photo copies of applicable pages of bulletins or brochures for mass produced, non-custom manufactured materials. Catalog data sheets shall be stamped to indicate project names, applicable section and paragraph, model number, and options.

B. Shop Drawings: Include the following:

1. Complete material lists stating manufacturer and brand name of each item or class of material.
2. Shop Drawings for grounding WORK not specifically indicated.
3. Front, side, rear elevations, and top views with dimensional data for all equipment and control panels.
4. Location of conduit entrances and access plates.
5. Component data.
6. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size, and cable numbers.
7. Method of anchoring, seismic requirements, weight.
8. Types of materials and finish.
9. Nameplates.
10. Temperature limitations, as applicable.
11. Voltage requirement, phase, and current, as applicable.
12. Front and rear access requirements.
13. Test reports.
14. Grounding requirements.
15. Hardcopy of programs or configurations.
16. Catalog cuts or photocopies of applicable pages of bulletins or brochures for mass produced, non-custom manufactured material. Catalog data sheets shall be stamped to indicate the project name, applicable Section and paragraph, model number, and options. This information shall be marked in spaces designated for such data in the ENGINEER's stamp.

C. Submit manufacturer's certified shop drawings and descriptive information on the following items. Follow specification section order and provide all information listed in the individual specification sections.

1. Meter and Main Disconnect

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2. Lighting Panelboard
3. Sonic Flowmeter Console and Flow Transducers and cables
4. Slide Gate Control Panel
5. Manual Transfer Switch
6. Portable Generator Receptacle, Plug, and portable cable
7. PLC Panel
8. Terminal Cabinet
9. Lights
10. Meter Vault Lights and Fan Control Panel
11. Manual Motor Rated Switches
12. Disconnect Switches
13. Temperature Switches
14. Meter Vault Flood Switch
15. Traveling Screen System, coordinate with other Specification Section
16. NETA Testing Agency, testing procedures, and testing results
17. Protective Device Studies
18. In addition to submittals for specific items mentioned above, furnish descriptive information on the following items:
 - (a) Rigid steel conduit.
 - (b) Raceway supports and fittings.
 - (c) PVC-coated rigid steel conduit.
 - (d) PVC Schedule 40 conduit.
 - (e) Flexible metal conduit, liquid tight.
 - (f) Pull boxes and junction boxes.
 - (g) Terminal blocks.
 - (h) Control relays.
 - (i) Precast Handholes including covers.

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- (j) 600V single- and multi-conductors.
 - (k) Receptacles.
 - (l) Device plates.
 - (m) Conduit tags.
 - (n) Warning tape.
 - (o) Conductor and cable tags.
 - (p) Ground rods.
 - (q) Ground conductors.
 - (r) Ground connections.
 - (s) Ground rod boxes.
 - (t) Nameplate schedules.
 - (u) Equipment identification inscription legend.
 - (v) All testing forms, procedures, documentation covering factory tests, field tests, system tests, etc.
- D. **Materials and Equipment Schedules:** The CONTRACTOR shall deliver to the ENGINEER within 40 Days of the Notice to Proceed, a complete list of materials, equipment, apparatus, and fixtures proposed for use. The list shall include type, sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.
- E. **Operation and Maintenance Manuals:** Complete information providing all information required for operation and maintenance of equipment. Provide 5 copies minimum or as stated elsewhere.
- F. **Record Drawings:** The CONTRACTOR shall show invert and top elevations and routing of duct banks and concealed below-grade electrical installations. Record drawings shall be prepared, be available to the ENGINEER.
- G. **Calculations:** Anchor bolt calculations are required for all equipment weighing more than 400 pounds. The analysis should be made on the complete assembly to determine the anchorage requirements. The calculations shall be performed, signed and stamped by a Structural or Civil Engineer registered in the state of California. Refer to Contract Documents for seismic criteria and applicable codes and standards.

1.8 AREA DESIGNATIONS

A. General

1. Raceway system enclosures shall comply with Section 26 05 33 - Electrical Raceway Systems and as noted below.

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2. Electric work specifically indicated in sections within any of the specifications shall comply with the requirements of those sections.

(a) The following table lists the type of electrical equipment and materials to be used based on Applied Area, unless electrical equipment and materials specifically called out on Drawings or in equipment Specifications.

Area Classification	Enclosure, Pull box, Panels, J-Box {Material}	Outlet/Device Box (Recessed)	Hardware	Exposed or Concealed Conduit System [Fittings]	Concrete Encased Conduit System [Fittings]
Exterior	NEMA 3R, 4 {Painted Steel}	Malleable Iron Form 7 or PVC Coated per Drawings (Concealed - Cast Steel) (Concrete - PVC)	Galvanized Steel Hot Dipped	PVC Coated Rigid [PVC Coated]	PVC Sch 40 [PVC]
Interior Damp	NEMA 3R, 4 {Painted Steel}	Malleable Iron Form 7 (Concrete-PVC)	Galvanized Steel Hot Dipped	Galvanized Rigid Steel [Malleable Iron]	PVC Sch 40 [PVC]
Interior General	NEMA 12 (Painted Steel)	Malleable Iron Form 7 (Concealed - Cast Steel) (Concrete – PVC)	Galvanized Steel Hot Dipped	Galvanized Rigid Steel [Malleable Iron]	PVC Sch 40 [PVC]

(b) The following identifies each Area Classification by Location/Site and Room/Area.

Location/Site	Room/Area	Area Classification
Control Building	All Areas Outside of Building	Exterior
	Inside Control Building	Interior General
Meter Vault	All Areas Outside of Vault	Exterior
	Inside Meter Vault	Interior Damp
Site and Slide Gate Deck	All Areas	Exterior

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B. Material Requirements

1. NEMA 4X enclosures shall be 304 or 316 stainless steel.
2. NEMA 1, 3R, 4 or 12 enclosures shall be steel, primed and coated with ANSI 61 light grey paint.

1.9 TESTS

- A. The CONTRACTOR shall be responsible for factory and field tests required by specifications in Division 26 and by the ENGINEER or other authorities having jurisdiction. The CONTRACTOR shall furnish necessary testing equipment and pay costs of tests, including replacement parts and labor, due to damage resulting from damaged equipment or from testing and correction of faulty installation.
- B. Where test reports are indicated, proof of design test reports for mass-produced equipment shall be submitted with the Shop Drawings, and factory performance test reports for custom-manufactured equipment shall be submitted and be approved prior to shipment. Field test reports shall be submitted for review prior to Completion.
- C. Equipment or material that fails a test shall be removed and replaced or if the ENGINEER approves, may be repaired and retested for compliance. Corrections to equipment or materials with a factory warranty shall be as recommended by the manufacturer and shall be done in a manner that does not void the warranty.
- D. Field testing company shall be submitted for ENGINEER's approval prior to any field testing. Submit all test forms for approval four (4) weeks prior to testing. Provide two (2) weeks notification of field tests to ENGINEER, minimum.

1.10 TEMPORARY LIGHTING

- A. The CONTRACTOR shall provide temporary lighting for all trades. The average lighting level (foot-candle) shall meet OSHA.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Equipment and materials shall be new, shall be listed by a nationally recognized testing laboratory that is acceptable to the authority having jurisdiction. Equipment and materials shall be the products of experienced and reputable manufacturers in the industry. Similar items in the WORK shall be products of the same manufacturer. Equipment and materials shall be of industrial grade standard of construction.
- B. Where a NEMA enclosure type is indicated in a non-hazardous location, the CONTRACTOR shall utilize that type of enclosure, despite the fact that certain modifications such as cutouts for control devices may negate the NEMA rating.

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- C. **Temperature Ratings of Equipment Terminations:** Terminations and lugs shall be rated for use with 75 degree C conductors. Wire sizes in the Contract Documents are based on NEC ampacity tables using the 75 degree C ratings.
- D. **Equipment Ratings:** Equipment shall be rated to provide full capacity, continuous duty, without sacrifice to manufacturer rated equipment lifetime and/or warranty to operate from -7° C up to 50° C ambient, at elevation of 3000 feet above sea level.

2.2 MOUNTING HARDWARE

A. Miscellaneous Hardware

1. Nuts, bolts, and washers shall be stainless steel.
2. Threaded rods for trapeze supports shall be continuous threaded galvanized steel, 3/8-inch diameter minimum.
3. Strut for mounting of conduits and equipment shall be aluminum or galvanized steel. Where contact with concrete or dissimilar metals may cause galvanic corrosion, suitable non-metallic insulators shall be utilized to prevent such corrosion. Aluminum strut shall not be utilized for free standing support frames. Strut shall be as manufactured by Unistrut, B-Line, or equal.
4. Anchors for attaching equipment to concrete walls, floors, and ceilings shall be stainless steel expansion anchors, such as "**Rawl-Bolt**," "**Rawl-Stud**" or "**Lok-Bolt**" as manufactured by **Rawl, similar by Star**, or equal.

2.3 ELECTRICAL IDENTIFICATION

- A. **Equipment and Substructure Nameplates:** Nameplates shall be fabricated from white-letter, black-face laminated plastic engraving stock, Formica Type ES-1, or equal. Each shall be fastened securely, using fasteners of stainless steel, screwed into inserts or tapped holes as required. Engraved characters shall be block style with no characters smaller than 3/16-inch top to bottom. Nameplates on outside panels or enclosures shall be similar except provide 1-inch high white letters.
- B. Nameplates shall be provided for Metering Panel, Panelboard, Manual Transfer Switch, Slide Gate Control Panel, Termination Panel, PLC Panel, Traveling Screen Panel, and all internal and door mounted devices, disconnect switches, light switches, etc. Provide Lighting Panelboard circuit breaker numbers on each cover plate for lighting switches and receptacles.
- C. **Conduit Tags Above Ground:** Provide permanent, stainless steel 2-inch diameter conduit tags with conduit number pressure stamped onto the tag. Conduit numbers shall be 1/2-inch minimum, and painted black. Tags relying on adhesives or taped-on markers are not acceptable.
- D. **Conduit Tags Below Ground:** Conduit tags in underground installations like handholes, shall be 2" diameter engraved black phenolic tags, with 1/2-inch white lettering. Attached to 316 stainless steel tie wire or black nylon cable zip tie.

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- E. Cable Identification: Cable labels shall be heat-shrink type with machine printed markings, refer to Specification 26 05 19. Every cable shall be identified at each termination end and where passed through panels or cabinets. etc.

2.4 EQUIPMENT FINISH

- A. Provide materials and equipment with manufacturers, standard finish application system with ANSI 61, light grey color. Provide two (2) quarts of ANSI 61 touchup paint. Some exterior equipment shall have further finish applied, refer to individual specifications.

2.5 OUTDOOR EQUIPMENT

- A. Provide equipment and devices to be installed outdoors capable of continuous operation within an ambient temperature range of -7° C to 50° C. Equipment must be capable of proper operation at rated output continuously in this ambient temperature range in direct sun. Provide any additional equipment such as enclosures, sunshades, and cooling equipment so that this performance requirement can be met.

PART 3 -- EXECUTION

3.1 GENERAL

- A. **Incidentals:** The CONTRACTOR shall provide materials and incidentals required for a complete and operable system, even if not required explicitly by the Contract Documents. Typical incidentals are terminal lugs not furnished with vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and control wiring required by vendor-furnished equipment to connect with other equipment, configuration and programming, adjustments and calibrations, etc., as required for complete and operational systems.
- B. **Field Control of Location and Arrangement:** The Drawings diagrammatically indicate the desired location and arrangement of outlets, conduit runs, handholes, equipment, and other items. Exact locations shall be determined by the CONTRACTOR in the field based on the physical size and arrangement of equipment, finished elevations, and other obstructions. Locations on the Drawings, however, shall be followed as closely as possible.
 1. Where conduit development drawings or "home runs" are indicated, the CONTRACTOR shall route the conduits in accordance with those requirements. Routings shall be exposed or encased as indicated, except that conduit in finished areas shall be concealed unless specifically indicated otherwise. Conduits shall not be routed within concrete slabs or walls; route below slabs.
 2. Conduit and equipment shall be installed in such a manner as to avoid obstructions. If equipment is installed without instruction and must be moved, it shall be moved without additional cost to the AGENCY. Lighting fixture locations shall be adjusted slightly to avoid obstructions and to minimize shadows.

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- C. **Workmanship:** Materials and equipment shall be installed in strict accordance with printed recommendations of the manufacturer. Installation shall be accomplished by workers skilled in the WORK. Installation shall be coordinated in the field with other trades to avoid interferences.
- D. **Protection of Equipment and Materials:** The CONTRACTOR shall fully protect materials and equipment against damage from any cause. Materials and equipment, both in storage and during construction, shall be covered in such a manner that no finished surfaces will be damaged, marred, or splattered with water, plaster, or paint. The CONTRACTOR shall replace or refinish damaged materials or equipment, including panels as part of the WORK.

3.2 CONCRETE HOUSEKEEPING PADS

- A. Concrete housekeeping pads shall be provided for free standing electrical equipment. Housekeeping pads for equipment shall be 4-inches above surrounding finished grade and 3-inches larger on sides and front dimensions than the equipment, unless otherwise indicated. Housekeeping pad dimensions shall be increased as necessary to provide the edge distance required in the anchor bolt calculations.

3.3 EQUIPMENT ANCHORING

- A. Floor-supported equipment shall be anchored in place by methods that will meet seismic requirements in the area where the project is located. If the supported equipment is a panel or cabinet enclosed within removable side plates, it shall match supported equipment in physical appearance and dimensions.
- B. **Equipment Supports:** Unless otherwise indicated, equipment supports, anchors, and restrainers shall be adequately designed for static, dynamic, wind, and seismic loads as stated in the International Building Code (IBC), approved edition. Submitted design calculations for equipment supports and anchorage shall bear the signature and seal of an Engineer registered in the State of California, unless otherwise indicated.
- C. **Wind Load:** The wind load shall be calculated in accordance with the IBC, using the following design parameters:
 - 1. Wind Speed: 75 mph
 - 2. Exposure: C
 - 3. Importance Factor: $I_w = 1.15$
- D. **Seismic Loads:** The seismic lateral force, F_p , shall be calculated in accordance with the IBC, using the following design parameters:
 - 1. Seismic Coefficient: $C_a = 0.36$
 - 2. Seismic Importance Factor: $I_p = 1.5$
- E. **Anchor Bolts:** Anchor bolts shall be designed to resist the above loads and type recommended by and equipment manufacturer being anchored and installed atmosphere. Anchor bolt calculations shall clearly show that the capacity of the anchor and the capacity of the concrete

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that the anchor is embedded in are adequate to resist all loads stated in the IBC, including lateral wind and seismic loads. Reduction factors associated with edge distance, embed length, and bolt spacing shall all be considered and based on the actual dimensions of the concrete that resists the anchorage forces. Anchor bolt details shall include required bolt diameter, embed, and edge distances. Anchor bolt calculations and details shall be submitted and shall bear the signature and seal of a Civil or Structural Engineer registered in the State of California.

- F. Anchoring methods and leveling criteria in the printed recommendations of the equipment manufacturers are a part of the WORK of this Contract. Such recommendations shall be submitted as Shop Drawings.

3.4 EQUIPMENT IDENTIFICATION

- A. **General:** Equipment and devices shall be identified as follows:

1. Nameplates shall be provided for all control panels, electrical overcurrent protection devices, instruments, starters, and each control device. In addition to nameplates, control devices shall be equipped with standard collar-type legend plates.
2. Control devices within enclosures shall be identified with nameplates.
3. Equipment names and tag numbers, where indicated on the Drawings, shall be utilized on nameplates. If no tag number is provided inscribe nameplate with equipment name and device function.
4. The CONTRACTOR shall furnish typewritten circuit directories for panelboards; circuit directory shall accurately reflect the connected to each circuit.
5. Termination points on terminal blocks shall be labeled by identifiers on the blocks. Identifiers shall be preprinted by the terminal manufacturer or custom-printed. Hand lettered markers will not be acceptable.
6. Low Voltage Distribution equipment, including but not limited to Metering Panel, Manual Transfer Switch, Lighting Panelboard, and Traveling Screen control panel, shall be tagged with appropriate arc-flash labels.
7. Submit for approval all equipment identification labels.

3.5 CLEANING

- A. Before final acceptance, the electrical WORK shall be thoroughly cleaned. Exposed parts shall be thoroughly cleaned of cement, plaster, and other materials. Temporary tags, markers, stickers, etc. shall be removed. Oil and grease spots shall be removed with a non-flammable cleaning solvent. Such surfaces shall be carefully wiped and cracks and corners scraped out. Touch-up paint shall be applied to scratches on panels and cabinets. All electrical enclosures and panels shall be vacuum-cleaned.
- B. Light fixtures shall be cleaned inside and out.

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- C. The interior of all electrical equipment and panels shall be vacuumed and wiped free of dust just before final acceptance. De-energization of equipment shall be at times approved in writing by the ENGINEER.
- D. Clean interior of handholes.
- E. Painting shall be in accordance with Specifications. Debris and refuse from cleaning shall be disposed of off the Site.

3.6 INSPECTION

- A. Allow materials, equipment, and workmanship to be inspected at any time by the ENGINEER and the AGENCY, or their representatives. Correct WORK, materials, or equipment not in accordance with these Contract Documents or found to be deficient or defective in a manner satisfactory to the ENGINEER.
- B. TESTING
 - 1. All testing sheets need to be signed off by the ENGINEER and the AGENCY. See individual specification sections for testing requirements.

END OF SECTION

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SECTION 26 05 19 WIRES AND CABLES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide wire and cable, complete and operable, in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All work specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals, and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings: Provide complete catalog cuts of all cables, wires, terminations, splices, fittings, identification systems, and tape.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Section 26 05 00 – Electrical Work, General.
- B. Store and protect in accordance with manufacturer's instructions.
- C. Cables shall not be laid out on ground for pulling into conduits. Cables shall remain on reels until installed in previously mandrelled and swabbed conduits that are free of debris.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Conductors, include grounding conductors, shall be stranded copper. Aluminum conductor wire and cable will not be permitted.
- B. Insulation shall bear UL label, the manufacturer's trademark, and identify the type, voltage, and conductor size.
- C. Conductors except flexible cords and cables, fixture wires, and conductors that form an integral part of equipment such as motors and controllers shall conform to the requirements of Article

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310 of the National Electric Code, latest edition, for current carrying capacity. Flexible cords and cables shall conform to Article 400, and fixture wires shall conform to Article 402.

D. Wiring shall have wire markers at each end.

2.2 LOW VOLTAGE WIRE AND CABLE

A. Power and Equipment Grounding Conductors

1. Power and equipment grounding conductors shall be Class B stranding. Conductors shall be stranded copper. Solid conductors shall not be used. Insulation for cables shall be XHHW-2, 600 Volt, and rated for 75° C.
2. Minimum power wire size shall be No. 12 AWG. Equipment grounding conductor sizes shall be per Drawings, or NEC, whichever is larger.
3. Wiring for 600 volt class power and equipment grounding conductors shall be as manufactured by **Okonite X-Olene Type XHHW-2**, or equal.

B. Control Wires

1. Control wires shall be the same type as power wire indicated above.
2. Control wires shall be No.14 AWG unless noted otherwise on the Drawings.
3. Control wires shall be as manufactured by **Okonite X-Olene Type XHHW-2**, or equal.

C. Instrumentation Cable

1. Instrumentation cable shall be rated at 600 volts. Instrumentation cables shall be composed of the individual conductors, an aluminum polyester foil shield, a tinned copper drain wire, and a PVC outer jacket with a thickness of 45 mils.
2. Individual conductors shall be No. 16 AWG stranded, tinned copper. Insulation shall be color coded polyethylene: black-red or black-white.
3. Single pair, No. 16 AWG, twisted, shielded cable shall be **Okonite Okoseal-N Type P-0S, Belden Part No. 8719**, or equal.

2.3 CATEGORY 6 CABLE

- A. Category 6 cable shall be ANSI/TIA/EIA enhanced Category 6 compliant and tested to 500 MHz. Cable shall be designed to handle voice, video and data simultaneously. Cable shall meet and exceed TIA/EIA 568.B.2-1 Category 6 Standard. Conductors to be 23 AWG bare copper wire insulated with polyethylene, twisted together to form a pair and four such pairs laid up to form a cable jacketed with flame retardant PVC insulation. Cable shall be UL listed. Cable shall be listed for IEEE 802.3 1000 Base-T applications.
- B. Acceptable products: Berk-Tek LANmark-6 OSP Cat 6, or equal.

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2.4 CABLE CONNECTORS

- A. Provide liquid-tight strain relief connectors for exposed flexible cord and power cable where cables enter electrical panels and enclosures. Connectors shall be OZ Gedney, Hubbell, Appleton, or equal.

2.5 CABLE END SEALING CAPS

- A. Heat-shrinkable cross-linked polymeric end sealing caps capable of sealing cables specified.
- B. End caps shall be pre-coated with a heat activated sealant and shall be able to accommodate a wide range of cable sizes and be completely independent of cable manufacturers' tolerances.
- C. Acceptable Products: **Raychem Corporation Model ESC**, or equal.

2.6 WIRE AND CABLE TAGS

- A. Tags relying on adhesives or taped-on markers are not acceptable for wire and cable tags.
- B. Provide tags for individual wires, at termination ends, for wires 1/0 and smaller. Tags shall be white heat-shrink with thermal transfer printing, 3 to 1 shrink ratio, two (2) inches long and meet UL224. Acceptable products: **Raychem Tyco Shrink Mark Heat Shrinkable Sleeves**, or equal. Wires larger than 1/0 shall be phase taped.

2.7 ANTENNA CABLE

- A. Antenna Cable shall be **Andrew 5/8-inch Heliac Model LDF4.5-50** for main cable feedline and **Andrew 1/2-inch Superflex Model FSJ4-50B** for jumper, no equal.
- B. Cable Connectors shall be **Andrew Models F4PNF-C, F4PNMV2-C, L4PNM-RC, L4PNF-RC, A5TNF-PS, A5TNM-PS**, or equals.
- C. Waterproofing kit at antenna to cable connection shall be **Andrew Waterproofing Kit Model 221213**, or equal.

2.8 FLOW TRANSDUCER CABLES

- A. Cables from Flow Transducers to remote mounted Flow Transmitter console shall supplied by Flow Meter manufacturer, no equal.

2.9 ELECTRICAL TAPE FOR COLOR CODING

- A. Electrical tape shall be premium grade, not less than 7 mils thick, rated for 90 degrees C minimum, flame-retardant, weather resistant, and available in suitable colors for color coding. The tape shall be resistant to abrasion, ultraviolet rays, moisture, alkalis, solvents, acids, and suitable for indoor and weather-protected outdoor use. The tape shall be suitable for use with PVC and polyethylene jacketed cables, and meet or exceed the requirements of UL 510.
- B. Color coding with phase tape is only allowed for conductors larger than #4. Conductors #4 and smaller shall have colored insulation.

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- C. Acceptable Products: **3M 35 Scotch Vinyl Electrical Tape for Color Coding, Plymouth Rubber Company Premium 37 Color Coding Tape**, or equal.

PART 3 -- EXECUTION

3.1 GENERAL

- A. The CONTRACTOR shall provide and terminate power, grounding, control, and instrumentation conductors.

3.2 INSTALLATION

- A. Conductors shall not be pulled into raceway until raceway has been cleared of moisture and debris.
- B. Pulling tensions on raceway cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where needed, shall be UL approved.
- C. Instrumentation wire (24 VDC) shall not be run in the same conduit with AC power and control wiring, except where specifically indicated.
- D. Provide conductors for Traveling Screen system per this Section, with minimum sizes per Contract Drawings, or larger as required by Traveling Screen system supplier.

3.3 SPLICES AND TERMINATIONS

A. General

- 1. Stranded conductors shall be terminated directly on equipment box lugs making sure that conductor strands are confined within lug.

B. Power Wire

- 1. Power conductors shall not be spliced. 120VAC lighting and receptacle circuits may be spliced with wire nuts in suitable boxes.

C. Control Wire

- 1. Control conductors shall be spliced or terminated only on terminal strips or terminal lugs.
- 2. The CONTRACTOR shall provide as a minimum the number of control wires listed in the conduit schedule or as indicated in the Contract Documents. Excess wires shall be treated as spares and terminated on terminal blocks.
- 3. Excess control cables shall be treated as spares and terminated on terminal blocks.

D. Instrumentation Cable

- 1. Shielded instrumentation cables shall be grounded at one end only.

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2. Excess instrumentation cables shall be treated as spares and terminated on terminal blocks.

3.4 CABLE IDENTIFICATION

- A. **General:** Wire and cable shall be identified to reduce maintenance effort.
- B. **Identification Numbers:** The CONTRACTOR shall assign to each power, control and instrumentation conductor a unique identification number. Numbers shall be assigned to conductors having common terminals and shall be shown on "as built" drawings. Identification numbers shall appear within 3-inches of conductor terminals. "Control Conductor" shall be defined as any conductor used for alarm, annunciator, or signal purposes.
 1. Each individual power wire, control wire and instrumentation wire shall be labeled at each termination point. CONTRACTOR shall assign a wire label, subject to approval from ENGINEER during Interconnect Drawing submittal review process.
 2. The 120/240-volt, 3 phase system conductors shall be color coded as follows: Line 1 - Black, Line 2 – Purple (high leg), Line 3 - Red, and Neutral - White. Color coding tape shall be used where colored insulation is not available and conductors are larger than #4 AWG. Insulated ground wire shall be green.
 3. General purpose AC control cable shall be red.
 4. General purpose DC control cable shall be blue.
 5. Spare conductors shall be labeled "SPARE".

3.5 LACING OF WIRES AND CABLES

- A. All wires and cables shall be laced in Panels. Wires and cables shall be laced so that the wires of the individual circuits are laced together by circuit and the laced-together circuit or cable shall be tagged with the cable number. All wiring entering and exiting the control panels shall be bundled into groups.
- B. Cables passing through handholes shall be looped around the handhole and laced together. Allow two (2) feet of slack in each run in a "drip loop" at least once along a wall. Loops and cables shall be organized, trained, and neatly installed.

3.6 TESTING

- A. **Cable Testing:** The following field tests shall be the minimum requirements:
 1. All field testing shall be done after cables are installed in the raceways and prior to termination and placing in service. Cables shall not be energized until successful testing has been accomplished.
 2. Cables failing the tests shall be replaced with a new cable. Replaced cables must pass same test.

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3. Power Wires:
 - (a) Perform insulation resistance testing of all power cables with conductors #10 AWG and larger, with a 1000-volt dc megger. Test duration shall be one (1) minute maximum. Minimum acceptable value for insulation resistance is 100 megohms.
 - (b) Perform insulation resistance testing in the presence of the ENGINEER.
 - (c) Prepare a written test report of the results and submit to the ENGINEER before energizing.
 - (d) Disconnect equipment that might be damaged by this test.
4. Control Wire and Instrumentation Cables:
 - (a) Control wire and instrumentation cables shall be tested for continuity, polarity, undesirable ground, and origination.
 - (b) Prepare a written test report of the results and submit to the ENGINEER before energizing.

END OF SECTION

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SECTION 26 05 26 GROUNDING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide the electrical grounding system, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 26 05 00 - Electrical Work, General apply to this Section.
- C. Provide grounding and bonding per electrical and telephone utility requirements.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All work specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
- B. **Shop Drawings:** Manufacturer's product information for rods, connections, clamps, and grounding system components, showing compliance with the requirements of this Section.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Components of the grounding electrode system shall be manufactured in accordance with UL 467 - Standard for Safety Grounding and Bonding Equipment, and shall conform to the applicable requirements of National Electrical Code Article 250 and local codes.

2.2 GROUNDING SYSTEM

- A. Grounding loop conductors shall be bare annealed, bare, stranded, copper conductors suitable for direct burial. Conductors shall be #2 AWG unless indicated otherwise.
- B. Ground Rods shall be a minimum of 3/4-inch in diameter, 10-feet long, and have a uniform covering of electrolytic copper metallurgically bonded to a rigid steel core. The copper-to-steel bond shall be corrosion resistant.
- C. Buried cable-to-cable and cable-to-ground rod connections shall be made using exothermic welds by **Cadweld**, or equal.

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- D. Exposed grounding connectors shall be of the compression type (connector-to-cable), made of high copper alloy, and be manufactured specifically for the particular grounding application. The connectors shall be **FCI-Burndy, O.Z. Gedney**, or equal.
- E. Equipment Grounding Circuit Conductors
 - 1. These conductors shall be the same type and insulation as the power conductors, with green insulation color, **Okonite X-Olene Type XHHW-2**, or equal. Refer to Section 26 05 19 – Wire and Cable.
- F. Manufacturers of grounding materials shall be **FCI-Burndy**, or equal.

2.3 GROUND ROD BOXES

- A. Boxes shall be precast, high density, reinforced concrete, approximately 13” diameter exterior at top, 9” interior diameter at top, 10” interior at bottom, and 12” deep. Covers shall be cast iron. Covers shall be marked “GROUND”.
- B. Boxes and covers shall be manufactured by **Christy G03**, or equal.

PART 3 -- EXECUTION

3.1 GROUNDING

- A. Provide a separate grounding conductor, securely grounded in each raceway, independent of raceway material, in every conduit.
- B. Provide grounding-type insulated throat bushings on all conduit ends. Jumper bushings to ground bus of equipment with conduit’s equipment grounding conductor.
- C. Provide grounding of Traveling Screen system per system supplier and NEC.
- D. Embedded Ground Connections
 - 1. Underground and grounding connections embedded in concrete shall be UL-listed compression type ground grid connectors and shall be made in accordance with the manufacturer’s instructions.
 - 2. The CONTRACTOR shall not conceal or cover any ground connections until the ENGINEER or authorized representative has established that every grounding connection conforms to the Contract Documents and has given the CONTRACTOR written confirmation.
- E. Ground Ring
 - 1. Furnish trenching and materials necessary to install the bare copper stranded grounding electrode conductor.
 - 2. Minimum burial depth shall be 36-inches.
 - 3. Re-compact disturbed soils to original density in 6-inch layers.

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4. Connect grounding electrode conductor to Metering Panel (bond to neutral), Lighting Panelboard, Manual Transfer Switch, Communication Backboard, and aqueduct pipeline near the flow meter.
- F. Instrumentation Shield Grounding
1. Shielded instrumentation cable shall have its shield grounded at one end only, on its own terminal screw. Connection to the ground bus shall be via a green No. 14 conductor

END OF SECTION

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SECTION 26 05 33 ELECTRICAL RACEWAY SYSTEMS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide electrical raceway systems, complete and in place, in accordance with the Contract Documents.
- B. In the event that individual equipment loads provided are larger than indicated in the Contract Documents, raceways, conductors, and branch circuit protectors shall be revised as necessary to control and protect the increased connected load in conformance to NEC requirements at no additional cost to the AGENCY.
- C. Provide raceways as required by electrical and telephone utility requirements.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All work specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings
 - 1. Complete catalog cuts of raceways, fittings, boxes, supports, and mounting hardware, marked where applicable to show proposed materials and finishes.

1.4 QUALITY ASSURANCE

- A. **Seismic Design Requirements:** All raceway systems to be furnished under this section shall be designed and constructed to meet the seismic requirements of Section 26 05 00 – Electrical Work, General.
- B. The CONTRACTOR shall demonstrate to the ENGINEER that the approved manufacturer's recommended installation tools and methods are being utilized on the job site by all persons engaged in the installation of PVC coated rigid steel conduit, elbows, nipples, and fittings. These tools and methods shall include, but not limited to, clamp inserts for use on power driven units of chain vises, new die heads and enlarged pipe guides in conduit threading machines, and strap wrenches and extra wide wrench jaws for use in conduit assembly.

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PART 2 -- PRODUCTS

2.1 GENERAL

- A. Pull and junction boxes, fittings, and other indicated enclosures that are dedicated to the raceway system shall comply with this Section.

2.2 CONDUIT

- A. Rigid Galvanized Steel Conduit

- 1. Rigid steel conduit shall be mild steel, hot-dip galvanized inside and out.
- 2. Rigid steel conduit shall be manufactured in accordance with ANSI C80.1 - Rigid Steel Conduit, Zinc Coated, and UL-6.
- 3. Manufacturer shall be **Allied Tube & Conduit, Wheatland Tube**, or equal.

- B. Rigid Non-Metallic Conduit

- 1. Rigid non-metallic conduit shall be Schedule 40 PVC, sunlight resistant. Provide Schedule 80 PVC if required by electrical utility.
- 2. Rigid non-metallic conduit shall be manufactured in accordance with NEMA TC-2 - Electrical Plastic Tubing and Conduit, and UL-651 - Standard for Rigid Non-metallic Conduit.
- 3. Manufacturer shall be **Carlton, Cantex**, or equal.

- C. Rigid PVC Coated Galvanized Steel Conduit

- 1. The conduit, prior to PVC coating, shall meet the requirements for Rigid Galvanized Steel conduit above.
- 2. A PVC coating shall be bonded to the outer surface of the galvanized conduit. The bond between the coating and the conduit surface shall be greater than the tensile strength of the coating. The inside surfaces and threads of the conduit shall have a 2-mil urethane coating.
- 3. PVC coating thickness shall be not less than 40-mils.
- 4. PVC coated Rigid Galvanized Steel shall be manufactured in accordance with the following standards:
 - (a) UL-6
 - (b) ANSI C80.1
 - (c) ETL Verified PVC-001.
 - (d) NEMA RN1 - PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

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5. Manufacturer shall be **Robroy, Perma-Cote**, or equal.

D. Liquidtight Flexible Metal Conduit

1. Liquidtight flexible metal conduit shall be constructed of a flexible galvanized metal core with a sunlight resistant thermoplastic outer jacket.
2. Liquidtight flexible metal conduit shall be manufactured in accordance with Article 350 of the NEC and UL-360 – Steel Conduits, Liquid-Tight Flexible.
3. Manufacturer shall be **Anaconda Sealtite, Electri-Flex Liguatite**, or equal.

2.3 CONDUIT BODIES, FITTINGS AND BOXES

- A. All conduit bodies, or condulets, shall be PVC coated rigid steel where used on Rigid Galvanized Steel conduits or PVC coated Rigid Galvanized Steel conduits.
- B. Fittings and boxes shall have neoprene gaskets and non-magnetic stainless steel screws. Covers shall be attached by means of holes tapped into the body of the fitting. Covers for fittings attached by means of clips or clamps will not be acceptable. Cast and malleable iron boxes shall be the threaded type with 5 full threads.
- C. Boxes larger than standard cast or malleable types shall be 304 or 316 stainless steel, NEMA 4X enclosures.
- D. Malleable Iron Fittings and Boxes
 1. Fittings and boxes for use with galvanized steel conduit shall be of malleable iron or gray-iron alloy with zinc plating.
 2. Manufacturer shall be **OZ Gedney, Crouse-Hinds, Appleton**, or equal.
- E. PVC Coated Fittings and Boxes
 1. Fittings and boxes for use with PVC coated Rigid Galvanized Steel conduits shall be PVC coated and shall be products of the same manufacturer as the conduit.
 2. Male and female threads and internal surfaces shall have a 2-mil urethane coating.

2.4 JUNCTION AND PULL BOXES

- A. Junction and pull box sizes shown on the Contract Drawings are considered minimum. If sizes are not shown, size junction and pull boxes in accordance with the NEC for the number of conductors enclosed in the box.
- B. Where boxes larger than outlet or device boxes are required for junction of pull boxes, provide the following:
 1. Utilize NEMA 4 watertight and raintight enclosures for outdoor locations or where the subscript WP (weatherproof) is indicated at the box location on the Drawings.

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- C. For surface mounted installations, use neoprene gasketed watertight and raintight hot-dipped galvanized cast iron boxes and full-access covers, with stainless steel cover hardware. Manufacturer shall be **Crouse-Hinds Type WJB Heavy Duty Junction Boxes**, or equal.
- D. Stainless Steel Boxes
 - 1. Stainless steel boxes shall be used with PVC coated Rigid Galvanized Steel conduit and where indicated.
 - 2. Stainless steel boxes shall be NEMA 4X, Type 316, unless noted otherwise.
 - 3. Stainless steel shall be minimum 14-gauge thickness, with a brushed finish.
 - 4. Doors shall have full length stainless steel piano hinges. Non-hinged boxes are not acceptable.
 - 5. Manufacturer shall be **Hoffman Enclosures, Hammond, Rohn**, or equal.

2.5 CONDUIT TAGS

- A. Conduit Tags Above Ground: Provide permanent, stainless steel 2-inch diameter conduit tags with conduit number pressure stamped onto the tag. Conduit numbers shall be 1/2-inch minimum, and painted black. Tags relying on adhesives or taped-on markers are not acceptable.
- B. Conduit Tags Below Ground: Conduit tags in underground installations like handholes, shall be 2" diameter engraved black phenolic tags, with 1/2-inch white lettering. Attached to 316 stainless steel tie wire or black nylon cable zip tie.

2.6 SUPPORTS AND FITTINGS

- A. Supports and fittings for electrical equipment and raceways shall be channel supports sized to meet seismic requirements. Finish shall be hot-dipped galvanized steel after fabrication for strut, pipe straps, clamp back spacers, hanger rod, strut nuts, U-bolts, beam clamps, and other supports and fittings.
- B. Manufacturer shall be **Unistrut, B-Line, Power Strut**, or equal.

2.7 WATERTIGHT HUBS

- A. In exterior rated areas all conduits shall be terminated with watertight hubs. Hubs shall be as manufactured by **Myers, OZ Gedney**, or equal.

2.8 CONDUIT PENETRATION SEALS

- A. Conduit penetration seals shall be modular, mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the conduit and the opening. The elastomeric element shall be sized and selected per the manufacturer's recommendations and shall be suitable for use in standard service applications.
- B. Manufacturer shall be **Thunderline Corporation Link-Seal**, or equal.

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2.9 DUCT SEAL

- A. Duct seal shall be a non-hardening compound designed as a water-stop and moisture barrier for sealing the annular space between conduit and electrical conductors and cables.
- B. Manufacturer shall be **OZ Gedney DUX**, or equal.

2.10 PULL TAPE

- A. Pull tape shall be flat, woven, polyester or polyester/Kevlar blend tape used for installing cables in underground conduit. Twisted rope is not allowed. Pull tape shall be printed with sequential footage. Pull tape shall be minimum width of $\frac{1}{2}$ " , or sized as needed for pulling strength required.
- B. Manufacturer shall be **NEPTCO WP900P**, or equal.

PART 3 -- EXECUTION

3.1 GENERAL

- A. Where raceways are indicated but routing is not indicated, such as home runs, raceway routings shall be the CONTRACTOR's choice and in strict accordance with the NEC and these Contract Documents.
- B. Support raceways at intervals not exceeding NEC requirements unless otherwise indicated. Support all raceways from structural members only. Support flexible metal conduit with conduit clamps.
- C. Provide conduits for Traveling Screen system as required per Contract Drawings, and system supplier. Conduits shall be sized based on minimum sizes per NEC or Contract Drawings, whichever is larger.
- D. Bends
 1. Make changes in direction of runs with symmetrical bends or cast metal fittings. Make bends and offsets of the longest practical radius. Avoid field-made bends and offsets where possible, but where necessary, make with an acceptable hickey or conduit bending machine.
 2. Make bends in parallel or banked runs of raceways from the same center or centerline so that bends are parallel and of neat appearance. Factory elbows may be used in parallel or banked raceways if there is a change in the plane of the run and the raceways are of the same size. Otherwise, make field bends in parallel runs.
 3. For PVC Schedule 40 conduits, use factory made elbows for all bends thirty (30) degrees or larger. Use acceptable heating methods for forming smaller bends.
 4. Make no bends in flexible conduit that exceed allowable bending radius of the cable to be installed or that significantly restricts the conduits flexibility.

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- E. Insulated Throat Grounding Bushings
 1. Where rigid steel conduit, PVC coated rigid steel conduit, or liquid-tight flexible metal conduit enters metal enclosures, install an insulated throat grounding bushing on the end of each conduit. Install a bonding jumper from the bushing to any equipment ground bus or ground pad.
 2. If neither a ground bus or ground pad exists, connect the bonding jumper to the metallic enclosure with a bolted-lug connection.
- F. PVC Schedule 40 Conduit: Solvent weld PVC conduit joints with solvent recommended by the conduit manufacturer. Follow manufacturer's solvent welding instructions and provide watertight joints. Use acceptable PVC terminal adapters when joining PVC conduit to metallic fittings. Use acceptable PVC female adapters when joining PVC conduit to galvanized rigid metal conduit or PVC coated rigid steel conduit. Route Schedule 80 conduit for duct bank and up riser pole if required by electrical utility.
- G. PVC Coated Rigid Steel Conduit: Install in strict accordance with the manufacturer's instructions. Touch up any damage to the coating with conduit manufacturer acceptable patching compound. PVC boot shall cover all threads. Leave no metallic threads uncovered. Clean field threads with solvent and coat with urethane touch-up. Keep two (2) cans of urethane touch-up at each threading station.
- H. Penetrations: Where conduit enters Meter Vault below grade, install a watertight conduit penetration seal and sleeve. Install the sealing assembly such that it may be tightened at any time from the interior side, and grout pack the exterior side.
- I. Conduit Sealing: Seal the interior of all raceways entering structures or control panels at the first box with duct seal to prevent the entrance into or exit from the structure or control panel of gases, liquids or rodents.

3.2 CONDUIT

- A. Exposed conduit shall be rigid galvanized steel except as follows, unless indicated otherwise:
 1. Where PVC coated rigid galvanized steel is to be installed based on Contract Documents.
 2. For conduits containing only the grounding system bonding conductor, galvanized rigid steel conduit shall be utilized.
- B. Underground conduits shall be Schedule 40 PVC. Where PVC conduit stubs up from underground, a PVC-coated Rigid Galvanized Steel elbow shall be utilized. The transition to PVC coated Rigid Galvanized Steel shall consist of a minimum of 12" of PVC coated rigid conduit on the horizontal conduit run prior to the elbow and minimum of 36" of PVC coated rigid conduit on the vertical conduit run after the elbow.
- C. Exposed conduit shall be 3/4-inch minimum trade size. Encased conduit shall be one-inch minimum trade size.

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- D. Connections to equipment subject to vibration shall be made with liquid-tight flexible conduit not exceeding 2-feet in length. Equipment subject to vibration that is normally provided with wiring leads shall be provided with a cast junction box or conduit for the make-up of connections. The flexible conduit shall be long enough to allow the item to which is connected to be withdrawn or moved off its base.
- E. Conduits shall be identified at ends and pulling points. Identification shall be the unique conduit number assigned by the CONTRACTOR.

3.3 REQUIRED RACEWAY TYPE FOR FINAL EQUIPMENT CONNECTION

- A. Final Connection to Certain Equipment
 - 1. Make final connection to motors, local instrumentation, and other equipment where flexible connection is required to facilitate removal or adjustment of equipment with 12-inch minimum, 24-inch maximum lengths unless otherwise approved by the ENGINEER, of liquid-tight flexible metal conduit.
 - 2. The flexible conduit shall be long enough to allow the item to which is connected to be withdrawn or moved off its base.

3.4 PREPARATION FOR PULLING IN CONDUCTORS

- A. Do not install crushed or deformed raceways. Avoid traps in raceways. Take care to prevent the lodging of plaster, concrete dirt, or trash in raceways, boxes, fittings, and equipment during the course of construction. Make raceways entirely free of obstructions or replace them. Ream all raceways, remove burrs, and clean raceway interior before introducing conductors or pull wires.
- B. Immediately after installation, plug or cap all raceway ends with watertight and dust-tight seals until the time for pulling in conductors.

3.5 EMPTY RACEWAYS

- A. Certain raceways will have no conductors pulled in as part of this Contract. Identify with conduit tags at each end and at any intermediate pull point of each such empty raceway. Provide a removal cap over each end of empty raceways. Provide a pull tape in each empty raceway.

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SECTION 26 05 43 UNDERGROUND RACEWAY SYSTEMS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide underground raceway systems, complete and in place, in accordance with the Contract Documents.
- B. Provide raceways as required by electrical and telephone utility requirements.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All work specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
- B. **Shop Drawings:** Complete catalog cuts of all handholes, warning tape, and pull tape to show proposed materials.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Handholes and fittings that are dedicated to the underground raceway system shall comply with the requirements of this Section.

2.2 HANDHOLES

- A. Typical inside dimensions for small handholes are as follows: 10-inches by 17-inches, and 17-inches by 30-inches. Use traffic rated, solid bottom, precast handholes with 28-day 3,000 psi minimum compressive strength reinforced concrete. Minimum dimensions for small handholes are shown on the Drawings. The depths of small handholes shall be 36-inches minimum; to accommodate the conduit entrances at their required elevations into short side of handholes.
- B. Handhole covers shall have letters 1-inch high and 3/4-inches wide minimum cast in the covers indicating "ELECTRIC HH-E1" (AC Power, 600 VAC or less) or "CONTROL HH-C1", as applicable based on handhole identifier shown on drawings.
- C. Provide handhole hardware, frames, and checker plate covers of steel, hot-dip galvanized after fabrication. Covers to have Penta style stainless steel bolts.

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- D. Manufacturer shall be **Christy Concrete Products, Inc. #B1017 and #B1730, Jensen Precast, Associated Concrete Products, Inc., Brooks Products, Inc.,** or equal.

2.3 DUCTBANKS

- A. Underground ducts shall be Schedule 40 PVC for power, control and instrumentation. Top of concrete duct banks shall be a minimum of 24" below finish grade.
- B. Ductbank conduit spacers shall be saddle type, non-metallic, interlocking, molded in rebar holder, accommodate 1" thru 2" conduit sizes. Spacers shall be Carlon Snap-Loc, or equal. Maximum spacing of spacers shall be 5'.
- C. Ducts shall be encased in red-dyed, controlled low-strength material (CLSM). CLSM shall have 2,000 psi strength. Colorant shall be an integral red-oxide coloring pigment in the proportion of 5 pounds per cubic yard of CLSM.

2.4 WARNING TAPE

- A. Continuous lengths of detectable underground warning tapes shall be installed 18 inches above and parallel to conduit runs. Tape shall be 3 inches wide polyethylene film imprinted "CAUTION - ELECTRIC UTILITIES BELOW."
- B. Manufacturer shall be **MSI #52215,** or equal.

2.5 CONDUIT TAGS

- A. Conduit Tags Above Ground: Provide permanent, stainless steel 2-inch diameter conduit tags with conduit number pressure stamped onto the tag. Conduit numbers shall be 1/2-inch minimum, and painted black. Tags relying on adhesives or taped-on markers are not acceptable.
- B. Conduit Tags Below Ground: Conduit tags in underground installations like handholes, shall be 2" diameter engraved black phenolic tags, with 1/2-inch white lettering. Attached to 316 stainless steel tie wire or black nylon cable zip tie.

2.6 PULL TAPE

- A. Pull tape shall be flat, woven, polyester or polyester/Kevlar blend tape used for installing cables in underground conduit and for pulling in spare conduits. Twisted rope is not allowed. Pull tape shall be printed with sequential footage. Pull tape shall be minimum width of 1/2", or sized as needed for pulling strength required.
- B. Manufacturer shall be **NEPTCO WP900P,** or equal.

PART 3 -- EXECUTION

3.1 GENERAL

- A. Underground raceways shall be installed between handholes as indicated. Raceway systems shall be electrically and mechanically complete before conductors are installed. Bends and

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offsets shall be smooth and symmetrical, and shall be fabricated with tools designed for this purpose. Factory elbows shall be utilized wherever possible.

- B. Provide phenolic tags on conduit ends inside handholes. Provide phenolic tags on cables, attached with plastic ties. Tags to be 2", round, black phenolic engraved to a white core, with ½" lettering.
- C. Handholes shall be installed

3.2 HANDHOLES

- A. Provide handhole excavation, backfilling, concrete collar, grading, etc., in accordance with requirements specified elsewhere in these Contract Documents.
- B. Do not install handholes until final conduit grading, including field changes necessitated by underground interferences, has been determined. Set frames just above final grade to prevent water from entering handholes.
- C. All construction of handholes shall include over excavation of the foundation area and placement of a minimum of 1 foot of 3/4-inch drain rock below the unit.
- D. Provide concrete collar, minimum 3000 psi strength, around handhole. Refer to installation procedures for concrete collar from Oldcastle Precast:
 - 1. <https://oldcastleinfrastructure.com/wp-content/uploads/2018/11/Christy-Concrete-Installation-Guide.pdf>
- E. Place and compact backfill material as specified in Section 31 23 23 – Fill And Compaction.

3.3 DUCTBANKS

- A. Ductbanks shall be installed in accordance with the criteria below:
 - 1. Duct shall be assembled using high impact non-metallic spacers and saddles to provide conduits with vertical and horizontal separation. Plastic spacers shall be set every 5 feet. The duct array shall be anchored every 5-feet to prevent movement during placement of concrete.
 - 2. Duct couplings shall be staggered a minimum of 6 inches.
 - 3. The bottom of trench shall be sand.
 - 4. Each bore of the completed ductbank shall be cleaned by drawing through it a standard flexible mandrel one foot long and 1/4-inch smaller than the nominal size of the duct. After passing of the mandrel, a wire brush and swab shall be drawn through.
 - 5. Spare raceways that are not indicated to contain conductors shall have a pull tape installed throughout the entire length of the raceway.
- B. Duct entrances shall be grouted smooth; ducts shall be terminated with flush end bells. Sections of pre-fabricated manholes and pullboxes shall be assembled with waterproof mastic and shall

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be set on a 12-inch bed of gravel as recommended by the manufacturer or as required by field conditions.

- C. Conduits shall be terminated with end bells within the Handholes.
- D. The transition from PVC conduit to PVC coated rigid steel shall consist of 12" of PVC coated rigid steel conduit on the underground horizontal conduit run prior to the elbow and minimum of 36" of PVC coated rigid on the vertical conduit run after the elbow.

3.4 PREPARATION FOR PULLING IN CONDUCTORS

- A. For underground conduits pull a bristle through each raceway to remove debris. Then pull a mandrel of a diameter approximately 1/4-inch less than the raceway inside diameter, through each raceway. Plug or cap all raceway ends with watertight and dust-tight seals until the time for pulling in conductors.

END OF SECTION

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SECTION 26 05 73 PROTECTIVE DEVICE STUDIES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall perform arc flash studies for the electrical power system in accordance with the Contract Documents. The studies shall cover 3-phase faults and line to ground faults to provide arc flash label information.
- B. The studies shall include all portions of the electrical distribution system for normal power source.
- C. It is the responsibility of the CONTRACTOR to obtain from the electric utility, Southern California Edison (SCE), and appropriate vendors the information required to perform the arc flash study. The CONTRACTOR shall contact the electric utility and obtain the short circuit contribution and impedance values in writing for these facilities needed for these studies. If information is not available, CONTRACTOR shall utilize approved estimates. The CONTRACTOR shall contact the protective device manufacturer's and obtain the ratings and time current curves for all protective devices including fuses, circuit breakers, and overload protective elements.
- D. The CONTRACTOR shall perform all needed field investigation and inspections to properly identify equipment, and any appropriate settings and nameplate data to get the correct information to work with including impedance values, voltage ratings, base kVA ratings and/or current ratings.
- E. The CONTRACTOR shall perform all needed field investigation and inspections to properly identify all cable and wire size, type, size and material for use in the studies. The CONTRACTOR shall also determine the cable and wire lengths and protective conduit type for use in the studies.
- F. The arc flash study shall be submitted as part of the normal construction sequencing, but prior to equipment startup. All arc flash labels must be installed prior to energizing equipment. After the project is operating, all comments on the studies and the studied equipment, shall be addressed, and all corrections made to input data.
- G. O&M Manuals shall contain the record (as-built) version of the arc flash study with all calculations rerun and adjusted reflecting the as-built equipment, and corrected input data.

1.2 QUALIFICATIONS

- A. Protective device studies shall be performed by a manufacturer who has been regularly engaged in such services for a period of at least 10 years.
- B. Studies shall utilize latest SKM software for making three-phase fault duty calculations.

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- C. Studies shall be thoroughly reviewed, stamped and signed by an electrical engineer registered in the State of California having experience performing such studies, and who directly supervised the collection of information, the creation of the studies and associated reports.

1.3 CONTRACTOR SUBMITTALS

- A. All studies shall be submitted and approved prior to final project acceptance in accordance with the General Conditions.
- B. Submit qualifications of firm to provide testing services. Refer to Qualification requirements within.
- C. The complete studies, reports, calculations, plots and tabulations shall be performed and submitted twice. The first time as a part of normal construction. The second time with the O&M Manual submittal as a separate submittal after all comments, corrections, updated input data, have been inserted into the software programs to produce an as-built set of studies, reports, calculations, plots and tabulations.
- D. Provide a portable USB drive (thumb drive) of the as-built set of studies, reports, calculations, plots and tabulations.
- E. A separate USB drive of the original source format of input data used as direct input to the selected software to perform the calculations, generate the reports, generate the labels, for the as-built facilities.
- F. The name and manufacturer of the software utilized to perform the calculations, with the specific version used. Submit all setup information for using the software used to generate the studies and reports submitted.
- G. Copy of Arc Flash labels inscriptions with description of installed location.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 GENERAL

- A. The study shall include single-line and impedance diagrams of the power system. This diagram shall identify all components considered in the study and the ratings of all power devices, including transformers, circuit breakers, relays, fuses, busses, and cables. The resistances and reactance of all cables shall be identified in the impedance diagram. Cable lengths can be estimated until actual installed cable lengths are known.
- B. The study shall contain all written data from the electric utility company regarding maximum available short circuit current, voltage, and X/R ratio of the utility power system. The utility supply overcurrent protective device and ground fault protective device for the utility circuit breaker delivering power to the facility shall be used as a fixed reference and starting point for these studies.

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- C. The study shall include all protective devices and feeders included under this Contract.
- D. The work shall be performed in the following sequence:
 - 1. Arc flash study submitted. Approval by the AGENCY and the ENGINEER.
 - 2. Install approved arc flash labels on equipment. Provide arc flash labels on: Metering Panel (include calculations and date), Manual Transfer Switch, Panelboard LP-1, Traveling Screen Panel, and disconnect switches at the gate actuators.
 - 3. Provide Electrical Field Testing per Section 26 08 00 – Electrical Tests.
 - 4. Energize equipment. Equipment shall not be energized until sequence steps above are completed and approved by the AGENCY and the ENGINEER.
 - 5. Update and replace arc flash labels on equipment if protective device modified during testing and start-up.
 - 6. Provide record set of studies for O&M Manual.

3.2 SHORT CIRCUIT STUDY

- A. The short circuit study shall be performed with the aid of a digital computer program, and shall be in accordance with:

ANSI/IEEE 141	Recommended Practice for Electrical Power Distribution for Industrial Plants
ANSI/IEEE 242	Recommended Practice for Protection, and Coordination of Industrial, and Commercial Power Systems
ANSI/IEEE C 37.13	Low-Voltage AC Power Circuit Breakers Used in Enclosures

3.3 ARC FLASH STUDY

- A. Arc Flash study shall be performed with the aid of a digital computer program to cover the whole power distribution system. The arc flash study shall calculate, determine and report the “Arc Flash Boundary”, incident energy at 18 inches expressed in cal/sq-cm, voltage shock hazard, limited shock approach boundary, restricted shock approach boundary, prohibited shock approach boundary and “Personal Protective Equipment” (PPE) level. The arc flash study shall calculate and determine these items for all new and existing electrical equipment in the power distribution system study. The arc flash study shall be performed in conjunction with short circuit calculations and protective device coordination. The arc flash study shall be done for worst case analysis; considering minimum/maximum utility fault current and motors either on or off. The arc flash study shall be in accordance with the latest version of:

NFPA 70E	Standard for Electrical Safety Requirements for Employee Workplaces – Article 130
IEEE 1584	IEEE guide for performing Arc Flash Hazard Calculations
OSHA (29 CFR PART 1910)	Occupational Safety and Health Standards for General Industry

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ANSI Z535.1	Safety Color Code
ANSI Z535.3	Criteria for Safety Symbols
ANSI Z535.4	Product Safety Signs and Labels

- B. All calculation shall be performed in accordance with IEEE 1584. The use of thumb rules is not acceptable in place of a calculated value as shown in IEEE 1584.
- C. The study shall determine and report the following: The recommended values for the “Arc Flash Boundary”, incident energy at 18 inches expressed in cal/sq-cm, voltage shock hazard, limited shock approach boundary, restricted shock approach boundary, prohibited shock approach boundary and PPE levels, based on the arc flash study results. These results shall be tabulated with all identified equipment.
- D. The study shall recommend the Personal Protective Equipment (PPE) that the AGENCY should maintain on site for standard maintenance and operations expected to be conducted for this electrical system. The study shall recommend the safety label design that should be posted on electrical equipment. The study shall recommend the specific information that should be type written as part of the safety label. Label information shall also be coordinated with the AGENCY requirements during submittal period. These recommendations shall be based on the NEC requirements, OSHA standards, and NFPA recommended practices. The CONTRACTOR shall furnish and install the field markings required by the NEC for Flash Protection on all power distribution equipment. The field marking shall be the approved recommended safety label.
- E. The CONTRACTOR shall as-built the arc flash study and rerun and adjust all the reports, calculations, and adjust the PPE recommendation reflecting the as-built facilities after all corrections have been inserted into the input data and all previous comments have been addressed.

3.4 REPORT

- A. The results of the power system studies shall be summarized in a final Report. Minimum four bound copies of the Report shall be submitted. The Report shall include the following:
 - 1. Single-line diagram.
 - 2. Impedance diagram for 3-phase faults.
 - 3. Impedance diagram for line to ground faults.
 - 4. Tabulation of all protective devices for 3-phase faults, which shall be identified on the single line diagram.
 - 5. Tabulation of all protective devices for line to ground faults, which shall be identified on the single line diagram.
 - 6. Computerized 3-phase fault current calculations.
 - 7. Computerized line to ground fault current calculations.
 - 8. Arc Flash Study report including tabulations, label design and recommendations.

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9. Specific recommendations shall include how to potentially reduce the arc-flash incident-energy levels for each location having more than 8 cal/sq-cm present. Include a budgetary estimate for implementing any proposed change.
- B. The Report shall include information concerning the computer program used for the study and also shall include a general discussion of the procedure, items, and data considered in preparing the study.
- C. The CONTRACTOR shall indicate in the Report suggested changes to the protection scheme or equipment selection that will result in improved system reliability and safety.
- D. The final record version of the arc-flash study shall include a USB drive, as well as hard paper copy form of all input data, all calculation reports, all drawings, all output data, and all device settings in tabulated organized form. Also, the CONTRACTOR shall submit all the final model with scenarios in original source format on a separate USB drive that can be utilized by the AGENCY.

END OF SECTION

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SECTION 26 05 83 ELECTRIC MOTORS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. General: The CONTRACTOR shall provide electric motors, accessories, and appurtenances complete and operable, in conformance with the individual driven equipment specifications and the Contract Documents.
- B. The provisions of this Section apply to low voltage 3 phase, AC squirrel cage induction motors throughout the Contract Documents, except as indicated otherwise.
- C. The CONTRACTOR shall assign to the equipment supplier the responsibility to select suitable electric motors for the equipment. The choice of motor manufacturer shall be subject to review by the ENGINEER. Such review will consider future availability of replacement parts and compatibility with driven equipment.
- D. Motors for pumps shall be provided by the pump supplier, per these Specifications, for a complete and operable packaged pump and motor system.
- E. All motors larger than 5 hp shall be rated for 50° C, IEEE Standard 841 compliant, inverter rated, premium efficiency, and shall include normally closed thermostat that opens on high temperature.
- F. All motor enclosures shall be totally enclosed fan cooled (TEFC) type.
- G. Coordinate motor terminal box dimensions, and number and size of conduit openings, with number and size of field installed conduits and cables on Drawings. Provide grounding lug within motor terminal box.

1.2 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01 33 23 Submittal Requirements.
- B. Complete motor data shall be submitted with the driven machinery Shop Drawings. Motor data shall include:
 - 1. Machine name and specification number of driven machine.
 - 2. Motor manufacturer.
 - 3. Motor type or model and dimension drawing. Include motor weight.
 - 4. Nominal horsepower.
 - 5. National Electrical Manufacturers Association (NEMA) Design.
 - 6. Enclosure materials and rating.

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7. Frame size.
 8. Winding insulation class and temperature rise class.
 9. Voltage, phase, and frequency ratings.
 10. Service factor.
 11. Full load current at rated horsepower for application voltage.
 12. Full load speed.
 13. Guaranteed minimum full load efficiency. Also, nominal efficiencies at 1/2 and 3/4 load.
 14. Motor thermostat, normally closed, with voltage and current rating. Include wiring diagram.
 15. Bearing data. Include recommendation for lubricants of relubricatable type bearings.
 16. All motors shall be inverter rated. If motor is driven by VFD, submit minimum speed at which motor may be operated.
 17. Power factor at 1/2, 3/4 and full load.
 18. Recommended size for power factor correction capacitors to improve power factor to 0.95 percent lagging when operated at full load for non-VFD driven motors.
- C. If water cooling or lubricant is required for motor or pump bearings, the Shop Drawing submittals shall indicate this requirement and be included at no extra cost to the AGENCY.

1.3 MAINTENANCE AND GUARANTEE, WARRANTY

- A. The CONTRACTOR shall submit a recommended spare parts list.
- B. The CONTRACTOR shall guarantee that the furnished equipment shall meet the requirements specified herein and specified elsewhere in the Contract Documents.
- C. The warranty for all provided equipment shall be not less than two years after initial startup or the AGENCY beneficial use, whichever is later, and shall include all costs for repairs, parts, travel and living expenses, and labor.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Electric motors driving identical machines shall be identical.
- B. Maximum motor loading shall be equal to nameplate horsepower rating or less, exclusive of service factor and be verifiable from the submittal data of the driven machinery.

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- C. Minimum Motor HP: The CONTRACTOR shall size motors to continuously carry the maximum load imposed through the full range for driven equipment operation; however, power ratings shall not be less than the specified values when indicated in the specification. If the specified values are less than those required from the first criterion above, then the CONTRACTOR shall provide greater capacity motors at no additional cost to the AGENCY. In addition, increases in circuit breaker, magnetic starter, conductor, and conduit size capacities related to increased motor size shall also be provided at no additional cost to the AGENCY.
- D. Exempt Motors: Motors for valve operators, or motors which are an integral part of standard manufactured equipment, i.e., non-NEMA mounting, common shaft with driven element, or part of domestic or commercial use apparatus may be excepted from these requirements to the extent that such variation reflects a necessary condition of motor service or a requirement of the driven equipment.

2.2 DESIGN REQUIREMENTS

- A. All electric motors shall comply with ANSI/NEMA MG-1 - Motor and Generator.
- B. All motors shall be IEEE Standard 841 compliant.
- C. Provide motors with lubrication instruction nameplate, thermostat information nameplate, motor information nameplate. Nameplates shall be stamped or etched stainless steel.
- D. Motor Voltage Ratings: Low voltage motors shall have voltage ratings in accordance with the following, unless otherwise indicated:
 - 1. Motors below 1/2 HP shall be rated 115 volts, single phase, 60 Hz. Dual voltage motors rated 115/230 volts, 115/208 volts, or 120-240 volts are acceptable, provided leads are brought out to the conduit box.
 - 2. Motors 1/2 HP and larger shall be rated 460 volts, 3 phase, 60 Hz. Dual voltage motors rated 230/460 volts or 208/230/460 volts are acceptable, provided every lead is brought out to the conduit box.
- E. Insulation: All 3-phase motors shall be provided with Class F insulation, rated to operate at a maximum ambient temperature of 50° C and at the altitudes where the motors will be installed and operated, without exceeding Class B temperature rise limits stated in ANSI/NEMA MG 1-12.42. Single-phase motors shall have Class F insulation with temperature rise not to exceed the insulation class.
- F. All motors shall be NEMA premium efficiency with a service factor of 1.15 unless otherwise indicated.
- G. Motors larger than 5 HP shall have thermostats provided; normally closed, opening on high temperature. Thermostat wiring shall be routed to motor terminal box.

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2.3 ACCESSORY REQUIREMENTS

- A. General: Horizontal motors 3 HP and larger and every vertical motor shall have split-type cast metal conduit boxes. Motors smaller than 3 HP shall have the manufacturer's standard conduit boxes. Motors other than open drip-proof shall be gasketed.
- B. Lifting Devices: Motors weighing 265 pounds or more shall have suitable lifting eyes for installation and removal.
- C. Special Requirements: The CONTRACTOR shall refer to individual equipment specifications for special requirements such as motor winding thermal protection.
- D. Grounding Lugs: Provide motor grounding lug suitable to terminate ground wire, sized as indicated, within motor terminal box. Provide two threaded connections on motor frame to mechanically attach grounding electrode conductor.
- E. Nameplate: All motors shall be fitted with permanent stainless steel nameplates indelibly stamped or engraved with NEMA Standard motor data, in conformance with NEMA MG-1-10.40.

2.4 MOTOR THERMAL PROTECTION

- A. Single Phase Motors: All single-phase 120, 208, or 230 volt motors shall have integral thermal overload protection or shall be inherently current limited. The CONTRACTOR is responsible to wire integral thermal overloads into the starting circuit, regardless of Contract Drawing schematics.
- B. Thermostats: Winding thermostats shall be snap-action, bi-metallic, temperature-actuated switch type. Thermostats shall be provided with one normally closed contact.

2.5 MOTOR BEARINGS

- A. Bearings shall be re-lubrication type ball bearings. Provide bearing isolators at both ends. Bearing protection shall exceed IP55. Provide seamless stainless steel grease extension tubes and automatic grease relief fittings.
- B. All motors greater than 2 HP shall have bearings designed for 17,500 hours (belted) or 100,000 hours (coupled) L-10 life.
- C. Fractional Horsepower: Motors with fractional horsepower through 2 HP shall be provided with lubricated-for-life ball bearings.
- D. Vertical Motors Over 2 HP: Vertical motors larger than 2 HP shall be provided with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per the manufacturer's recommendation for smooth operation and long life of the bearings.

2.6 MANUFACTURERS

- A. Baldor Reliance Electric
- B. U.S. Motors

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- C. WEG
- D. General Electric
- E. Or approved equal

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Motor installation shall be performed in accordance with the motor manufacturer's written recommendations and the written requirements of the manufacturer of the driven equipment.
- B. Related electrical WORK involving connections, controls, switches, and disconnects shall be performed in accordance with the applicable sections of Division 26.
- C. Following completion of the specified installation, the CONTRACTOR shall check the alignment of each unit. Field tests shall be performed on all motors after installation, but before putting motors into service.
- D. Bond motor frame to grounding electrode conductor that is connected to grounding grid or ductbank grounding conductor. Motor frame grounding connection shall be threaded, ready to accept bolted connection. Where exposed, route grounding electrode conductor is galvanized rigid steel conduit.

3.2 FACTORY TESTING

- A. Motors rated 100 HP and larger shall be factory tested in conformance with IEEE 112, IEEE 43 - Recommended Practice for Testing Resistance of Rotating Machinery, and NEMA MG-2.
- B. Each motor Factory Test shall consist of full load heat run, percent slip, running light current, locked rotor current, breakdown torque (calculated), starting torque, winding resistance, high potential, efficiencies at 100, 75, and 50 percent of full load, power factors at 100, 75 and 50 percent of full load, and bearing inspection.
- C. Test report shall indicate test procedure and instrumentation used to measure and record data. Test report shall be certified by the motor manufacturer's test personnel and be submitted to the ENGINEER.

3.3 FIELD TESTING

- A. The CONTRACTOR shall perform the following field tests on all irrigation water pump motors:
 - 1. Inspect each motor installation for any deviation from rated voltage, phase, or frequency, improper installation, physical and mechanical condition, deviations from drawings and specifications from nameplate. Inspect anchorage. Confirm correct application of lubricants.
 - 2. Visually check for proper phase and ground connections. Verify that multi-voltage motors are connected for proper voltage.

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3. Check thermostats and solenoids (if applicable) for functional operation.
4. Visually check that motor overload heaters are properly sized, or the solid state overloads are properly set, and that MCP breaker settings are correct for the motor installed. Replace or adjust overloads and MCP breaker as required for complete and operable installation in compliance with the National Electrical Code.
5. Test insulation (megger test) of new and re-used motors in accordance with NEMA MG-1. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.
6. Provide additional motor testing per Section 26 08 00 – Electrical Tests.
7. Test for proper rotation prior to connection to the driven equipment.
8. Measure running current and evaluate relative to load conditions and nameplate full-load amperes.
9. Log recorded field measured running current. Submit for review. Final test forms shall be included in as-built O&M Manual.

END OF SECTION

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SECTION 26 08 00 ELECTRICAL TESTS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. This section specifies the WORK necessary to test, commission and demonstrate that the electrical WORK satisfies the criteria of this Specification and functions as required by the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All work specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 GENERAL

- A. The WORK of this Section includes furnishing the labor, equipment, and power required to support the testing specified in other sections of the specification. This scope of WORK may require the CONTRACTOR to activate circuits, shutdown circuits, and run equipment, make electrical measurements, replace blown fuses, install temporary jumpers, etc.
- B. The CONTRACTOR shall provide support to disconnect and reconnect cables and perform any other functions required to test electrical equipment at no extra cost to the AGENCY. CONTRACTOR is responsible for all WORK, equipment damage, power interruptions, and schedule delays caused by the testing agency.

1.4 SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
- B. Results of all testing shall be submitted to the ENGINEER prior to final project acceptance. Six (6) copies are required to be included as part of final Technical Manuals. Submittal shall describe test conditions, weather including temperature and humidity, test date, plant flows, duration of test, test equipment, tested equipment, testing technician, “as found” and “as-left” results, expected results, actual results, pass/fail status based on listed testing standards, and a registered Professional ENGINEER’s stamp and signature; registered in Electrical Engineering in the State of California.
- C. Specific data relative to insulation resistance, voltage levels, load currents, relay settings, dial settings, etc., shall be provided for all equipment and material required to be tested.

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- D. Test reports shall be based on NETA's latest Acceptance Testing Specifications having a sign-off, pass/fail data filed for each line item covered by NETA's Acceptance Testing Specifications latest edition.
- E. CONTRACTOR shall submit a testing plan for review and approval by the ENGINEER three (3) weeks prior to electrical testing. Plan shall outline in enough detail all items to be tested, the sequence, and duration. CONTRACTOR shall provide enough detail to verify that the test is meeting the specification requirements.

1.5 TESTING ORGANIZATION'S QUALIFICATION

- A. Field testing shall be performed by a separate and independent Subcontractor, who has been regularly engaged in the testing of equipment for a period of at least five (5) years. All testing shall be coordinated with testing by manufacturer's representatives.
- B. Testing equipment required to conduct the specified tests shall be furnished by the testing organization. Testing equipment shall be in good working condition and comply with the requirements of this Specification and applicable industry standards.
- C. Testing shall be done in accordance with the manufacturer's instructions, these Specifications, and applicable NETA Acceptance Testing Specifications, NEMA, ANSI, NFPA, and ASTM Standards. All testing shall be done in the presence of the ENGINEER, and forms shall include space for ENGINEER sign off at time of test.
- D. The testing organization shall cooperate with any manufacturer's representative that may be retained by the CONTRACTOR. Testing organization shall be NETA certified.
- E. The testing organization shall be responsible for testing of equipment listed below:
 - 1. Metering Panel and main breaker
 - 2. Manual Transfer Switch
 - 3. Circuit Breakers 100 amp and larger
 - 4. Panelboard and main breaker
 - 5. Cables
 - 6. System Grounding
 - 7. Miscellaneous Testing

1.6 TESTING

- A. The following test requirements are intended to supplement test and acceptance criteria that may be stated elsewhere:
 - 1. Metering and Main Disconnect – Test per latest NETA Standards. Also test Main Circuit Breaker and System Grounding at Metering Panel.

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2. Manual Transfer Switch – Test per latest NETA Standards.
3. Panelboard – Test per latest NETA Standards. Also test Main Circuit Breaker and System Ground at Panelboard.
4. Cables – Test per latest NETA Standards. Megger testing may be done by CONTRACTOR, witnessed by the AGENCY and ENGINEER. Refer to Section 26 05 19 for testing requirements.
5. System Ground – Test per latest NETA Standards, in two locations: Metering Panel and Panelboard.
6. Miscellaneous Testing – as listed below.
 - (a) CAT 6 cable test: Provide functional testing of installed CAT 6 cable. All CAT 6 cable will be Permanent Link tested with a Level III tester for full compliance with TIA/EIA Category 6 specifications, up to 500 MHz.
 - (b) Demonstrate that circuitry is in accordance with panel schedules.
 - (c) Perform overall system function tests upon completion of equipment tests. Verify correct operation of all interlock devices, alarms, sensing devices and indicating devices.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 TESTING

- A. All testing shall be witnessed and signed-off by the AGENCY and ENGINEER. Each test sheet must be signed-off prior to submittal.

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SECTION 26 24 16 PANELBOARD

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide the Lighting Panelboard "LP-1", complete and operable, in accordance with the Contract Documents.
- B. Provide arc flash label on exterior of Panelboard. Provide electrical hazard warning signs on exterior of Panelboard, per contract documents and latest edition of the National Electrical Code.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All WORK specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings
 - 1. Panelboard
 - (a) Breaker layout drawings with dimensions and nameplate designations
 - (b) Drawings of conduit entry/exit locations
 - (c) Assembly ratings including short circuit, voltage and current ratings
 - (d) Cable terminal sizes
 - (e) Product catalog cut sheets
 - (f) Installation information
 - (g) Panelboard schedule
 - (h) Seismic certification and equipment anchorage details
 - (i) O&M Manual

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PART 2 -- PRODUCTS

2.1 GENERAL

A. Panelboard

1. Panelboard shall be dead front factory assembled. Panelboards shall comply with NEMA PB-1-Panelboards, as well as the provisions of UL 50 - Safety Enclosures for Electrical Equipment and UL 67 - Safety Panelboards. Panelboard used for service equipment shall be UL labeled for such use. Lighting Panelboard "LP-1" shall be rated for 120/240 volt, 3 phase, 4 wire operation.
2. The manufacturer of the Panelboard shall be the manufacturer of the major components within the assembly, including circuit breakers.
3. Coordinate breaker sizes with submitted and approved equipment, including but not limited to HVAC equipment, gate actuators, and Traveling Screen system.

2.2 PANELBOARD

A. Requirements

1. Panelboard shall be designed, manufactured and tested in accordance with latest applicable standards of ANSI and NEMA. Products shall be UL listed and labeled. Products shall be rated for continuous operation.
2. Panelboard shall be NEMA 1 rated per Contract Drawings, suitable for wall mounting, and factory painted with ANSI 61 light grey color paint.
3. Provide nameplate on panelboard with voltage, number of phases, ampacity, short circuit rating, number of wires. Provide typed schedule within panelboard. Panelboard shall be surface mounted.

B. Construction

1. Panelboard shall be dead front factory assembled. Panelboard shall comply with NEMA PB-1-Panelboards, as well as the provisions of UL 50 - Safety Enclosures for Electrical Equipment and UL 67 - Safety Panelboards.
2. Panelboard shall be rated 120/240 volt, 200 amp bus, 3 phase, 4 wire operation. Panelboard shall have short circuit ratings not less than 22,000 amperes. Refer to Contract Drawings for further ratings and requirements. Provide with minimum 42 branch circuits, unless shown otherwise on Contract Drawings.
 - (a) Panelboard shall be surface mounted on wall. Line and loads side shall be bottom fed. Panelboard shall have copper bus bars.
 - (b) Panelboard shall have integral surge protection device.

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- (c) Breakers shall be one, 2, or 3 pole as indicated, with ampere trip ratings as required by the equipment. Breakers shall be quick-make and quick-break, inverse time trip characteristics, to trip free on overload or short circuit, and to indicate trip condition by the handle position.
 - (d) Circuit breakers shall be interchangeable and capable of being operated in any position as well as being removable from the front of the panelboard without disturbing adjacent units. Circuit breakers shall be bolt-on type. No plug-in type circuit breakers will be allowed.
 - (e) Provide with breaker lock out/tag out device for main breaker and two devices for each type of breaker based on number of poles; provide two lock out/tag out device for a single pole, a two pole, and a three pole breaker, and the main panelboard breaker. Lock out devices may be shipped separately or installed on at least the following breakers: Main Breaker, Gate Actuator breakers, two 2-pole breakers, and two 1-pole breakers.
 - (f) Provide typed panelboard schedule, located within interior window pocket.
- 3. Provide Panelboard with integral surge protection device (SPD). Provide a SPD for application within an ANSI/IEEE C62.41 Category A environment, 60 kA per mode, 120 kA per phase. Provide a LCD surge counter that indicates how many surges have occurred at the location. SPD shall be same manufacturer as Panelboard.
 - 4. Panelboard shall be as manufactured by **Cutler-Hammer Eaton Pow-R-Line 2a, Siemens, or equal.**

PART 3 -- EXECUTION

3.1 GENERAL

- A. All WORK of this Section shall be installed as indicated in Section 26 05 00.

3.2 INSTALLATION

- A. The CONTRACTOR shall install the Panelboard in accordance with the manufacturer's instructions. CONTRACTOR shall anchor the Panelboard in conformance with seismic criteria stated in Section 26 05 00 - Electrical Work, General. Conduit installation shall be coordinated with manufacturer's as-fabricated drawings so that conduit stub-ups are within the area allotted for conduit. Conduit shall be stubbed up in the section that contains the devices to which conductors are terminated.
- B. If stored at the Site, Panelboard shall be stored in a clean, dry space. Factory wrapping shall be maintained or an additional heavy plastic cover shall be provided to protect units from dirt, water, construction debris, and traffic.
- C. Torque bus bar bolts to manufacturer's recommendations. Tighten sheet metal and structure assembly bolts.

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- D. Prior to energizing, all equipment shall be cleaned, inspected for loose connections, checked out for electrical and mechanical operations, and phase-sequenced, and all circuits made free of any shorts of ground connections following field testing.

3.3 FIELD TESTING

- A. Visual and mechanical inspection after installation:
 - 1. Inspect for physical damage, proper anchorage, and grounding
 - 2. Check tightness of bolted connections.
- B. Provide electrical testing per Section 26 08 00 – Electrical Tests.

END OF SECTION

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SECTION 26 27 00 LOW VOLTAGE DISTRIBUTION EQUIPMENT

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall furnish all labor, materials, tools, equipment and services for supply, installation and wiring of the Metering Panel, Manual Transfer Switch, portable generator receptacle, and disconnect switches, as indicated in accordance with provisions of the Contract Documents. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
- B. The Metering Panel shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements. The Metering Panel shall comply with EUSERC and the serving electric utility (SCE) requirements and be rated for service entrance. Refer to utility specifications for further requirements.
- C. CONTRACTOR to verify with electric utility all service requirements including trenching details, metering compartment, etc.
- D. Provide arc flash labels and maximum available fault current (with calculation date) on exterior of Metering Panel. Provide electrical hazard warning signs on exterior of Metering Panel, Manual Transfer Switch, Traveling Screen Panel, and disconnect switches at gate actuators, per contract documents and latest edition of the National Electrical Code.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All WORK specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings shall include:
 - 1. Complete list of special tools required for the operation and maintenance of the unit.
 - 2. Bus ampacity, voltage rating and interrupting capacity.
 - 3. Certified outline drawings complete with dimensions, available space for conduits, cable terminations, bus terminations, weights.

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4. Equipment anchorage provisions meeting seismic requirements of IBC. Provide anchoring calculations.
 5. Metering Panel utility metering section complete with letter of acceptance by serving utility.
 6. Main Breaker catalog cut sheet.
 7. All components equipment data sheets and manufacturer catalog cut sheets.
 8. Manual Transfer Switch
 9. Portable Generator Receptacle with matching plug (reverse feed).
 10. Installation, instruction and testing bulletins for Metering Panel assembly. Submit factory testing forms, signed off by manufacturer.
 11. Complete one-line diagrams showing all metering equipment, main breaker, and lug information.
 12. Certified factory test report.
- C. **Operation and Maintenance Manuals:** The CONTRACTOR shall submit Operation and Maintenance Manuals for the Metering Panel in accordance with the requirements of Section 01330 – Submittals.

1.4 QUALITY ASSURANCE

- A. **General:** All materials shall be tested and inspected in accordance with Section 26 05 00 and the following requirements.
- B. Metering Panel shall be stored in a clean, dry space. Factory wrapping shall be maintained or a heavy plastic cover shall be provided to protect units from dirt, water, construction debris, and traffic. Storage space shall have heated or space heaters shall be energized.
- C. Factory Tests
1. Metering Panel and components shall be given manufacturer's standard electrical and mechanical production tests and inspections. The tests shall include electrical continuity check, dielectric tests for each circuit, and inspection for proper functioning of components including controls and protective devices.
 2. Perform an insulation resistance test on each bus section phase-to-phase and phase-to-ground, for one minute in accordance with NETA.
- D. **Environmental Conditions:** Metering Panel shall be designed for continuous duty service in the environmental conditions specified in Section 26 05 00 - Electrical Work, General.

1.5 MAINTENANCE AND GUARANTEE, WARRANTY

- A. The CONTRACTOR shall submit a recommended spare parts list.

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- B. The CONTRACTOR shall guarantee that the furnished equipment shall meet the requirements specified herein and specified elsewhere in the Contract Documents.
- C. The system warranty shall be 1 year starting when the equipment is commissioned. Warranty shall include all costs for repair, parts, travel and living expenses and on site labor.

PART 2 -- PRODUCTS

2.1 METERING PANEL

- A. Provide, install and field test NEMA 3R, Metering Panel per Contract Drawings. The Metering Panel shall include SCE approved metering section, and main disconnect circuit breaker. Metering Panel shall accept utility feeder either underground or overhead, and provide for underground load side feeder. Metering Panel shall include provisions for padlocking and for lock out tag out of main breaker. Include lock out tag out device with Metering Panel main disconnect device.
- B. CONTRACTOR responsible to provide electrical service and grounding per SCE requirements. Provide complete and operable electrical service from SCE distribution system to Control Building.
- C. Metering Panel shall be 200 amps, 120/240 VAC, three phase, 4 wire. Provide bonding and equipment ground connection, via grounding electrode conductor connected to ground rod, at Metering Panel. Metering Panel shall withstand 22,000 amperes minimum of symmetrical fault current at rated voltage, or as required based on arc flash study. Main Disconnect breaker size shall be as shown on Drawings.
- D. Metering Panel with Main Disconnects shall be **Eaton, Milbank**, or equal.

2.2 DISCONNECT SWITCHES

- A. Provide and install manual disconnect switch in NEMA 3R rated enclosure, three pole, 240 VAC, rated for up to 7.5 hp. Provide disconnect switches that can be locked in the "OFF" position. Provide switches having external marking clearly indicating "ON" and "OFF" positions.
- B. Provide disconnect switches with engraved, laminated nameplates (black background with white lettering) citing the name of the equipment serving, voltage, number of phase, and power source (distribution panel name and feeder circuit numbers).
- C. Disconnect Switches shall be **Square D Class 2510 KW2-H**, or equal.

2.3 MANUAL TRANSFER SWITCH

- A. Manual Transfer Switch (MTS) shall be minimum 200 amp, 4 pole, 240 VAC, minimum 22 kAICS, non-fusible, molded case type, manually operated transfer switch. MTS shall be UL rated. Front door must be opened to operate handle. Provide MTS with terminal lugs as required per cable sizes shown on drawings. MTS enclosure shall be NEMA 12, ANSI 61 light grey, wall mount surface type. Provide switch on normal source and breaker on emergency source.

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- B. Provide phenolic labels for handle positions inscribed: "UTILITY (NORMAL)" and "GEN RECEPTACLE (EMERGENCY)".
- C. MTS shall be **Eaton MT-H-X-KD-D-4-0225-W-J-U**, or equal.

2.4 PORTABLE GENERATOR RECEPTACLE, PLUG, AND PORTABLE CABLE

- A. Generator receptacle and plug shall be rated for 200 amps, 4 poles, 120/240V, 3 phase, plus grounding through shell, NEMA 3R/4, UL 1682, and minimum 22 kAICS. Mount receptacle with angle mounting box on side of Control Building. Provide matching plug, connected to portable generator power cords, as specified below. Receptacle and plug shall be reverse service type for generator application. Provide receptacle with spring door. Provide duct cap on plug.
- B. Generator receptacle and plug shall be **Emerson Appleton Powertite Reverse Service Receptacle with AJA Mounting Box, and Reverse Service Plug**, or equal.
- C. Provide 35' of portable generator power cord, rated minimum 200 amps, four conductors plus equipment grounding conductor, stranded copper, SO (or equivalent) outdoor type insulation, sunlight resistant, 90 degree C wet, 600 VAC rated, UL listed. Conductors shall be four #4/0 (minimum) with #4 AWG (minimum) ground, or larger. Connect generator plug to one end of power cord, with mechanical lugs on other end. Portable generator power cord shall be **Okonite FMR Okolon TS-CPE UL Type TC-ER**, or equal.

PART 3 -- EXECUTION

3.1 GENERAL

- A. All WORK of this Section shall be installed as indicated in Section 26 05 00.

3.2 INSTALLATION

- A. The CONTRACTOR shall install the equipment in accordance with the manufacturer's instructions. CONTRACTOR shall anchor the equipment in conformance with seismic criteria stated in Section 26 05 00 - Electrical Work, General. Conduit installation shall be coordinated with manufacturer's as-fabricated drawings so that conduit stub-ups are within the area allotted for conduit. Conduit shall be stubbed up in the section that contains the devices to which conductors are terminated.
- B. If stored at the Site, equipment shall be stored in a clean, dry space. Factory wrapping shall be maintained or an additional heavy plastic cover shall be provided to protect units from dirt, water, construction debris, and traffic.
- C. Torque bus bar bolts to manufacturer's recommendations. Tighten sheet metal and structure assembly bolts.
- D. Prior to energizing, all equipment shall be cleaned, inspected for loose connections, checked out for electrical and mechanical operations, and phase-sequenced, and all circuits made free of any shorts of ground connections following field testing.

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3.3 FIELD TESTING

- A. Visual and mechanical inspection after installation:
 - 1. Inspect for physical damage, proper anchorage, and grounding
 - 2. Check tightness of bolted connections.
- B. Provide electrical testing per Section 26 08 00 – Electrical Tests.

END OF SECTION

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SECTION 26 27 26 WIRING DEVICES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide wiring devices, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 26 05 00 - Electrical Work, General apply to this Section.
- C. **Single Manufacturer:** Like products shall be the end product of one manufacturer in order to achieve standardization of appearance, operation, maintenance, spare parts, and manufacturer's services.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All WORK specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings
 - 1. Complete catalog cuts of switches, receptacles, enclosures, covers, and appurtenances, marked to clearly identify proposed materials.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Devices shall carry the UL label.
- B. General purpose duplex receptacles and toggle switch handles shall be brown everywhere except in finished rooms where they shall be ivory. Special purpose receptacles shall have a body color as indicated. Receptacles and switches shall be specification grade and conform to NEMA WD-1, Federal Specifications W-C-596E and W-S-896E, respectively.

2.2 LIGHTING SWITCHES

- A. Local branch switches shall be toggle type, rated at 20 amperes, 120 VAC, and shall be **General Electric Cat. No. GE-5951-1** for single pole, **Hubbell, Leviton**, or equal.

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2.3 GENERAL PURPOSE RECEPTACLES

- A. Duplex receptacles rated 125 V, 20 amperes shall be polarized 3 wire type for use with 3 wire cord with grounded lead and one designated stud shall be permanently grounded to the conduit system (NEMA 5-20R). Duplex 120 V receptacles shall be **Hubbell 5362**, or equal. Single receptacles shall be **Hubbell 5361**, or equal.
- B. Ground-fault circuit interrupting receptacles (GFCIs) shall be installed at the locations indicated and as required by the NEC. GFCIs shall be duplex, specification grade. Ratings shall be 125 V, 20 amperes, NEMA WD-1, Configuration 5-20R, capable of interrupting 5,000 amperes without damage. Feed-through type GFCIs serving standard receptacles will not be permitted. GFCI's shall be **Hubbell GF-5362**, or equal.

2.4 ENCLOSURES AND COVERS

- A. Surface mounted switches and receptacles shall be in FS or FD type weatherproof conduit fittings.
- B. Switch and receptacle covers on surface mounted boxes shall be die cast copper-free aluminum, unless within Fiberglass Buildings or Sheds, in which case they will be PVC.
- C. In areas where cast boxes are used, switch and receptacle covers shall be **Crouse-Hinds Catalog No. DS185 and WLRD-1, or Adalet No. WSL and WRD**, or equal.
- D. Receptacles in wet locations or damp locations, shall be provided with a hinged metallic cover/enclosure marked "Suitable for Wet Locations when in use" and "UL Listed." There shall be a gasket between the enclosure and the mounting surface and between the hinged cover and mounting plate/base. The cover shall be **Hubbell**, or equal.

2.5 METER VAULT INTAKE FAN MANUAL MOTOR RATED SWITCH

- A. Provide manual motor rated starter horsepower rated switch, complete with thermal overloads sized for Intake Fan based on motor nameplate ratings. Switch to be single pole, rated 120 VAC, 60 Hz and 1 horsepower maximum. Provide manual motor starter in NEMA 4 enclosure with handle guard/lock off and red pilot light. Provide Nameplate inscribed "Intake Fan". Manual Motor Starter shall be **Square D Class 2510 Type FW1P**, or equal.

2.6 CONTROL BUILDING EXHAUST FAN MANUAL MOTOR RATED SWITCH AND THERMOSTAT

- A. Provide manual motor rated starter horsepower rated switch, complete with thermal overloads sized for Exhaust Fan based on motor nameplate ratings. Switch to be single pole, rated 120 VAC, 60 Hz and 1 horsepower maximum. Provide manual motor starter in NEMA 12 enclosure with handle guard/lock off and red pilot light. Provide Nameplate inscribed "Exhaust Fan". Manual Motor Starter shall be **Square D Class 2510 Type FW1P**, or equal. Switch may be installed in same enclosure as Hand-Off-Auto switch.
- B. Provide adjustable thermostat complete with cast device box for Exhaust Fan control. Thermostat shall be line voltage type, adjustable from 60° to 200° F and close a normally open contact when temperature rises above set point. SPST contact to be rated for 120 VAC and 15 amps. Thermostat shall be **Chromalox**, or equal.

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- C. Provide Hand-Off-Auto switch for exhaust fan control, in NEMA 12 enclosure. Switch to be **Allen-Bradley Bulletin 800 Type H, Square D Class 9001 Type K, Cutler-Hammer Type 10250T**, or equal. Hand-Off-Auto switch may be in same enclosure as motor rated switch.

2.7 HIGH TEMPERATURE SWITCHES

- A. Provide High Temperature Switches in Control Building for alarming. High Temperature Switches shall be in NEMA 12 enclosures, with adjustable temperature range from 25° F to 150° F. Switches to be SPDT, rated for 5 amps at 120 VAC. Temperature switch accuracy shall be at least +/- 6° F with deadband of 2° F to 12° F. All sensor materials and hardware shall be stainless steel. Enclosure to be polyurethane coated cast aluminum housing. High Temperature Switch shall be set to trip at 110° F. Wire switch's contacts to PLC Panel. Switches shall be separate from thermostats to control heating and ventilation systems. Switches to be **Raychem DigiTrace AMC-1B**, or equal.

2.8 INTRUSION SWITCHES

- A. Provide Intrusion switches on Control Building doors. Switches shall be magnetic type in NEMA 4X housing and shall be suitable for use on steel doors. Switches shall be closed when doors are closed. Wire switches in series at PLC Panel, such that when all doors are closed the circuit is closed. Switches shall be **GE Sentrol 341-BT-12J**, or equal.
- B. Meter Vault Hatch Intrusion Switches shall be of the mechanical type. All switches shall be UL listed. Mechanical switches shall be the lever arm with roller wheel type or plunger type suitable for installation on hatch. Switches shall be **Square D Class 9007**, or equal.

2.9 NAMEPLATES

- A. Provide nameplates or equivalent markings on switch enclosures to indicate ON and OFF positions of each switch.
- B. Provide light switch covers and receptacle covers with nameplates indicating circuit number. Refer to requirements of Section 26 05 00 – Electrical Work, General.

PART 3 -- EXECUTION

3.1 GENERAL

- A. Perform WORK in accordance with the National Electrical Code.

3.2 CONNECTION

- A. Rigidly attach wiring devices in accordance with National Electrical Code, and as indicated, avoiding interference with other equipment.
- B. Securely fasten nameplates using screws, bolts, or rivets centered under or on the device, unless otherwise indicated.

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3.3 GROUNDING

- A. Ground devices, including switches and receptacles, in accordance with NEC, Article 250, and Section 26 05 26 - Grounding.
- B. Ground switches and associated metal plates through switch mounting yoke, outlet box, and raceway system.
- C. Ground receptacles and their metal plates through positive ground connections to outlet box and grounding system. Maintain ground to each receptacle by spring-loaded grounding contact to mounting screw or by grounding jumper, each making positive connection to outlet box and grounding system at all times.

3.4 FIELD TESTING

- A. Provide electrical testing per Section 26 08 00 – Electrical Tests.
- B. Test each receptacle for polarity and ground integrity with a standard receptacle tester.
- C. Each field device shall be tested for functional operation after connection of external conductors and prior to equipment startup.

END OF SECTION

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SECTION 26 50 00 LIGHTING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide lighting fixtures, and accessories, complete and operable, in accordance with the Contract Documents.
- B. The CONTRACTOR shall provide, install, test and place into operation, a complete and functional lighting control system.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All WORK specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General
- B. Additional Specifications, Codes and Standards:
 - 1. ANSI
 - 2. TITLE 24 California Energy Commission

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
- B. Shop Drawings shall provide information on:
 - 1. Luminaries
 - (a) Catalog data sheets and pictures.
 - (b) Luminaire finish and metal gauge.
 - (c) Lens material, pattern, and thickness.
 - (d) Lamp type, location, and method of fastening.
 - (e) For light poles, submit finish, materials, dimensions, handhole locations, fixture attachments, reinforced concrete base design, and wind loading.

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2. Lamps
 - (a) Voltages.
 - (b) Foot-candle output and distribution pattern.
 - (c) Approximate life (in hours).
3. LED Drivers
 - (a) Input voltage and power factor.
 - (b) Temperature rating.
 - (c) Efficiency ratings.
4. Photocells
 - (a) Voltage and power consumption.
 - (b) Contacts and time delay.
 - (c) Operating levels.
 - (d) Enclosure type and dimensions.
 - (e) Temperature rating.

PART 2 -- PRODUCTS

2.1 LUMINARIES

- A. Specific requirements relative to execution of WORK of this section are located in the Luminaire Schedule on Drawings.
- B. Component Access: Accessible and replaceable without removing luminaire.
 1. Exterior and damp installations shall be UL Labeled: SUITABLE FOR WET LOCATIONS.
 2. When factory-installed photocells are provided, entire assembly shall have UL label.

2.2 POLES

- A. General
 1. Rating (with Luminaire): 100 mph steady winds, without incurred damage.
 2. Pole foundation depth and reinforcement shall be per Contract Drawings and as approved by pole manufacturer. CONTRACTOR responsible for final reinforced concrete pole base design.

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PART 3 -- EXECUTION

3.1 LUMINARIES

A. General

1. Install in accordance with manufacturer's recommendations.
2. Provide necessary hangers, pendants, and canopies.
3. Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building and to concrete pole bases required to safely mount.
4. Install plumb and level.
5. Mount Control Building interior lights directly on ceiling, unless shown otherwise. Mounting heights indicated for wall mounted are measured from bottom of luminaire to finished floor or finished grade, whichever is applicable.
6. Mount Control Building exterior light 6" above door frame to bottom of fixture, centered with door, unless shown otherwise.

B. Pendant Mounted

1. Provide swivel type hangers and canopies to match luminaires, unless otherwise indicated.
2. Space single stem hangers on continuous row luminaires normally 48 inches apart.
3. Provide twin stem hangers on single luminaires.

C. Pole Mounted

1. Provide cast-in-place concrete base.
2. Pole base to be installed above finished grade when the pole is located in areas subject to damage from vehicular traffic.
3. Poles shall be set on anchor bolts and secured with double nuts on each bolt. After fixture has been leveled and plumbed, the pole base shall be dry-packed with grout.

3.2 LAMPS

- ##### A. Provide in each fixture, the number and type for which the fixture is designed, unless otherwise indicated.

3.3 LIGHTING CONTROL

- ##### A. Outdoor fixtures shall have integral photocells that switch lights ON at dusk and OFF at dawn.

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- B. Provide toggle switch and weatherproof cover on each site light pole for operation, assuming photocell is permissive.

3.4 CLEANING FOLLOWING CONSTRUCTION

- A. Remove all labels and other markings, except UL listing mark.
- B. Wipe luminaires inside and out to remove construction dust.
- C. Clean luminaires' lens with antistatic cleaners only.
- D. Touch up all painted surfaces of luminaires and poles with matching paint type and color from manufacturer.

END OF SECTION

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SECTION 31 11 00 CLEARING AND GRUBBING

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials, and equipment and perform all operations necessary to complete all required clearing and grubbing work for areas within the work site as specified, shown on the Drawings, or as directed.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Construction Sequencing and Schedule Constraints: 01 11 14
- B. Fill and Compaction: 31 23 23

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 CLEARING AND GRUBBING

- A. Areas within the work site shall be cleared and grubbed of all trees, vines, stumps, including tap roots and lateral roots, roots, brush, rubbish, fences, and other unsuitable materials including buried irrigation pipe to be abandoned. Localized stripping of organics shall be performed as necessary to remove organics from native fill to be used as backfill in accordance with Section 31 23 23 – Fill and Compaction. Grubbing also includes filling holes and depressions which result from the clearing and grubbing operations below the ground surface or required subgrades with native fill in accordance with Section 31 23 23 – Fill and Compaction.
- B. No waste materials from the clearing and grubbing operation shall be incorporated into compacted backfill or embankments.
- C. The subgrade beneath all permanent structures and embankments shall be grubbed and cleared of all stumps, roots, and objectionable organic matter.
- D. Where directed by the ENGINEER, all work specified herein shall be accomplished by the CONTRACTOR prior to placement of construction stakes.
- E. All cleared, grubbed, and demolished materials shall become the property of the CONTRACTOR and shall be removed from the work site before the date of completion of Contract or otherwise disposed of as approved by the ENGINEER.
- F. Upon completion of the work, the CONTRACTOR shall perform all required clean-up operations as directed, including all excavation, backfill and grading to lines shown on the Drawings or as directed in order to leave affected areas in a condition satisfactory to the ENGINEER. No materials or debris shall be burned within the work site.

END OF SECTION

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SECTION 31 23 15 DEWATERING

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. Design, furnish, install, operate, monitor, maintain and remove a temporary dewatering system as required to lower and control water levels at least 5-feet below subgrades of excavations and to permit construction to proceed in the-dry.
- B. Furnish and maintain temporary surface water runoff control measures adequate to capture and remove surface water entering excavations.
- C. Retain the services of a professional engineer registered in the State of California to prepare dewatering system designs and submittals described herein.
- D. WORK shall include the design, equipment, materials, installation, protection, and monitoring of the performance of the dewatering system as required herein.
- E. Collect and properly dispose of all discharge water from the dewatering systems in accordance with all State, County, and Local requirements and applicable water quality standards. Under no circumstances shall water from dewatering systems be discharged into the existing or new sanitary sewer systems.
- F. Obtain and pay for all permits required for dewatering systems.
- G. Repair damage caused by dewatering system operations.
- H. Remove temporary surface water runoff control measures after the completion of the excavation and backfilling work, and when approved by the AGENCY'S REPRESENTATIVE.

1.2 RELATED WORK

Not used.

1.3 SUBMITTALS

- A. Dewatering system designs shall be prepared by a licensed professional engineer ("DEWATERING ENGINEER") retained by the CONTRACTOR and shall, as a minimum, comply with recommendations and/or requirements in the project's Geotechnical Investigation Report. The CONTRACTOR is responsible for investigating the soil and groundwater conditions at the site prior to submitting a dewatering plan. The CONTRACTOR shall submit the DEWATERING ENGINEER's and the dewatering subcontractor's qualifications for review and approval by the AGENCY'S REPRESENTATIVE and the Engineer of Record (AGENCY/ENGINEER).
- B. The CONTRACTOR shall submit a dewatering system design plan developed and signed and sealed by the DEWATERING ENGINEER. The plan shall include a description of the proposed

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dewatering system and include the proposed installation methods to be used for dewatering system elements and for observation wells. The plan shall include equipment, drilling methods, hole sizes, filter sand placement techniques, sealing materials, development techniques, the number and location of dewatering points and observations wells, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water away from the site to an adequate disposal area, etc. Include the dewatering system design calculations in the plan.

- C. The plan shall identify the anticipated area influenced by the dewatering system and address impacts to adjacent existing and proposed structures.
- D. Coordinate dewatering submittals with the excavation and support of excavation submittals. The dewatering submittal shall show the areas and depths of excavation to be dewatered.
- E. Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation. Do not proceed with any excavation or dewatering activities until the dewatering submittal has been reviewed and accepted in writing by the AGENCY/ENGINEER.
- F. Prior to excavation activities, the DEWATERING ENGINEER shall certify in writing that the dewatering system has been installed according to the accepted plan and that it is functioning properly. However, acceptance by the AGENCY/ENGINEER shall not relieve the CONTRACTOR of the responsibility for the adequacy of the dewatering system to achieve the required results.
- G. Include a written report outlining control procedures to be adopted if dewatering problems arise.
- H. Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.
- I. Insure compliance with all conditions of regulating permits and provide such information to the AGENCY/ENGINEER. Obtain written approval from the AGENCY/ENGINEER before discontinuing operation of the dewatering system.

1.4 REFERENCES

Not used.

1.5 QUALITY ASSURANCES

- A. Regulations: Perform all work in accordance with current applicable regulations and codes of all Federal, State and local agencies.
- B. The CONTRACTOR shall have at least 5 years of experience with work compatible to the WORK shown and specified, employing labor and supervisory personnel who are similarly experienced in this type of work.

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- C. The CONTRACTOR's DEWATERING ENGINEER shall be registered in the State of California and have a minimum of five (5) years of professional experience in the design and construction to-dewatering systems and shall have completed not less than five (5) successful dewatering projects of equal type, size, and complexity to that required for the work.

1.6 DESIGN REQUIREMENTS

- A. The CONTRACTOR is responsible for the proper design and implementation of methods for controlling surface water and groundwater.
- B. Prior to excavation, the CONTRACTOR shall lower the groundwater to at least 5-feet below the lowest excavation subgrade elevation. Additional groundwater lowering may be necessary beyond the 5-foot requirement, depending on construction methods and equipment used and the prevailing groundwater and soil conditions. The CONTRACTOR is responsible for lowering the groundwater as necessary to complete construction in accordance with the plans and specifications at no additional cost to the AGENCY.
- C. Design wells, well points and sumps, and all other groundwater control system components to prevent loss of fines from surrounding soils. Sand filters shall be used with all dewatering installations unless screens are properly sized by the CONTRACTOR's DEWATERING ENGINEER to prevent passage of fines from surrounding soils.
- D. The CONTRACTOR shall be responsible for damage to properties, buildings or structures, wet wells, sewers and other utility installations, pavements and work that may result from dewatering or surface water control operations.
- E. Design review and field monitoring activities by the AGENCY/ENGINEER shall not relieve the CONTRACTOR of its responsibilities for the work.
- F. Plan the wells to meet the requirements of Section 1.06.8 in the transverse and the longitudinal directions. Submit dewatering plan and calculations to identify the wells to be kept operational in front of, behind, and sides of the active excavation zone.
- G. The dewatering duration should be adequate to allow for soil to be exposed within the excavation bottom to adequately drain and attain stable moisture content prior to excavation.
- H. The groundwater level should be maintained an adequate distance ahead and behind the working area to prevent water from migrating into the excavation during pipeline installation.

1.7 DEFINITIONS

- A. Where the phrase "in the-dry" is used in this Section, it shall be defined as an excavation subgrade where the groundwater level has been lowered to at least 5-feet below the lowest level of the excavation, is stable with no ponded water, mud, or muck, is able to support construction equipment without rutting or disturbance and is suitable for the placement and compaction of fill material and pipe.

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PART 2 -- PRODUCTS

2.1 PIPING AND EQUIPMENT

- A. Pipe for observation wells shall consist of minimum 1-inch LD., Schedule 40 PVC pipe and machine slotted PVC wellpoints, maximum slot size 0.020-inches or as shown on the dewatering Drawings.
- B. Piping, pumping equipment and all other materials required to provide control of surface water and groundwater in excavations shall be suitable for the intended purpose.
- C. Standby pumping systems and a source of standby power shall be maintained at all sites

PART 3 -- EXECUTION

3.1 GENERAL

- A. Control surface water and groundwater such that excavation to final subgrade is made in-the-dry, the natural undisturbed condition of the subgrade soils are maintained, and softening and/or instability or disturbance due to the presence or seepage of water does not occur. All construction and backfilling shall proceed in the-dry and flotation of completed portions of work shall be prohibited.
- B. The method and timing of groundwater control shall be such that the groundwater shall be lowered to the required levels starting at a minimum of 48 hours prior to excavation. Achieving the required dewatering level only after excavation (e.g. sump pumping inside an initially wet trench bottom) is not permitted.
- C. Where groundwater levels are above the proposed bottom of the excavation level, a pumped dewatering system will be required prior to excavation, and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged.
- D. It is expected that the type of system, spacing of dewatering units and other details of the work will have to be varied depending on soil/water conditions at a particular location. Any such field changes or deviations shall be approved in writing by the DEWATERING ENGINEER and the AGENCY/ENGINEER.
- E. All WORK included in this Section shall be done in a manner which will protect adjacent structures and utilities and shall not cause loss of ground or disturbance to the pipe bearing soils, lateral pipe support soils, or to soils which support overlying or adjacent structures.
- F. Install, monitor and report data from observation wells. Evaluate the collected data relative to groundwater control system performance and modify systems as necessary to dewater the site in accordance with the Contract requirements.

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- G. Locate groundwater control system components where they will not interfere with construction activities adjacent to the work area or interfere with the installation and monitoring of observation wells. Excavations for sumps or drainage ditches shall not be made within or below slopes extending downward and out from the edges of existing or proposed foundation elements or from the downward vertical footprint of the pipe.

3.2 SURFACE WATER RUNOFF CONTROL

- A. Construct surface water runoff control measures, including dikes, ditches, sumps and other methods to prevent, as necessary, flow of surface water runoff into excavations and to allow construction to proceed without delay.

3.3 EXCAVATION DEWATERING

- A. At all times during construction, provide and maintain proper equipment and facilities to promptly remove and properly dispose of all water entering excavations. Excavations shall be maintained in-the-dry. Groundwater levels shall be kept at least 5-feet below the lowest excavation level.
- B. Excavation dewatering shall maintain the subgrade in a natural undisturbed condition and until the fill, structure or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
- C. Pipe, fabric, bedding, Controlled Low Strength Material (CLSM), Controlled Density Fill (CDF), or concrete shall not be placed in water or water shall not flow over item, or any unbalanced water pressure exerted over them for a minimum of two (2) days after their placement.
- D. Dewatering shall at all times be conducted in such a manner as to preserve the in place condition of the subgrade soils at the proposed bottom of excavation.
- E. If the subgrade of the trench or excavation bottom becomes disturbed due to inadequate dewatering or drainage, excavate below normal grade as directed by the AGENCY/ENGINEER and refill with structural fill, CLSM, CDF or other material as approved by the AGENCY/ENGINEER at the CONTRACTOR's expense.
- F. The initial dewatering plan may have to be modified to suit the variable soil/water conditions to be encountered during construction. This modification shall be designed by the DEWATERING ENGINEER and shall be accepted by the AGENCY/ENGINEER. Dewater and excavate, at all times, in a manner which does not cause loss of ground or disturbance to the pipe bearing soil or soil which supports overlying or adjacent structures.
- G. If the method of dewatering does not properly dewater the excavation as specified, install additional wells as required and do not place any pipe or structure until the readings obtained from the observation wells indicate that the groundwater has been lowered a minimum of 5-feet below the bottom of the final excavation within the excavation limits.
- H. Dewatering units used in the work shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from the dewatering system shall be continuous until pipe or structure is adequately backfilled. Stand-by pumps shall be provided.

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- I. Water entering the excavation shall be drained to a sump and pumped from the excavation to maintain a bottom free from standing water. Surface runoff water shall be collected in shallow ditches around the excavation and prevented from entering the excavated area.
- J. Prior to any excavation below the ground water table, place the dewatering system into operation to lower the ground water table as required and provide the AGENCY/ENGINEER proof that the dewatering system is operating as required. The dewatering system shall operate continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.
- K. The CONTRACTOR shall provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain dewatering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.
- L. Water removed from dewatering operations shall be disposed of in an approved area in accordance with local, state and federal requirements related to the discharge of dewatering water. Existing or new sanitary sewers shall not be used to dispose of dewatering.

3.4 WELL POINT SYSTEMS

- A. Where necessary, install a vacuum wellpoint system around the excavation to dewater the excavation. Each wellpoint and riser pipe shall be surrounded by a sand filter. Sand shall be of such a gradation that, after initial development of the wellpoints, the quantity and size of soil particles discharged shall be negligible. Wellpoint systems shall be capable of operating continuously under the highest possible vacuum.
- B. Installation of well point systems shall be in accordance with the accepted submittal in the presence of the AGENCY/ENGINEER. The installation shall be certified in writing by the DEWATERING ENGINEER that it complies with the design and that it is functioning properly.

3.5 DEEP WELLS

- A. Where necessary, install a deep well system around the excavation to dewater the excavation. Each well shall be surrounded by a sand or gravel filter with adequate gradation such that after development, the quantity and size of soil particles discharged are negligible. Sufficient number of wells shall be installed to lower the groundwater level to allow excavation to proceed in-the-dry.
- B. Installation of deep well shall be in accordance with the accepted dewatering system design plan submittal. The installation shall be certified in writing by the DEWATERING ENGINEER that it complies with the design and that it is functioning properly.

3.6 OBSERVATION WELLS

- A. Install observation wells to monitor and measure the success of the dewatering prior to commencement of excavations. The number and location of the monitoring wells should be adequate to demonstrate that the water table has been lowered to the required level as required under this Section or in accordance with the accepted dewatering system design

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- plan submittal. Monitor and verify adequately low groundwater levels beneath and around the excavated area until pipelines are completed and backfilled.
- B. Observation Well Locations and Depths:
1. A minimum of one well every 500 feet of pipe shall be installed within approximately 5-feet (+ 1-foot) of the pipe centerline, staggered in an alternating fashion on either side of the pipe to monitor performance of dewatering systems designed by the CONTRACTOR's DEWATERING ENGINEER.
 2. Observation wells required shall be installed to a depth of at least 10-feet below the deepest level of excavation, unless otherwise approved by the AGENCY/ENGINEER, and to whatever depth is necessary to indicate that the groundwater control system designed by the CONTRACTOR's DEWATERING ENGINEER is performing as intended. Additional observation wells may be required by the AGENCY/ENGINEER if deemed necessary to monitor the performance of the CONTRACTOR's groundwater control system.
 3. Locations and depths of observation wells are subject to approval by the AGENCY/ENGINEER.
- C. Protect the observation wells at ground surface by providing a lockable box or outer protective casing with lockable top and padlock. Design the surface protection to prevent damage by vandalism or construction operations and to prevent surface water from infiltrating.
1. Provide two copies of keys for each padlock to the AGENCY/ENGINEER for access to each well.
 2. Observation wells shall be developed so as to provide a reliable indication of groundwater levels. Wells shall be re-developed if well clogging is observed, in the event of apparent erroneous readings, or as directed by the AGENCY/ENGINEER.
 3. Submit observation well installation logs, top of casing elevation, and well locations to the AGENCY/ENGINEER within 24 hours of completion of well installation.
- D. Observation Well Maintenance
1. The CONTRACTOR shall maintain each observation well until pipelines are completed and backfilled. Clean out or replace any observation well which ceases to be operable before adjacent work is completed.
 2. It is the CONTRACTOR's obligation to maintain observation wells and repair or replace them at no additional cost to the AGENCY, whether or not the observation wells are damaged by the CONTRACTOR's operations or by third parties.
- E. Monitoring and Reporting of Observation Well Data
1. The CONTRACTOR shall begin daily monitoring of groundwater levels in work areas prior to initial operation of the dewatering system. Daily monitoring in areas where

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groundwater control is in operation shall continue until the time that adjacent pipelines are completed and backfilled and until the time that groundwater control systems are turned off.

2. The CONTRACTOR is responsible for processing and reporting observation well data to CWVD/ENGINEER on a daily basis. Data shall be provided to the AGENCY/ENGINEER on a form that includes the following information: observation well number, depth to groundwater, total depth of well, top of casing elevation, groundwater level elevation and date and time of reading.

3.7 REMOVAL OF SYSTEMS

- A. At the completion of the excavation and backfilling work, and when approved by the AGENCY/ENGINEER, all pipe, deep wells, wellpoints, pumps, generators, observation wells, other equipment and accessories used for the groundwater and surface water control systems shall be removed from the site. All materials and equipment shall become the property of the CONTRACTOR. All areas disturbed by the installation and removal of groundwater control systems and observation wells shall be restored to their original condition.
- B. Leave in place any casings for deep wells, wellpoints or observation wells located within the plan limits of pipelines or within the zone below '1 H:1 V planes extending downward and out from the downward vertical footprint of the pipe, or where removal would otherwise result in ground movements causing adverse settlement to adjacent ground surface, utilities installed pipe, or existing structures.
- C. Where casings are pulled, holes shall be filled with sand or cement slurry. Where left in place, casings shall be filled with cement grout and cut off a minimum of 3- feet below finished ground level.
- D. When directed by the AGENCY/ENGINEER, observation wells shall be left in place for continued monitoring. When so directed, cut casings flush with final ground level and provide protective lockable boxes with locking devices. The protective boxes shall be suitable for traffic and for any other conditions to which the observation wells will be exposed.
- E. Well abandonment or removal shall comply with all conditions of permits required for the dewatering systems and the County well abandonment requirements.

3.8 WATER DISPOSAL

- A. The CONTRACTOR shall be responsible to dispose of water removed from the excavations in such a manner that will
 1. Not endanger portions of work under construction or completed.
 2. Not cause any inconvenience to others working or residing near site.
 3. Not cause or contribute to a violation of water quality standards.
 4. Comply with the stipulations of required permits for disposal of water.

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5. Control runoff in all work areas including, but not limited to, excavations, access roads, parking areas, laydown, and staging areas. The CONTRACTOR shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.

B. Excavation Dewatering:

1. The CONTRACTOR shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
3. Drainage features shall be arranged and altered as required to avoid degradation of the final excavated surface(s).
4. The CONTRACTOR shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

C. The CONTRACTOR shall comply with best management practices as described in the storm water pollution prevention plan for the project. Dewatering fluids shall be disposed of in an approved area in accordance with local, state and federal requirements. Existing or new sanitary sewers shall not be used to dispose of dewatering water or surface runoff water.

D. Water removed from the dewatering operation and conveyed to a municipal separate storm sewer system or receiving water shall not cause or contribute to an exceedance of the current Colorado River Basin Water Quality Control Plan. The CONTRACTOR will be responsible for obtaining appropriate local, state and federal permits related to the discharge of dewatering water.

3.9 CORRECTIVE ACTION

- A. If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), the CONTRACTOR shall be responsible to perform the necessary work for remediation, repair or strengthening of foundation soil and damaged structure resulting from such inadequacy or failure by CONTRACTOR, at no additional cost to the AGENCY.
- B. As the CONTRACTOR obtains information about the soil and groundwater conditions in the field, the CONTRACTOR is responsible to update and revise the dewatering plan and dewatering system to continue to meet the requirements of this specification.
- C. All corrective actions and applicable repairs of damages caused by dewatering operations shall be completed immediately, at no cost to the AGENCY.

END OF SECTION

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SECTION 31 23 16 EXCAVATION

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials, and equipment and perform all operations necessary to complete all required excavation as specified, shown on the Drawings, or as directed.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Safety: Section 5.7 of the General Provisions
- B. Supplemental Safety Requirements: 01 35 23
- C. Clearing and Grubbing: 31 11 00.
- D. Dewatering: 31 23 15

1.3 SUBMITTALS

- A. Submit excavation and shoring drawings for worker protection in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit plans as required for work protection in excavations. Designs for shoring, bracing, sloping, or similar provisions shall bear the seal of a registered civil or structural engineer.

1.4 DISPOSAL OF EXCESS MATERIALS

- A. Unless otherwise specified, all suitable materials removed in contract excavation, or as much thereof as required, shall be used in the construction of embankments or for backfill. All additional excess shall be deposited within or adjacent to the Contract work area, with the exact location and grading requirements provided by the ENGINEER in the field. Unsuitable excavated material shall be disposed of in accordance with all Federal, State and Local laws.

1.5 DUST CONTROL

- A. All excavation shall be performed to comply with the Antelope Valley AQMD Rule 403 Fugitive Dust.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 EXCAVATION, GENERAL

- A. Excavations shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926 Subpart P-Excavations, CAL/SHA requirements, and the General Conditions.

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- B. Excavation is unclassified. Perform excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate excavation equipment within 3 feet of existing structures or newly completed construction. Excavate with hand tools in these areas.
- C. All excavation and embankment shall be graded to provide uniform surfaces to the lines and grades shown on the Drawings, or as specified, or as directed by the ENGINEER. Tolerances for finished earth line and grade elevations and thicknesses shall be as given below.
 - 1. All excavation or compacted embankment lines, including such lines for earthwork adjacent to concrete construction, shall have a tolerance of plus or minus 0.1 foot or be governed by concrete tolerances, whichever is more restrictive.
 - 2. All specified material thicknesses shall have a tolerance of plus 10 percent (+10%) or minus 5 percent (-5%).

3.2 EXCAVATION FOR PIPE TRENCHES

- A. Excavation for pipe trenches includes excavation for delivery pipelines and pipeline accessories. The CONTRACTOR shall perform all necessary excavation for pipelines to the required lines, grades, and depths, all in conformance with these Specifications and details shown on the Drawings, or as directed. All trench widths shall be of adequate width for proper pipe installation based upon the pipe trench details shown on the Drawings.
- B. Trench excavation shall include removal and disposal of all materials of whatever nature encountered, including all obstructions that would interfere with the proper construction and completion of the work, and shall include furnishing, placing, and maintaining all shoring necessary to safely support the sides of the excavation. The work shall also include all dewatering efforts in accordance with Section 31 23 15 - Dewatering. Wherever necessary or required for the convenience of the public or individual residents at street or highway crossings, at private driveways, or where parcels of land have been severed by the excavation, or elsewhere, the CONTRACTOR shall provide suitable temporary bridges over unfilled excavations, except in such cases where the CONTRACTOR shall secure the written consent of the individuals or authorities concerned to omit such temporary bridges. Not more than 2,000 feet of trench in any reach shall be open at any one time, nor shall more than a total of 4,000 feet of trench be open in the entire Contract work area. Subject to the determination of the ENGINEER, if any of the following conditions are encountered in pipe trench excavation, separate payment will be made in conformance with the General Conditions for required additional work authorized or directed by the ENGINEER:
 - 1. If the bottom of the pipe trench is in soft, unstable material, it shall be excavated below grade for the full width of the trench as directed and the below-grade excavation subsequently refilled with approved compacted materials.
 - 2. If the pipe trench is excavated in rock, hardpan, or other similar hard and unyielding material, or has rocks or cobbles which, in the opinion of the ENGINEER, will be detrimental to the pipe, the bottom of the trench shall be overexcavated 6 inches below grade, and said over-excavation refilled with approved compacted material.
 - 3. The assessment, by the ENGINEER, of unstable or unsuitable material will not be made until the material has been dewatered in accordance with Section 31 23 15 - Dewatering. If, after dewatering and excavation of the trench, it is determined that the pipe trench is

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in soft, unstable material, it shall be excavated below grade as directed by the ENGINEER and the below-grade excavation subsequently refilled with approved compacted materials. Payment for authorized removal and replacement of soft, unstable material will be made in accordance with the General Conditions.

4. If natural foundation or subgrade material is disturbed or loosened during the excavation process or otherwise, it shall be compacted to a degree satisfactory to the ENGINEER, or where directed, it shall be removed and replaced with approved material and compacted in accordance with requirements of Section 31 23 23 – Fill and Compaction and details shown on the Drawings, all at no additional cost to the AGENCY. Any and all excess excavation or over-excavation performed by the CONTRACTOR for any purpose or reason, except as may be authorized in writing by the ENGINEER, and whether or not due to the fault of the CONTRACTOR, shall be at the expense of the CONTRACTOR. Fill and compacting of fill for such unauthorized excess excavation or over-excavation shall be placed and compacted by and at the expense of the CONTRACTOR. Insofar as practicable, material excavated shall be used for backfill in accordance with Section 31 23 23 – Fill and Compaction; otherwise, it shall be wasted as directed. When water is encountered in the trench, it shall be removed by pumping or draining in accordance with Section 31 23 15 - Dewatering.
5. Grade bottom of trench by hand to specified line and grade, with proper allowance for pipe thickness and the sandbags that will support the pipe prior to backfilling with CLSM.
6. Excavate trench bottom and sides of ample dimensions to permit proper joining, welding (for welded steel pipe), visual inspection, and testing of entire joint.

3.3 EXCAVATION FOR STRUCTURES AND CONCRETE SLABS

- A. The CONTRACTOR shall perform all excavation required to construct or furnish and install structures or concrete slabs to the lines and grades as specified or shown on the Drawings or to such lines and grades as are directed by the ENGINEER. The CONTRACTOR shall prepare the foundations at structure sites by methods which will provide firm foundations for the concrete structures.
- B. At areas to receive concrete slabs, other than for structures, the surface soil shall be scarified to a depth of 12-inches, uniformly moisture conditioned in accordance with Section 31 23 23 – Fill and Compaction; and compacted to a minimum of 95% of the maximum density per ASTM D1557-12 methods.
- C. The bottom and side slopes of excavation upon or against which concrete is to be placed shall be finished to the prescribed dimensions, and the surfaces so prepared shall be moistened and tamped with suitable tools for the purpose of thoroughly compacting them and forming firm foundations upon or against which to place the concrete structures. The work shall also include all dewatering efforts in accordance with Section 31 23 15 - Dewatering. If at any point in excavation the foundation material is over-excavated, the over-excavation shall be filled with select materials and compacted in accordance with the requirements of Section 31 23 23 – Fill and Compaction. Any and all excess excavation or over-excavation performed by the CONTRACTOR for any purpose or reason, except as may be ordered in writing by the ENGINEER, and whether or not due to the fault of the CONTRACTOR, shall be at the expense of the CONTRACTOR. Fill and compacting of fill for such excess excavation or over-excavation shall be placed and compacted at the expense of the CONTRACTOR. Insofar as practicable, the material removed in excavation for structures shall be used for backfill and embankments

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in accordance with Section 31 23 23 – Fill and Compaction; otherwise, it shall be disposed of as indicated under Part 1 of this Section.

END OF SECTION

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SECTION 31 23 23 FILL AND COMPACTION

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials, and equipment and perform all operations necessary to complete all required earthwork, backfilling and compaction as specified, shown on the Drawings, or as directed. Included is placement and compaction of embankments, earthwork for all structures, backfill for pipe trenches, site grading, fencing, and all other required miscellaneous site work and earthwork.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Clearing and Grubbing: 31 11 00.
- B. Dewatering: 31 23 15
- C. Controlled Low Strength Material: 31 23 24

1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01 33 23 Submittal Requirements.
- B. All certifications, gradations, and source content for onsite materials proposed to be used in the WORK. Sample sizes shall be as determined by testing laboratory.
- C. Earth and Rock Materials:
 - 1. Description and location of proposed source(s) of each material.
 - 2. Test results documenting that the proposed materials conform to applicable Specification requirements.
 - 3. Delivery tickets showing source, type and weight of each load of material imported to the Site.
- D. Source(s) of imported materials must be approved by the AGENCY before material is delivered to the Site.
- E. Embankment and Backfill Construction Plan. Include the following as a minimum not less than seven (7) days prior to beginning fill placement operations.
 - 1. Obtain required approvals prior to the delivery of materials to the Project Site or the start of embankment or backfill placements, whichever occurs first.
 - 2. Planned sequence for construction of embankments and backfills.
 - 3. Planned sequence of constructing particular portions of embankments or backfills.

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4. Placement rates and planned equipment spread for material delivery, on-site handling and stockpiling, placing and compacting.
 5. Protection of completed embankments and backfills during prolonged shutdowns; preparation methods prior to resuming placement after prolonged shutdowns.
 6. Provide narrative with figures to illustrate the Plan.
- F. Quality Control Plan. The CONTRACTOR shall submit a Quality Control Plan for AGENCY approval. The Quality Control Plan shall identify the CONTRACTOR's methods for regulating tests, and inspecting its procedures, equipment, materials and personnel so that the completed product complies with the requirements of the Contract Documents. The Quality Control Plan shall address the following:
1. The CONTRACTOR shall only use an independent, established, commercial laboratory or laboratories approved by the ENGINEER. Laboratory facilities and personnel are to be in accordance with ASTM D 3740 and ASTM E 329 (soils).
 2. Earthwork Equipment: Type, size, number of units, and suitability for construction of the prescribed work.
 3. Grade and Cross Section: Surveys to verify that the dimensions, slopes, lines and grades conform to those shown on the Drawings.
 4. Test results for in-place materials. Frequency of testing as necessary to develop and manage operations and produce consistent embankments and backfills meeting Specification requirements.
 - (a) Gradation: ASTM D 422.
 - (b) Plasticity index: ASTM D 4318.
 - (c) Classification: ASTM D 2487.
 - (d) Determination of Sand Equivalent Value of Soils and Fine Aggregate: ASTM D 2419.
 - (e) Field dry density of non-free draining soils: use either ASTM D 1556 or ASTM D 6938. In case of differing results, ASTM D 1556 shall govern.
 - (f) Field dry density of free draining soils: ASTM D 2922.
 - (g) Moisture content: ASTM D 2216, ASTM D 6938 or ASTM D 4643. In case of differing results, ASTM D 2216 shall govern.
 - (h) Maximum dry density of free draining soils: ASTM D 4253.
 - (i) Maximum dry density of non-free draining soils: ASTM D 1557.
 - (j) Optimum water content of non-free draining soils: ASTM D 1557.
 - (k) Provide interpretation of passing or failing test results; in the event of a failed test, provide results of retests after corrective measures are taken.

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5. Test results of imported materials for in-place materials. Provide one complete set of test results for each 100 tons of material delivered to the Site.
6. Submit results of in-place tests within 24 hours of test or measurement performance.
7. Line and grade measurements confirming clearing, stripping, excavation and embankment and backfill limits.

1.4 DISPOSAL OF EXCESS MATERIALS

- A. Unless otherwise specified, all suitable materials removed in contract excavation, or as much thereof as required, shall be used in the construction of embankments or for backfill. All additional excess or unsuitable excavated material shall be disposed of in accordance with all Federal, State and Local laws.

1.5 DUST CONTROL

- A. All WORK shall be performed to comply with the Antelope Valley AQMD Rule 403 Fugitive Dust.

PART 2 -- PRODUCTS

2.1 MATERIALS

- A. Native materials used for backfill and embankment construction will not be classified. Embankment and backfill material shall consist of suitable native material from Contract excavation, and the material shall be free of trash, organic matter or other debris. CONTRACTOR is responsible for selectively separating, stockpiling, and transporting suitable embankment and backfill material from required excavations for use in embankment construction and backfill.
- B. Controlled Low Strength Material shall be as specified in Section 31 23 24 – Controlled Low Strength Material.

PART 3 -- EXECUTION

3.1 COMPACTION AND MOISTURE CONDITIONING

- A. Laboratory Density Determination - For cohesive materials, the maximum laboratory density at optimum moisture content will be determined by test methods in conformance with ASTM D1557-12. For cohesionless materials, the relative density shall be based on the following formula, wherein the maximum density is the highest dry unit weight of the soil (determined by test methods in conformance with ASTM D4253-06) and the minimum density is the lowest dry unit weight of the soil (determined by test methods in conformance with ASTM D4254-06), and the in-place density is the dry unit weight of the soil in place (determined by test methods in conformance with ASTM D4914-08):

$$\text{Rel. Den.} = (\%) \frac{\text{max. den.} \times (\text{in - place den.} - \text{min. den.})}{\text{in - place den.} \times (\text{max. den.} - \text{min. den.})} \times 100$$

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B. Compaction Requirements

1. In all cases, compaction equipment and methods shall be adequate for and consistent with achieving the specified degree of compaction. Unless otherwise specified or directed, a minimum of 95 percent of the laboratory standard maximum density for cohesive materials and a minimum relative density of 70 percent for cohesionless materials will be required.
2. When compacting cohesionless material containing some clays and silts, the material shall be tested using the procedures described in Paragraph A above, utilizing whichever method results in the higher dry density of the compacted material in the placement.

- C. Moisture Conditioning - Unless otherwise stated or directed, prior to and during compaction operations, the materials shall have a moisture content of not more than 2 percentage points wet or 3 percentage points dry of optimum moisture content, and the moisture content shall be uniform throughout each layer. If the moisture content is less than the approved requirement, compaction operations shall not proceed until the CONTRACTOR has added the necessary amount of water. If the moisture content is greater than the approved requirement, compaction operations shall not proceed until such time as the materials have dried sufficiently or have been otherwise mechanically dewatered or replaced with materials having the approved moisture content. The term "moisture conditioning," as used in the Specifications, is defined to refer to the above methods of obtaining an approved moisture content for materials to be compacted. Included under moisture conditioning requirements are the furnishing of all required water and the furnishing of all other necessary labor, materials, and equipment required to provide the approved percent of moisture content. Moisture conditioning, where required, shall be performed for all materials specified to be compacted regardless of whether or not such requirement is specifically stated.

3.2 BACKFILL

- A. When the material has been conditioned as specified under Paragraph 3.1, it shall be compacted by rollers or by hand or power tampers. Where hand or power tampers are used to compact soils in confined areas, such as under pipe, they shall be equipped with suitably shaped heads to obtain the required density. The thickness of each horizontal layer after compaction shall not be more than 4 inches for hand or power tampers, and 8 inches for roller equipment.
- B. Backfill in Pipe Trenches - Flexible pipes derive essentially all of their external load-carrying capacity from the interaction of the pipe with the embedment soils. During the installation and trench consolidation processes these types of pipes will deflect slightly to accommodate these actions resulting in a small deformation of the geometry that in turn creates a state of static equilibrium.

When supports such as trench sheeting, trench jacks, trench shields or boxes are used, the Contractor shall employ procedures that maintain the support of the pipe and its embedment is throughout the installation process. Sheeting shall be sufficiently tight so as to prevent washing out of the trench wall from behind the sheeting. Unless otherwise directed by the ENGINEER, sheeting driven into or below the bedding zone shall be left in place to preclude any loss of support of the foundation and embedment materials. When the CONTRACTOR chooses to cut off the top of the sheeting, this cut shall be made at least 1.5 feet above the

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crown of the pipe. Rangers, whalers, and braces shall be left in place to support the cut off sheeting.

Movable trench wall supports shall not be used below the top of the pipe zone unless approved methods are used for maintaining the integrity of the embedment material for both rigid and flexible pipes. Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. As supports are moved, finish placing and compacting the embedment. All voids shall be filled immediately upon removal of these supports.

When excavating while depressing the groundwater level, the CONTRACTOR shall maintain the temporary surface of the water is at least 5.0 feet below the bottom of the trench at all times to prevent washout from behind the sheeting or sloughing of the exposed trench walls. Control of the water level below the bottom of the trench shall be maintained before, during, and after pipe installation, and until the embedment is installed and sufficient backfill has been placed to prevent flotation of the pipe. To preclude loss of soil support from the native materials' original measured values, the dewatering methodology shall employ techniques that minimize the removal of fines and the creation of voids in the in-situ materials.

1. Trench Backfill Zones – Pipe trenches for the Project are divided into zones (1) Bedding Zone, (2) Pipe Zone, and (3) Trench Zone. The backfill requirements for each trench zone are listed below.

(a) **Bedding Zone** – The bedding requirements for the various pipe type options are as follows:

(1) Pipe bedding for pipes shall be Controlled Low Strength Material (CLSM), furnished in accordance with Section 31 23 24 – Controlled Low Strength Material, and placed to the limits below the pipe invert as shown on the Drawings. The trench for these pipe types shall be over-excavated to the limits shown on the drawings and the pipe installation shall require sand bag supports to provide the required depth below the pipeline. See installation requirements in the Specifications.

(b) **Pipe Zone** – The pipe zone is defined as the portion of the trench from the pipe invert to the top of pipe.

(1) The pipe zone backfill material for all pipe types shall be Controlled Low Strength Material (CLSM), furnished in accordance with Section 31 23 24 – Controlled Low Strength Material, and placed to the limits shown on the Drawings.

(c) **Trench Zone** - Backfill in pipe trenches shall be placed to the required level of the top of trench, or original ground surface, or as otherwise directed by the ENGINEER or shown on the Drawings. Prior to backfilling, the excavated area shall be cleaned of all trash and debris. All materials in this zone shall free from rocks, hard lumps, and clods greater than 5 inches in diameter. Backfill shall be compacted to the limit lines shown on the Drawings, or as specified herein. The CONTRACTOR shall take all necessary precautions to prevent water from flooding the trenches. Unless otherwise directed, pipe trenches shall be backfilled within 48 hours after the time the pipe has been installed; provided, however, that no backfilling shall be performed until trenching and pipe installation have been approved. Sufficient over-backfill shall be placed as directed to compensate for subsequent settlement or shrinkage of fill material. Pipe trench backfill under all structures or compacted

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embankments shall be consolidated or compacted for the full height of the trench or to the bottom of embankment or to other limits if so shown. Methods of placement of compacted backfill shall be in conformance with applicable requirements specified for backfill about structures under Paragraph 3.3C.

- (d) Final Grading and Restoration - As shown on the drawings and as directed by the ENGINEER, the CONTRACTOR shall perform all pipe-related final grading/restoration work.

C. Structure Backfill

- 1. Prior to backfilling any structure, all forms shall be removed and the excavation to be backfilled shall be cleaned of all trash and debris. The backfill material shall contain no rocks larger than 5 inches in diameter. The CONTRACTOR shall place all backfill about structures to the lines shown on the Drawings or as directed. Backfill shall be brought up uniformly about any structure, and at no time during backfilling operations shall the differential elevation at the top of backfill on any two sides of a structure exceed 2 feet.

3.3 EMBANKMENT FILL

- A. General Requirements - Embankments shall be built in approximately horizontal layers carried across the entire width of the embankment to the required slopes. Embankments shall not be widened with loose material dumped from the top. The CONTRACTOR's operations in the excavation of materials for embankments shall result in an acceptable gradation of materials to provide for stability when compacted. The maximum dimensions of rocks placed in embankments shall not exceed 5 inches. Rocks and indurated material larger than 5 inches shall be removed prior to compacting operations.
- B. Preparation of Surfaces Beneath Embankments – The entire ground surface (foot print) under all compacted embankments shall be thoroughly scarified or plowed, wetted or dried, and compacted as described in this paragraph or as shown on the Drawings. Unless otherwise shown on the Drawings or specified elsewhere, the foot print of embankments shall be scarified or plowed to a depth of not less than 12 inches, wetted or dried, and compacted to a depth of 12 inches below original ground surface in accordance with Paragraph 3.1. Where the existing ground surfaces beneath permanently constructed embankments contain unsuitable materials, as determined by the ENGINEER, the CONTRACTOR shall strip these areas of such unsuitable materials to a depth as directed by the ENGINEER. Removed material shall be disposed of as provided under Paragraph 1.4. All depressions or holes in the foundations of compacted embankments, whether caused by removal of debris, unacceptable materials or other conditions, shall be backfilled with approved material and compacted to a level surface before the construction of overlying embankment layers.
- C. Compacted Embankments - When the embankment fill has been moisture conditioned as specified under Paragraph 3.1, it shall be compacted by equipment that is suitable for the type of material being placed. In general, coarse grained sands and gravels will require compaction with smooth-drum, vibratory rollers, and fine-grained materials will require compaction with sheeps-foot rollers. The CONTRACTOR shall demonstrate to the ENGINEER that the selected compaction equipment is suitable for the proposed use and achieves the required densities. No hydro-compaction of embankments will be allowed. Approved embankment materials shall be deposited in horizontal layers with a maximum thickness of 8 inches after

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compaction. Embankment areas immediately adjacent to structures shall be compacted by hand equipment in horizontal layers with a maximum thickness of 4 inches after compaction. The layers shall be brought up in the full required width from the bottom of the embankment to avoid widening lower edges after the center has been brought up to grade.

3.4 SITE GRADING

- A. Perform earthwork to the lines and grades shown on the Drawings. Shape, trim, and finish tops and slopes of embankments to conform to the lines, grades, and cross sections as shown on the Drawings.
- B. Aggregate base surfacing for embankments shall be 3/4-inch Class 2 aggregate base, in conformance with Section 26 of the Caltrans Standard Specifications.

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SECTION 31 23 24 CONTROLLED LOW STRENGTH MATERIAL

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials, and equipment for furnishing and placing Controlled Low Strength Material (CLSM), complete and in place, in accordance with the Contract Documents.
- B. CLSM Options - The CONTRACTOR may use imported and/or native aggregate materials conforming to ASTM C 33; or the CONTRACTOR may use native soils not conforming to ASTM C 33.
 - 1. **CLSM** – For the purposes of this Specification, the acronym CLSM is defined as Controlled Low Strength Material consisting of imported and/or native (if available) aggregate conforming to ASTM C 33. The CONTRACTOR must make its own determination as to the availability of native soils that would conform to ASTM C 33 with and/or without screening.
 - 2. **Native Soil CLSM** – As an alternative to CLSM (as defined above) the CONTRACTOR may, at its discretion, elect to manufacture CLSM from native soils consisting of aggregates not conforming to ASTM C 33. For the purposes of this Specification, “native soil” is defined as soil material excavated from the Project site including soil material excavated from the pipeline trench during construction. However, the term “native soil”, as used herein, does not include bedrock materials or organic top soils that may be present in the trench at various locations along the pipeline alignment. Bedrock or organic materials shall not be used for the manufacture of Native Soil CLSM unless approved in advance by the ENGINEER. Native Soil CLSM is further described by the American Concrete Institute (ACI) in publications ACI 116R and ACI 229R. The CONTRACTOR must make its own determination as to availability of suitable native soils.
- C. As stated above, CONTRACTOR shall make its own determination as to the availability of suitable native materials for CLSM or Native Soil CLSM. If the need arises for the import of suitable aggregate to meet the specified requirements for pipe backfill, said need shall not be the basis for any claim.
- D. CLSM or Native Soil CLSM shall be placed where indicated and may be used, if the ENGINEER approves, for the following purposes:
 - 1. CLSM and Native Soil CLSM with high slump, non-segregating consistency that readily flows and fills voids and difficult to reach places.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Fill and Compaction: 31 23 23

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1.3 CONTRACTOR SUBMITTALS

- A. Submittals shall be furnished in accordance with Section 01 33 23 Submittal Requirements.
- B. Shop Drawings:
 - 1. CLSM and Native Soil CLSM mix designs which show the proportions and gradations of all materials to be used for each type of CLSM indicated. Each mix design shall be accompanied by independent laboratory test results of the indicated properties.
 - 2. If the CONTRACTOR proposes to provide lower strength Native Soil CLSM with aggregates that do not conform to ASTM C 33 - Concrete Aggregate, Shop Drawings shall include a testing program that will be used to control the variability of the aggregates. The testing program shall be acceptable to the ENGINEER. CONTRACTOR shall submit a proposed mix design for the Native Soil CLSM prior to construction.
 - (a) Submit laboratory tests demonstrating that laboratory-mixed Native Soil CLSM conforming to the proposed mix design, using the proposed native soil source, meet the performance requirements, including 7-day and 28-day strength. Samples of the native soil shall be collected to demonstrate to the ENGINEER's satisfaction that the full variability of the source material has been represented by the laboratory testing program. For each sample of the native soil source material, the laboratory results should include sieve analysis of the Native Soil per ASTM D422, Plastic and Liquid (Atterberg) Limits of the native soil per ASTM D4318, and 7-day unconfined compressive strength of the mix per ASTM D4832. The mix design shall indicate in detail how the proposed field equipment will be calibrated, and controlled, in order to achieve the intended mix design.
 - 3. Provide a submittal showing the proposed methods to support the pipe during CLSM or Native Soil CLSM placement.

1.4 QUALITY ASSURANCE

- A. A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related adjacent work.
- B. All testing shall be performed and paid for by the CONTRACTOR, except that the AGENCY's Representative may perform separate quality assurance testing at its discretion.
- C. If tests of the CLSM or Native Soil CLSM show non-compliance with the Specifications, the CONTRACTOR shall make changes as may be required to achieve compliance. Performing and paying for subsequent testing to demonstrate compliance shall be the CONTRACTOR's responsibility.
- D. Correlation Tests
 - 1. The CONTRACTOR shall perform a field correlation test for each mix of CLSM or Native Soil CLSM used in pipe zone, trench zone, or backfill used in amounts greater than 100 cubic yards or when CLSM or Native Soil CLSM is required to support traffic or other live loads on the fill less than 7 days after placing CLSM or Native Soil CLSM.

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2. Field correlation tests shall be performed in a test pit similar in cross section to the WORK and at least 10-feet long at a location near the Work. The proposed location shall be acceptable to the ENGINEER.
3. Laboratory and field tests shall be performed on samples taken from the same CLSM or Native Soil CLSM batch mix. All tests shall be performed by a laboratory at the CONTRACTOR's expense.
4. Testing shall be performed at the end of 24 hours and subsequently until it reaches design strength.
 - (a) Compression testing shall be in accordance with ASTM D 4832 - Preparation and Testing of Soil-Cement Slurry Test Cylinders.
 - (b) Setting test shall be in accordance with ASTM C 403 - Time of Setting of Concrete Mixtures by Penetration Resistance
 - (c) Density tests shall be in accordance with ASTM C 138 - Unit Weight, Yield and Air Content (Gravimetric) of Concrete.
- E. Provide a daily report of CLSM and Native Soil CLSM construction in a format selected by the AGENCY's REPRESENTATIVE, including the following information:
 1. Total station to station range of CLSM or Native Soil CLSM placement for the day.
 2. A list of soil samples and cylinders collected during the day, identified by station. Two station numbers shall be provided for each sample: 1) the station number at which CLSM or Native Soil CLSM was being placed at the time the sample was collected, and 2) the approximate station number from which the source soil for the mix was obtained.
 3. Results of all field testing, including the station number at the location where the equipment was operating during sampling, the time of sampling, and the test parameters.

1.5 SAMPLING AND TESTING DURING CONSTRUCTION – FOR NATIVE SOIL CLSM

- A. During Native Soil CLSM placement, the CONTRACTOR shall take samples under the observance of the AGENCY's REPRESENTATIVE and perform tests to determine compliance with the product requirements.
- B. Perform field sampling and testing as follows:
 1. One sample event per day or per 200 feet or 200 cubic yards of trench backfill, whichever is more frequent.
 2. Each Sample event shall consist of:
 - (a) Four 3x6 cylindrical test specimens collected and prepared in accordance with ASTM D4832 and ASTM D5971. The specimens shall be labeled with the date and time of collection, and corresponding pipeline station number.
 - (b) Soil sample in 1-gallon bags.

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3. Perform additional flow-ability tests whenever requested by the ENGINEER. In general, additional testing will be requested when it appears visually that the flow-ability of the CSLM is outside of typical range for the material.
4. Perform additional sample events when requested by the ENGINEER. These additional sampling events may be requested in response to changes in native soil condition, changes in the consistency of the CSLM mix, or to evaluate non-conforming conditions. Additional sampling events may be requested at the start of construction, or when the construction procedure changes.
5. Provide an appropriate location for on-site storage of cylinders for at least 4 days meeting the requirements of ASTM D4832. Store the 1-gallon bags of soil in a protected environment. Store all cylinders and soil until collected by the AGENCY's REPRESENTATIVE, or directed by the AGENCY's REPRESENTATIVE to discard them.

PART 2 -- PRODUCTS

2.1 CONTROLLED LOW STRENGTH MATERIAL

- A. CSLM or Native Soil CSLM shall be a mixture of cement, pozzolan, coarse and fine aggregate, admixtures, and water, mixed in accordance with ASTM C 94 - Ready Mixed Concrete. Admixtures must be approved in advance by the ENGINEER.
- B. Native soils that conform to ASTM C 33 may be used in CSLM mix as long as it meets the requirements of this section.
- C. Native soils that do not conform to ASTM C 33 may be used in Native Soil CSLM mix as long as it meets the corresponding requirements of this section
 1. The definition of "native soil" includes soil material excavated from the pipeline trench during construction.
 2. The definition of "native soil" does not include bedrock materials or organic top soils that are anticipated to be present in the trench at various locations along the pipeline alignment.
- D. Composition: The following parameters shall be within the indicated limits and as necessary to produce the indicated compressive strengths.
 1. Mix proportions as necessary
 2. Entrained air content shall be between 0 percent minimum and 6 percent maximum.
 3. Water reducing agent content as necessary
- E. Properties
 1. Density shall be between 120 PCF minimum and 145 PCF maximum

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2. Slump shall be as required by the CONTRACTOR's methods, but shall not promote segregation nor shall slump exceed 10 inches.
3. Compressive strength at 28 days:
 - (a) CLSM and Native Soil CLSM: Between 50 psi minimum and 150 psi maximum.

2.2 CEMENT

- A. Cement shall be Type II or V in accordance with ASTM C 150 - Portland Cement.

2.3 POZZOLAN

- A. Pozzolan shall be Type F or C in accordance with ASTM C 618 - Flyash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete. Pozzolon content, by weight, shall not exceed 25% of the cement content.

2.4 AGGREGATE

- A. **CLSM** - Aggregate shall consist of a well graded mixture of crushed rock, soil, or sand, with a nominal maximum size of 3/8-inch. One hundred percent shall pass the 1/2-inch sieve; no more than 30 percent shall be retained on the 3/8-inch sieve; and no more than 12 percent shall pass the number 200 sieve. If more than 5 percent of the aggregate passes the number 200 sieve, the material passing the number 200 sieve shall have a plasticity index of less than 5 and a liquid limit less than 20, when tested in accordance with ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils. All aggregate shall be free from organic matter and shall not contain more alkali, sulfates, or salts than the native materials at the Site.
- B. **Native Soil CLSM – CONTRACTOR'S Option** – Native soil and/or aggregate shall consist of a well graded mixture of crushed rock and soil. One hundred percent shall pass the 1-1/2-inch sieve; no more than 10 percent shall be retained on the 1-inch sieve; no more than 30 percent shall be retained on the 3/8-inch sieve; and the CONTRACTOR shall determine the allowable percentage passing the number 200 sieve. If more than 5 percent of the soil material passes the number 200 sieve, the material passing the number 200 sieve shall have a plasticity index of less than 5 and a liquid limit less than 20, when tested in accordance with ASTM D 4318 - Liquid Limit, Plastic Limit, and Plasticity Index of Soils. All aggregate shall be free from organic matter and shall not contain more alkali, sulfates, or salts than the native materials at the Site.

2.5 ADMIXTURES

- A. Air entraining admixtures shall be in accordance with ASTM C 260 - Air-Entraining Admixtures for Concrete.
- B. Water reducing admixtures shall be in accordance with ASTM C 494 - Chemical Admixtures for Concrete.

2.6 WATER

- A. Water shall be potable, clean, and free from objectionable quantities of silt, organic matter, alkali, salt, and other impurities.

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PART 3 -- EXECUTION

3.1 PREPARATION

- A. Subgrade and compacted fill to receive CLSM and Native Soil CLSM shall be prepared in accordance with Section 31 23 23 – Fill and Compaction.

3.2 BATCHING, MIXING AND DELIVERY

- A. Batching, mixing, and delivery of CLSM and Native Soil CLSM shall conform to ASTM C 94 and in accordance with recommendations of ACI 229R as applicable. CLSM and Native Soil CLSM shall be mixed at a central batch plant or a pug mill acceptable to the ENGINEER. Mixing CLSM and Native Soil CLSM in ready-mix trucks will not be acceptable.
- B. CLSM and Native Soil CLSM may be batched by at a central concrete plant and mixed and delivered to the jobsite by means of transit mixing trucks, or may be produced onsite with approved portable batching equipment operated by qualified personnel .
- C. Equipment calibration, to adjust cement dosage rate, must be performed prior to starting work, and whenever requested by the AGENCY's REPRESENTATIVE to evaluate suspected or known non-conformance, or at least monthly. The CONTRACTOR shall notify the AGENCY's REPRESENTATIVE at least 24 hours prior to performing any calibration.

3.3 PLACEMENT

- A. Where indicated on the Drawings, pipe bedding and pipe zone backfill material shall be CLSM or Native Soil CLSM, as specified, and placed to the limits indicated on the Drawings.
- B. CLSM and Native Soil CLSM shall be placed by tailgate discharge, conveyor belts, pumped, or other means acceptable to the ENGINEER. CLSM and Native Soil CLSM shall be directed in place by vibrator, shovel, or rod to fill all crevices and pockets. Avoid over-consolidation which causes separation of aggregate sizes.
- C. CLSM and Native Soil CLSM shall be continuously placed against fresh material unless otherwise approved by the ENGINEER. When new material is placed against existing CLSM or Native Soil CLSM, the placement area shall be free from all loose and foreign material. The surface of the existing material shall be soaked a minimum of one hour before placement of fresh material but no standing water shall be allowed when placement begins.
- D. Temperature of the CLSM and Native Soil CLSM shall be between 50 and 90 degrees F, when placed. CLSM and Native Soil CLSM shall not be placed when the air temperature is below 40 degrees F. No CLSM or Native Soil CLSM shall be placed against frozen subgrade or other materials having temperature less than 32 degrees F.
- E. Use sufficient shores or other supports to prevent soil from caving onto pipe. Remove soil fallen into trench before placing CLSM and Native Soil CLSM.
- F. Ensure the trench bottom is smooth and regular before placing the pipe.

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- G. Remove all loose soil, rubbish, organic material, or other deleterious material from the trench prior to placing CLSM and Native Soil CLSM.
- H. For flowability, CLSM and Native Soil CLSM shall be placed on one side of the pipe and allowed to flow under until it rises to the level of at least $0.15 \times D$ above the bottom of the pipe, where D is the diameter of the pipe, before placing additional material on that side of the pipe. The CONTRACTOR can elect to use an alternative sequence for placing CLSM if the CONTRACTOR can demonstrate to the ENGINEER's satisfaction that flowability requirements are being met. The CONTRACTOR must provide the AGENCY's REPRESENTATIVE with means to inspect the area below the pipe to ensure that it is being filled with CLSM or Native Soil CLSM.
- I. The CLSM or Native Soil CLSM shall be brought uniformly to a final elevation called out on the Drawings.
- J. The CLSM or Native Soil CLSM shall be placed so that it completely fills the area between the pipe and excavated pipe trench walls and floor.
- K. CONTRACTOR shall prevent CLSM or Native Soil CLSM from entering bell holes before joint coating and inspection are complete.
- L. If CLSM or Native Soil CLSM is placed near a joint before coating and inspection are complete, place a blanket or cover over joint to prevent CLSM or Native Soil CLSM spatter onto joint area.
- M. Pipe pads may be used to support the pipe and/or to contain the CLSM or Native Soil CLSM during placement. Pipe pads shall consist of sand bags. Pipe pads shall be limited to 2 feet, measured along the pipeline, at each support point.
- N. The CONTRACTOR shall take the necessary measures to prevent flotation or lateral movement of the pipe during CLSM and Native Soil CLSM placement.
- O. CONTRACTOR shall allow CLSM or Native Soil CLSM to set before placing backfill above CLSM or Native Soil CLSM as described herein. The CLSM or Native Soil CLSM must demonstrate suitability for backfilling based on an average diameter of impression of 3 inches or less after performing a ball drop test according to ASTM D 6024.
- P. No equipment or traffic shall be allowed on the CLSM or Native Soil CLSM until the surface of the CLSM or Native Soil CLSM will withstand the weight of the equipment or traffic without displacement or damage. Suitability for load applications shall be determined by ASTM D 6024.
- Q. If necessary to prevent displacement or damage, provide steel trench plates that span the trench or other means that prevent equipment or traffic contact with CLSM or Native Soil CLSM.

3.4 FINISHING

- A. The finish surface shall be smooth and to the grade indicated or directed by the ENGINEER. Surfaces shall be free from fins, bulges, ridges, offsets, and honeycombing. Finishing by wood float, steel trowel, or similar methods is not required.

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3.5 CURING

- A. CLSM and Native Soil CLSM shall be kept damp for a minimum of 7 days or until final backfill is placed. An application of curing compound is acceptable.

3.6 PROTECTION

- A. CLSM and Native Soil CLSM shall be protected from freezing for 72 hours after placement.
- B. CLSM and Native Soil CLSM shall be protected from running water, rain, and other damage until the material has been accepted and final fill completed.

END OF SECTION

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SECTION 32 12 16 ASPHALT PAVING

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section includes providing all labor and materials, testing, and furnishing all equipment to perform the operations necessary to complete all required installation of asphalt concrete pavement, aggregate base course, herbicide, prime coat, tack coat, and striping paint placement as specified, shown on the Drawings, as directed, or in conformance with permit requirements from the governing agency.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Demolition: 02 41 00.
- B. Fill and Compaction: 31 23 23.

1.3 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit six copies of a report from a testing laboratory verifying that aggregate material conforms to the specified gradations or characteristics.
- C. Mix Design.
- D. Shop drawings.
- E. Quality Control Submittals:
 - 1. Test Results
 - 2. Submit manufacturer's certificate of compliance or product literature for the following materials:
 - (a) Aggregate: Gradation.
 - (b) Asphalt for Binder: Type and grade.
 - (c) Tack Coat: Type and grade of asphalt.
 - (d) Mixes: Conforms to job-mix formula.
 - (e) Herbicide.
 - (f) Paint for traffic striping.
 - (g) Pavement markers.

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3. Certificate of Competence.

1.4 TESTING FOR COMPACTION

A. See Section 31 23 23 – Fill and Compaction.

1.5 STANDARD SPECIFICATIONS

A. Wherever reference is made to the Caltrans Standard Specifications such reference shall mean the State of California, Business, Transportation, and Housing Agency, Department of Transportation Standard Specifications, 2010 edition.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Asphalt

1. Asphalt shall be Performance Grade PG 70-10 per Section 92 in the Caltrans Standard Specifications.
2. Asphalt paving shall conform to 3/4-inch HMA Type B in Section 39 of the Caltrans Standard Specifications.
3. Aggregate for Asphalt Concrete shall be HMA Type B per Section 39-1.02 in the Caltrans Standard Specifications.

B. Aggregate Base Course

1. Aggregate base shall be Class 2 aggregate base, 3/4-inch-maximum size per Section 26 of the Caltrans Standard Specifications.

C. Tack Coat

1. Tack coat shall conform with Section 94, Grade SS1h in the Caltrans Standard Specifications.

D. Herbicide or Weed Killer

1. Use Gallery (Isoxaben) or Surflan (Oryzalin) by Dow AgroSciences, Pre-M (Pendimethalin) by American Cyanamid Co., or equal.

E. Paint for Traffic and Parking Lot Striping and Marking

1. Provide yellow thermoplastic paint per Section 84-2 of the Caltrans Standard Specifications.

2.2 MIX DESIGN

A. Mix design shall conform to Section 39-1.03, "Hot Mix Asphalt Mix Design Requirements" of the Caltrans Standard Specifications.

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PART 3 -- EXECUTION

3.1 INSTALLATION

- A. Producing, transporting, placing, compacting, and finishing of asphalt concrete shall conform to Section 39 of the Caltrans Standard Specifications. The requirements presented below are in addition to Section 39 of the Caltrans Standard Specifications.

3.2 PREPARATION OF SUBGRADE

- A. Excavate and shape subgrade to line, grade, and cross section shown in the drawings. The subgrade shall be considered to extend over the full width of the base course.
- B. Scarify and cultivate the top 6 inches of subgrade when the subgrade consists of dry soils which are impervious to the penetration of water, soils which contain excessive amounts of moisture which may result in unstable foundations, soils which are nonuniform in character which may result in nonuniform relative compactions and subsequent differential settlements of finished surfaces, or when pavement is to be placed directly on the roadbed material.
- C. After rough grading has been completed, when scarifying and cultivating are required, loosen the roadbed to a depth of at least 6 inches. Work the loosened material to a finely divided condition and remove rocks larger than 3 inches in diameter. Bring the moisture content to optimum by the addition of water, by the addition and blending of dry material, or by the drying of existing material. Compact the material to the specified relative compaction.
- D. Uniform pervious soils that allow the immediate penetration of water or uniform impervious soils which will allow the penetration of water to a depth of at least 6 inches after the addition of a suitable wetting agent will not require scarifying and cultivating. When scarifying and cultivating are not required, bring the moisture content of the top 6 inches of the subgrade material to optimum by the addition of water at the surface, and compact the material to the specified relative compaction.
- E. Remove soft material disclosed by the subgrade preparation, replace aggregate base course material, and recompact.
- F. Compact the top 12 inches of subgrade to 95% relative compaction in accordance with ASTM D 1557.
- G. The finished subgrade shall be within a tolerance of ± 0.08 of a foot of the grade and cross-section shown and shall be smooth and free from irregularities and at the specified relative compaction.

3.3 PLACING AGGREGATE BASE COURSE

- A. Place aggregate base course to a minimum thickness of 12 inches, unless shown otherwise on the Drawings. Install in accordance with Section 26 of the Caltrans Standard Specifications.

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3.4 COMPACTION OF AGGREGATE BASE AND LEVELING COURSES

- A. Compaction and rolling shall begin at the outer edges of the surfacing and continue toward the center. Apply water uniformly throughout the material to provide moisture for obtaining the specified compaction. Compact each layer to the specified relative compaction before placing the next layer.

3.5 APPLYING HERBICIDE OR WEED KILLER

- A. Apply weed killer or herbicide on base prior to placing pavement. Apply herbicide along with water at the rate recommended by the manufacturer to control dawny brome grass, puncture vine, and plaintain. Apply for the full width of roadway.

3.6 PLACING TACK COAT

- A. Apply tack coat on surfaces to receive finish pavement per Section 39-1.09 in the Caltrans Standard Specifications. In addition to the locations identified in Section 39 of the Caltrans Standard Specifications apply tack coat to all metal or concrete surfaces that will be in contact with the asphalt concrete paving.

3.7 MINIMUM ASPHALT THICKNESS

- A. Place asphalt paving to a minimum thickness of 4 inches unless otherwise shown on the Drawings or in conformance with permit requirements from the governing agency.

3.8 SURFACE TOLERANCE

- A. Finished grade shall not deviate more than 0.02 foot in elevation from the grade indicated in the drawings. Slopes shall not vary more than 1/4 inch in 10 feet from the slopes shown in the drawings.
- B. After paving has been installed and compacted, spray water over the entire paved area. Correct any areas where water collects and does not drain away.

3.9 APPLYING PAINT FOR TRAFFIC STRIPING AND MARKING

- A. Apply in accordance with Section 84 of the Caltrans Standard Specifications.

END OF SECTION

APPENDIX G

SECTION 32 31 13 CHAIN LINK FENCE AND GATES

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, furnish all materials for the chain-link fence, including fabric and barbed wire; posts, gates, ground rods, grounding cable, and accessories; concrete; and other materials required, provide all equipment and perform all operations necessary for the complete erection of the fence. The fence shall be standard chain-link fence with gates and a guard of three strands of barbed wire in accordance with the details shown on the Drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Demolition: 02 41 00
- B. Cast-In-Place Concrete: 03 30 00

1.3 SUBMITTALS

- A. Submittals shall be in accordance with this paragraph and Section 01 33 23 Submittal Requirements.
- B. The CONTRACTOR shall submit the manufacturer's certification that the chain-link fence materials to be furnished under these specifications meet the Specifications requirements. The certification shall include the manufacturers' names, catalog numbers and names, Federal Specification references, weights and gauges of materials, and weights of zinc or aluminum coatings.

1.4 MEASUREMENT AND PAYMENT

- A. The cost of furnishing all materials and erecting the chain-link fence shall be included in the lump sum prices bid in the schedule for the applicable structure.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Chain-link fencing shall conform to Federal Specification RR-F-191K/GEN, Chain-Link Fence Manufacturers Institute, and the following detail Federal Specifications.

2.2 CHAIN LINK FABRIC

- A. Zinc-coated steel fabric. - Federal Specification RR-F-191/1D, Type I (ASTM A 392), 2-inch mesh, No. 11 gauge (0.120-inch nominal wire diameter after coating), and minimum weight of zinc coating of 1.2 ounces per square foot of uncoated wire surface area.

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- B. Aluminum-coated steel fabric. - Federal Specification RR-F-191/1D, Type II (ASTM A 491), 2-inch mesh, No. 11 gauge (0.120-inch nominal wire diameter after coating), and minimum weight of aluminum coating of 0.35 ounce per square foot of uncoated wire surface area.
- C. Aluminum alloy fabric. - Federal Specification RR-F-191/1D, Type III, 2-inch mesh, No. 9 gauge (0.148-inch nominal wire diameter).

2.3 FENCE POSTS, TOP RAILS, AND BRACES

- A. Federal Specification RR-F-191/3D, class Class 1, grade A, except all steel pipe shall be ASTM A 53, schedule Schedule 40, standard weight and as otherwise provided in this paragraph or shown on the drawings. The fence posts, top rails, and braces shall be hot dip, zinc coated with not less than 1.8 ounces per square foot of coated surface area.

2.4 GATES AND GATE ACCESSORIES

- A. Federal Specification RR-F-191/2D, Type I or II (ASTM F 900), except as otherwise provided in this paragraph or shown on the drawings.
- B. Gates shall be swing-type gates with hot-dip, zinc-coated steel pipe frames. Steel pipe shall conform to ASTM A 53, schedule 40, standard weight. The zinc coating shall have a weight of not less than 1.8 ounces per square foot of coated surface area. The gate fabric shall be the same as the fabric that is furnished for the fence.
- C. Each gate leaf shall be equipped with one pair of heavy hinges that will allow a full gate opening between gate posts. The hinges shall be designed to not twist or turn under gate action and shall allow the gate to swing a full 180° to lie along and parallel to the fence line.
- D. Gate hinges, latches, stops, keepers, and other accessories shall be of zinc-coated steel, ductile iron, or malleable iron, except that wire ties and clip bolts and nuts may be of aluminum alloy. The minimum weight of the zinc coating shall be 1.2 ounces per square foot of coated surface area. The barbed wire guard at the top of each gate shall be in accordance with the details shown on the drawings.

2.5 CHAIN-LINK FENCE ACCESSORIES

- A. Federal Specification RR-F-191/4D, except as otherwise provided in this paragraph or shown on the drawings.
- B. Post caps, rail ends, and barbed wire support arms shall be of zinc-coated steel, malleable iron, or ductile iron, except that post caps and rail ends may be of cast iron. Rail sleeves, wire ties and clips, brace bands, tension bands, reinforcing wire, and tension or stretcher bars shall be of zinc-coated steel, except that wire ties, clip bolts, and nuts may be of aluminum alloy. Two No. 12-1/2-gauge twisted barbless zinc-coated strands may be substituted for the No. 7 gauge bottom reinforcing wire.
- C. The barbed wire shall be either zinc-coated steel or aluminum alloy barbed wire to match the type of fence fabric furnished.

2.6 FENCE GROUNDING

- A. Grounding cables - The copper-clad steel cables for grounding shall be 9/16-inch (seven No. 5 AWG nominal diameter 0.546 inch) or 11/32 inch (seven No. 9 AWG nominal diameter 0.343

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inch), dead-soft annealed, 40 percent conductivity, as indicated on the drawings. The cables shall be equal to Copperweld, annealed stranded, as manufactured by Copperweld Bimetallics Division, Glassport, Pennsylvania, and in accordance with ASTM B 228, where applicable.

- B. Cable fittings, lugs, and connectors - All cable fittings, other than welded type, shall be of the bolted-solderless type and shall have current-carrying capacity equal to that of the cable with which they are used. All cable fittings, lugs, and connectors for copper-clad ground cables, together with the bolts, nuts, and washers used therewith, shall be of copper alloy, containing not more than 4 percent zinc. Aluminum connectors shall be used to connect aluminum to aluminum, and tinned-bronzed connectors shall be used to make aluminum-to-copper connections.
- C. Grounding rods - Each grounding rod shall have a layer of copper inseparably bonded to a steel core, 3/4-inch nominal diameter, 10 feet long, and shall meet requirements of ANSI/UL 467 (C 33.8).
- D. Welding - Where Cadweld, Thermoweld, or an equivalent process is used, it shall be a heavy-duty type, made of new material from fresh stock, and the installation shall be performed with heavy-duty welding equipment in accordance with the manufacturer's instructions.

2.7 CONCRETE

- A. Concrete shall be in accordance with Section 03 30 00 - Concrete.

2.8 MISCELLANEOUS MATERIALS

- A. Materials required for completion of the work and for which detailed specifications are not provided shall be of standard commercial quality suitable for the intended use.

PART 3 -- EXECUTION

3.1 FENCE ERECTION

- A. The chain-link fence shall be in accordance with the details shown on the drawings. Ground surface irregularities and other obstacles that would interfere with the proper erection of the fence shall be removed in advance of starting other fencing work. Removed materials shall be disposed of in accordance with Section 02 41 00 – Demolition and all local, state and federal laws. Existing cross fences shall be connected to the new fence by placing a corner post at the junction and properly fastening the wire in both fences to the post. The finished fence shall be in alignment, taut, and solid at all points. The fence shall be thoroughly braced as shown on the drawings.
- B. The CONTRACTOR shall perform all required excavating, backfilling, and compacting of backfill for posts. All posts shall be set plumb in postholes to the depths shown on the drawings and in accurate alignment.
- C. Corner, gate, line and brace posts, and post braces shall be set in concrete as shown on the drawings and in accurate alignment. Gatekeepers shall also be set in concrete.
- D. Post holes shall be excavated in earth material to the depth and diameters shown on the drawings.
- E. The chain-link fence shall be grounded as shown on the drawings and specified in this Section.

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- F. All wire shall be drawn tight and fastened securely to each post. Wire stays shall be placed as shown on the drawings.
- G. The maximum length of fence without corner, end, gate or pull posts shall be 500 feet. Additional pull posts shall be placed as directed. Panels adjoining pull posts shall be identical to panels adjoining corner posts, except in fence line. The woven wire shall terminate at each corner or pull post. The fence shall be placed on chords around curves with corner panels at the end of each chord.
- H. At changes in alignment, the deflection points shall be considered as corners and corner posts and bracing shall be installed.
- I. Where directed or shown on the drawings, the CONTRACTOR shall tie or connect the fence to the existing fence. The CONTRACTOR shall install an end post within two feet of the existing fence or structure.

3.2 INSTALLING GATES

- A. Double swing gates 16 feet in width and 4-foot single pedestrian gates will be installed where shown on the drawings or as directed. The gates will be installed in accordance with the criteria shown on the drawings and as described in the preceding paragraphs.

3.3 GROUNDING INSTALLATION

- A. The CONTRACTOR shall furnish and install all the materials and shall perform all earthwork required to complete a low-impedance grounding system for these fences as shown on the drawings and herein specified. Fencing constructed in natural ground or fill shall have a fence ground installed at each side of a gate. Fencing constructed on structures, which requires grounding, shall be bonded to the adjacent fence.
- B. The grounding systems indicated on the drawings supplement the requirements in this paragraph. The conductors used for grounding purposes shall be sized as shown on the drawings. After the connections are made, any metal finishes that have been damaged or removed as a result of the grounding connections being made shall be repaired. Grounding connections shall be made in accordance with the methods outlined on the drawings and in Chapter 2, Electrical Standards for Equipment Installation, of the U.S. Bureau of Reclamation's "Field Procedures for Electrical Installations." Spray paint all exposed bare copper conductors with galvanizing paint.
- C. Grounding rods shall be driven vertically the full length of the rod until the top of the rod is at the depth, as shown on the drawings, below the established elevation of the grade.

3.4 THEFT DETERRENT

- A. A bar shall be installed as shown on the Drawings 18 inches from the bottom edge of the fence to serve as a theft deterrent

END OF SECTION

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SECTION 33 11 00 GENERAL PIPING REQUIREMENTS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials, and equipment and perform all operations required to furnish, install, test, and transport all piping, specials and fittings as specified herein and as shown on the drawings. Specials and fittings shall include, but not be limited to closure pieces, bends, elbows, reducers, tees, wyes, bulkheads, and other piping and appurtenances as required to provide the WORK, complete.
- B. Definitions of Buried and Exposed Piping
 - 1. Buried piping is piping buried in soil, commencing at the wall or beneath the slab of a structure. Piping encased in concrete is considered to be buried.
 - 2. Exposed piping (above ground) is piping in any of the following conditions:
 - (a) Above ground.
 - (b) Inside buildings, vaults, or other structures.
 - (c) In underground concrete trenches or galleries.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Protection of Existing Utilities and Irrigation Facilities: 01 14 20
- B. Surveying Requirements: 01 32 23
- C. Pipe Coupling and Expansion Joints: 33 11 06
- D. Welded Steel Pipe (AWWA C200): 33 11 10

1.3 SUBMITTALS

- A. Submittals shall be in accordance with Section 00 01 33 23 Submittal Requirements, and this Section.
- B. Prior to purchasing, CONTRACTOR shall furnish manufacturer product data and literature for all PVC and ductile iron pipe and fittings.
- C. Prior to fabrication of any pipe materials, the CONTRACTOR shall submit line-layout drawings and shop drawings showing all pertinent details for field installation and shop fabrication of pipe, pipe fittings and specials for piping, including joint details, for approval by the ENGINEER. Line-layout drawings shall indicate as a minimum, the type, location and dimensions of fittings and specials. Line-layout drawings shall show all elevations, grade changes, and identification of all fittings. All shop drawings of pipe fittings and specials shall be reviewed and approved

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by the CONTRACTOR before being submitted to the ENGINEER. Pipe and pipe fittings shall be fabricated in accordance with approved shop drawings.

- D. Prior to fabrication of any specified pipe materials for farm turnouts and connections to Landowner's system, the CONTRACTOR shall submit line-layout drawings and shop drawings showing all pertinent details for field installation and shop fabrication of pipe, pipe fittings and specials for pipelines, including all joint details, for approval by the ENGINEER. Line-layout drawings shall indicate as a minimum the type, location and dimensions of fittings and specials. Pipe, pipe fittings and specials, and joints therefor either shall be fabricated in accordance with the Specification Drawings or in accordance with the CONTRACTOR's approved shop drawings, at the option of the AGENCY. Line-layout drawings shall show all elevations, grade changes and identification of all fittings.
- E. Submittals for steel pipe and steel pipe fittings and specials shall be prepared and submitted by a single pipe supplier only.
- F. Action Submittals
 - 1. Shop Drawings showing pipe layout.
 - 2. Material list (grade, tensile strength, etc).
 - 3. Fabrication information including design calculations of fittings and specials, cylinder thickness, joint details including manufacturing tolerances, deflection limitations of field joints, weld lead outlets and plugs, bulkheads, outlets, stulling size and layout, welded joint details, shop welding data in accordance with AWWA 200 and 208 and AWS A2.4 and A3.0.
 - 4. Product data including pipe materials data, chemical and physical test reports, coatings and linings (manufacturers name, product number or name, and thickness), rubber gasket joints that indicates compliance with the Drawings and Specifications.
- G. Information Submittals
 - 1. Certificates of compliance that state the products furnished meet the requirements of the Specifications.
 - 2. The pipe supplier's written Quality Assurance/Control (QA/QC) program that shall ensure the achievement of adequate quality throughout all applicable areas of the Contract, procedures for defining a program for control of inspections, non-conformances and corrective actions, special processes and personnel qualifications, audits, documented control/quality records.
 - 3. Statement of Qualifications of pipe manufacturer, fittings and specials fabricator, welders or welding operators, and certified welding inspector NDT Quality control personnel.
 - 4. Reports, including Source Quality Control Test Reports, Coating and lining site visit letter by qualified technical representative, applicator's quality control records, and cement mortar lining compressive strength tests in accordance with AWWA C205.
- H. Coating and Lining Submittals

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1. Shop Drawings: Catalog cuts and other information for products proposed. Provide a copy of approved coating system submittals to the coating applicator.
2. Quality Control Submittals
 - (a) Applicator's experience with list of references substantiating compliance.
 - (b) Coating manufacturer's certification stating the applicator meets or exceeds their coating application requirements and recommendations.
 - (c) Coating manufacturer shall furnish a copy of the manufacturer's coating application quality assurance manual.
 - (d) If the manufacturer of field-applied coating differs from that of the shop-applied primer, furnish written confirmation from both manufacturers that the 2 coating materials are compatible.

1.4 DELIVERY, HANDLING, STORAGE, AND PROTECTION

- A. All piping materials, fittings, specials, appurtenances, and accessories shall be delivered in a clean and undamaged condition and stored on the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials at no additional cost to the AGENCY.
- B. Pipe Marking
 1. Legibly mark installation sequence number on pipe, fittings, and specials in accordance with the piping layout submitted by the CONTRACTOR.
 2. Special pipe sections and fittings shall be marked at each end with the notations "TOP FIELD CENTERLINE".
- C. Delivery
 1. Secure bulkhead or otherwise seal ends of steel and ductile iron pipe, specials, and fittings prior to loading at manufacturer's site.
 2. Pipe ends shall remain sealed until installation.

1.5 QUALITY ASSURANCE

- A. Inspection: All pipe shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the AGENCY's REPRESENTATIVE and the ENGINEER shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.
- B. Tests: Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards. Welds shall be tested as specified in individual piping sections. The CONTRACTOR shall perform all tests at no additional cost to the AGENCY.

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- C. **Welding Requirements:** All welding procedures used to fabricate pipe shall be prequalified under the provisions of ANSI/AWA D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.
- D. **Welder Qualifications:** All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the WORK shall be used in qualification tests. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

PART 2 -- PRODUCTS

2.1 PIPE FLANGES

- A. **General:** Flanges shall have flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207. Flange faces shall be perpendicular to the axis of the adjoining pipe. Flanges for miscellaneous small pipes shall be in accordance with the standards indicated for these pipes.
- B. **Pressure Ratings:**
 - 1. 150 psi or less: Flanges shall conform to either ANSI/AWWA C207 - Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In., Class D, or ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings, 150-lb class.
 - 2. 150 psi to 275 psi: Flanges shall conform to either ANSI/AWWA C207 Class E or Class F, or ANSI/ASME B16.5 150-lb class.
- C. **Blind Flanges:** Blind flanges shall be in accordance with ANSI/AWWA C207, or as indicated for miscellaneous small pipes. Blind flanges for pipe sizes 12 inches and greater shall be provided with lifting eyes in the form of welded or screwed eye bolts.
- D. **Flange Coating:** Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.
- E. **Flange Bolts:**
 - 1. Bolts and nuts for Class 125 or 150 flanges (including AWWA C207, Class D) located indoors, outdoors above ground, and in vaults and structures shall be carbon steel, ASTM A307, Grade B, hot-dipped galvanized per ASTM F2329.
 - 2. Bolts and nuts for buried or submerged flanges shall be Type 304 stainless steel conforming to ASTM A193 (Grade B8) for bolts and ASTM A194 (Grade 8) for nuts.
 - 3. Fit shall be Classes 2A and 2B per ASME B1.1 when connecting to ductile-iron valves having body bolt holes.

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4. Lubricants shall be used on stainless steel nuts and bolts to prevent bonding. Lubricants shall be chloride free and shall be RAMCO TG-50, Anti-Seize by RAMCO, Specialty Lubricants Corporation Husky™ Lube O'Seal, or equal.
- F. Insulating Flanges and Flange Set: Insulating flanges and flange sets shall be as shown on the drawings.
- G. Flange Gaskets: Flange gaskets shall be full face, 1/8-inch thick, cloth-inserted rubber, with a Shore "A" hardness of 75 to 85. Gaskets shall be suitable for a water pressure of 200 psi at a temperature of 180°F. Gaskets shall have "nominal" pipe size inside diameters not the inside diameters per ASME B16.21. Flange gaskets shall be **Garlock Style 19** or equal

2.2 THREADED INSULATING CONNECTIONS

- A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.
- B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.3 PIPE THREADS

- A. Pipe threads shall be in accordance with ANSI/ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

2.4 COUPLINGS

- A. See Section 33 11 06 – Pipe Couplings and Expansion Joints for pipe coupling requirements.

PART 3 -- EXECUTION

3.1 GENERAL INSTALLATION

- A. All piping, fittings, and appurtenances shall be installed in accordance with the requirements of the applicable Sections of Division 33. Care shall be taken to ensure that piping flanges, mechanical-type couplings, sleeve-type couplings, flexible connectors, and expansion joints are properly installed as follows:
 1. In no case shall the deflection of rubber gasket joints exceed 50 percent of the maximum deflection recommended by the pipe manufacturer.
 2. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection. Each gasket shall be centered properly on the contact surfaces.
 3. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.

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4. Bolts shall be initially hand-tightened with the piping connections properly aligned. Bolts shall be tightened with a torque wrench in a staggered sequence to the AISC recommended torque for the bolt material.
5. After installation, joints shall meet the indicated leakage rate. Flanges shall not be deformed nor cracked.

3.2 INSTALLING FLANGED PIPING

- A. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16 inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.
- B. Inspect each gasket to verify that it is the correct size, material, and type for the specified service and that it is clean and undamaged. Examine bolts or studs, nuts, and washers for defects such as burrs or cracks and rust and replace as needed.
- C. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing, lubricate carbon steel bolts with oil and graphite, and tighten nuts uniformly and progressively.
- D. Bolt lengths shall extend completely through their nuts. Any that fail to do so shall be considered acceptably engaged if the lack of complete engagement is not more than one thread.
- E. Do not use more than one gasket between contact faces in assembling a flanged joint.
- F. Tighten the bolts to the manufacturer's specifications, using the recommended cross bolt pattern in multiple steps of increasing torque, until the final torque requirements are achieved. Use torque-limiting wrenches to provide uniform bearing and proper bolt tightness.
- G. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

3.3 INSTALLING BLIND FLANGES

- A. At outlets not indicated to be connected to valves or to other pipes and to complete the installed pipeline hydrostatic test, provide blind flanges with bolts, nuts, and gaskets.

3.4 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

- A. Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

END OF SECTION

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SECTION 33 11 06 PIPE COUPLINGS AND EXPANSION JOINTS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section includes materials and installation of mechanical-type couplings, sleeve-type couplings flexible, flanged coupling adaptors, and expansion joints.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Painting and Coating: 09 90 00.
- B. General Piping Requirements: 33 11 00.

1.3 SUBMITTALS

- A. Submittal shall be furnished in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit manufacturer's catalog data on each type of couplings
- C. Show manufacturer's model or figure number for each type of coupling.
- D. Submit manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible gasketed sleeve-type compression pipe couplings.
- E. Submit calculations and manufacturer's shop drawings of all proposed expansion joints, piping layouts, and anchors and guides, including information on materials, temperature and pressure ratings.
- F. Show materials of construction by ASTM reference and grade. Show dimensions.
- G. Show number, size, and material of construction of tie rods and lugs for each thrust harness on the project.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. The coupling manufacturer shall furnish the gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings of all types and shall design these components as an integral system.
- B. Design the gaskets for the coupling and appropriately size to provide a watertight seal at the design pressure and temperature.
- C. Ship gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings with the pipe coupling and clearly label indicating the origin of the material, including place and date of

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manufacture. Package the manufacturer's printed installation instructions with each pipe coupling.

2.2 MECHANICAL-TYPE GROOVED COUPLINGS

- A. General: Mechanical-type grooved couplings shall be provided where indicated. The couplings shall conform to the requirements of AWWA C606 - Grooved and Shouldered Joints. Gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations. The wall thickness of grooved piping shall conform with the coupling manufacturer's recommendations to suit the highest expected pressure. To avoid stress on equipment, equipment connections with mechanical-type couplings shall have rigid-grooved couplings or flexible type coupling with harness in sizes where rigid couplings are not available, unless thrust restraint is provided by other means. Mechanical-type couplings shall be bonded. The CONTRACTOR shall have the coupling manufacturer's service representative verify the correct choice and application of couplings and gaskets, and the workmanship, to assure a correct installation. To assure uniform and compatible piping components, all grooved fittings, couplings, and valves shall be from the same manufacturer. Bolts and nuts for indoors, outdoors above ground, and in vaults and structures shall be carbon steel, ASTM A307, Grade B, hot-dipped galvanized per ASTM F2329.
- B. **Manufacturers:** Victaulic; or equal.

2.3 SLEEVE-TYPE COUPLINGS

- A. Sleeve-type couplings shall be provided where indicated, in accordance with AWWA C219 - Standard for Bolted Sleeve-Type Couplings for Plain-End Pipe. Couplings shall be steel with steel bolts, without pipe stop. Couplings shall be of sizes to fit the pipe and fittings indicated. The middle ring shall be not less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected. If the strength of the middle ring material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe. The coupling shall be 7 inches long for sizes up to and including 30 inches and 10 inches long for sizes greater than 30 inches, for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill sections welded and cold-expanded as required for the middle rings, and of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Sleeve bolts in exposed service shall be carbon steel per AWWA C219, Section 4. Sleeve bolts in buried or submerged service shall be Type 304 stainless steel per AWWA C219, Section 4. Buried sleeve-type couplings shall be epoxy-coated at the factory as indicated.
- B. **Manufacturers:** Dresser; Smith-Blair; or equal.

2.4 JOINT HARNESES FOR SLEEVE-TYPE COUPLINGS

- A. Tie bolts or studs shall be as shown in the following table. Bolt or stud material shall conform to ASTM A193, Grade B7. Nuts shall conform to ASTM A194, Grade 2H. Lug material shall conform to ASTM A36, ASTM A283, Grade B, C, or D, or ASTM A285, Grade C. Lug dimensions

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for steel pipe shall be as shown in AWWA Manual M11 (2004 edition), Figure 13-20, using the number and size of lugs as tabulated below.

- B. Lugs for steel pipe shall be Type P for pipes 6 through 12 inches and Type RR for pipes 14 inches and larger.

TIE BOLTS OR STUD REQUIREMENTS FOR FLEXIBLE PIPE COUPLINGS FOR STEEL PIPE				
Nominal Pipe Size (inches)	Tie Bolt or Stud Minimum Requirements			
	150 psi		250 psi	
	No. Bolts or Studs and Size (inches)	Minimum Pipe Wall Thickness (inches)	No. Bolts or Studs and Size (inches)	Minimum Pipe Wall Thickness (inches)
6	2 x 5/8	0.193	2 x 5/8	0.282
8	2 x 5/8	0.239	2 x 5/8	0.354
10	2 x 5/8	0.312	2 x 3/4	0.466
12	2 x 3/4	0.188	4 x 7/8	0.250
14	2 x 7/8	0.188	4 x 1	0.250
16	2 x 1	0.250	4 x 1 1/8	0.250
18	2 x 1 1/8	0.250	4 x 1 1/8	0.250
20	2 x 1 1/4	0.250	4 x 1 1/8	0.250
24	4 x 7/8	0.250	4 x 1 1/8	0.250
30	4 x 1 1/8	0.250	4 x 1 3/8	0.375
36	4 x 1 3/8	0.313	6 x 1 3/8	0.375
42	6 x 1 1/4	0.375	6 x 1 5/8	0.375
48	6 x 1 3/8	0.375	6 x 1 3/4	0.500
54	6 x 1 1/2	0.375	8 x 1 3/4	0.625
60	6 x 1 5/8	0.375	12 x 1 3/4	0.625
66	8 x 1 5/8	0.469	14 x 1 3/4	0.688
72	8 x 1 3/4	0.500	14 x 1 7/8	0.750

2.5 FLANGED COUPLING ADAPTERS FOR STEEL PIPE

- A. Flanged coupling adaptors for steel pipe shall be steel: Dresser Style 128, Smith-Blair Type 913, or equal. Flange ends shall match the flange of the connecting pipe; see detail piping specifications.

2.6 EXPANSION JOINTS

- A. All piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be flanged end, stainless steel, Monel, rubber, or other materials best suited for each individual service. The CONTRACTOR shall submit

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detailed calculations and manufacturer's Shop Drawings of all proposed expansion joints, piping layouts, and anchors and guides, including information on materials, temperature and pressure ratings.

PART 3 -- EXECUTION

3.1 DELIVERY AND STORAGE

- A. Inspect on receipt for damage in shipment and conformance with quantity and description on the shipping notice and order. Unload carefully to the ground without dropping. Do not load or unload by inserting forklift tines or lifting chains inside the waterway. Use nonmetallic slings, padded chains, or padded forklift tines to lift items. Lift with eyebolts or rods through flange holes or chain hooks at ends.
- B. Protect from weather and the accumulation of dirt, rocks, and debris. Do not expose rubber seats to sunlight or ozone for more than 30 days. Also, see the manufacturer's specific storage instructions.
- C. Make sure flange faces, joint sealing surfaces, body seats, and disc seats are clean.

3.2 INSTALLATION OF FLEXIBLE PIPE COUPLINGS AND EXPANSION JOINTS

- A. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installing.
- B. Install expansion joints per manufacturer's recommendations, so that 50% of total travel is available for expansion and 50% is available for contraction.
- C. Do not spring flanges or ends of connecting piping into position. Separately work connecting piping system into position to bring the piping flanges or ends into alignment with the matching coupling flanges or joints. Do not move couplings to achieve piping alignment.
- D. Line up pipe flange bolt holes with coupling or joint flange bolt holes within 1/16 inch maximum offset from the center of the bolt hole to permit insertion of bolts without applying any external force to the piping.
- E. Flange face separation shall be within the gasket spacing $\pm 1/16$ inch. Use only one gasket per flanged connection.
- F. Lubricate bolt threads with graphite and oil prior to installation.
- G. Thoroughly clean contact surfaces of gaskets and pipe ends of flexible pipe couplings just prior to assembly for a distance equal to center-sleeve length plus 2 inches. Install flexible pipe couplings such that the center sleeves are centered over the gap between the ends of the pipes being joined. Install centerline gaps per AWWA C219, Table 5 unless otherwise indicated. Install harnessed flexible pipe couplings in straight-run piping such that 50% of the total travel of the center sleeve or permissible centerline gap is available for expansion and 50% of the travel is available for contraction. In assembling the bolted or studded harnesses of flexible pipe couplings, tighten the nuts gradually and equally at diametrically opposite sides

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until snug. Do not misalign the harness bolts or studs. Tighten such that bolts or studs carry equal loads. Do not use wrenches or power fastening tools to tighten the nuts.

3.3 PAINTING AND COATING

- A. Coat buried flexible pipe couplings (including joint harness assemblies), transition couplings, segmented sleeve couplings, and flanged coupling adapters in accordance with Section 09 90 00 – Painting and Coating, System No. 21. Coat buried bolt threads, tie bolt threads, and nuts in accordance with Section 09 90 00 – Painting and Coating, System No. 24. Following the coating work, wrap all buried couplings with polyethylene in accordance with Section 09 97 54 – Polyethylene Sheet Encasement.
- B. Coat above ground or in vault/structures flexible pipe couplings (including joint harness assemblies), transition couplings, segmented sleeve couplings, and flanged coupling adapters with the same coating system specified for the adjacent pipe. If the adjacent pipe is not coated, coat couplings in accordance with Section 09 90 00 – Painting and Coating, System No. 10. Prime coat shall be applied at factory.
- C. Line carbon steel and iron flexible pipe couplings and segmented sleeve couplings in accordance with Section 09 90 00 – Painting and Coating, System No. 1.
- D. Coat expansion joints located above ground or in vaults/structures with the same coating system as specified for the adjacent pipe. If the adjacent pipe is not coated, coat couplings in accordance with Section 09 90 00 – Painting and Coating, System No. 10.

3.4 HYDROSTATIC TESTING

- A. Hydrostatically test flexible pipe couplings, expansion joints, segmented sleeve couplings, and expansion compensators in place with the pipe being tested. Test in accordance with Section 33 11 10 – Welded Steel Pipe

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SECTION 33 11 10 WELDED STEEL PIPE (AWWA C200)

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR shall provide all labor, materials and equipment and perform all operations required to furnish, install, test, and transport all piping, specials and fittings as specified herein and as shown on the Drawings. Specials and fittings shall include, but not be limited to closure pieces, elbows, reducers, tees, wyes, bulkheads, and other piping and appurtenances as required to provide the Work, complete.
- B. See Section 33 11 00 – General Piping Requirements for additional requirements.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Dewatering: 31 23 15
- B. Excavation: 31 23 16
- C. Fill and Compaction: 31 23 23
- D. General Piping Requirements: 33 11 00.
- E. Pipe Couplings and Expansion Joints: 33 11 06

1.3 SUBMITTALS

- A. Submittals shall be furnished in accordance with Section 01 33 23 Submittal Requirements.
- B. Prior to fabrication of any pipe materials, the CONTRACTOR shall submit line layout drawings and shop drawings showing all pertinent details for field installation and shop fabrication of pipe, pipe fittings and specials for piping, including joint details, for approval by the ENGINEER. All shop drawings of pipe fittings and specials shall be reviewed and approved by the CONTRACTOR before submittal to the ENGINEER. Pipe and pipe fittings shall be fabricated in accordance with approved shop drawings.
- C. Submittals for steel pipe and steel pipe fittings and specials shall be prepared and submitted by a single pipe supplier only.
- D. Submit fabrication information including design calculations of fittings and specials, cylinder thickness, joint details including manufacturing tolerances, deflection limitations of field joints, weld lead outlets, and plugs, bulkheads, outlets, stulling size and layout, welded joint details, shop welding data in accordance with AWWA 200 and 208 and AWS A2.4 and A3.0.
- E. Reports, including Source Quality Control Test Reports, Coating and lining site visit letter by qualified technical representative, applicator's quality control records, and cement mortar lining compressive strength tests in accordance with AWWA C205.

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1.4 QUALITY ASSURANCE

- A. Steel pipe manufacturer shall be experienced in fabricating steel pipe of similar diameters and wall thicknesses required for this work and shall have the manufacturing capability to meet the schedule requirements of this project. Pipe manufacturer shall be ISO-9001 or SPFA certified with at least 20 years of experience in the manufacture of steel cylinders, fittings, and coatings similar in diameter and wall thickness to those specified herein. All cylinder manufacturing, fittings, linings and coatings shall be the product of one company.

PART 2 -- PRODUCTS

2.1 PIPE

- A. Steel pipe shall be designed in conformance with AWWA M11 and be manufactured in accordance with the requirements of AWWA C200. Pipe shall be of the diameter and steel plate thickness shown on the Drawings.
- B. Steel pipe fabricated in conformance with AWWA C200 shall be electrically welded pipe, fabricated from steel plate or coils. There shall be not more than one longitudinal seam per section of pipe for 30-inch size pipe or less; and not more than two (2) seams for larger pipe. No seam shall intersect an outlet.
- C. Pipe Ends.
 - 1. For welded pipe joints, pipe ends shall be prepared for single welded lap joints.
 - 2. For rubber gasket joints, bell and spigot ends may be formed integrally with the steel cylinder, or may be fabricated from separated plates, sheets, or special sections for attachment to pipe ends.
 - 3. Where shown on the Drawings or specified, flanged or mechanically coupled field joints shall be provided in conformance with details shown on the Drawings.
 - 4. Pipe ends may be prepared for butt-strap connections for pipe closures, make-up pieces, and beginning or end of pipeline, as required.
 - 5. The top and bottom centerlines shall be match marked on the inside of each end of each section. All items shall be prepared for shipment in such a manner as to protect them against damage in transit.
- D. Provide steel coils for spiral welded steel pipe or steel plate for straight seam welded steel pipe per AWWA C200 and as follows:
 - 1. Minimum Yield Strength: 36,000 psi.
 - 2. Maximum Measure Yield Strength: 85 percent of measured tensile strength.
 - 3. Minimum Elongation in 2-inch Gauge length: In conformance with ASTM A1018/A018M.

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4. Weld-Ability: Maximum carbon equivalent of 0.45 as measured using AWS D1.1, Annex XI, Guideline on Alternative Methods for Determining Preheat formula: $CE=C(Mn+Si)/6+(Cr+Mo=V)/5+(Ni+Cu)/15$.
5. Pressure Vessel Quality: Coils shall be continuous cast process, fully killed, fine grained practice conforming to physical, manufacturing and testing requirements of:
 - (a) ASTM A1018, HSLAS Grade 50, Class 1 (modified), or
 - (b) ASTM A1018, SS Grade 40 (modified), or
 - (c) ASTM A1018, SS Grade 36, Type 2 (modified), or
 - (d) ASTM A1011, SS Grade 40 (modified)

Plate shall be fully-killed, conforming to ASTM A20, fine grained practice conforming to physical, manufacturing and testing requirements of ASTM A516, Grade 70 or ASTM A36.

- E. Straight pipe sections shall be standard 40-foot lengths unless otherwise indicated on the Drawings or as required to accommodate the location of bends, tees, reducers, valves, and field closures.

2.2 FITTINGS AND SPECIALS

- A. At locations shown on the Drawings, and in conformance with details shown on the Drawings, the CONTRACTOR shall furnish and install all required in-line fabricated steel plate specials and fittings.
- B. Fittings and specials to be provided shall include, as applicable and shown on the Drawings, the following:
 1. Bends and tees
 2. Wyes
 3. Reducers
 4. Bumped heads
 5. Test Bulkheads
 6. Butt-Straps
 7. Flanges, including blind flanges
 8. Steel rings at wall penetrations
- C. Fittings shall be fabricated in accordance with AWWA C208 from pipe conforming to the above standards.
- D. Except where otherwise shown, all steel plate specials and fittings shall be fabricated in accordance with AWWA C200 with dimensions in accordance with AWWA C208. Where shown on the drawings, special welded fittings shall be provided; all welded fittings shall have the wall thickness of the adjacent pipe; however, in no case shall any plate thickness be less than 1/4-inch (for reducers, the larger diameter shall govern). Design and fabrication of

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bumped heads and reinforcement for tees, outlets, and other fittings and specials shall be in conformance with applicable requirements of AWWA M11.

- E. Curves and Bends—Standard pipe ends may be beveled to form bends or curves for pipe alignment provided that the angular change for any steel plate special shall not exceed $22\frac{1}{2}^{\circ}$ per miter cut. Elbows up to $22\frac{1}{2}$ degrees shall be two piece; over $22\frac{1}{2}$ degrees through 45 degrees shall be three piece; over 45 degrees through $67\frac{1}{2}$ degrees shall be four pieces; and over $67\frac{1}{2}$ degrees through 90 degrees shall be five pieces. Elbows shall have a minimum radius of $2\frac{1}{2}$ times the pipe outside diameter.
- F. For all fabricated specials and fittings, including crotch plates, steel plate shall be in conformance with ASTM A36. Unless otherwise specified or shown on the Drawings, all steel pipe flanges and bolts, nuts and gaskets therefore shall be in conformance with AWWA C207, Class D, for 150 psi service with flanges in conformance with ASTM A283, Grade C for plate, or ASTM A181 Grade I for flange forgings. All steel plate flanges shall be faced after welding onto pipe. All bolts and nuts shall be galvanized or cadmium plated. Steel castings shall be in conformance with ASTM A27, Grade 70-36. Steel for all other miscellaneous structural steel shapes shall be in conformance with ASTM A36. Steel plate thicknesses for all specials and fittings shall be as shown on the Drawings; however, in no case shall any plate thickness be less than 1/4-inch (for reducers, the larger diameter shall govern).

2.3 JOINTS

- A. **General** – Unless otherwise specified or shown on the Drawings, pipe joints shall be single welded lap joints or rubber gasket joints. See Drawings for welded/restrained joint locations.
- B. Gasketed Joints
 1. Gasketed joints shall conform to AWWA C200. The difference in diameter between the inside diameter of the bell and the outside diameter of the spigot shoulder at point of full engagement, with allowable deflection, shall be no more than 0.04 inches as measured circumferentially.
 2. The gasket shall have sufficient volume to approximately fill the area of the groove and shall conform to AWWA C200.
 3. The joint shall be suitable for the pressures of the class of pipe on which it is furnished, and shall operate satisfactorily with a deflection, the tangent of which is not to exceed $0.75\text{-inch}/D$, where D is the outside diameter of the pipe in inches, or with a uniform pull-out of $\frac{3}{4}$ -inch.
 4. Rubber gaskets shall be furnished only by the manufacturer of the pipe and shall be suitable for the conditions specified in the Contract Documents.
 5. Shop applied coating shall be continuous to the end of the pipe on the bell end and shall be held back on the spigot end sufficiently to allow full engagement of the joint. Shop applied lining shall be continuous to the end of the pipe on the spigot end and shall be held back on the bell end to the point of maximum engagement or further as recommended by the manufacturer. For gasketed joints, the exposed surfaces of the bell and spigot shall be painted with one shop coat of holding primer.

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C. Single Welded Lap Joints

1. The bell shall provide for a nominal lap such that the minimum engagement, with 1-inch allowable pull, is at least 1-inch or three times the thickness of the bell, whichever is greater. Shop applied lining and coating shall be held back sufficiently to allow for welding of the joint, except that lining shall be continuous to the end of the spigot for pipe diameters 24-inches and smaller.
2. Weld lead outlets may be furnished, at the CONTRACTOR's option.

D. Flanges

1. Flanges and flange gaskets shall be as specified in Section 33 11 00 - General Piping Requirements.
2. Nuts and bolts for flanges shall be as specified in Section 33 11 00 - General Piping Requirements.

- E. Couplings shall be installed and of the type indicated on the Drawings. See Section 33 11 06 – Pipe Couplings and Expansion Joints for requirements.

2.4 FABRICATION

- A. The fabrication of the steel piping shall be in accordance with these Specifications and Drawings and with the requirements of AWWA standard C200. The outside surface of the steel piping sections, larger than 24 inches and joined by sleeve-type couplings, shall be sufficiently free from indentations, projections, or roll marks for a distance of eight (8) inches from the ends of the steel piping sections to make a tight joint with the rubber-gasket type of coupling. The maximum permissible outside diameter shall permit passing a ring gage having a bore 3/32 inch larger than the steel piping section for the same 8-inch length. The outside diameter shall not be more than 1/32 inch smaller than the nominal outside diameter for a distance of eight (8) inches from the end. The minimum outside diameter shall be determined by the use of a steel tape circumferentially applied to prevent the shipment of undersize, out-of-round, steel piping sections, which, if measured diametrically through the maximum diameter or checked with a No-Go ring gage, might appear within the specified tolerance. The dimensions and tolerances for pipe ends to be joined by sleeve-type couplings shall be shown on the shop drawings.
- B. Longitudinal joints shall be staggered. Longitudinal and girth joints shall not intersect at outlet connections. All longitudinal and girth joints shall be butt welded. All butt welds shall have complete penetration. Manual welding will be permitted for all welded joints. The ends of pipe sections shall lie in a plane normal to the longitudinal axis of the section within a maximum deviation of 1/16 inch on either side of the plane. Care shall be exercised in matching the edge and ends of the adjoining plates and courses to ensure that the inner surfaces of the plates to be joined by welding are in continuity within a maximum allowable offset at any point of 1/16 inch. Flange faces shall be sufficiently true to provide a watertight joint. All outlets in steel piping shall be reinforced per ASME code.
- C. Pipe bracing requirements are provided in Section 09 90 00 – Painting and Coating.

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D. Marking

1. Legibly mark installation sequence number on pipe, fittings, and specials in accordance with the piping layout submitted by the CONTRACTOR.
2. Special pipe sections and fittings shall be marked at each end with the notations "TOP FIELD CENTERLINE".

2.5 COATING AND LINING

A. Above Ground Piping

1. Exterior: See Section 09 90 00 – Painting and Coating
2. Interior: See Section 09 90 00 – Painting and Coating

B. Buried Piping

1. General

- (a) All steel piping shall be cement mortar lined and coated in accordance with AWWA C205.
- (b) Cement shall conform to ASTM C150, Type II.
- (c) Grout bands or diapers shall be polyethylene foam-lined fabric with steel strapping of sufficient strength to hold fresh mortar, resist rodding of the mortar and allow excess water to escape. The foam plastic shall be 100 percent closed cell, chemically inert, insoluble in water and resistant to acids, alkalis, and solvents.

2. Holdback Corrosion Protection

- (a) Primer coating shall be applied to exposed steel at the pipe ends to prevent corrosion during storage and construction.
- (b) Application and thickness of primer shall be in accordance with the primer manufacturer's recommendations, but shall not impair the clearances required for proper joint installation.

3. Mortar Lining Protection

- (a) Tightly close ends of lined pipe and fittings with plastic sheet caps. Plastic end caps shall be of sufficient thickness and strength to resist shipping, handling, and storage stresses.

2.6 HANDLING, TRANSPORTATION, AND STORAGE

A. Pipe shall be handled in such a manner as to protect the pipe and coating from damage.

B. Coated pipe shall not be shipped or installed until coating has developed full adhesion and cure.

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- C. During coating application, storage, loading, and transportation, every precaution shall be taken to protect and prevent damage to pipe, lining, and coating. Forklift equipment shall have load-bearing surfaces padded with suitable material. Lift pipe with web slings a minimum of 12-inches wide and of a type that will not damage the coating. Metal chains, cable, tongs, forklifts or other equipment likely to damage the coating will not be permitted. Dragging or skidding of pipe on grade or in the trench will not be permitted.
- D. Provide transportation vehicles with padded bolsters between each layer of pipe and heavy padding under load ties. Bolsters shall be curved to fit the outside of the pipe and 12-inches wide, minimum. Pipe contact locations shall be heavily padded with carpet and strips of the outer tape wrap material (adhesive side against the carpet) during shipment to the Site and from the storage yard to the point of installation.
- E. Pipe shall not be stored on rocks, gravel, or other hard materials that might damage the coating. Provide padded 12-inch wide skids and chucks, sand bags, select loamy or sand berms, or suspended from cutback ends, where possible, to minimize coating damage. Pipe shall not be laid on asphalt without suitable padding at contact points.
- F. Pipe shall be inspected by CONTRACTOR at the Site for damage. Any damage to the pipe, lining, or coating shall be repaired as directed if, in the opinion of ENGINEER, a satisfactory repair can be made; otherwise, the damaged section shall be replaced at the sole expense of CONTRACTOR.
- G. No metal tools or heavy objects shall be permitted to come into contact unnecessarily with the finished coating. Workers shall not be permitted to walk on the coating except when absolutely necessary and approved by ENGINEER. When permitted, shoes with rubber or composition soles and heels or other suitable footwear that will not damage coating shall be used.
- H. Long-term Exposure: Pipe shall either be provided with UV inhibitor for lengthy of above grade exposure or covered to prevent UV degradation of outer wrap. Amount of UV stabilizers required shall depend on the project location, laying schedule, anticipated length of exposure, and type of outer wrap. Manufacturer shall be consulted for recommended UV inhibitors requirements or pipe shall be stored under a protective cover. Protective covering can be colored plastic sheeting, canvas, or other UV blocking material. Clear plastic sheets are not acceptable. Areas of coating that display UV degradation shall be removed and repaired at sole cost of CONTRACTOR.
- I. End Caps: Pipe ends of mortar lined pipe and fittings shall be tightly closed with a plastic wrap to aid in curing and to minimize drying out of and contamination of the lining. Plastic end cap shall consist of a minimum of one 10-mil sheet of polyethylene or other suitable material. End caps shall be substantial enough to resist shipment, handling, and storage loads and to remain firmly attached in place. The plastic end cap shall remain intact and in place until pipe installation. Damaged or missing plastic end caps shall be repaired or replaced.
- J. Bracing
 - 1. The manufacturer shall install adequate bracing or strutting to keep the pipe from becoming deformed or damage from occurring to the coating or linings. Strut-type bracing shall be installed as soon as possible after application of lining. Struts shall remain

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in place during handling, storage, transportation, and installation of pipe and fittings until after the pipe zone material is compacted. Adequate strutting shall be provided by pipe manufacturer, so that after completion of backfilling, pipe deflection or elongation shall not exceed one percent of the nominal inside diameter of cement-mortar-lined pipe. The CONTRACTOR may need to install additional bracing as required by the installation method or other field conditions.

2. The minimum bracing shall consist of crossed struts (horizontal and vertical). The maximum spacing along the pipe shall be near each end and at the one-third points for each 40-foot section of pipe, with a minimum of 4 sets of struts per 40-foot section of pipe. Random lengths of pipe shall have an equivalent number of sets of struts, with a minimum of one set of struts in a 10-foot section of pipe. Pipe manufacturer shall submit to ENGINEER the proposed type, installation method, and spacing of bracing struts for review and approval.
3. The struts shall be installed with pads and wedges in such a manner that the pipe lining will not be damaged and the struts will not be dislodged during shipping and handling of the pipe. If struts are welded, they shall be installed and removed in such a manner to prevent damage to the steel cylinder, lining, or coatings. Damage shall be repaired to the satisfaction of ENGINEER.

PART 3 -- EXECUTION

3.1 INSTALLATION OF STEEL PIPE

- A. Pipe delivery, storage, and handling shall include the following:
 1. In no case shall the deflection rubber gasket joints exceed 50 percent of the maximum deflection recommended by the pipe manufacturer.
 2. All pipe, fittings, and specials shall be carefully handled and protected against damage to lining and coating/interior and exterior surfaces, impact shocks, and free fall. All pipe handling equipment shall be acceptable to the ENGINEER. Pipe shall not be placed directly on rough ground but shall be supported at the 1/3 and 2/3 points along the length of the pipe section in a manner which will protect the pipe against injury whenever stored at the trench site or elsewhere. Pipe shall be handled and stored at the trench site in accordance with the requirements stated below. No pipe shall be installed when the lining or coating/interior or exterior surfaces show cracks or other damage that may be harmful as determined by the ENGINEER. Such damaged lining and coating/interior and exterior surfaces, shall be repaired to the satisfaction of the ENGINEER, or a new undamaged pipe shall be furnished.
 3. All pipe fittings, specials, and appurtenances damaged prior to Substantial Completion shall be repaired or replaced by the CONTRACTOR at no additional cost to the AGENCY.
 4. Inspect each pipe and fitting to insure that there are no damaged portions of the pipe. Remove or smooth out any burrs, gouges, weld splatter or other small defects prior to laying the pipe.

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5. Before placement of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of any foreign substance, which may have collected thereon and shall be kept clean at all times thereafter. For this purpose, the openings of all pipes and fittings in the trench shall be closed during any interruption to the WORK.
 6. Lifting points shall be no closer than the 1/3 and 2/3 points along the length of the section. CONTRACTOR shall be responsible for selecting lifting points that when used, do not result in damage to the pipe.
 7. Pipe and Specials Protection: The openings of all pipe and specials where the pipe and specials have been cement-mortar lined in the shop shall be protected with suitable bulkheads to maintain a moist atmosphere and to prevent unauthorized access by persons, animals, water or any undesirable substance. The bulkheads shall be so designed to prevent drying out of the interior of the pipe up to installation. The CONTRACTOR shall maintain all bulkheads and introduce water into the pipe to keep the mortar moist where moisture has been lost due to damaged bulkheads at all times from delivery to just prior to installation.
- B. All straight pipe, bends, tees, adapters, access manholes, closure pieces, blowoff fittings, caps and plugs necessary for testing, and other fittings or specials shall be furnished as indicated on the Drawings or as required to complete the Work. All piping shall be installed complete with all jointing materials and accessories, anchors, and other appurtenances.
- C. Steel pipe shall not be installed until the pipe manufacturer's field service representative has provided training to CONTRACTOR's pipe installation crews and the AGENCY's REPRESENTATIVE on proper installation and handling techniques. The pipe manufacturer's field service representative shall visit the site and inspect, check, instruct, and guide CONTRACTOR's procedures for pipe handling, laying, and jointing at the start of pipe installation by each crew. The pipe manufacturer's representative shall coordinate its service with CONTRACTOR.
- D. The pipe manufacturer's field service representative shall submit to the AGENCY's REPRESENTATIVE a written report certifying that CONTRACTOR's installation personnel have been properly instructed and have employed proper pipe handling and installation procedures prior to the installation of any welded steel pipe. The pipe manufacturer's representative shall also furnish to the AGENCY's REPRESENTATIVE a written report of each site visit.
- E. Joints and related work for field assembly of fittings and specials shall conform to requirements for straight pipe, unless otherwise shown.
- F. Make minor field adjustments by pulling standard joints.
1. Maximum Allowable Angle: 50 percent of manufacturer's recommended or angle that results from 3/4 inch pull out from normal joint closure, whichever is less.
 2. Maximum Allowable Gap: 1/8 inch between bell and spigot at weld location.
- G. Horizontal deflections or fabricated angles shall fall on alignment, as shown.

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- H. Vertical deflections shall fall on alignment, and pipe angle point locations shall match those indicated on Drawings.
- I. Stulling:
 - 1. Maintain stulling in place until pipe backfill is completed to final grade.
 - 2. When CLSM is used for backfill, the stulling shall be left in place until the CLSM has achieved a minimum compressive strength of 75 psi as demonstrated by test cylinders of the product used for the backfill in the field.
 - 3. The horizontal stulling may be temporarily removed to perform interior welding of the pipe joints.
 - 4. If the stulling is temporarily removed, it shall be reinstalled prior to backfilling.
 - 5. Stulling shall be reinstalled so that the pipe is not out of round from a true circle by more than 1 percent.
- J. Out of Round Pipe: Pipe which deviates from a true circle by more than 1 percent shall be laid with its larger diameter vertical, or by using struts on continuous head and sill timbers to correct the vertical diameter where acceptable to the ENGINEER. Struts shall be left in place in accordance with the requirements for stulling specified herein. Final inspection, repair, and checking of interior lining shall be performed after the struts have been removed.
- K. Pipe Deflection: After completion of backfilling and before acceptance of the WORK, the AGENCY's REPRESENTATIVE will randomly test pipes 30 inches and larger in diameter for excessive deflection by measuring the actual inside vertical diameter. Deflection measurements will be made by the AGENCY's REPRESENTATIVE. Pipe diameter deflection shall not exceed 2.25 percent of the nominal inside diameter measured in the vertical direction at any point in the pipe for cement mortar lined and flexible coated pipe. Deflection in excess of the limits set forth above shall be corrected by the CONTRACTOR at no additional cost to the AGENCY.
- L. Laying Pipe:
 - 1. All trenching for and backfilling of buried piping shall conform to Section 31 23 16 – Excavation, Section 31 23 23 – Fill and Compaction, the details indicated on the Drawings, and additional requirements specified herein.
 - 2. Water shall be controlled in trench per Section 31 23 15 – Dewatering.
 - 3. Lower pipe, fittings, and appurtenances into trench, piece by piece, by means of a crane, slings, or other suitable tools and equipment, in such a manner as to prevent damage to pipe materials, protective coatings, and linings.
 - 4. Lay pipe directly on moist sand bag supports in preparation for CLSM. Place sand bag supports to provide depth of CLSM below bottom of pipe as shown. Space supports at a maximum interval of 8 feet and one set within 3 feet on both sides of each joint. Provide additional sand bags as needed to support pipe on line and grade.

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5. Each section of pipe shall be laid in the order and position shown on the line layout and marking diagrams. In laying pipe, it shall be laid to the set line and grade. Maximum allowable deviation from horizontal or vertical lines and grades shall be plus or minus 1/8-inch per foot, with total maximum allowable deviation for any point not to exceed plus or minus one inch, and the pipe shall be laid such that there are no high or low points other than those shown on the Drawings.
6. After joint has been made, check pipe alignment and grade.
7. Except for short runs which may be permitted by the ENGINEER, pipes shall be laid uphill on grades exceeding 10 percent. Pipe which is laid on a downhill grade shall be blocked and held in place until sufficient support is furnished by the following pipe to prevent movement. All bends shall be properly installed as shown.
8. Use care to secure pipe from movement before next joint is installed.
9. Prevent uplift and floating of pipe prior to backfilling with CLSM.
10. The CONTRACTOR shall assume full responsibility for any damage due to this cause and shall at its own expense, restore and replace the pipe to its specified condition and grade if it is displaced due to floating.
11. Laser beam equipment shall be used to indicate alignment and grade. At least one elevation reading shall be taken on each length of pipe. Periodic elevation measurements shall be made with surveying instruments to verify accuracy of grades. If such measurements indicate thermal deflection of the laser beam due to differences between the ground temperature and the air temperature within the pipe, precautions shall be taken to prevent or minimize further thermal deflections. Laser set up shall be verified at least daily using an independent benchmark or temporary benchmark.
12. Placement of pipe locating tape shall be as shown on the Drawings.
13. **Test Section:** At the beginning of pipe laying operations, the CONTRACTOR shall perform a test section to demonstrate that the methods and materials to be utilized will satisfy the pipe zone backfill compaction and pipe deflection criteria. The maximum length of the test section shall be 500 feet. The CONTRACTOR shall not proceed with production pipe laying beyond the test section without the ENGINEER's approval. The entire test section length that does not comply with the Contract Documents shall be reworked as necessary to comply. The AGENCY's REPRESENTATIVE will observe construction of the test section. The AGENCY's REPRESENTATIVE will take measurements and keep records for quality assurance purposes. Any change in means, methods, and trench conditions, including excavation, bedding, and pipe zone materials, insitu soils, water conditions, and backfill and compaction methods will require another successful test section before additional production pipe installation.

M. Jointing:

1. Gasketed Joints

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- (a) Immediately before jointing pipe, the spigot end of the pipe shall be thoroughly cleaned, and a clean rubber gasket lubricated with a non-toxic vegetable-based lubricant shall be placed in the spigot groove. The volume of the gasket shall be "equalized" by moving a metal rod between the gasket and the spigot ring around the full circumference of the spigot ring. The bell of the pipe already in place shall be carefully cleaned and lubricated with the vegetable-based lubricant. The spigot of the pipe section shall then be inserted into the bell of the previously laid joint and telescoped into its proper position. Tilting of the pipe to insert the spigot into the bell will not be permitted. After the pipe units have been joined, a feeler gage shall be inserted into the recess and moved around the periphery of the joint to detect any irregularity in the position of the rubber gasket. If the gasket cannot be "felt" all around, the joint shall be disassembled. The joint shall be reassembled with a new gasket.

2. Welded Joints

(a) Welding:

- (1) All welds shall be sound and free from embedded scale or slag, shall have tensile strength across the weld not less than that of the thinner of the connected sections, and shall be watertight. CJP butt joint welds shall be used for all welded joints in pipe assemblies, in the fabrication of bends, other specials, and as indicated. Field-welded joints shall be either single welded butt strap joints, welded butt joints, or single welded lap joints as shown on the Drawings and shall conform to AWS D1.1, AWWA C206, approved welding procedures, and referenced welding codes. In case of conflict, AWS D1.1 shall govern.
- (2) Preheat and interpass temperature requirements for unlisted base metals shall be determined according to AWS D1.1, Annex XI guideline on Alternative Methods for Determining Preheat.
- (3) Rejectable weld defects shall be repaired or redone and retested until sound weld metal has been deposited in accordance with appropriate welding codes.
- (4) Where exterior welds are performed, adequate space shall be provided for welding and inspection of the joints.
- (5) When fitting up the ends of pipe to be welded or fitting butt-strap pieces, minor jacking or clamping will be allowed. Cold working the metal with sledges or localized application of heat and working the metal with sledges will not be allowed. If field displacement of joints, where butt strap joints are indicated, does not allow proper fit up with the tolerances indicated, special closure butt straps or mitered pieces shall be shop fabricated and installed.
- (6) Welded Lap Joints: During installation of welded steel pipe in straight alignment, the pipe shall be laid so that at any point around the circumference of the joint there is a minimum lap as shown on the Drawings. The toe of the weld shall also be held back from the nearest point of tangency of the bell radius as shown on the Drawings. Prior to welding, the pipe shall be shimmed at the joints to equalize the gap between the bell and the spigot around the joint circumference. The welding shall be performed in a manner that will maintain the equalized fit up.
- (7) Butt Joint Welds: Where used or required, shall be CJP as shown.

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- (8) Prior to the beginning of the welding procedure, any tack welds or joint stops used to position the pipe during laying shall be removed. Any annular space between the faying surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. The weld shall then be made in accordance with ANSI/AWWA C206.
- (9) After the pipe and pipe joint are properly positioned in the trench, weld and provide external joint protection for all joints except the special temperature control lap joint hereinafter specified. The lengths of pipe between special temperature control joints shall be backfilled to at least 1 foot above the top of the pipe as hereinafter specified. The special temperature control joints shall be welded after the pipe is backfilled to at least 1 foot above the top of the pipe for the full distance to the temperature control joints upstream and downstream. Joint protection shall be provided for special temperature control joints after completion of the joint welds and tests as specified. Care shall be exercised during the initial backfilling to prevent movement of the pipe and to prevent any backfill material from being deposited on the special temperature control joint.

(b) Control of Temperature Stresses:

- (1) Control temperature stresses in welded joint sections accordance with AWWA C206, the approved temperature stress control submittal, and these Specifications. Provide special temperature control lap joints at intervals of 300 feet or less, unless otherwise approved by the ENGINEER.
- (2) To control temperature stresses, the unbackfilled special temperature control joint areas of all pipe shall be shaded from the direct rays of the sun by the use of properly supported awnings, umbrellas, tarpaulins, or other suitable materials until the pipe is backfilled at least 1 foot over the top of the pipe. The Temperature Control Joint Area is defined as the entire length of pipe left exposed near a control joint after placing the pipe backfill between it and the other control joints in each direction. Shading materials at the joint area shall not rest directly on the pipe but shall be supported to allow air circulation around the pipe. Shading of the pipe joints need not be performed when the ambient air temperature is below 50 degrees F.
- (3) At intervals not exceeding 300 feet along welded reaches of the pipeline, at the first regular lap-welded field joints outside concrete encasements and structures, and where shown, the pipe shall be supplied with a special temperature control lap joint and laid with an initial lap of not less than 3 inches greater than the typical lap joint. Where temperature control lap joints occur in a traveled roadway or other inconvenient location, the location of the joint may be adjusted, as acceptable to the ENGINEER.

(c) Welding Procedures, Welder Qualifications, and Testing:

- (1) Field welding procedures, welders, welding operators, and tackers shall be qualified in accordance with AWS D1.1. All qualifications shall be in accordance with all-position pipe tests as defined in Section 4 of AWS D1.1.
- (2) The welder qualification testing for field welding shall be conducted at the project site. Results of previous qualification tests will not be accepted. The CONTRACTOR shall provide the services of an independent testing laboratory to perform the welder qualification. Copies of all test data and certifications shall be

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submitted to the AGENCY. All costs of welder qualification testing shall be paid by the CONTRACTOR.

- (3) Upon completion of each field-welded joint, the welding operator shall mark his/her regular identification number and the last two digits of the year the Work was completed, or the CONTRACTOR may have a records system that traces a welder's work. Steel stamping directly on piping will not be acceptable unless "low stress" die stamps, such as interrupted dot or round-nose types, are used.
 - (4) All field welded joints shall be tested by the CONTRACTOR in accordance with Paragraph 3.3 below. All testing costs shall be paid by the CONTRACTOR as further specified.
 - (5) Field weld test specimens shall be furnished to the AGENCY for testing by an independent testing laboratory whenever, in the judgment of the AGENCY's REPRESENTATIVE or the ENGINEER, a satisfactory weld is not being made. Test specimens shall also be furnished when the AGENCY's REPRESENTATIVE or the ENGINEER desires. All costs for this additional testing and repair of the test area will be paid by the AGENCY. If the weld is defective, the inspection costs shall be paid by the CONTRACTOR. Defective welds shall be repaired and retested at no additional cost to the AGENCY.
 - (6) Welded joints shall not be field coated or field lined until having passed all NDT requirements.
3. Flange joints shall conform to AWWA C207, Class D and as follows:
- (a) Buried and Submerged Service:
 - (1) Bolts or Threaded Rod: Stainless steel, ASTM A193, Grade B8.
 - (2) Nuts: Stainless Steel, ASTM A194, Grade 8.
 - (b) Exposed Service:
 - (1) Bolts or Threaded Rod: ASTM A193, Grade B7
 - (2) Nuts: ASTM A194, Grade 2H
4. Mechanical Couplings (AWWA C219): In accordance with Section 33 11 06 – Pipe Couplings and Expansion Joints.
5. Dismantling joints for connecting flanged pipe shall be AWWA C219 compliant. The dismantling joint shall consist of a self-contained flanged restrained joint fitting that allows for longitudinal adjustment similar to Smith-Blair; Model 972 or 975 or Baker Couplings. Provide as a complete assembly consisting of flanged spigot piece, flange adapter, follower ring and bolts, tie bars and gasket piece, flange adapter, follower ring and bolts, tie bars, and gasket. The dismantling joints shall:
- (a) Flanges shall be in accordance with AWWA C207 or ANSI Class 150 flanges with raised face removed. The flange shall be compatible to the class of flange that it will be connected to.

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- (b) All dismantling joints shall be of the restrained type unless otherwise indicated on the Drawings.
- (c) Tie bars shall be equal to flange bolts and shall be equal to one fourth of the number of flange bolt holes or four, whichever is greater. Tie bars, bolts, follower ring bolt material, and rods shall be the same materials as specified for flanges.
- (d) Gasket materials shall be ethylene propylene diene rubber (EPDM) Grade E or other material as listed in AWWA Standard C219 subject to approval by the ENGINEER.
- (e) Coating and lining of dismantling joints shall be fusion bonded epoxy in accordance with AWWA C213 and buried couplings shall be covered with heat shrink sleeves as specified in Section 09 97 50 - Lining and Coating for Piping.

N. Coating and Lining of Field Joints

- 1. Cement mortar coating shall be applied at joints in accordance with AWWA C205, with the cement mortar grout retained by bands or diapers.
- 2. After the pipe backfill has been completed to final grade and all required joint testing has been performed, the interior joint recess shall be cleaned, and the joint surfaces shall be thoroughly wetted before being filled with cement mortar grout, tightly packed into the joint recess and troweled flush with the interior surface in accordance with AWWA C205. All excess shall be removed, and curing compound shall be applied to the grout. At no point shall there be an indentation or projection of grout exceeding 1/16 inch.

3.2 FIELD QUALITY CONTROL

A. Field Welding:

- 1. All welds (100 percent inspection) shall be VT inspected in addition to PT, MT, and VT testing of lap welded and butt welded joints by CONTRACTOR's Certified Weld Inspector and marked to indicate acceptance or rejection
- 2. Test all butt strap connections by pressurizing to 40 psi at the connection between the two fillet welds in accordance with AWWA C206.
 - (a) Apply air or other ENGINEER approved gas into connection between the two fillet welds.
 - (b) Paint welds with soap solution.
 - (c) Mark leaks indicated by escaping gas bubbles.
 - (d) Close threaded openings with flush pipe plugs or by welding them.
- 3. In addition:
 - (a) Inspect 100 percent of all butt joint welds with full circumference RT.
 - (b) Inspect 100 percent of all lap joint welds with PT or MT.
- 4. Weld Acceptance:
 - (a) VT: Perform VT per AWS D1.1 Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.

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- (b) UT: Perform UT of CJP groove welds in accordance with AWS D1.1, Paragraph 6.13.1.
 - (c) RT: Perform RT of CJP butt joint welds in accordance with AWS D1.1, Paragraph 6.12.1.
 - (d) PT or MT:
 - (1) Perform on fillet and PJP groove welds in accordance with AWS D1.1, Paragraph 6.10.
 - (2) Acceptance shall be in accordance with VT standards specified above.
 - (e) Remove in manner that permits proper and complete repair by welding.
 - (f) Caulking or peening of welds is not permitted.
 - (g) Retest unsatisfactory welds.
5. Submit test results to ENGINEER.
6. The AGENCY'S REPRESENTATIVE will conduct random nondestructive inspections of field welded joints. Inspections will be of an appropriate type for weld being evaluated. Possible types of inspection include, but are not limited to, radiographs, magnetic particle, and ultrasonic. Testing will be performed and evaluated in accordance with AWS D1.1. Provide CWI access to the WORK.
- B. Internal Cleaning:
- 1. After the interior joints have been lined with sufficient time allowed for curing of the mortar and prior to hydrostatic testing, pipe shall be thoroughly cleaned of foreign matter, including water.
 - 2. Cleaning may be by hand or mechanical method that is approved by the ENGINEER.
 - 3. Waste materials and water from cleaning operations shall not be passed through section of existing pipe or pipe that has already been lined.
 - 4. No pipe shall be hydrostatic tested until inspected and approved by the AGENCY and the ENGINEER.
- C. The CONTRACTOR shall install a temporary restrained dished head at the lower end of each heading. The CONTRACTOR shall fill each 1,000-foot segment of pipe with water to the invert of the uphill end of the pipe as it is installed in order to maintain a humid atmosphere in the pipe. Additional restrained dished heads shall be provided for each construction heading and stored on-site by the CONTRACTOR. The CONTRACTOR shall monitor the weather and shall install the additional temporary restrained dished heads at the construction headings of the pipe in the event of a storm.

3.3 FIELD TESTING

- A. The piping system shall be tested at the equivalent pressure head resulting from maintaining the normal maximum water elevation in the California Aqueduct.

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- B. The CONTRACTOR shall test to the specified hydrostatic heads for 24 hours, in conformance with provisions specified herein.
- C. The CONTRACTOR shall provide all labor, materials, and equipment required to perform the tests, including all required measuring devices, water and means for conveying water and establishing required hydrostatic head.
- D. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment.
- E. Conduct field hydrostatic test on buried piping after trench has been completely backfilled. Testing may, as approved by the ENGINEER, be done prior to placement of asphaltic concrete or roadway structural section.
- F. Tests shall be made as soon as practical after completion of pipeline construction, but in no event sooner than three days after the placing of any mortar or concrete that will be subjected to hydrostatic pressure during a test.
- G. No test shall be performed without 48 hours prior written notice of intent to test being given to the ENGINEER, and no test shall be performed without the presence of the ENGINEER.
- H. All test and testing procedures will be subject to the approval of the ENGINEER.
- I. The AGENCY will not be responsible for any damage, including damage to pipelines, connected with testing.
- J. Leaks exposed by the tests shall be repaired by and at the expense of the CONTRACTOR.
- K. The CONTRACTOR shall continue testing and repair until the line shows no evidence of leakage over a 24 hour test period.
- L. If pipe repair is unsatisfactory or if leakage persists after repair, as determined by the Engineer, pipe shall be removed and replaced by new pipe of equivalent type, size and pressure class and the new pipe similarly retested.

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SECTION 33 12 16 ELECTRIC MOTOR ACTUATORS

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. The WORK of this Section includes providing all labor, material, and equipment for furnishing and installing electric motor actuators and accessories for valves and sluice gates.
- B. Actuators and accessories provided under this section shall be fabricated and assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the manufacturer, unless exceptions are noted by the ENGINEER.
- C. Actuators shall be furnished with all necessary parts and accessories indicated on the drawings, specified, or otherwise required for a complete, properly operating installation and shall be the latest standard products of a manufacturer regularly engaged in the production of actuators.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Painting and Coating: 09 90 00
- B. General Valve Requirements: 33 12 15
- C. Heavy Duty Sluice Gates: 35 20 17

1.3 SUBMITTALS

- A. Submittals shall be furnished in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit drawings, details, and specifications covering the electric actuators and their appurtenances. Submittal drawings shall clearly indicate the country of origin of each actuator and its components
- C. The drawings shall include separate wiring diagrams for each electric actuator and the electrical control equipment. Each actuator drawing shall be identified with the respective valve name or identification number.
- D. Certified copies of reports covering proof-of-design testing of the actuators as set forth in ANSI/AWWA C542, together with an affidavit of compliance as indicated in ANSI/AWWA C542, shall be submitted to the ENGINEER before the actuators are shipped.

1.4 QUALITY CONTROL

- A. Factory Testing
 - 1. Test each actuator prior to shipment in accordance with AWWA C542, Section 5.3. The application torque shall be the maximum torque required to open or close the valve and slide gate at any position including seating and unseating conditions.

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PART 2 -- PRODUCTS

2.1 ELECTRIC MOTOR ACTUATOR FOR VALVES

A. Actuator Identification

1. Motor actuators shall have the name of the manufacturer cast or molded onto the actuator body or shown on a permanently attached plate in raised letters

B. Actuator Designations and Designs

1. Actuator designations consist of a type number (1, 2, or 3) and one or more suffix letters. The number and the letters are intended to be compatible and the actuator shall meet the requirements of all.

Suffix	Description
None (basic design)	15-minute duty cycle (Type 1 actuators); NEMA 4 enclosure; open-stop-close or throttling operation; voltage per Electrical Drawings, 60-hertz, valve to remain in last position upon loss of control signal. Any of these basic requirements may be modified or superseded by suffixes (described below).
J	Class 1 throttling/modulating service per AWWA C542.
K	Class 2 throttling/modulating service per AWWA C542.
L	Class 3 throttling/modulating service per AWWA C542.
M	Class 4 throttling/modulating service per AWWA C542.

C. Actuator Torque Requirements

1. The rated output torque of the motor actuator shall be at least 1.5 times the maximum torque required to open or close the valve at any position including seating and unseating conditions when subjected to the most severe operating condition including any mechanical friction and/or other restrictive conditions that are inherent in the valve assembly. Do not include hammer-blow effect in sizing the actuator to comply with this torque requirement. Coordinate with the valve manufacturer to assure that the motor actuator stall torque output does not exceed the torque limits of the valve operating stem or shaft.
2. Maximum torque shall include seating or unseating torque, bearing torque, dynamic torque, and hydrostatic torque. Assume that the differential pressure across the valve is equal to the pressure or head rating of the valve.

D. Design of Electric Motor Actuators

1. Actuators shall comply with AWWA C542, except as modified herein. Output capacity of motors shall be sufficient to open or close the valve against the maximum differential pressure when the voltage is 10% above or below normal at the specified service conditions. Motors shall have Class H insulation system. Provide motor with torque output (at duty rating) that exceeds the requirements of the following paragraphs including safety factor.

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2. Design the actuator to move valves from fully closed to fully open in the time specified in the subsection on “Service Conditions.”
3. Provide valve actuators with local controls. Include LCD display, transformer, reversing electro-mechanical starters for Class 1 service or solid state starters rated for Class 2 through 4 service. Refer to Schematics on Contract Drawings for actuator controls. Provide a battery back- up to keep the LCD display lit and remote contact wetted in the event of power failure. The motor shall be de-energized in the event of stall when attempting to unseat a jammed valve. Motor temperature shall be sensed by a thermostat to protect against overheating. Datalogger included in the main control board to record the last 1000 actuator events.
4. Do not use external conduit for wiring any components within the actuator.
5. Gear actuators shall be totally enclosed and factory-grease packed or oil lubricated. The power gearing shall consist of helical gears of heat-treated steel. Worm gears shall be alloy bronze accurately cut with a hobbing machine. Worm shall be hardened steel alloy. Design gears for 24-hour continuous service with an AGMA rating of 1.50.
6. A minimum of seven programmable contacts shall be provided, unless otherwise indicated on the drawings, which can be selected to indicate any position of the valve with each contact externally selectable as normally open or normally closed. The contacts shall be rated at 5A, 120VAC, 30V DC.
7. Torque sensing must be affected directly electrically or electronically and shall be governed by a solid-state torque sensor that directly measures the output torque of the actuator to protect the valve and actuator from damage from possible obstructions. Extrapolating torque from mechanically measured motor speed is not acceptable due to response time. Torque measurement shall be independent of variations in frequency, voltage or temperature. Torque shall be adjustable in 1% increments. The actuator shall store actual operational torque curves for retrieval by the AGENCY personnel.
8. Provide a manually operated handwheel that shall not rotate during electrical operation. In the event electrical power is interrupted, handwheel operation shall be activated by a hand lever attached to the mechanism. While the valve is being operated manually, the motor shall not rotate. Upon restoration of electrical power, the handwheel shall automatically disengage. Design the handwheel diameter such that hand operation will not damage the valve.
9. Torque Sensor: shall be a piezo sensor to measure motor shaft thrust produced from motor worm and wheel assembly. The system can will display the torque value on the LCD display and be captured by the datalogger and stored in the unit’s event log.
10. Provide a lost motion device for open/close operation to permit the motor to reach full speed before the load is applied. Provide lost motion action for manual operation also. Do not provide lost motion device for modulating applications.
11. Actuator enclosure shall be a non-intrusive type sealed enclosure watertight, double o-ring sealed IP68 rated.

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12. Motor shall de-energize in the event of a stall when attempting to unseat a jammed valve.
13. Provide a time delay to prevent instant reversal of the actuator motor.
14. Provide terminal connections for external remote controls fed from an internal 120-volt supply as noted on Contract Drawings. Actuator 120-volt supply shall be sized for loads shown on Contract Drawings.

2.2 ELECTRIC MOTOR ACTUATOR FOR VALVES - MANUFACTURER

- A. Manufacturers and models shall be **Rotork, Auma, or EIM.**

2.3 ELECTRIC MOTOR ACTUATOR FOR SLUICE GATES

- A. General: Unless otherwise indicated, all shutoff and throttling valves, and externally actuated valves and gates, shall be provided with manual or power actuators. Furnish all actuators complete and operable with mounting hardware, motors, gears, wiring, solenoids, handwheels, levers, chains, and extensions, as applicable. All actuators shall be capable of holding the valve or gate in any intermediate position between fully-open and fully-closed without creeping or fluttering. Actuators shall be sized to produce the torque or thrust required to operate the valve or gate with the maximum pressure differential specified on the valve/gate when subject to the maximum seating and unseating operating heads specified. All wires of motor-driven actuators shall be identified by unique numbers.
- B. Manufacturers: Where indicated, certain valves and gates may be provided with actuators manufactured by the valve or gate Manufacturer. Where actuators are furnished by different manufacturers, a single manufacturer shall be designated for all actuators.
- C. Materials: All actuators shall be current models of the best commercial quality materials and liberally sized for the maximum expected torque. All materials shall be suitable for the environment in which the valve or gate is to be installed. All external fasteners shall be stainless steel.
- D. Mounting: All actuators shall be securely mounted by means of brackets or hardware specially designed and sized for this purpose and of ample strength. The word "open" shall be cast on each valve or actuator with an arrow indicating the direction to open in the counter-clockwise direction. All gear and power actuators shall be equipped with position indicators.
- E. Standard: Unless otherwise indicated and where applicable, all actuators shall be in accordance with ANSI/AWWA C 540 AWWA Standard for Power-Actuating Devices for Valves and Sluice Gates.
- F. Functionality: Electric actuators shall be coordinated with power and instrumentation equipment indicated elsewhere in the Contract Documents. Actuators shall work in conjunction with Valve Pushbutton Stations provided by the Instrumentation Supplier. Actuator faceplate shall be blank, no controls. Refer to Contract Drawings for actuator schematics and controls.

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2.4 INTELLIGENT NON-INTRUSIVE ELECTRIC MOTOR ACTUATORS FOR SLUICE GATES

- A. Equipment Requirements: Where electric motor actuators are indicated, an electric motor-actuated valve control unit shall be attached to the actuating mechanism housing by means of a flanged motor adaptor piece.
1. All actuators shall be the product of a single manufacturer. Manufacturer shall be Rotork Controls (<http://www.rotork.com/en/>), or equal.
 2. It shall be the responsibility of the CONTRACTOR to ensure that all actuators are from the same manufacturer regardless of gate or valve type, manufacturer or supplier.
 3. It shall be possible to carry out the setting of the torque, turns, and configuration of the indication contacts without the necessity to remove any electrical compartment covers. The actuator shall include a padlockable Local-Off-Remote selector switch, open, close and stop pushbuttons, and status lights on the front cover.
- B. Gearing: The motor actuator shall include the motor, reduction gearing, reversing starter, torque sensor and position sensor in a weatherproof NEMA 4/4X/6 assembly.
1. Motor Operator gearing shall be of materials as specified in AWWA C540, and shall include a hardened steel worm shaft and high tensile alloy bronze worm wheel that provide a self locking characteristic. Gears shall be oil bath lubricated.
 2. Actuator housing shall be FM Certified NEMA6P/IP68 Weatherproof/Submersible, such that an internal heater is not required.
- C. Starting Device: Except for modulating valves, the unit shall be so designed that a hammer blow is imparted to the stem nut when opening a closed valve/gate or closing an open valve/gate. The device should allow free movement at the stem nut before imparting the hammer blow. The actuator motor must attain full speed before stem load is encountered. Modulating actuators shall have a direct drive.
- D. Switches and Wiring: The actuator movement shall be governed by a solid-state motor speed and torque control sensor that measures the output torque of the actuator to protect the valve and actuator from damage from possible obstructions. Torque shall be adjustable in 1% increments. The actuator shall store actual operational torque curves for retrieval by plant maintenance staff. Position sensing shall be via a solid-state position encoder that eliminates the use of counting gear trains or potentiometers. The actuator shall have 7 user configurable contacts, or as many as required to produce the control as shown in the Contract Drawings. Provide 4 to 20 milliamp gate position output as shown on the Contract Drawings. Position shall be indicated on a backlit LCD display. The indicating contacts and position display shall remain active and visible when primary power is turned off. The terminal area shall be protected by double O-ring sealing, one for the terminal cover and one for the terminal block, such that the actuators internals are protected from the environment even when the terminal cover is removed and from any moisture or dirt that may enter the conduits connected to the actuator.
- E. Handwheel Operation: A permanently attached handwheel shall be provided for emergency manual operation and shall be padlockable in either manual or auto. Manual operation shall be via power gearing to minimize required rimpull and facilitate easy change-over from motor

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to manual operation when actuator is under load. Return from manual to electric mode of operation shall be automatic upon motor operation. The handwheel shall not rotate during electrical operation. The maximum torque required on the handwheel under the most adverse conditions shall not exceed 40 pounds per foot, and the maximum force required on the rim of the handwheel shall not exceed 40 pounds. A seized or inoperable motor or gearing shall not prevent manual operation. An arrow and either the word "open" or "close" shall be cast or permanently affixed on the handwheel to indicate the appropriate direction to turn the handwheel.

- F. Motor: The motor shall be of the totally enclosed, nonventilated, high-starting torque, and low-starting current type for full voltage starting. It shall be suitable for operation based on design voltage and number of phases, as well as have Class H insulation and a motor frame with all dimensions in accordance with the latest revised NEMA MG Standards. The observed temperature rise by thermometer shall not exceed 55 degrees C above an ambient temperature of 50 degrees C when operating continuously for 15 minutes under full rated load. All bearings shall be of the ball type and thrust bearings shall be provided where necessary. All bearings shall be provided with suitable seals to confine the lubricant and prevent the entrance of dirt and dust. Motor conduit connections shall be watertight. Motor construction shall incorporate the use of stator and rotor as independent components from the valve operation such that the failure of either item shall not require actuator disassembly or gearing replacement. The motor shall have thermostats in the windings to thermally protect it. The actuator shall include a phase protection device to ensure the motor runs in the correct direction regardless of how the 3-phase is connected for applicable 3 phase installations. It shall also include a device to protect against "single phasing" as applicable.
- G. Standard SAE80EP gear oil shall be used to lubricate the gearcase. Special or exotic lubricants shall not be used as they may be difficult to source in remote locations.
- H. The actuator shall be capable of functioning in an ambient temperature ranging from minus - 22°F (-30°C) to + 158°F (+70°C). Actuators that require an integral space heater to control moisture ingress are not acceptable.
- I. Diagnostics Facilities: Actuators shall include a diagnostic data logger module, which shall store and enable download of historical actuator data logger information to permit analysis of changes in actuator or valve performance. It shall be possible for customer to setup, calibrate and access actuator data via non-intrusive infrared means using any of three methods: Setting Tool, Laptop PC or hand-held Windows Mobile-based 'Personal Digital Assistant (PDA)' device capable of duplex IrDA communications. Appropriate diagnostic software shall be provided by the actuator manufacturer to allow configuration and diagnostic information to be reviewed, analyzed and reconfigured.
- J. Provision shall be made to display valve torque demand as a percent of rated actuator torque and position simultaneously, so as to facilitate valve troubleshooting and diagnostics. The data logger shall also enable the retrieval of all configurable actuator date and time-stamped events, including the ability to search for occurrences of any particular event. Valve torque profiles shall be available in 1° positional increments. The diagnostics shall also enable retrieval of at least three types of alarms - actuator alarms, valve alarms and control system alarms.
- K. Actuator Appurtenances: Actuators shall work in conjunction with Slide Gate Control Panel, refer to Contract Drawings. Actuator faceplate shall include digital display and Local-Off-Remote

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Switch, Open pushbutton, Close pushbutton, Stop pushbutton, and status lights. Refer to Contract Drawings. Actuators shall supply 120 VAC for remote controls as indicated on the Contract Drawings. Actuators shall include digital inputs for remote open and remote close commands (from Slide Gate Control Panel if hand switch at actuator is in Remote, and SGCP is selected); as well as contact outputs configured closed when gate is fully opened (two sets of contacts), and fully closed (two sets of contacts), and gate opening contact, and gate closing contact, and fault alarm contact for status feedback. Provide 4-20 mA signal feedback based on gate position, 0-100% open. Provide for permissive input, so if Slide Gate Control Panel Location Selector Switch is in "GATE" position, the local gate actuator Open and Close pushbuttons are allowed to function. Refer to Contract Drawings for gate control schematics and wiring interconnects. Fault contact shall close if any of the following conditions arise: over torque, over temp, not in remote, low battery, lost phase, motor stall, or overload.

- L. Starter: The starter shall be suitably sized amperage rated reversing starter with its coils rated for operation on 240 VAC, three phase, 60 Hz current. A control power transformer shall be included to provide internal control power and a 120-volt source. Modulating actuators shall be fitted with a solid state starter suitable for up to 1200 starts per hour.
- M. Opening Speed: The actuator shall be designed to move the gate from a fully closed to fully open position or vice versa at a minimum speed of 8 to 12 inches of gate height per minute.

PART 3 -- EXECUTION

3.1 ELECTRIC MOTOR ACTUATOR FOR VALVES - DELIVERY AND STORAGE

- A. Prepare equipment for shipment per AWWA C542, Section 6.2 and the following. The preparation shall make the equipment suitable for six months of outdoor storage from the time of shipment, with no disassembly required before operation except for inspection of bearings and seals.
- B. Pack and ship one copy of the manufacturer's standard installation instructions with the equipment. Provide the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the jobsite and before start-up.
- C. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Provide closures at the place of manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures.
- D. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Provide caps or plugs at the place of manufacture prior to shipping.
- E. Clearly identify lifting points and lifting lugs on the equipment or equipment package. Identify the recommended lifting arrangement on boxed equipment.

3.2 ELECTRIC MOTOR ACTUATOR FOR VALVES - INSTALLATION

- A. Attaching Electric Actuators

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1. The valve manufacturer shall mount the electric motor actuator and accessories on each valve and stroke the valve prior to shipment. Adjust limit switch positions and torque switches.

B. Field Installation

1. Install the valve and actuator as indicated in the drawings in accordance with the manufacturer's instructions.

3.3 ELECTRIC MOTOR ACTUATOR FOR VALVES - FIELD TESTING

- A. Test motor actuators as installed by measuring the current drawn (in amperes) by each motor for unseating, seating, and running conditions. The measured current shall not exceed the current measurement recorded during the factory performance test.
- B. If the measured current drawn exceeds the above value, provide a larger motor or gear drive or adjust the actuator so that the measured amperage does not exceed the value.
- C. Assure that limit switches are placed at their correct settings. Open and close valves twice and assure that limit switches function.

3.4 ELECTRIC MOTOR ACTUATOR FOR SLUICE GATES - SERVICES OF MANUFACTURER

- A. Field Adjustments: An approved field representative from manufacturers of gates with hydraulic or electric actuators mounted on the gates shall adjust actuator controls and limit switches in the field for the required function. Said approved actuator manufacturer representative shall visit the site two times during the installation as coordinated with the CONTRACTOR and the AGENCY'S REPRESENTATIVE.

3.5 ELECTRIC MOTOR ACTUATOR FOR SLUICE GATES - INSTALLATION

- A. All valve and gate actuators and accessories shall be installed in accordance with the manufacturer's written instructions and shop drawings.
- B. Stems shall be lubricated prior to operating.

3.6 ELECTRIC MOTOR ACTUATOR FOR SLUICE GATES - PERFORMANCE TEST CERTIFICATE

- A. Each actuator shall be performance tested and individual test certificates shall be submitted to the ENGINEER at no additional cost. The test equipment shall simulate a typical valve load and the following parameters should be recorded:
 1. Current at maximum torque setting
 2. Torque at maximum torque setting
 3. Flash Test Voltage
 4. Actuator Output Speed or Operating Time
 5. Meets operational controls: refer to Contract Drawings.

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- B. In addition, the test certificate shall include details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.

3.7 ELECTRIC MOTOR ACTUATOR FOR SLUICE GATES - EXPERIENCE

- A. All technologies and devices used in the actuator must have a minimum of five years of commercial operating experience for that specific manufacturer, including torque and position sensing, lubrication, and electrical compartment design.

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SECTION 35 20 17 HEAVY DUTY SLUICE GATES

PART 1 -- GENERAL

1.1 DESCRIPTION

- A. This section includes requirements for heavy duty sluice gates. Sluice gates shall be furnished and installed complete with operating stem, operating floorstand, and other appurtenances or accessories as specified. The gates shall be the rising stem type.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Bolts, Washers, Anchors, and Eyebolts: 05 05 20.
- B. Painting and Coating: 09 90 00.
- C. Electric Motor Actuators: 33 12 16

1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01 33 23 Submittal Requirements.
- B. Submit manufacturer's installation instructions.

PART 2 -- PRODUCTS

2.1 HYDRAULIC GATES

- A. General - The sluice gates shall be in the quantities and sizes indicated on the plans and listed in the Gate schedule elsewhere in the specifications. The sluice gates shall be mounted directly to the headwall or furnished with wall thimbles as shown on the drawings and specified herein. The sluice gates shall be as manufactured by Hydro Gate Corp., Rodney Hunt Company, or approved equal.
 - 1. Liberal safety factors shall be used in the design of all equipment. Working stresses shall not exceed the lower value of: one third of the yield strength or one fifth of the ultimate strength of the material. The sluice gates and appurtenances shall be designed for installation in the structures shown on the plans.
 - 2. All work shall be performed in accordance with the best modern practice for the manufacture of high-grade machinery. All parts shall have accurately machined mounting and bearing surfaces so that they can be assembled without fitting, chipping, or re-machining. All parts shall conform accurately to the design dimensions and shall be free of all defects in workmanship or material that will impair their service. The sluice gates shall be completely shop assembled to insure proper fit and adjustment of all parts.
- B. All materials used in construction of the gates and appurtenances shall be the best suited for the application and shall conform to the following specifications:

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Part	ASTM Designation
Iron castings for frame, disc and guides, stem guides, floorstands, and other items	A-126, Class-B
Bronze castings for wedges, thrust nut, lift nut, and coupling	B-584, C86500
Bronze for seat facings in frame and disc	B-21, C46400
Bronze tongue	B98, C65500
Stainless steel for stems	A-276, Type 304
Stainless steel for fasteners	A-276, Type 304

1. Sluice Gates - Sluice gates shall be cast iron, fully bronze mounted, and shall have side wedges for seating head conditions and side, top, and bottom wedges for unseating head conditions when the width of the gate exceeds 24". All gate components shall be designed to safely withstand the heads listed in the Sluice Gate Schedule.

(a) Sluice Gate Schedule:

Quantity	Size	Design Seating Head (ft)	Design Unseating Head (ft)
2	96" W x 72" H	20	15

- C. Frame - The frame shall be of cast iron, one-piece construction with mounting flange and rectangular or circular opening as indicated on the plans. All contact surfaces of the frame shall be machined. The frame shall have machined dovetailed grooves on the front face into which bronze seat facings shall be driven and machined to a 63 micro-inch finish. The back of the frame shall be machined to bolt directly to the machined face of the wall thimble or anchor bolt pattern. Anchor bolts shall be provided with leveling nuts and shall be stainless steel in accordance with Section 05 05 20. Anchor bolt size shall be as recommended by the gate manufacturer. Gates mounted directly to the headwall shall include a minimum of 1-1/2" of non-shrink grout between the gate back and concrete wall. Sealant shall be applied at the juncture of the gate back and non-shrink grout, and at the juncture of the non-shrink grout and concrete wall. Sealant shall be in accordance with Section 03 15 10, paragraph 2.4. Frames for sluice gates, greater than 24" wide, subject to unseating heads shall have integrally cast pads machined with keyways to receive top and bottom wedge seats.
- D. Disc or Sluice - The disc shall be of cast iron, one-piece construction, rectangular with integrally cast vertical, horizontal ribs and bullnose design for flow. A reinforcing rib along each side shall be provided to insure rigidity between the side wedges. The disc shall have machined dovetailed grooves on the seating face into which bronze seat facings shall be driven and machined to a 63 micro-inch finish. A tongue on each side, extending the full length of the disc, shall be machined on all sides with a 1/16" clearance maintained between the disc tongue and gate guide groove. Wedge pads for side and top wedges, when required, shall be cast integrally on the disc and machined to receive adjustable bronze wedges. A heavily reinforced nut pocket shall be cast integrally on the vertical centerline and above the horizontal center, and be of such shape to receive the square-backed thrust nut.
- E. Guides - The guides shall be cast iron, one-piece, designed to withstand the total thrust due to water pressure and the wedging action. The guides shall be machined on all contact surfaces,

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and a groove shall be machined the entire length of the guide to allow 1/16" clearance between the disc tongue and guide groove. The guides shall be of such length as to retain and support at least one half the disc in the full open position. The guides shall be integrally cast with or attached to the frame with silicon bronze or stainless steel studs and nuts, and shall be dowelled to prevent any relative motion between the guides and frame. On sluice gates over 48" wide, a reinforcing rib extending from the guide flange over the top of the wedge seat shall be provided. Bronze wedge seats shall be securely attached to machined pads on the guides.

- F. Flush Bottom Closure - The flush bottom closure type of gate shall have a compressible resilient seal attached to the bottom of the disc (sliding member) with a stainless steel bar and fasteners. The seal shall be of a specially extruded shape, and designed to accurately fit to the bottom rib of the disc. The seal shall be shaped to produce a wide sealing area on a machined cast iron stop bar that is bolted to the gate frame to form a flush invert. The differential sealing pressure of the resilient seal on the stop bar shall be variable by adjustment of the side wedges on the gate.
- G. Wedges - The wedges shall be solid cast bronze, machined on all contact surfaces. They shall be attached to the disc with studs and nuts and shall have adjusting screws with lock nuts.
- H. Seat Facings - All seat facings shall be malleable extruded bronze of a composition which will increase in wearing ability with cold working. The extruded seat facings shall be of special shape to fill and permanently lock in the machined dovetailed grooves when driven into place. Attaching pins and screws will not be allowed. The installed seat facings shall be machined to a 63 micro-inch finish or better.
- I. Wall Thimbles - Wall thimbles shall be furnished for all sluice gates that are not attached to pipe flanges or concrete headwalls with anchor bolts. Wall thimbles shall be "F" section with a depth of 12 inches, or as shown on the Drawings. They shall be cast iron, one-piece construction of adequate section to withstand all operational and reasonable installation stresses. Wall thimbles shall be internally braced during concrete placement. A center ring or water stop shall be cast around the periphery of the thimble. The front flange shall be machined and have tapped holes for the sluice gate attaching studs, and metal stamped vertical centerlines with the word "top" for correct alignment. Large rectangular wall thimbles shall be provided with holes in the invert to allow air to escape during concrete placement beneath the thimble. A permanent gasket for uniform thickness or suitable mastic shall be provided between the sluice gate and wall thimble.
- J. Stems - The operating stem shall be of a size to safely withstand, without buckling or permanent distortion, the stresses induced by normal operating forces. In addition, the stem shall be designed to transmit in compression at least 2-1/2 times the rated output of the floorstand or benchstand with a 40 pound effort on the crank or handwheel. The threaded portion of the stem shall have machine cut threads of the 29o Acme type. Stems of more than one section shall be joined by bronze couplings threaded and keyed to the stems. All threaded and keyed couplings of the same size shall be interchangeable.
- K. Stem Guides - Stem guides shall be cast iron, bronze bushed, mounted on cast iron brackets. They shall be adjustable in two directions and shall be spaced at sufficient intervals to adequately support the stem. Stem guide spacing shall not exceed and L/r ratio of 200, and shall not be spaced greater than 10 feet except where required by gate travel.

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- L. Electrically Operated Floorstands - The manual override for the electric actuator shall operate the gates under the specified operating head with not greater than a 40 pound pull on the crank or handwheel. For electric actuated gates the stem shall with stand 1.5 times the actuator stall torque. Also reference AWWA C542 power-actuating devices for sluice gates.
- M. Floorstands shall include a high strength pedestal designed to position the input, shaft, or handwheel approximately 36" above the operating floor. Benchstands shall be provided with a rectangular cast iron base machined and drilled for mounting purposes. An arrow with the word "open" shall be permanently attached or cast on the floorstand, benchstand, or handwheel indicating the direction of rotation to open the gate.

2.2 PAINTING

- A. Painting shall conform to Section 09 90 00 – Painting and Coating.
- B. The gate manufacturer shall be responsible for shop prime and finish painting of all gates and appurtenances supplied under this contract. All coatings shall conform with VOC Emission Regulations in effect at the manufacturing location and at project site to allow touch-up or recoating to be performed with the same products. The type of paint shall be as specified in the following schedule. Where required by application, the coating shall be approved for contact with drinking water by the NSF, EPA, or other appropriate governing agencies. Number of coats, mil thickness, and surface preparation shall be in accordance with the paint manufacturer's recommendations for that application, but in no case shall be less than the requirements stated in Division 10 of these specifications. All coatings shall be free of carcinogens as listed on the IARC monographs.

2.3 ACTUATORS

- A. See Section 33 12 16 – Electric Motor Actuators

PART 3 -- EXECUTION

3.1 SERVICES OF MANUFACTURER

- A. Field Adjustments: An approved field representative from manufacturers of gates with hydraulic or electric actuators mounted on the gates shall adjust actuator controls and limit switches in the field for the required function. Said approved actuator manufacturer representative shall visit the site two times during the installation as coordinated with the CONTRACTOR and ENGINEER.

3.2 INSTALLATION

- A. All valve and gate actuators and accessories shall be installed in accordance with the manufacturer's written instructions and shop drawings.
- B. Stems shall be lubricated prior to operating.

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3.3 PERFORMANCE TEST CERTIFICATE

- A. Each actuator shall be performance tested and individual test certificates shall be submitted to AGENCY's REPRESENTATIVE at no additional cost. The test equipment shall simulate a typical valve load and the following parameters should be recorded:
1. Current at maximum torque setting
 2. Torque at maximum torque setting
 3. Flash Test Voltage
 4. Actuator Output Speed or Operating Time
 5. Meets operational controls: Actuator faceplate open and close pushbuttons shall be functional only when Remote Mounted Pushbutton Station is in Local mode. Remote Mounted Pushbutton Station controls and SCADA controls only work when Remote Mounted Pushbutton Station is in Remote.
- B. In addition, the test certificate shall include details of specification, such as gear ratios for both manual and automatic drive, closing direction, and wiring diagram code number.

3.4 EXPERIENCE

- A. All technologies and devices used in the actuator must have a minimum of five years of commercial operating experience for that specific manufacturer, including torque and position sensing, lubrication, and electrical compartment design.

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SECTION 40 90 00 PROCESS CONTROL AND INSTRUMENTATION SYSTEMS

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide Process Control and Instrumentation Systems (PCIS) complete and operable, in accordance with the Contract Documents. This includes but is not limited to all Control Panels and instruments detailed in these Specifications and those shown on the Contract Drawings. This work shall be done by the Instrumentation Supplier.
- B. CONTRACTOR shall coordinate PLC Panel hardware installation with the AGENCY. The AGENCY to provide hardware to be installed in PLC Panel. CONTRACTOR is responsible to install and terminate. Both the AGENCY and CONTRACTOR shall test PLC I/O from field device to PLC processor register. CONTRACTOR shall install antenna and cable, including antenna orientation, as directed by the AGENCY.
- C. Traveling Screen Control Panel shall meet the requirements of this Section.
- D. WORK performed by the Instrumentation Supplier (IS) shall strictly follow the Sequence of Work outlined below. Acceptance of work shall only be approved if Sequence of Work is followed. Documentation of each sequenced item must be approved by ENGINEER prior to start of next item. Sequence of Work shall be:
 1. **Instrument Installation Form:** completed and approved upon satisfactory installation means by Instrumentation Supplier. Sample Form shall be submitted by Instrumentation Supplier and approved by ENGINEER.
 2. **Configuration and Programming of Equipment:** Instrumentation Supplier shall configure the Gate Position digital displays, and assist flowmeter installing representative with flowmeter transmitter configuration. CONTRACTOR shall coordinate with the AGENCY for configuration requirements, such as flowmeter measurement units and analog ranges, totalizer units, etc.
 3. **Loop Testing Forms:** completed and approved upon satisfactory loop test of instrument by Instrumentation Supplier verifying wiring and instrument operation. Loop Testing Form is attached. All testing to be witnessed by the AGENCY and ENGINEER.
 4. **Functional Testing:** Instrumentation Supplier shall provide Functional Test forms and verify correct operation of Flowmeter. All testing to be witnessed by the AGENCY and ENGINEER.
- E. Responsibilities
 1. The CONTRACTOR, through the use of an Instrumentation Supplier and qualified electrical and mechanical installers, shall be responsible to the AGENCY for the implementation and integration of the PCIS.

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2. As a minimum, the Instrumentation Supplier shall perform the following WORK:
 - (a) Implementation of the PCIS
 - (i) Prepare instrumentation hardware submittals
 - (ii) Prepare Control Panel submittals: Slide Gate Control Panel, PLC Panel, Terminal Cabinet, Meter Vault Lights and Fan Control Panel, Exhaust Fan controls.
 - (iii) Prepare Factory and Field Test forms for submittal
 - (iv) Prepare hardcopy submittals of configuration and programming values for the Flowmeter equipment.
 - (v) Prepare and schedule testing and training. Schedules for all testing and training shall be included on CONTRACTOR's project schedule.
 - (vi) Procure hardware
 - (vii) Oversee, document, and certify installation.
 - (viii) Configure and Program Sonic Flowmeter with meter manufacturer.
 - (ix) Configure Slide Gate Position digital indicators.
 - (x) Perform, coordinate, document, and certify Loop Testing.
 - (xi) Perform, coordinate, document, and certify Field Testing.
 - (xii) Prepare O&M Manuals.
 - (xiii) Conduct training classes in conjunction with Flowmeter manufacturer.
 - (xiv) Prepare record drawings and submit as required.
 - (b) Integration and functionality with instrumentation, equipment and control devices provided under other sections or from the AGENCY:
 - (i) Resolve signal, power, or functional incompatibilities between interfacing devices and provide fix at no extra cost.
 - (ii) Program and configure all instruments and equipment. Provide hardcopy print out of all programmed and configurations parameters for each device with O&M Manual.
 - (iii) Verify and correct if needed type, size, and number of power and or signal wires with their associated raceways.
3. Provide all tools, equipment, materials, and supplies and be responsible for all labor required to complete the installation, programming/configuration, startup and operational testing of a complete and operable Process Control and Instrumentation System as indicated on the Drawings and as specified herein.

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4. **Site and Instrument Inspection:** Inspect site for conformance to Drawings, paying special attention to space allocation and dimensions shown or required on Drawings. Inspect completed work and verify that it is ready for installation of instruments and equipment. Inspect each instrument and piece of equipment for damage, defects, completeness, and correct operation before installing.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All work specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 INSTRUMENTATION QUALIFICATIONS

- A. An Instrumentation Supplier shall be a UL listed Panel Shop and shall have demonstrated experience in purchasing, calibrating, fabricating, installing and testing the Instrumentation and Control (I&C) products listed in this Specification Division. The Instrumentation Supplier shall be a systems house regularly engaged in the business of panel fabrication, control component procurement, instrumentation installation and start-up in the process control industry.
- B. Instrumentation Supplier shall be **Tesco Controls, Inc.** (Mr. Shain Thomas at 916-395-8800), **Technical Systems Incorporated** (Mr. Jon Rogers at 707-678-1111), or equal.

1.4 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General and the following:
- B. Shop Drawings
 1. General
 - (a) Shop Drawings shall include the letter head or title block of the Instrumentation Supplier. The title block shall include, as a minimum, the Instrumentation Supplier's registered business name and address, project name, drawing name, revision level, and personnel responsible for the content of the drawing. The quantity of submittal sets shall be as indicated in Section 01 33 00 – Submittals.
 - (b) Organization of the Shop Drawing submittals shall be compatible with eventual submittals for later inclusion in the O&M Manual. Submittals not so organized and incomplete submittals for a given loop will not be accepted.
 - (c) Shop Drawing information shall be bound in standard size, 3 ring, loose-leaf, vinyl plastic, and hard cover binders suitable for bookshelf storage. Binder ring size shall not exceed 3-inches.

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2. **Hardware Equipment Submittal:** The CONTRACTOR shall submit a complete bound package at one time, including:
 - (a) A complete index which lists each device by installed location description, type, and manufacturer. A separate technical brochure or bulletin shall be included with each instrument data sheet. The data sheets shall be indexed in the submittal by systems or loops, as a separate group for each system or loop. Each brochure or bulletin shall include a list of installed location descriptions for which it applies.
 - (b) Fully executed data sheets according to ISA S20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves, for each component, together with a technical product brochure or bulletin. The technical product brochures shall verify conformance to Contract Document requirements. The data sheets, as a minimum, shall show:
 - (i) Manufacturer's model number or other product designation.
 - (ii) Project tag number used in the Contract Documents or derived by Contractor if one does not exist.
 - (iii) Project location or assembly at which the component is to be installed.
 - (iv) Input and output characteristics.
 - (v) Scale, range, units, and multiplier (if any).
 - (vi) Requirements for electric supply.
 - (vii) Materials of component parts to be in contact with or otherwise exposed to process media and corrosive ambient air and operating ambient air temperature.
 - (viii) Special requirements or features or trip setpoints.
 - (c) Instrument installation, mounting, and anchoring details shall be submitted in hard copy format and follow manufacturer recommendations. Each instrument shall have a dedicated 8-1/2 inch by 11-inch detail that only pertains to the specific instrument by tag number. Each detail shall be certified by the Instrument Supplier that the proposed installation is in accordance with the instrument manufacturer's recommendations and is fully warrantable.
3. **Training Submittals:** CONTRACTOR shall submit a training plan which includes schedule of training courses including dates, durations, and locations of each class.

C. O&M Manual

1. **General:** Information in the O&M Manual shall be based upon the approved Shop Drawing submittals as modified for conditions encountered in the field during the WORK.
2. The O&M Manual shall have the following organization for each process:
 - (a) Section A - Instrument ISA Data Sheets
 - (b) Section B - Instrument Installation Details

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(c) Section C - Configuration and Programming Parameters

(d) Section D - Field and Functional Test Results

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Box, crate, or otherwise enclose and protect instruments and equipment during shipment, handling, and storage. Keep all equipment dry and covered from exposure to weather, moisture, corrosive liquids and gases or any element which could degrade the equipment. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Notify the ENGINEER in writing in the event that any equipment or material is damaged. Obtain prior favorable review by the ENGINEER before making any repairs to damaged products.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. **Code and Regulatory Compliance:** PCIS WORK shall conform to or exceed the applicable requirements of the National Electrical Code.
- B. **Hardware Commonality:** Instruments which utilize a common measurement principle (for example, d/p cells, pressure transmitters, level transmitters that monitor hydrostatic head) shall be furnished by a single manufacturer. 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.
- C. **Instrument and Loop Power:** Power requirements and input/output connections for components shall be verified. Power for transmitted signals shall, in general, originate in and be supplied by the control panel devices.
- D. **Signal Levels:** Analog measurements and control signals shall be as indicated herein, and unless otherwise indicated, shall vary in direct linear proportion to the measured variable. Electrical signals shall be 4 to 20 milliamperes dc.

2.2 OPERATING CONDITIONS

- A. The PCIS shall be designed and constructed for satisfactory operation and long, low maintenance service under the following conditions:

Environment	Outdoor
Temperature Range	0° through 50° C
Thermal Shock	1 degree F per minute, max
Relative Humidity	20 through 90 percent, non-condensing

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2.3 NAMEPLATES

- A. CONTRACTOR shall identify each instrument, piece of equipment, and control device with a nameplate.
 - 1. **Field Instruments:** Stamp stainless steel nameplates with the tag number and inscription as indicated on the Drawings. Nameplates shall contain stamped characters of 3/16 inch minimum height. Securely fasten nameplate in place using stainless steel tie wire, 20 AWG minimum. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the ENGINEER upon prior request by the CONTRACTOR.
 - 2. **Panel Mounted Instruments and Control Devices:** Panel mounted instruments and control devices shall have inscribed phenolic tags, attached with contact cement. Engrave nameplates with the inscriptions indicated on the Drawings. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the ENGINEER upon prior request by the CONTRACTOR.

PART 3 -- EXECUTION

3.1 PRODUCT HANDLING

- A. **Special Instructions:** Special instructions for proper field handling, storage, and installation required by the manufacturer shall be securely attached to each piece of equipment prior to packaging and shipment.
- B. **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 tabulation, shall be provided on each piece of equipment in the PCIS. Identification shall be prominently displayed on the outside of the package.

3.2 MANUFACTURER'S SERVICES

- A. The CONTRACTOR shall furnish the following manufacturer's services for the instrumentation listed below:
 - 1. Verify installation of installed instruments.
 - 2. Train the AGENCY's personnel on Sonic Flowmeter (vendor supplied training).
 - 3. Configuration and setting up of Gate actuators, coordinated with Slide Gate Control Panel design and operation.
 - 4. Testing and start up of Traveling Screen system.

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3.3 INSTALLATION

A. General

1. Instrumentation, including instrumentation furnished under other Divisions, shall be installed under Division 40 and the manufacturers' instructions.
2. **Equipment Locations:** The locations of equipment are approximate. 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 AGENCY 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 AGENCY.

B. **Instrumentation Tie-Downs:** Instruments and equipment shall be anchored by methods that comply with seismic requirements applicable to the Site.

C. **Installation Criteria and Validation:** Field-mounted components and assemblies shall be installed and connected according to the requirements below:

1. Power and signal wires shall be terminated with crimped type lugs.
2. Connectors shall be, as a minimum, water tight.
3. Wires shall be mounted clearly with an identification tag that is of a permanent and reusable nature.
4. Mounting stands and bracket materials and workmanship shall comply with requirements of the Contract Documents.
5. Verify the correctness of each installation, including polarity of electric power and signal connections, and make sure process connections are free of leaks.

3.4 CALIBRATION

A. **General:** Devices provided under Division 40 shall be factory calibrated. If field calibration is required it shall be done according to the manufacturer's recommended procedures to verify operational readiness and ability to meet the indicated functional and tolerance requirements.

3.5 LOOP TESTING

A. **General:** The CONTRACTOR shall provide the services of experienced field personnel to perform loop testing as described below.

1. **Analog Loop Testing:** Verify that each analog instrument loop is operating by simulating analog outputs from the primary element of each loop to mimic device operational function. Verify correct operation of loop receiver instruments or indicators. Sample Loop Testing Form attached.
2. **Discrete Loop Testing:** Verify that each discrete instrument loop is operating by simulating wetting voltage and receiving proper equipment status back at monitoring device. Verify

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correct status of monitoring pilot lights and pushbutton commands to equipment. Sample Loop Testing Form attached.

3. All defects and malfunctions disclosed by tests must be corrected and loop retested before final signoff.

3.6 FIELD AND FUNCTIONAL TESTING

A. **General:** The CONTRACTOR shall provide the services of experienced field personnel to perform Field and Functional Testing.

1. **Field Test:** Field Testing shall demonstrate operation of individual equipment and instruments. For example, a Field Test on the Slide Gates shall verify operation of the Slide Gates from the Slide Gate actuator. CONTRACTOR shall coordinate with ENGINEER for scheduling.
2. **Functional Test:** Functional Test shall demonstrate operation of equipment and instruments as a system. For example, a Functional Test on the Slide Gate system shall verify operation of the Slide Gates from the Slide Gate Control Panel and note the Gate position as indicated on the Slide Gate Control Panel and the analog signal to the PLC Panel terminal blocks. CONTRACTOR shall coordinate with ENGINEER for scheduling.
3. All defects and malfunctions disclosed by tests must be corrected and retested before final signoff.
4. Confirm all drawings to be submitted as Record Drawing and/or included in O&M Manuals reflect as installed field conditions.

3.7 TRAINING

- A. **General:** The CONTRACTOR shall train the AGENCY's personnel on the maintenance, calibration, and repair of Flowmeters provided under this Contract.
- B. **Instructions:** The training shall be performed by qualified representatives of the equipment manufacturers or the Instrumentation Supplier and shall be specific to each piece of equipment.
- C. **Duration:** Each training class shall be maximum 2 hours per day (9:00 am to 2:00 pm), using multiple days if required. Training shall take place Tuesdays through Thursdays, unless approved by the AGENCY.
- D. **Schedule:** 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 parameters, calibration (as applicable) and configuration for that specific piece of equipment.

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3.8 CRITERIA FOR SUBSTANTIAL COMPLETION

- A. For the purpose of this Section and all Division 40, the following conditions shall be fulfilled before the WORK is considered substantially complete:
1. Submittals have been completed and approved.
 2. The equipment and instruments have been successfully Loop, Field and Functionally tested.
 3. Spare parts are provided and on site.
 4. Nameplates and all tags and labels are installed.
 5. The AGENCY training has been performed.
 6. Punch-list items have been corrected.
 7. Record drawings in both hard copy and electronic format have been submitted.
 8. Revisions to the O&M Manuals that may have resulted from the field tests, have been made and reviewed.
 9. Debris associated with installation of instrumentation has been removed.
 10. Instruments and enclosures have been cleaned and are in like-new condition.

3.9 WARRANTY AND MAINTENANCE SERVICE

- A. All equipment and instruments provided under Division 40 shall be provided with one year warranty starting from date of completion. Warranty to include material replacement, removal, installation, calibration, configuration, testing and startup at no cost to the AGENCY.

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AVEK CA Aqueduct Turnout/Turn-In

LOOP TEST FORM

Manufacturer: _____

Loop Number: _____

Model Number: _____

Device Description: _____

Serial Number: _____

Tag Number: _____

Initials for Sign-off

Installation

Date: _____

Contr. Engr IS

- 1. Installed per Contract Drawings
- 2. Installed per Manufacturer's recommendation

Labeling

Date: _____

- 1. Wires labeled with correct number and tag type.
- 2. Conduits labeled with correct number and tag type, at device.
- 3. Device Instrument Tag installed with correct number and tag type.
- 4. Device Calibration Tag installed and signed by Instr Supplier (see * below)

Loop Drawing Verification

Date: _____

- 1. Drawing matches field at device, terminal numbers and wire labels.
- 2. Drawing matches field at Panel, terminal numbers and wire labels.
- 3. Drawing matches field at JTB, terminal numbers and wire labels.
- 4. ISA Sheet data fields verified; check model and serial numbers.

Calibration - Analog

Date: _____

- 1. Range: _____ units: _____

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2. Tested under actual condition or simulation (describe):

3. Analog Loop Resistance: _____

Ohms: _____

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4. Measurements milliamps Expected @ PLC

0% (4.00 mA)			
25% (8.00 mA)			
50% (12.00 mA)			
75% (16.00 mA)			
100% (20.00 mA)			

Calibration - Digital

Date: _____

1. Setpoint _____

units: _____

2. Contact position at normal condition, (circle one)

NO or NC

3. Actual trip measurement: _____

units: _____

Operational

Date: _____

1. Verify status, interlocks based on Schematics

Local Mode _____

Remote Mode _____

Open Status _____

Close Status _____

Alarm Status 1 _____

Alarm Status 2 _____

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Interlock 1, describe

Interlock 2, describe

Acceptance and Completion Signatures:

Date: _____

IS or Contractor:

Owner or Engineer:

*Note: Upon successful completion of Loop Test, Engineer to sign off on Instrument Calibration Tag.

END OF SECTION

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SECTION 40 91 00 PRIMARY PROCESS MEASUREMENT DEVICES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. **General:** The CONTRACTOR shall provide Sonic Flowmeter System and high level float, complete and operable, in accordance with the Contract Documents. Contractor is responsible to provide all instruments as shown on the Contract Documents and listed within this Specification.
- B. Provide, install, calibrate, start up, and field test Sonic Flowmeter System with thru pipe mounted flow transducers installed to measure flow in both directions. Sonic Flowmeter System will be complete, operational system including remote mounted Transmitter, cabling, thru pipe transducers, conduits, mounting hardware, and configuration.
- C. Manufacturer of Sonic Flowmeter System shall be available for installation and provide alignment and configuration of system, and on-site training. Sonic Flowmeter System to provide two 4-20 mA signals based on forward and reverse directional flows, for display and totalizing at digital indicators located in the PLC Panel. Sonic Flowmeter System to provide a digital output that closes when reverse flow detected.
- D. Flowmeter transducers shall be mounted in approximate locations as shown on Contract Drawings but final locations determined by Sonic Flowmeter System service representative.
- E. CONTRACTOR shall field verify actual distance from transducers, located within Meter Vault, to Flow Transmitter Console located in Control Building, prior to ordering of manufacturer supplied transducer cables. No splices shall be allowed in transducer cables.
- F. The requirements of Section 40 90 00 - Process Control and Instrumentation Systems apply to this Section.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All work specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General and Section 40 90 00 – Process Control and Instrumentation Systems.
- B. Section 26 05 00 – Electrical Work, General.

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- C. Shop Drawings shall include:
1. Complete list of special tools required for the operation and maintenance of the flowmeter unit.
 2. All components equipment data sheets and manufacturer catalog cut sheets.
 3. Drawings of complete Sonic Flowmeter installation details, measurements, conduits with sizes and quantity of cables, cabling, and configuration parameters installed. Provide drawings showing location and installation details of sensors mounted within pipeline and how transducers penetrate pipeline wall.
 4. Installation, instruction and testing bulletins for The Sonic Flowmeter System.
 5. Submit factory testing forms, signed off and certified by manufacturer.
 6. Training materials including training topics outline, sample of handouts and estimated training duration.
- D. **Operation and Maintenance Manuals:** The CONTRACTOR shall submit Operation and Maintenance Manuals for the Sonic Flowmeter System in accordance with the requirements of Section 0 133 00 – Submittals.

1.4 SERVICES OF MANUFACTURER

- A. The CONTRACTOR shall be responsible for furnishing a Manufacturer's Service Engineer to assist in CONTRACTOR's installation, commissioning, and provide on-site training. Testing, checkout, and start-up of the Sonic Flowmeter System shall be performed under the technical direction of the Manufacturer's Service Engineer.
- B. The services of the Manufacturer's Service Engineer shall be provided for the periods stated in the following schedule:
- | | |
|---------------------|---|
| Installation Trip: | 4 days |
| Commissioning Trip: | 3.5 days (after installation) |
| Training: | 0.5 day (after operational and certified) |
- C. A maximum of eight service days shall be provided by the Manufacturer's Service Technician, with minimum of two trips.
- D. The Manufacturer's Service Technician shall direct all final adjustments necessary for the installation to meet all operational and performance requirements outlined herein.
- E. If any additional Manufacturer's Service Technician time is required beyond that specified, to achieve successful installation and operation, it shall be at the expense of the CONTRACTOR.

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PART 2 -- PRODUCTS

2.1 GENERAL

- A. **Power Input:** Flowmeter Transmitter shall be 120 VAC powered.
- B. **Signal Outputs:** Flowmeter Transmitter shall include two 4-20 mA signal outputs. Flow range out of Aqueduct (Forward Flow) shall be 0 CFS to 300 CFS, unless noted otherwise during submittal review process. Flow range into Aqueduct (Reverse Flow) shall be 0 CFS to 300 CFS, unless noted otherwise during submittal review process. Totalizer shall accumulate in "XXXX.x Acre-feet", unless noted otherwise during submittal review process. Provide with Modbus communication option, utilizing Modbus RTU protocol via communication network (RS-232, RS-485, TCP/IP) as approved by AGENCY during submittal review, at no extra cost.
- C. **Contact Output:** Flowmeter Transmitter with programmable contact output for user defined alarm conditions. Configure additional contact output for flow direction.
- D. **Ambient Conditions:** Flowmeters shall be suitable for continuous operation under the conditions indicated on the Contract Documents and as follows.
 - 1. Equipment shall operate satisfactorily in ambient temperatures between 0° C and plus 50° C or shall be provided with isothermal enclosures so that accuracies will not exceed one percent of span.
 - 2. Process fluid temperatures will range between 40° and 100° Fahrenheit.
- E. **Controller/Transmitter Indication:** The Sonic Flowmeter System shall be provided with indication scaled in process units and also indicate totalized flow.
- F. **Installation and Calibration Guarantee:** The Sonic Flowmeter System shall be factory calibrated, and provided with calibration/installation verification sticker from Instrumentation Supplier after installation and set up in field.
- G. **Warranty:** The Sonic Flowmeter System shall come with Manufacturer's one year warranty starting from completion of Contract.

2.2 SONIC FLOWMETER SYSTEM

- A. **Sonic Flowmeter System:** The Sonic Flowmeter System shall provide flow measurement analog outputs and shall measure flow in forward and reverse directions by use of a four path system. Measured flow shall be in full 84" diameter pipe, refer to Contract Drawings for pipe thickness. Accuracy shall be +/- 0.5% of measured flow. Manufacturer to provide transducers, cables, mounting hardware, as well as installation design detailing sensor locations and installations on pipeline as required to measure forward and reverse flows within stated accuracies.
- B. **Sonic Flow Transmitter:** Remote mounted Sonic Flow Transmitter console shall be NEMA 4/4X panel, mounted within Control Building. Power shall be 120 VAC. Transmitter shall provide two 4-20 mA analog outputs for each flow measured; forward and reverse. Transmitter shall provide two digital contact outputs; system alarm, and when forward flow is measured. Transmitter shall be equipped with internal storage and 4 lines by 20 characters LCD touch

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screen display. Transmitter shall display flow and total flow for each direction. Transmitter shall have an AGC circuit to enable proper assessment of transducer life. Provide with MODBUS RTU protocol.

- C. Flow Transducers: Flow Transducers shall be provided, total of 8 transducers, suitable for 4 path measurement. Transducers shall be fully removable, including the face, through a ball-type shut-off valve, without dewatering the pipe. The Transducer and feed-through assembly shall be constructed of Type 316 stainless steel. Chordal measurement is required to ensure the accuracy of the measurement.
- D. Jacking Mechanism: Provide one jacking mechanism with valve for removal of transducer under pressurized conditions. The jacking mechanism requires 36" of radial clearance around the pipe for proper transducer removal.
- E. Flow Transducer Cables: Cables shall be provided by Flowmeter System manufacturer. Cables shall include eight lengths of RG-108 HDPE coated with E/O connectors, each 150' cable length for bid purposes, but actual field measurements need to be verified by Contractor. Flow Transducer Cables shall be installed in flexible liquidtight conduit at connection to Transducers, 18" length; and in galvanized rigid conduits where exposed in Meter Vault. Flow Transducer Cables shall be installed underground in PVC Sch 40 conduits to Control Building, except exposed run at transition from underground to exposed within Control Building which shall be galvanized rigid steel including elbow fitting. Minimum 8 cables required from flow transducers to Flow Transmitter.
- F. Manufacturer services to include: kickoff meeting conference call, submittal drawings, installation, commissioning, and on-site training. Manufacturer services expected to take two trips of four consecutive days each, total of eight days. Contractor shall assist with field measurements, and provide installation labor, tools, conduits and cables, ladders, fastening hardware, AC power, and mounting of transmitter.
- G. Provide two spare transducers, refer to Spare Parts within this Section.
- H. Flow Transmitter and Transducers shall be **Accusonic 8510+10ACR6** with Modbus communications, four **Model 7601-454-ISE** transducers, four **Model 7601-454-OSE** transducers, eight **Model 7641** feed through assemblies, eight **Model 7600-0384-FEET** transducer cables, **Model 7642** installation/extraction tool, and **Standard Equipment Manual**, plus spare parts one **Model 7601-454-ISE** transducer and one **Model 7601-454-OSE**, for a complete and operational system, no equal.

2.3 HIGH LEVEL FLOAT SWITCH

- A. Provide Flood Switch in Meter Vault. Flood Switch shall be magnetic float type liquid level flood switch shall be hermetically sealed reed contact actuated magnetic float type. Flood Switch shall be SPDT, rated for 0.5 amps at 25 VDC. Switch shall be Normally Closed in dry condition; hence a "high level" opens the circuit.
- B. Switch shall include NEMA 12 junction terminal box to connect ½" NPT stem fitting. Stem length shall be 12" such that NEMA 12 junction terminal box will be sitting high enough off flooded area so not to get submerged. Trip point shall be 2" above finished floor. Flood switch shall be mounted on stainless steel stem with adjustable stainless steel fittings and 316 SS float.

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- C. Manufacturer shall be **Kobold NCG-1-2-1-1-NT**, or equal.

PART 3 -- EXECUTION

3.1 GENERAL

- A. The Sonic Flowmeter System shall be handled, installed, Loop Tested, and Functional Tested according to this Section and Section 40 90 00 – Process Control and Instrumentation Systems. The manufacturer shall furnish the manufacturer's service and training indicated by this Section and Section 40 90 00 – Process Control and Instrumentation Systems.
- B. The CONTRACTOR shall install the Flowmeter, transducers and cabling with assistance for the Manufacturer's Service Technician. Installation shall be per Sonic Flowmeter Manufacturer's instructions.
- C. Prior to energization of equipment, Manufacturer's Service Technician shall verify installation and provide approval.
- D. High level float shall be mounted in Meter Vault and open when water level is 2" above floor. Refer to installation detail on Drawings.

3.2 SPARE PARTS

- A. Provide two spare transducers, same as approved transducers, one inner path and one outer path. Deliver spare parts in manufacturer's packaging with labels.

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SECTION 40 95 13 PROCESS CONTROL PANELS AND HARDWARE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

- A. The CONTRACTOR shall provide complete local control stations and or local control panels as indicated herein or in other Sections of the Specifications. Local Control Stations and or Local Control Panels shall be referred to as “stations” or “panels” synonymously here within.
- B. The CONTRACTOR through the use of the Instrumentation Supplier shall provide the following panels: Slide Gate Control Panel, Meter Vault Lights and Fan Control Panel, PLC Panel, Terminal Cabinet, and Control Building Exhaust Fan Panel.
- C. This Section applies to all Control Stations and Control Panels identified in the Contract Documents, including those that are vendor supplied, such as the Traveling Screen Control Panel.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. All WORK specified herein shall conform to or exceed the applicable requirements of the NEC, NEMA and UL. Where a local code or ordinance is in conflict with the Referenced Specifications, Codes and Standards; the provisions of said local code or ordinance shall take precedence. For additional requirements, see paragraph Reference Codes and Standards of Section 26 05 00 - Electrical Work, General.

1.3 CONTRACTOR SUBMITTALS

- A. Furnish Shop Drawings in accordance with Section 01 33 00 – Submittals and Section 26 05 00 – Electrical Work, General.
 - 1. Panel enclosure dimensions.
 - 2. Panel front and interior layout drawings.
 - 3. Nameplate schedule for panels, devices, components and terminal blocks.
 - 4. Schematic diagrams
 - 5. Catalog cuts of all equipment including but not limited to Indicators, relays, pilot lights, pushbuttons, switches, terminal blocks, filtered louvers, wiring, and nameplates.
- B. The CONTRACTOR shall submit O&M Manuals for the Local Control Stations.

1.4 UL LABEL

- A. Each panel shall bear the UL label of panel shop. The UL label shall apply to the enclosure, the specific equipment supplied with the enclosure, and the installation and wiring of the equipment within and on the enclosure. If required for UL labeling, provide ground fault

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interrupters, isolation transformers, fuses, and any other necessary equipment, even though such equipment is not indicated on the Contract Drawings. The panel shop shall be a UL-508A panel shop.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Box, crate, or otherwise enclose and protect instruments and equipment during shipment, handling, and storage. Keep all equipment dry and covered from exposure to weather, moisture, corrosive liquids and gases or any element which could degrade the equipment. Protect painted surfaces against impact, abrasion, discoloration, and other damage. Notify the ENGINEER in writing in the event that any equipment or material is damaged. Obtain prior favorable review by the ENGINEER before making any repairs to damaged products.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. The CONTRACTOR shall provide the panels with required equipment to satisfy the functional requirements of the Contract Documents. Each panel shall be fabricated with UL labeled components and built by a UL listed shop. Panels not specifically indicated as being WORK of other Sections shall be provided under this Section.
- B. All panels shall be wired as required by this Section.
 - 1. Control Panels shall include a single disconnect switch to de-energize power source.
 - 2. Control power shall be 120 VAC maximum.
 - 3. Wiring to door-mounted devices shall be extra flexible and anchored to doors using wire anchors cemented in place. Exposed terminals of door-mounted devices shall be guarded to prevent accidental personnel contact with energized terminals. Secure all station wiring to the panel surfaces with plastic cable ties.
 - 4. All wires shall be identified with machine printed heat shrink labels. Number all electrically common wires the same, and number each electrically different wire uniquely. Refer to Section 26 05 19 – Wires and Cables.
 - 5. Wire type and sizes within Control Panels: Conductor shall be flexible stranded copper machine tool wire, UL listed Type MTW, and shall be rated 600 volts. 120 VAC power wiring shall be 14 AWG minimum. Wires for 120 VAC control circuits shall be 14 AWG minimum. 24 VDC power wiring shall be 14 AWG minimum. Wires for 24 VDC control circuits shall be 14 AWG minimum. Analog wiring shall be 16 AWG twisted shielded pairs.
 - 6. Wire Insulation Colors within Control Panels: Conductors supplying 120 VAC power on the line side of a disconnecting switch shall have a black insulation for the ungrounded conductor. Grounded circuit conductors shall have white insulation. Insulation for ungrounded 120 VAC control circuit conductors shall be red. Wires energized by a voltage source external to the control panel shall have yellow insulation. Insulation for 24 VDC+ shall be blue; insulation for DC common shall be brown.

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7. Stations shall be provided with a 1/4-inch by 1/4-inch by 2-inch minimum copper ground bus complete with screw type compression connectors.
- C. If equipment or a device is powered directly from the station, whether 120 VAC or 24 VDC, the circuit shall include an overload device sized for the specific load. Overload device shall be circuit breakers, not fuses unless shown on Drawings.
- D. Each station shall be provided with identified terminal strips for the connection of field conductors. The CONTRACTOR shall provide sufficient terminal blocks to connect 20 percent additional conductors for future use. Termination points shall be identified uniquely with machine imprinted labels. All spare conductors shall be landed on terminal blocks.
- E. Provide nameplates for all local control panels and external and internal panel devices and components including terminal blocks. Nameplates shall be phenolic type with inscribed letters, refer to Section 26 05 00. Control devices that are front panel mounted shall include nameplates on the back side of the front panel door. Nameplates shall match description on ENGINEER approved submittal panel drawings.
- F. Front panel-mounted devices shall be mounted a minimum of 3-feet and maximum of 6-feet above finished floor elevation.
- G. Provide stainless steel screened weep holes for draining condensation on all outdoor panels, and junction boxes within Meter Vault, where required by ENGINEER during submittal review.
- H. Safety Requirements: The electrical supply to each control panel shall be arranged to be disconnected by a single switch or circuit breaker, except for necessary foreign circuits. Any live parts within the control panel fed from foreign control or signal circuits shall be covered or arranged to be disconnected by one of the following methods:
 1. Enclosed relays that are automatically de-energized when the main disconnecting switch is opened.
 2. Door-operated enclosed disconnect switches.
 3. Clearly identified enclosed manually operated disconnect switches, which may be located inside the control panel door, provided the operating handles are isolated or barriered from all open live parts. Each control panel shall be arranged so that adjustments to timing relays or replacement of fuses can be done without exposure to live parts.
- I. Ventilation
 1. Ventilation shall be provided to prevent internal panel temperatures from exceeding 120°F.
 2. Louvers shall be provided, when required for cooling, near the bottoms and tops of the side of panels. Provide removable cleanable or disposable dust filter for each louver.
 3. Provide a thermostatically controlled fan in each enclosure when louvers cannot dissipate heat adequately or cause sufficient flow to all panel areas. Ventilation fans shall be low acoustic type suitable for control rooms. Provide removable cleanable or disposable dust filter for each louver.

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2.2 SLIDE GATE CONTROL PANEL

- A. Provide Slide Gate Control Panel complete with devices, digital indicators, pilot lights, terminal blocks, labels and nameplates as shown on the Contract Drawings and specified herein.
- B. Slide Gate Control Panel shall be wall mounted, NEMA 4/12, with hinged panel, with removable back panel. Provide with three-point latch. Enclosure shall be **Hoffman, Eaton B-Line**, or equal.
- C. Slide Gate Control Panel shall be provided by Instrumentation Supplier.

2.3 METER VAULT LIGHTS AND FAN CONTROL PANEL

- A. Provide Meter Vault lights and Intake Fan Control Panel complete with control devices, terminal blocks, labels and nameplates as shown on the Contract Drawings and specified herein
- B. Provide Timer Switch to control Meter Vault lights and Intake Fan (Auto mode). Timer Switch shall be 0-6 hour spring wound timer, rated for 20 amps and 1 HP rated, DPST. Mount switch on front panel of NEMA 4X enclosure, and locate near access hatch of Meter Vault. Provide nameplate inscribed "Vault Lights and Intake Fan". Timer Switch to be **Intermatic FF46H**, or equal.
- C. Provide three-position Hand-Off-Auto switch for Intake Fan control and mount on front panel of NEMA 4X enclosure. Position switches shall be maintained contact type, rated 20 A minimum at 120 VAC. Control knobs shall be black, NEMA 4X, and shall show clearly the control switch position. Provide nameplate inscribed "Intake Fan Control". Three position H-O-A switch to be **Allen-Bradley 800H**, or equal.
- D. Provide adjustable thermostat complete with cast device box for Intake Fan (Auto mode) control. Thermostat shall be line voltage type, adjustable from 60° to 200° F and close a normally open contact when temperature rises above set point. SPST contact to be rated for 120 VAC and 15 amps. Thermostat shall be **Chromalox**, or equal.
- E. NEMA 4X enclosure for Meter Vault Lights and Fan Control Panel shall be hinged panel with removable backpanel. Enclosure shall be **Hoffman Enclosures Bulletin A51S CHNFSS**, or equal.
- F. Meter Vault Lights and Fan Control Panel shall be provided by Instrumentation Supplier.

2.4 PLC PANEL

- A. PLC Panel shall be wall mounted, NEMA 4/12, single door, with back panel. Provide back panel to AGENCY to install equipment. Provide with three-point latch. Panel shall be 36"h x 30"w x10"d minimum, yet final dimensions shall be approved by AGENCY.
- B. PLC Panel shall be **Hoffman, Eaton B-Line**, or equal.
- C. PLC Panel shall be provided by Instrumentation Supplier.

2.5 TERMINAL CABINET

- A. Provide Terminal Cabinet Panel "TCP" complete with back panel, terminal blocks, wireways and nameplates as shown on the Contract Drawings and specified herein.

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- B. All terminal blocks shall be disconnecting type. For analog terminal blocks, the positive leg of the loop shall have a fused disconnecting type terminal block and the return leg of the loop shall be knife style disconnecting type. For discrete terminal blocks (both AC and DC voltages) furnish knife style disconnecting terminal blocks.
- C. Provide two rows of terminal blocks; one for AC terminals and one for DC terminals. Provide 4 inches of space between wireway and terminal blocks typical on each side of terminal blocks for each row of terminal blocks. Provide labels on all terminal blocks. Provide wiring terminal diagram with Cabinet. Provide 25% spare terminal blocks.
- D. Terminal Cabinet shall be wall mounted, NEMA 4/12, single door, with hinged panel with removable back panel. Provide with three-point latch. Enclosure shall be **Hoffman, Eaton B-Line**, or equal. Cabinet shall be 30”h x 24”w x 12”d, minimum.
- E. Terminal Cabinet shall be provided by Instrumentation Supplier.

2.6 CONTROL BUILDING EXHAUST FAN PANEL

- A. Provide Control Building Exhaust Fan Panel complete with back panel, terminal blocks, control device, time clock, wireways and nameplates as shown on the Contract Drawings and specified herein.
- B. All terminal blocks shall be disconnecting type. Provide labels on all terminal blocks. Provide wiring terminal diagram with Cabinet. Provide 25% spare terminal blocks.
- C. Time Clock shall be electronic type with battery back-up, 24 hour, one circuit, 120 VAC, SPST contact rated for 20 amps. Mount on panel back panel. Time clock shall have up to 14 events, minute accuracy, temporary override, automatic daylight saving time adjustment. Time clock shall be **Intermatic #ET1105C**, or equal.
- D. Control Building Exhaust Fan Panel shall be wall mounted, NEMA 12, single door, with hinged panel with removable back panel. Enclosure shall be **Hoffman, Eaton B-Line**, or equal.
- E. Control Building Exhaust Fan Panel shall be provided by Instrumentation Supplier.

2.7 DIGITAL INDICATORS

- A. Digital indicators shall be self-contained instruments that display process signals directly in engineering units. The unit shall be suitable for panel mounting and shall utilize a 6 digit LED display of no less than 0.5-inch height.
- B. The input signal to the digital indicators shall be 4-20 mA DC or 1-5 VDC as indicated on Drawings. The indicators shall have provisions for field adjustable scaling and offset and low cutoff inhibits (configurable). Accuracy shall be plus and minus 0.1% of full scale. Input power to the digital indicator shall be 120 VAC, 60 Hz. Temperature rating up to 50° C.
- C. **Gate Position Indicators:** Gate Position indicators shall display gate percent open, 0-100%. Provide analog output option. Gate Position indicators shall be mounted on Slide Gate Control Panel.

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- D. Digital indicators shall be as manufactured by **Kessler-Ellis Products INT69RTALAD**, or equal.

2.8 RELAYS

- A. Control relays shall be 3PDT with 10 amp contacts with indicating light and check button. Relays shall be plug-in type utilizing rectangular blades and provided with sockets for screw-type termination and hold-down clips. Contacts to be rated for motor load, ¼ HP or more per UL. Voltage shall be 120 VAC unless shown otherwise. Where more than 3 contacts are shown or required for a relay coil, additional relay(s) shall be furnished, installed, and connected. Relays shall be manufactured by **IDEC Series RR, Square D Class 8501 Type KU**, or equal.

2.9 CONTROL DEVICES

- A. Selector switches, pushbuttons and indicating lights shall be 30.5mm heavy duty, oil tight, and NEMA rated for the installation location. Each shall have a factory engraved legend plate. Miniature type assemblies are not acceptable.
- B. Position switches shall be maintained contact type, rated 20 A minimum at 120 VAC. Control knob shall be black, NEMA 4X, and shall show clearly the control switch position.
- C. Pushbuttons shall be heavy duty, NEMA 4X, bootless, flush head pushbutton, with momentary contact.
- D. Pilot light lens colors shall be red for "run," "open," or "on"; green for "stopped," "closed," or "off;" amber for alarm. Pilot lights shall have LED lamps, transformer type, and push to test.
- E. Emergency Stop pushbuttons shall be push to operate, locking, and twist to release type.
- F. Devices shall be manufactured by **Allen-Bradley Bulletin 800 Type H, Square D Class 9001 Type K, Cutler-Hammer Type 10250T**, or equal.

2.10 TERMINAL BLOCKS

- A. Terminal blocks shall be rated 600V at a minimum of 20 amperes and sized for the conductors served. Provide terminal blocks with "follower" plates that compress the wires and have wire guide tangs for ease of maintenance. Terminal blocks, which compress the wires with direct screw compression, are unacceptable. Provide 20% spare terminal blocks.
- B. Provide fused disconnecting style terminal blocks for analog loop wiring as part of Terminal Cabinet DC terminal blocks.
- C. Provide knife disconnecting style terminal blocks for discrete loop wiring as part of Terminal Cabinet AC and DC terminal blocks.
- D. Provide green and yellow colored grounded terminal blocks.
- E. Terminal blocks shall be snap-in type for mounting on DIN mounting rails. End clamps and end cover plates shall be provided to hold terminal blocks securely in place. Provide single level terminal blocks only, stacked terminal blocks will not be allowed.

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- F. Terminal blocks shall be manufactured by **Buchanan 500 Series, Phoenix Type UK, or Entelec**, or equal.

2.11 CIRCUIT BREAKERS

- A. Circuit breakers shall be din rail mounted, thermal magnetic, tease-free, trip-free, snap action mechanism with two button operation. Circuit breakers shall be din rail mounted. Breakers shall be manufactured by **Phoenix Contact Model No. TMC 42-01**, or equal.

2.12 PANEL SUPPLIER

- A. Panels shall be designed, furnished, assembled and tested by Instrumentation Supplier meeting requirements of Section 40 90 00. Panel Supplier shall be UL-508A panel shop.
- B. Panel Supplier shall be **Tesco Controls, Inc.** (Mr. Shain Thomas at 916-395-8800), **Technical Systems Incorporated** (Mr. Jon Rogers at 707-678-1111), or equal.

2.13 COMMUNICATION BACKBOARD

- A. Provide painted, 3/4" thick plywood, communication backboard complete with ground bus bar, 50 pair punch down blocks and OWNER approved modem (Bell 202). Modem to be **Data-Linc LLM-1100**, or approved equal. Backboard shall be 4' x 8', unless shown otherwise.

2.14 SPARE PARTS

- A. Provide the following spare parts in one complete delivery to Engineer prior to completion of Contract:

Description	Quantity
Control Relays, 120 VAC, 3PDT	1
Control Device – LED bulbs	4
Fuses, typical for each size	2

PART 3 -- EXECUTION

3.1 FACTORY TESTING

- A. Each panel shall be factory assembled and tested for sequence of operation prior to delivery. Submit results of all un-witnessed factory testing to ENGINEER prior to delivery.
- B. Configure digital indicators per Contract Documents setpoints.

3.2 INSTALLATION

- A. Panels shall be installed in accordance with Section 26 05 00 and in accordance with the manufacturer's recommendations.

APPENDIX G

- B. Panels shall be protected at the Site from loss, damage, and the effects of weather. Panels shall be stored in an indoor, dry location. Heating shall be provided in areas subject to corrosion and humidity.
- C. Panel interiors and exteriors shall be cleaned, and coatings shall be touched up to match original finish upon completion of the WORK.
- D. Conduit, conductors, and terminations shall be installed in accordance with Section 26 05 00.
- E. All equipment associated with the stations shall be ready for service after connection of conductors to equipment, controls, and panels.
- F. Provide two duplex receptacles on Communication Backboard.
- G. Mount Traveling Screen Control Panel on stanchion per Contract Drawing detail. Field locate Control Panel location with Traveling Screen system supplier and the AGENCY. Locate Traveling Screen system equipment (pumps, orientation of screen motors, etc.) with Traveling Screen system supplier and the AGENCY.

3.3 FIELD TESTING

- A. Each panel shall be field tested for functional operation in the field after the connection of external conductors and prior to equipment startup. Field test shall replicate Factory Test procedures.
- B. Refer to Section 26 08 00 – Electrical Tests for additional testing requirements.

3.4 CLEANING

- A. Prior to completion of Contract, CONTRACTOR shall thoroughly clean all panels, interior and exterior. Vacuum interiors and wipe down all components. Clean exterior of panel removing all foreign matter.

END OF SECTION

APPENDIX G

SECTION 46 21 51 TRAVELING WATER SCREEN

PART 1 -- GENERAL

1.1 DESCRIPTION OF WORK

- A. A single qualified manufacturer shall furnish the material in these specifications. A qualified manufacturer is one that has been engaged in the manufacturer of this equipment for a period of at least 5 years and can document at least 100 installations. A submittal verifying compliance with this experience clause is required.
- B. The manufacturer shall provide all the following equipment along with the appropriate submittals; service manuals and installation supervision for a complete installation as shown on the plans and as specified herein.

1.2 SUBMITTALS

- A. Submit shop drawings in accordance with the General and Special Conditions.
- B. Show complete nameplate data, characteristics, mounting arrangements and structural supports, size and location of conduits and conductors, location and size of structural supports, and coatings.
- C. Submit layout, characteristics, and wiring diagrams for electrical and mechanical equipment.

PART 2 -- MATERIALS

2.1 TRAVELING WATER SCREEN

- A. Two traveling water screens shall be as manufactured by FPI Water Screens, International Water Screens of Bakersfield, CA, or approved equal. Each screen shall have an outside to outside frame width and overall length as shown on the Drawings.
- B. Each screen shall be capable of passing a minimum of 125 cfs with a minimum water depth of 14 feet in the canal. The traveling water screens shall require no mounting, holding, or fastening to the sidewalls and/or floor of the intake.
- C. The main reduction ratio of the drive motor shall be about 7:1 with a final screen travel speed of approximately 9 feet per minute. All drive components shall be designed to withstand the full NEMA stalling torque of the motor without damage to any part of the drive components. The drive motor shall include a mechanism to protect the machine from overload.
- D. The screen main frame shall be an all welded construction, adequately braced to withstand warping due to handling, transport and operation.

APPENDIX G

2.2 MAIN FRAME

- A. The mainframe side rails shall be 12" 20.7# per foot "structural channel" held in position by 6" box channels.
- B. A rubber boot flap will be provided to prevent passage of debris through the boot section.
- C. Carrier chain supports of 2 1/2" X 1 1/2" X 1/4" angles, shall be part of the main frame and positioned under each carrier chain. These supports and all other contact surfaces shall be covered with ultra high molecular weight polyethylene wear strips appropriately fastened to facilitate removal/replacement.
- D. If the main frame is not made of stainless steel then it should be appropriately cleaned and coated with Devco 233H, or equal.

2.3 SCREENING MEDIA (WIRE BELT)

- A. The wire belting shall be stainless steel (304 SS) standard balanced weave with an opening size of 0.42 X 0.49 ft, with a total percent clear area of 58.7%.
- B. Supports for the wire belting shall be 5/16" diameter stainless steel rods supported by the stainless steel C2060 (304 SS) carrier chains at 6" intervals the total horizontal length of the wire belt. Trash pick up bars (2" X 2" X 1/4") made of stainless steel (304 SS) shall be installed parallel to the 5/16" diameter support rods, approximately every 5 foot.

2.4 SCREEN DRIVE

- A. The main drive motor shall be a minimum of 1 HP. This shall be a NORD or equal motor. Gear reduction is 58:1 with output speed of 30 RPM. Voltage 240, 3 phase. There shall be a speed reduction assembly. The sprocket on the head shaft shall be equipped with a torque clutch to prevent screen overloads.

2.5 SCREEN HEADSHAFT & FOOTSHAFT ASSEMBLIES

- A. Both head shaft and foot shaft assemblies shall be made of a type 17-4 Series stainless steel. Head shaft bearings shall be of the lubricated type. Foot shaft bearings shall be Stellite alloy, and non-lubricated.

2.6 SCREEN CONTROLS

- A. A control box shall be supplied to include HOA (Hand-Off-Auto) switch, delay timers (on-off timers), starters, fuses, and central power transformer. Shock relay units for overload protection will be panel mounted and will be adjusted to suit the debris load.

2.7 SCREEN SPRAY WASH SYSTEM

- A. The spray wash system components include the solenoid and spray bar with a minimum of 14 - 2 gpm nozzles for each screen.

APPENDIX G

2.8 TRASH RECEPTACLE

- A. The trash receptacle shall be a flume type of minimum size 24" wide by 12" deep, as shown on the drawings.

2.9 CONTROL PANEL

- A. The provided control panel shall be UL listed and shall operate all items; Screens, pumps, and conveyor/elevators where applicable.

PART 3 -- EXECUTION

3.1 INSTALLATION

- A. The manufacturer shall provide installation supervision for a complete installation as shown on the drawings and as specified herein.

END OF SECTION

APPENDIX G

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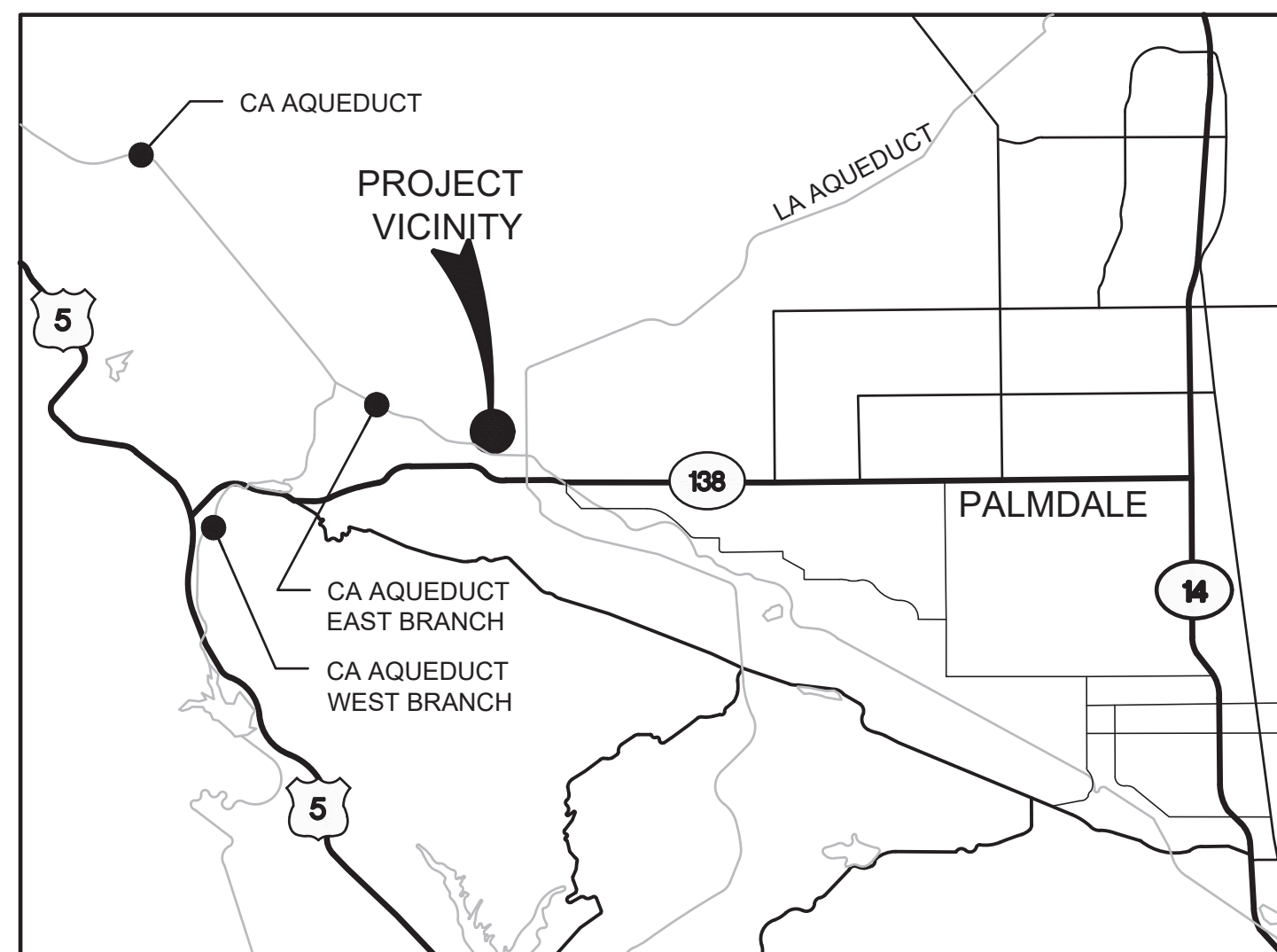
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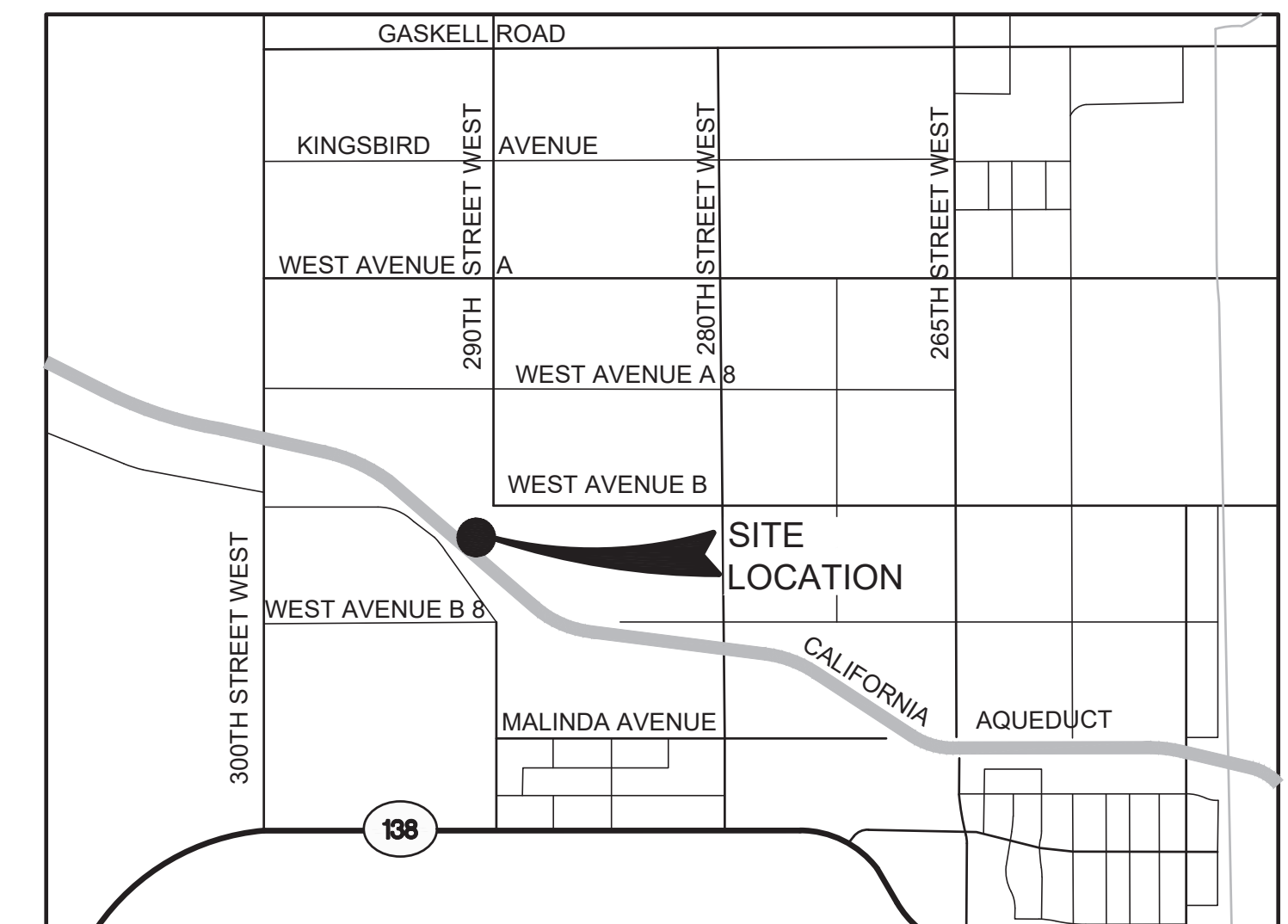
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PROJECT NO. HDWB 21-01

NOVEMBER 2021



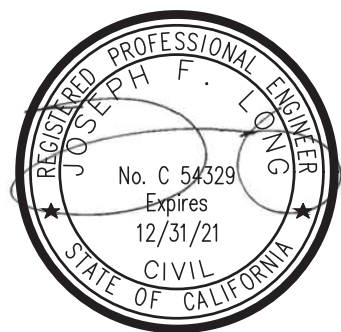
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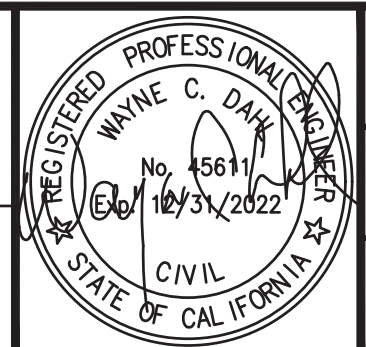


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GENERAL MANAGER

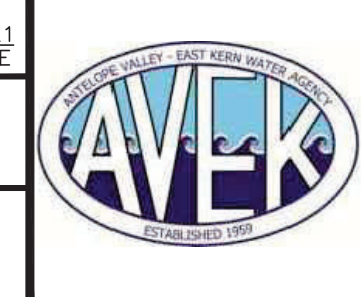
Dwayne Chisam P.E., R.C.E., CA 43851 DATE

NO.	DATE	REVISIONS	APPROVED



WAYNE C. DAHL DESIGN TEAM LEAD 11/10/21
NAME R.C.E. 45611 DATE

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

GENERAL
COVER SHEET

SHEET
G-01
1 of 54
SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

APPENDIX G

SHEET NO.	DRAWING NO.	TITLE
GENERAL		
1	G-01	COVER SHEET
2	G-02	DRAWING LIST
3	G-03	GENERAL NOTES
4	G-04	SYMBOLS AND ABBREVIATIONS
CIVIL		
5	CG-01	TYPICAL DETAILS - SHEET 1 OF 3
6	CG-02	TYPICAL DETAILS - SHEET 2 OF 3
7	CG-03	TYPICAL DETAILS - SHEET 3 OF 3
8	C-01	AQUEDUCT TURNOUT/TURN-IN - GENERAL SITE PLAN
9	C-02	AQUEDUCT TURNOUT/TURN-IN - SITE GRADING PLAN
10	C-03	AQUEDUCT TURNOUT/TURN-IN - PROFILE VIEW, SECTION, AND DETAIL
11	C-04	AQUEDUCT TURNOUT/TURN-IN - CANAL LINING REMOVAL/REPLACEMENT
12	C-05	TYPICAL WATERSTOP DETAILS
STRUCTURAL		
13	SG-01	STRUCTURAL GENERAL NOTES
14	SG-02	STRUCTURAL TYPICAL DETAILS - SHEET 1 OF 3
15	SG-03	STRUCTURAL TYPICAL DETAILS - SHEET 2 OF 4
16	SG-04	STRUCTURAL TYPICAL DETAILS - SHEET 3 OF 4
17	SG-05	STRUCTURAL TYPICAL DETAILS - SHEET 4 OF 4
18	S-01	AQUEDUCT TURNOUT/TURN-IN - STRUCTURAL PLAN
19	S-02	AQUEDUCT TURNOUT/TURN-IN - STRUCTURAL SECTIONS AND DETAILS - SHEET 1 OF 3
20	S-03	AQUEDUCT TURNOUT/TURN-IN - STRUCTURAL SECTIONS AND DETAILS - SHEET 2 OF 3
21	S-04	AQUEDUCT TURNOUT/TURN-IN - STRUCTURAL SECTIONS AND DETAILS - SHEET 3 OF 3
22	S-05	TRASHRACKS DETAILS - SHEET 1 OF 2
23	S-06	TRASHRACKS DETAILS - SHEET 2 OF 2
24	S-07	STOP LOG PLAN, SECTIONS, AND DETAILS
25	S-08	TRASH RACK ACCESS PLATFORM PLAN AND SECTIONS
26	S-09	TRASH RACK ACCESS PLATFORM SECTIONS AND DETAILS
27	S-10	METER VAULT - PLAN AND SECTION
28	S-11	METER VAULT COVER - PLAN, SECTIONS, AND DETAILS
29	S-12	METER VAULT LADDER - SECTIONS AND DETAILS
30	S-13	CONTROL BUILDING - PLAN, ELEVATIONS, AND SECTIONS
31	S-14	CONTROL BUILDING - FLOOR PLAN AND SECTIONS
32	S-15	CONTROL BUILDING - ROOF FRAMING, PLAN, SECTIONS, AND DETAILS
33	S-16	CONTROL BUILDING - DOOR AND MISCELLANEOUS DETAILS
34	S-17	CONTROL BUILDING - STANDARD DETAILS AND NOTES
MECHANICAL		
35	M-01	MECHANICAL - SLIDE GATE INSTALLATION DETAILS
36	M-02	MECHANICAL - METER VAULT PLAN AND DETAILS
37	M-03	MECHANICAL - METER VAULT VENTILATION DETAILS
38	M-04	MECHANICAL - CONTROL BUILDING - MECHANICAL EQUIPMENT
39	M-05	MECHANICAL - TRAVELING WATER SCREEN INSTALLATION DETAILS
ELECTRICAL		
40	EG-01	ELECTRICAL - GENERAL NOTES, SYMBOLS, AND ABBREVIATIONS
41	EG-02	ELECTRICAL - DETAILS - SHEET 1 OF 2
42	EG-03	ELECTRICAL - DETAILS - SHEET 2 OF 2
43	E-01	ELECTRICAL - SINGLE LINE, CONDUIT AND CABLE SCHEDULE
44	E-02	ELECTRICAL - AQUEDUCT TURNOUT/TURN-IN SITE PLAN
45	E-03	ELECTRICAL - AQUEDUCT TURNOUT/TURN-IN CONTROL BUILDING PLANS
46	E-04	ELECTRICAL - AQUEDUCT TURNOUT/TURN-IN METER VAULT PLAN AND DETAILS
47	E-05	ELECTRICAL - PANELBOARD, LIGHTING FIXTURE, AND HANDHOLE SCHEDULES
48	E-06	ELECTRICAL - SCHEMATICS - SHEET 1 OF 2
49	E-07	ELECTRICAL - SCHEMATICS - SHEET 2 OF 2
50	E-08	ELECTRICAL - TCP ELEVATIONS AND BILL OF MATERIALS
51	E-09	ELECTRICAL - TCP, SGCP, AND PLC PANEL INTERCONNECTION DIAGRAMS - SHEET 1 OF 2
52	E-10	ELECTRICAL - TCP, SGCP, AND PLC PANEL INTERCONNECTION DIAGRAMS - SHEET 2 OF 2
53	IG-01	INSTRUMENTATION - ABBREVIATIONS AND SYMBOLS
54	I-01	INSTRUMENTATION - P&ID



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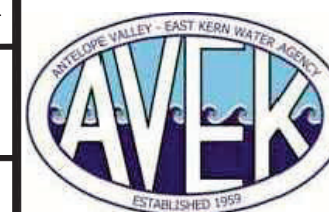
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1	12/29/21	ADDENDUM NO. 3	

38 TECHNOLOGY DRIVE, SUITE 100
IRVINE, CA 92618
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WAYNE C. DAHL DESIGN TEAM LEAD 11/10/21
NAME R.C.E. 45611 DATE

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

GENERAL
DRAWING LIST

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G-02
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SHEETS

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

GENERAL NOTES

1. THE OWNER MAY UNDERTAKE OR AWARD OTHER CONTRACTS FOR ADDITIONAL WORK IN THE PROJECT AREA. CONTRACTOR SHALL COORDINATE WORK WITH SUCH OTHER CONTRACTORS WITHIN OR ADJACENT TO CONTRACT WORK AREAS. CONTRACTOR SHALL NOT COMMIT OR PERMIT ANY ACT WHICH WILL INTERFERE WITH THE PERFORMANCE OF WORK BY ANY OTHER CONTRACTOR OR BY OWNER'S EMPLOYEES.
2. AN OSHA PERMIT IS REQUIRED WHEN WORKERS ENTER TRENCHES OR EXCAVATIONS FIVE (5) FEET IN DEPTH OR DEEPER. CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS AND CONFORM TO REQUIREMENTS OF OSHA.
3. THE OWNER WILL FURNISH BASIC CONTROL AND BENCH MARK ELEVATIONS FOR LOCATING THE PRINCIPAL COMPONENTS OF THE CONTRACT WORK. CONTRACTOR SHALL PERFORM ALL DETAILED SURVEYS NEEDED FOR CONSTRUCTION, INCLUDING SLOPE STAKING, GRADE STAKING, BATTER BOARDS, STRUCTURE LOCATION AND ALL OTHER WORKING POINTS, LINES AND ELEVATIONS REQUIRED.
4. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE REGULATIONS OF THE CONSTRUCTION SAFETY ORDERS OF THE CALIFORNIA DIVISION OF INDUSTRIAL SAFETY AND THE FEDERAL SAFETY STANDARDS OF THE DEPARTMENT OF HEALTH EDUCATION AND WELFARE.
5. WATER REQUIRED FOR CONSTRUCTION PURPOSES AND FOR DUST CONTROL SHALL BE PROVIDED BY THE CONTRACTOR. CONTRACTOR MAY USE WATER FROM THE AQUEDUCT BY OBTAINING A TEMPORARY TURNOUT PERMIT FROM DWR'S SOUTHERN FIELD DIVISION BY CALLING AT 661-944-8600.
6. CONTRACTOR SHALL REMOVE ALL BRUSH AND STRUCTURAL DEBRIS REQUIRED FOR CONSTRUCTION. ALL REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN APPROVED WASTE SITES.
7. THE LOCATION, PIPE DIAMETER AND ELEVATIONS OF UNDERGROUND UTILITIES SHOWN ON THESE DRAWINGS ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL CONTACT ALL UTILITY COMPANIES SO THAT THOSE COMPANIES MAY MARK THE LOCATIONS OF THEIR LINES PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL CONTACT UNDERGROUND UTILITIES SERVICE ALERT (USA) AT 1-800-422-4133 PRIOR TO EXCAVATION (48 HOURS MINIMUM). PROTECT THE EXISTING UTILITIES AND FIELD VERIFY THE LOCATION AND DEPTH OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.
8. ALL UNDERGROUND UTILITIES AND ABOVE GROUND UTILITIES SHALL BE PROTECTED IN PLACE UNLESS OTHERWISE SHOWN. IF THE CONTRACTOR FINDS CONFLICT BETWEEN CONTRACT FACILITIES AND EXISTING FACILITIES, HE SHALL NOTIFY THE ENGINEER IMMEDIATELY AND FOLLOW NOTIFICATION UP IN WRITING.
9. LIMITS OF WORK ARE SHOWN ON THE DRAWINGS. PRIOR TO COMMENCING ANY WORK WITHIN A GIVEN AREA, THE CONTRACTOR SHALL STAKE THE RIGHT-OF-WAY LIMITS WITH LATH AT 300-FOOT INTERVALS (MAXIMUM), AND SHALL MAINTAIN SAME UNTIL ALL WORK WITHIN THE GIVEN AREA IS COMPLETE.
10. PIPELINE STATIONING AND HORIZONTAL DIMENSIONS SHOWN ON THESE PLANS IS HORIZONTAL DISTANCE MEASURED ON A LEVEL PLANE. ACTUAL PIPE LENGTH SHALL BE DETERMINED BY MEASUREMENT ALONG THE SLOPE OR CURVE ON WHICH THE PIPE IS INSTALLED.
11. STRAIGHT SLOPES SHALL BE MAINTAINED BETWEEN INVERT ELEVATIONS OR TOP OF PIPE ELEVATIONS SHOWN ON THE DRAWINGS.

POTHOLING OF DWR COMMUNICATION AND CONTROL CABLE

DWR'S COMMUNICATION AND CONTROL CABLES SHALL BE LOCATED AND EXPOSED BY POTHOLING PRIOR TO DWR ISSUING AN ENCROACHMENT PERMIT. ALL WORK WITHIN 3 FEET OF THE CABLE(S) SHALL BE DONE USING HAND-HELD TOOLS ONLY. THE APPLICANT SHALL CONTACT UNDERGROUND SERVICE ALERT (USA) AT (800) 422-4133 FOR SOUTHERN CA AND MCI TELECOMMUNICATIONS CORPORATION AT (800) 624-9675 FOR INFORMATION REGARDING THE LOCATION OF THE COMMUNICATION AND CONTROL CABLES. THE PRESENCE OF A DWR INSPECTOR WILL BE REQUIRED THROUGHOUT THE CABLE EXPOSURE PROCESS. PLEASE CALL THE SOUTHERN FIELD DIVISION AT (661) 944-8600 FOR TEMPORARY ACCESS AND AN APPOINTMENT TO PERFORM THE EXPOSURE OF THE CABLE(S).

THE RESULTANT ELEVATION INFORMATION SHALL BE DELINEATED ON THE PROFILE VIEW AND LABELED AS:

CABLE POTHOLED ELEVATION XX.X
 SURFACE ELEVATION XX.X
 (WHERE XX.X IS THE ELEVATION IN FEET TO THE NEAREST TENTH.)

DWR NOTES

1. A SEVEN (7) DAY ADVANCE NOTIFICATION IS REQUIRED PRIOR TO STARTING WORK WITHIN THE DWR RIGHT OF WAY. CONTACT DWR, DIVISION OF ENGINEERING, ENCROACHMENT PERMIT SECTION, SACRAMENTO, CALIFORNIA AT (800) 600-4397. THE SOUTHERN FIELD DIVISION SHALL BE SIMULTANEOUSLY NOTIFIED AT (661) 944-8600.
2. MEASURES SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT IN PLACE ALL SWP FACILITIES AND APPURTENANCES, INCLUDING BUT NOT LIMITED TO COMMUNICATION AND CONTROL CABLES AND CATHODIC PROTECTION TEST STATIONS. THE CONTRACTOR WILL BE LIABLE FOR ALL DAMAGES TO SWP FACILITIES AND APPURTENANCES AS A RESULT OF THE CONSTRUCTION, AND FOR ANY OTHER DAMAGES OR LOSSES SUFFERED BY DWR OR ITS WATER CONTRACTORS, INCLUDING POWER, IRRIGATION, MUNICIPAL AND INDUSTRIAL WATER SUPPLY, AND COMMUNICATION LOSSES.
3. COMMUNICATION AND CONTROL CABLES CONNECTED WITH THE OPERATION OF THE STATE WATER PROJECT ARE BURIED ALONG EITHER OR BOTH SIDES OF THE AQUEDUCT WITHIN DWR RIGHT OF WAY. PRIOR TO ANY EXCAVATION IN THIS AREA, THE COMMUNICATION CABLES SHALL BE LOCATED AND EXPOSED BY POTHOLING BY THE CONTRACTOR IN THE PRESENCE OF A DWR FIELD DIVISION REPRESENTATIVE. THE CONTRACTOR SHALL CALL DWR SOUTHERN FIELD DIVISION AT (661) 944-8600 AT LEAST SEVEN (7) DAYS IN ADVANCE FOR AN APPOINTMENT. ALL EXCAVATIONS WITHIN THREE (3) FEET OF THE CABLE(S) SHALL BE DONE USING HAND-HELD TOOLS ONLY. THE CONTRACTOR SHALL INDICATE LOCATIONS AND ELEVATIONS OF THE CABLES ON THE AS-BUILT DRAWINGS.
4. THE CONTRACTOR SHALL CONTACT UNDERGROUND SERVICE ALERT (USA) AT (800) 422-4133 FOR SOUTHERN CA AND MCI TELECOMMUNICATIONS CORPORATION AT (800) 624- 9675 FOR INFORMATION REGARDING THE LOCATION OF THE PIPELINE AND THE COMMUNICATION AND CONTROL CABLES.
5. ALL TRENCH EXCAVATION SHALL COMPLY WITH THE MOST CURRENT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION STANDARDS. TRENCH BACKFILL SHALL BE PLACED IN NO GREATER THAN 4-INCH LIFTS IF HAND COMPACTED OR NO GREATER THAN 8-INCH LIFTS IF POWER COMPACTED. TRENCH BACKFILL WITHIN DWR RIGHT OF WAY SHALL BE COMPACTED TO 95 PERCENT RELATIVE COMPACTION (ASTM D1557-12).
6. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL INSPECT THE CONDITION OF DWR'S FACILITIES (CONCRETE CANAL PANELS, ROAD, FENCES, ADJACENT LAND AREAS, ETC.) IN THE PRESENCE OF A DWR FIELD DIVISION REPRESENTATIVE. UPON COMPLETION OF THE CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL RE-INSPECTED THE CONDITION OF DWR'S FACILITIES IN THE PRESENCE OF A DWR FIELD DIVISION REPRESENTATIVE. THE CONTRACTOR SHALL RETURN THESE FEATURES TO PRE-CONSTRUCTION CONDITIONS.
7. UPON COMPLETION OF WORK UNDER THE TURNOUT AGREEMENT, ALL WASTE MATERIAL, DEBRIS, ETC SHALL BE REMOVED FROM DWR RIGHT OF WAY AND DISPOSED OF IN APPROVED WASTE SITES.
8. PROVISIONS SHALL BE MADE BY THE CONTRACTOR TO PREVENT CONTAMINATION OF CANAL WATER DURING CONSTRUCTION.
9. DWR'S ONGOING OPERATIONS AND MAINTENANCE ACTIVITIES SHALL NOT BE DISRUPTED DURING CONSTRUCTION. THE PRIMARY OR SECONDARY OPERATING ROAD MUST BE KEPT AVAILABLE FOR DWR USE AT ALL TIMES.
10. A DWR INSPECTOR SHALL BE PRESENT DURING ALL WORK WITHIN DWR RIGHT-OF-WAY.
11. TEMPORARY ENTRY ACCESS FOR VISUAL INSPECTIONS, GROUND SURVEYS, OR POTHOLING CAN BE OBTAINED DIRECTLY FROM THE SOUTHERN FIELD DIVISION OFFICE. (CONSTRUCTION ACTIVITIES ARE NOT PERMITTED UNDER A TEMPORARY ENTRY ACCESS.) PLEASE CALL SOUTHERN FIELD DIVISION AT (661) 944-8600, FOR A TEMPORARY ENTRY ACCESS AND APPOINTMENT TO PERFORM ANY PRELIMINARY WORK.

CA AQUEDUCT OUTAGE REQUESTS AND DIVE PLAN

1. OUTAGE REQUESTS SHALL BE SUBMITTED 30 DAYS BEFORE THE INTENDED DATE TO SOUTHERN FIELD DIVISION.
2. CONTRACTOR CONSTRUCTION ACTIVITIES SHALL BE PERFORMED ON A SEVEN DAYS PER WEEK, 24 HOURS PER DAY SCHEDULE TO MINIMIZE POTENTIAL IMPACTS TO SWP WATER DELIVERIES.
3. PROVIDE TIMEFRAMES FOR A NO-FLOW OUTAGE(S), A DIVING PLAN, AND DAILY DIVE OPERATIONS APPROVAL(S), IF NEEDED. NOTE THAT COFFERDAMS ARE TYPICALLY INSTALLED OR REMOVED WITH A SLIGHTLY LOWER WATER SURFACE ELEVATION AND IN NO-FLOW CONDITIONS DURING DAYLIGHT HOURS IN A SINGLE DAY.
4. ALL DIVES IN THE CALIFORNIA AQUEDUCT SHALL COMPLY WITH DWR'S DIVE POLICY AT THE TIME OF SUBMITTAL. DIVE ACTIVITIES SHALL BE PRE-APPROVED BY THE DWR DIRECTOR OR HIS DESIGNEE AND DWR'S PROJECT SAFETY OFFICE BEFORE DIVE ACTIVITIES CAN COMMENCE. ONCE THE DIRECTOR'S AND PROJECT SAFETY OFFICE APPROVALS HAVE BEEN OBTAINED, ALL DIVING SHALL BE COORDINATED THROUGH THE SOUTHERN FIELD DIVISION FOR CLEARANCE AND SCHEDULING REQUIREMENTS.
5. DIVE SUBMITTALS SHALL BE SUBMITTED 30 DAYS BEFORE THE INTENDED DIVE DATE.

SURVEY NOTES

1. COORDINATES ARE BASED ON THE CALIFORNIA COORDINATE SYSTEM (CCS83) ZONE V, NAD 83 (2010.00 EPOCH ADJUSTMENT), AS PER RECORDS ON FILE WITH NGS. ALL DISTANCES ARE GRID DISTANCES. TO OBTAIN GROUND DISTANCES, USE CSF 0.999978628.
2. ELEVATIONS ARE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)
3. ALL UNITS ARE U.S. SURVEY FEET
4. TO CONVERT ELEVATIONS FROM NAVD88 TO NAVD29 (DWR EAST BRANCH CANAL DATUM), SUBTRACT 3.08 FEET.
5. BASIS OF SURVEY
 - A. HORIZONTAL CONTROL -- REFERENCE STATIONS ZLA1 AND P558 PER RECORDS ON FILE WITH NGS
 - B. VERTICAL CONTROL -- BM L 1492, NAVD88 (2012) ELEVATION 3091.394 FEET CSBM MON FL 49FT NW C/L HWY 138 & 0.6MI W/O 300TH ST W 9.8FT N/O PP #1049047E 5FT SW/O FENCE COR MKD (BM 102-71 1957) MKR SIGN 1FT S/O MON
6. SITE BENCHMARK - BRASS CAP ON THE WALKWAY DECK ON CHECK NO. 43
 - A. ELEVATION 2966.80 FEET -- VERTICAL CONTROL MEAN SEA LEVEL USC & GS 1929 ADJUSTED DATUM (DWR EAST BRANCH CANAL DATUM)
 - B. ELEVATION 2969.876 FEET -- NAVD88 (SEE REFERENCE ABOVE)

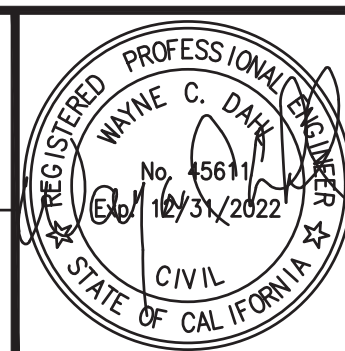
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NO.	DATE	REVISIONS	APPROVED

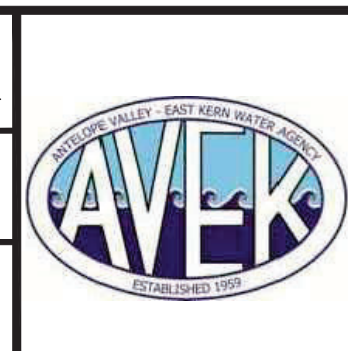


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WAYNE C. DAHL DESIGN TEAM LEAD 11/10/21
 NAME R.C.E. 45611 DATE

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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
 AQUEDUCT TURNOUT/TURN-IN

GENERAL

GENERAL NOTES

SHEET
G-03

3 of 54
 SHEETS

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

ABBREVIATIONS

AB	ANCHOR BOLT
ABAND	ABANDONED
AC	ASPHALTIC CONCRETE
ADJ	ADJUSTABLE
AVE	AVENUE
BC	BEGIN CURVE
BCR	BEGIN CURB RETURN
BM	BENCH MARK
BOTT	BOTTOM
BVC	BEGIN VERTICAL CURVE
CL	CENTERLINE
CAV	COMBINATION AIR VALVE
C/E	CONSTRUCTION EASEMENT
CCT	CENTRAL CALIFORNIA TRACTION
CDF	CONTROL DENSITY FILL
CI	CAST IRON
CLPG	COUPLING
CMP	CORRUGATED METAL PIPE
CO	CLEAN OUT
CONC	CONCRETE
COTG	CLEAN-OUT TO GRADE
DI	DRAIN INLET
DIA. Ø	DIAMETER
DWG	DRAWING
E	ELECTRICAL
EA	EACH
EC	END CURVE
ECR	END CURVE RETURN
EF	EACH FACE
EG	EXISTING GRADE
EL	ELEVATION
ELEC	ELECTRICAL OR ELECTRONIC
EVC	END VERTICAL CURVE
EW	EACH WAY
EXP JT	EXPANSION JOINT
FG	FINISH GRADE
FH	FIRE HYDRANT
FIG	FIGURE
FIN	FINISHED
FL	FLOWLINE OR FLOOR
FLG	FLANGE
FM	FORCE MAIN
FPS	FEET PER SECOND
FT	FEET OR FOOT
G	GAS OR GATE
GA	GAGE OR GAUGE
GAL	GALLON
GALV	GALVANIZED
GEN	GENERAL OR GENERATOR
GV	GATE VALVE
H/B	HOSE BIBB
HD	HAND
HDPE	HIGH DENSITY POLYETHYLENE
HGL	HYDRAULIC GRADE LINE
HORIZ	HORIZONTAL
HP	HORSEPOWER
HPI	HORIZONTAL POINT OF INTERSECTION
ID	INSIDE DIAMETER
IN	INCH
INV	INVERT
IRR	IRRIGATION
JT	JOINT
L	LENGTH
L/D	LIMITS OF DISTURBANCE
LOW	LIMITS OF WORK
LS	LIFT STATION
LT	LEFT
MAX	MAXIMUM
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MW	MANWAY
NAVD	NORTH AMERICAN VERTICAL DATUM
NO	NUMBER
NTS	NOT TO SCALE
OD	OUTSIDE DIAMETER OR OVERALL DIMENSION
OH	OVERHEAD

ABBREVIATIONS (CONTINUED)

P	POLE
PC	POINT OF CURVATURE
PVMT	PAVEMENT
PCC	PORTLAND CEMENT CONCRETE
PE	POLYETHYLENE
PH	POT HOLE
PI	POINT OF INTERSECTION
PL	PLATE, PROPERTY LINE OR PLACE
PRC	POINT OF REVERSE CURVE
PREFAB	PREFABRICATED
PRESS	PRESSURE
PS	PIPE STIFFNESS
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENCY
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
QTY	QUANTITY
R	RADIUS
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RCCP	REINFORCED CONCRETE CYLINDER PIPE
REF	REFERENCE
REQD	REQUIRED
REV	REVISION
RR	RAILROAD
RT	RIGHT
R/W	RIGHT OF WAY
S	SLOPE (ALSO SIGN SYMBOL)
S/E	SEWER EASEMENT
SCH	SCHEDULE
SD	STORM DRAIN
SEC	SECTION
SHT	SHEET
SPECS	SPECIFICATIONS
SP	STEEL PIPE
SS	SANITARY SEWER, STAINLESS STEEL
STA	STATION
STL	STEEL
T	TELEPHONE
T&B	TOP AND BOTTOM
TBM	TEMPORARY BENCH MARK
TBC	TOP BACK CURB
TCE	TEMPORARY CONSTRUCTION EASEMENT
TEMP	TEMPORARY
TO	TURNOUT
TOC	TOP OF CONCRETE
TW	TOP OF WALL
TYP	TYPICAL
UG	UNDERGROUND
UNO	UNLESS NOTED OTHERWISE
VAR	VARIES OR VARIABLE
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
VPI	VERTICAL POINT OF INTERSECTION
W	WATER
W/	WITH
WL	WATERLINE
WSEL	WATER SURFACE ELEVATION
WP	WORK POINT
WWM	WELDED WIRE MESH

NOTES:
ADDITIONAL ABBREVIATIONS CONFORM TO ANSI STANDARD ABBREVIATIONS Z32. 2.3

SYMBOLS

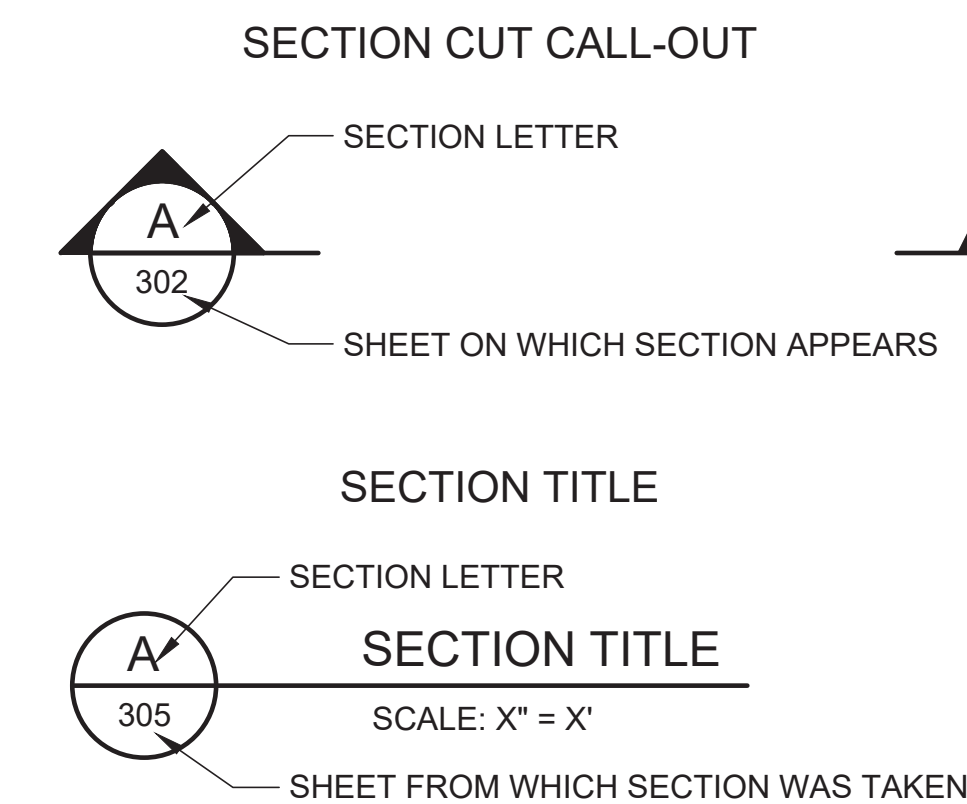
	CONCRETE (CIVIL)
	CONCRETE (STRUCTURAL)
	GRAVEL
	EARTH
	SAND
	ALUMINUM OR METAL DECKING
	CHECKERED PLATE
	GRATING
	RIPRAP
	NEW STRUCTURE OR FACILITY
	EXISTING STRUCTURE OR FACILITY (DASHED OR SCREENED)
	FUTURE STRUCTURE OR FACILITY
	POTHOLING LOCATION
	DRAINAGE SLOPE
	CONCRETE ENCASED PIPE
	CONTOUR LINE, FINISHED GRADE
	CONTOUR LINE, EXISTING GRADE
	FINISHED ELEVATION
	EXISTING ELEVATION
	EARTHEN CUT OR FILL SLOPE TO BE CONSTRUCTED
	CONCRETE CUT OR FILL SLOPE TO BE CONSTRUCTED
	NEW AC PAVING
	EXISTING AC PAVING (DASHED OR SCREENED)
	TEST PIT

SYMBOLS (CONTINUED)

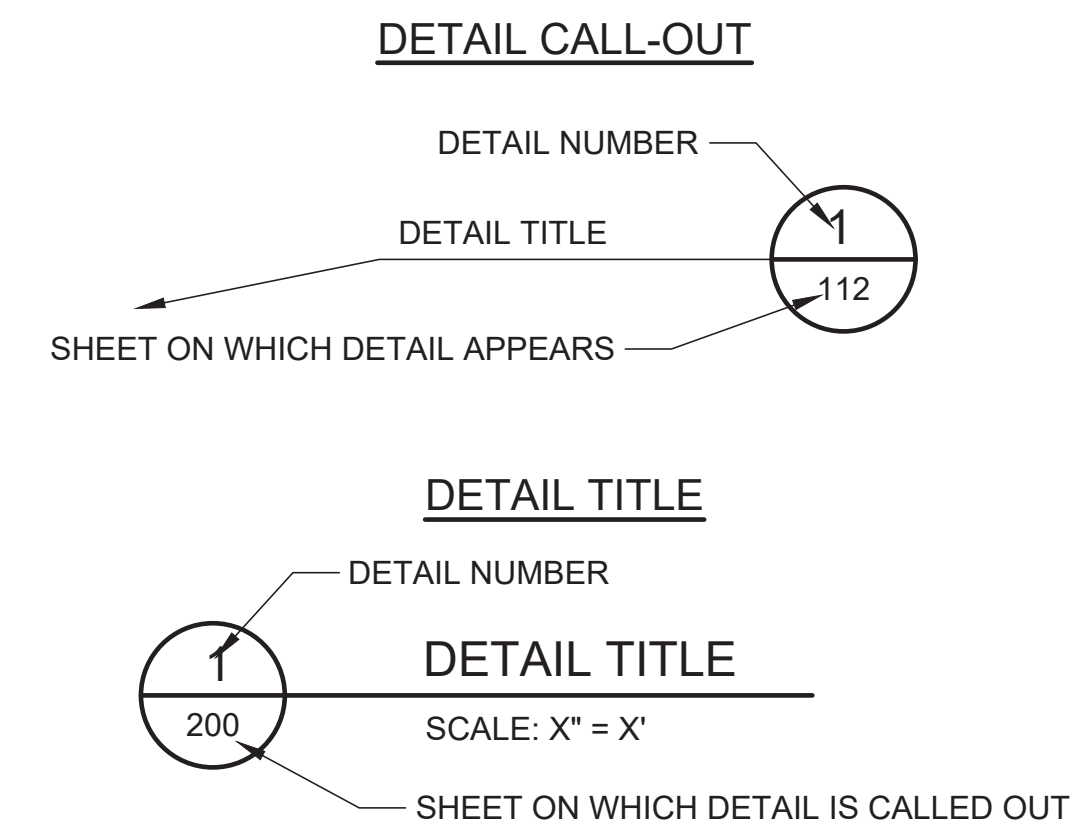
	CULVERT
	IRRIGATION LINE
	PLUG VALVE
	UNDERGROUND ELECTRICAL
	OVERHEAD ELECTRICAL
	UNDERGROUND TELEPHONE
	OVERHEAD TELEPHONE
	FENCE
	ROAD R/W OR LIMITS-OF-WORK
	SECTION LINE OR MID-SECTION LINE
	ABANDONED UTILITIES
	DEFLECTION ANGLE
	SOIL BORING & IDENTIFICATION NUMBER
	BENCH MARK
	CONTROL POINT & NUMBER
	EXISTING WELL
	STILLING WELL
	HORIZONTAL AND VERTICAL CONTROL POINT
	POTHOLE LOCATION
	CAPPED END OR PLUGGED
	INLINE BURIED MANWAY
	CATHODIC PROTECTION TEST BOXES (PLAN VIEW)
	REDUCER
	SECTION CORNER

DETAIL & SECTION IDENTIFICATION

SECTION IDENTIFICATION:



DETAIL IDENTIFICATION



NOTES:

- IF PLAN AND SECTION (OR DETAIL CALL-OUT AND DETAIL) ARE SHOWN ON THE SAME SHEET, THEN THE SHEET NUMBER IS REPLACED WITH "-".
- IF DETAIL IS SHOWN ON NUMEROUS SHEETS THEN THE SHEET NUMBER IN THE DETAIL TITLE IS REPLACED WITH "VAR" FOR "VARIES".

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NO.	DATE	REVISIONS	APPROVED

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WAYNE C. DAHL NAME	DESIGN TEAM LEAD R.C.E. 45611	11/10/21 DATE
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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

GENERAL

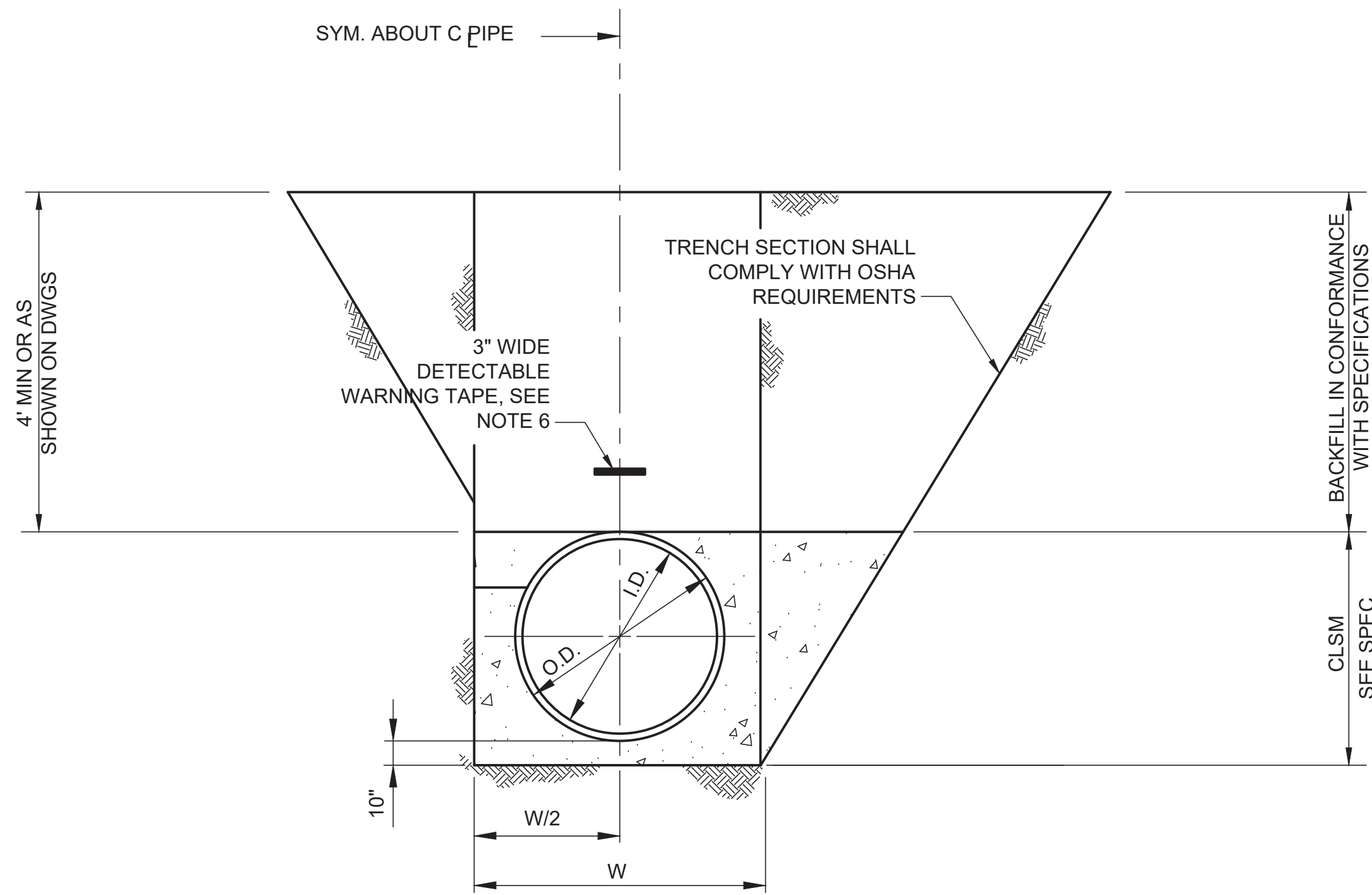
SYMBOLS AND ABBREVIATIONS

SHEET
G-04

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SHEETS

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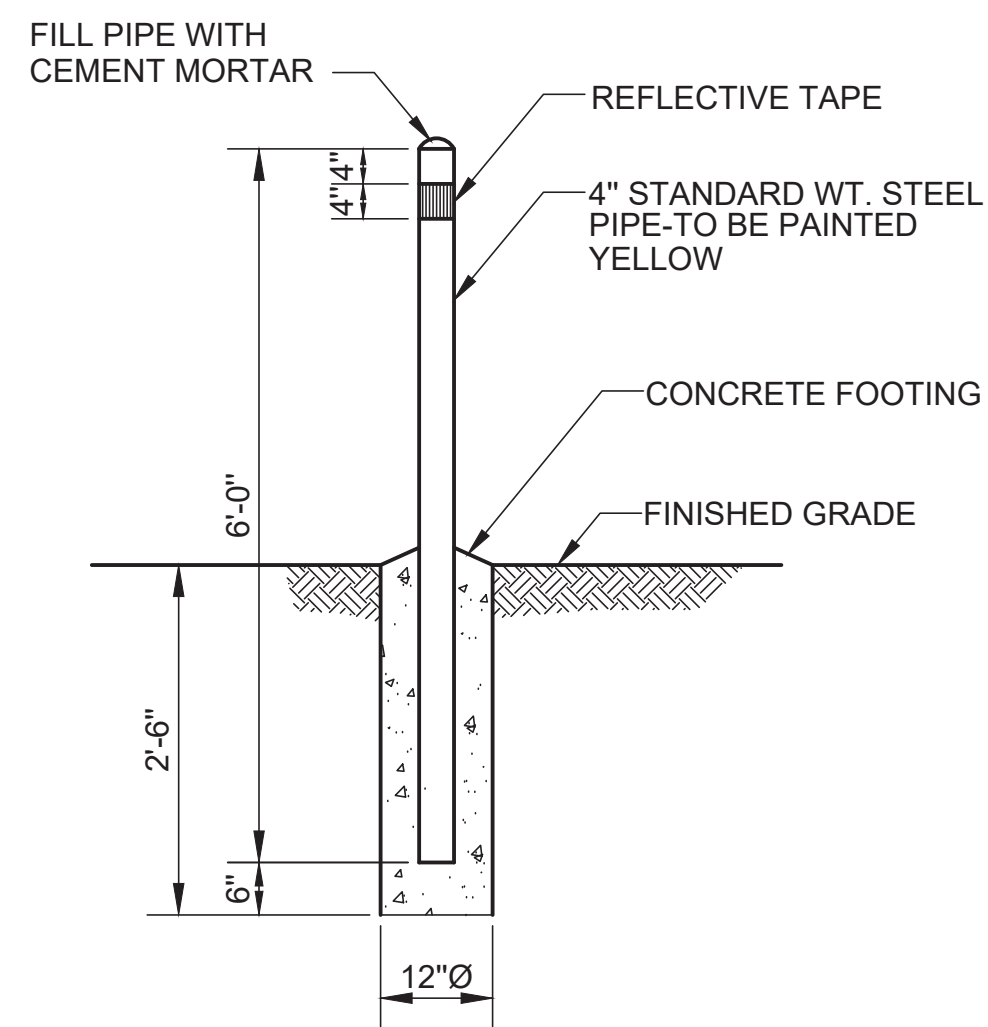
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



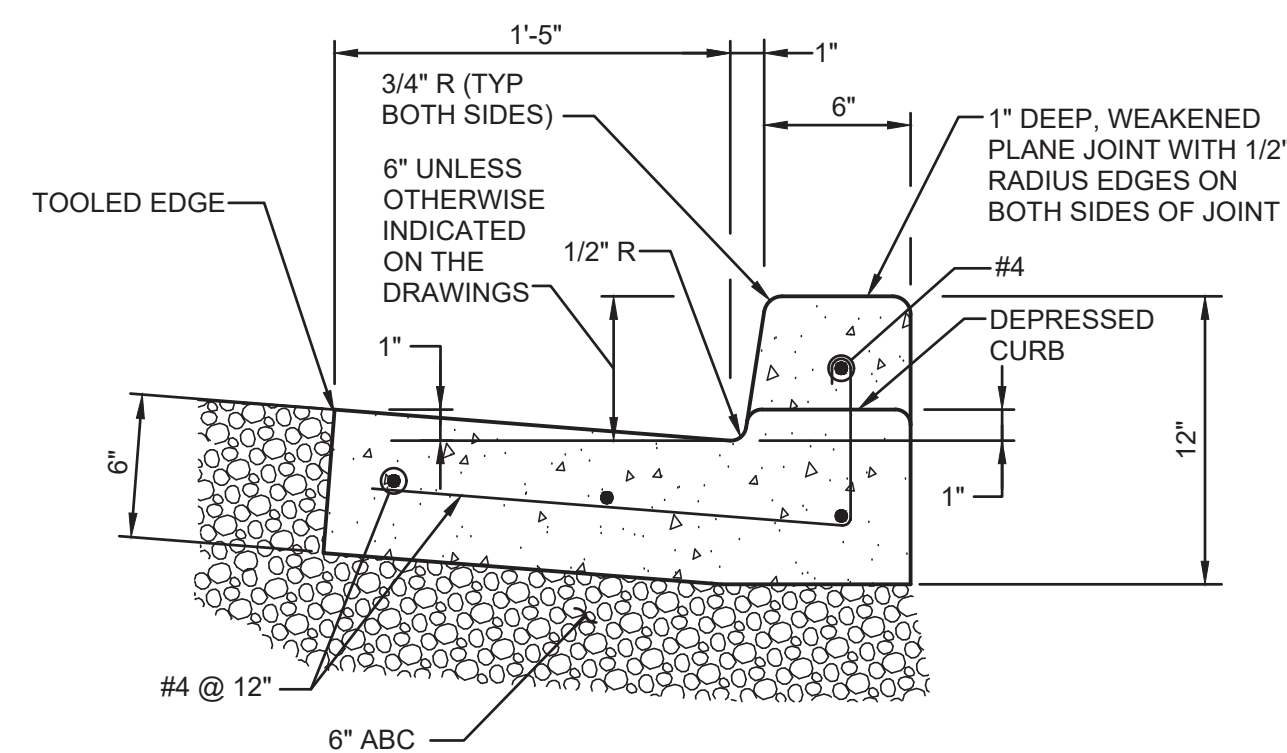
1 TYPICAL PIPE TRENCH SECTION
- NTS

TRENCH SECTION NOTES:

- PIPE DIAMETERS SHOWN ARE THE NOMINAL INSIDE DIAMETER (I.D.) OF THE PIPE IN INCHES UNLESS OTHERWISE INDICATED. OUTSIDE DIAMETER (O.D.) IS IN INCHES OF THE PIPE ACTUALLY INSTALLED.
- W IS THE MINIMUM WIDTH OF EXCAVATION IN FEET AT BOTTOM OF TRENCH. $W = O.D. + 24"$. THE TRENCH WIDTH SHOULD BE KEPT AS NARROW AS PRACTICABLE FOR WHICH WILL ALLOW PROPER DENSIFICATION OF THE PIPE BEDDING AND BACKFILL. IF SIDES OF TRENCH REMAIN VERTICAL AFTER EXCAVATION, THE MINIMUM TRENCH WIDTH (MEASURED AT TOP OF PIPE) SHALL BE $O.D. + 32$ INCHES.
- ALL TRENCH EXCAVATION SHALL COMPLY WITH THE MOST CURRENT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION STANDARDS.
- WITHIN DWR RIGHT OF WAY, BACKFILL SHALL BE COMPACTED TO 95 PERCENT RELATIVE COMPACTION (ASTM D1557-12). BACKFILL SHALL BE PLACED IN NO GREATER THAN 4-INCH LIFTS IF HAND COMPACTED OR NO GREATER THAN 8-INCH LIFTS IF POWER COMPACTED.
- FOR AREAS OUTSIDE OF DWR RIGHT OF WAY, BACKFILL SHALL BE COMPACTED TO 90 PERCENT RELATIVE COMPACTION (ASTM D1557-12).
- PROVIDE 3-INCH-WIDE DETECTABLE WARNING TAPE 18" TO 24" ABOVE TOP OF PIPE. WARNING TAPE SHALL BE COLOR "PURPLE" AND IMPRINTED WITH "CAUTION BURIED NON-POTABLE WATERLINE."
- TRENCH BOTTOM OR BEDDING FOR ALL PIPE SHALL BE GRADED TO PROVIDE UNIFORM SUPPORT FOR THE ENTIRE LENGTH OF THE PIPE EXCEPT AT BELLHOLES.
- BELLHOLES, AS REQUIRED, FOR PIPE SHALL HAVE A CLEARANCE OF 3" BETWEEN THE BOTTOM OF THE BELLHOLE AND THE EXTERIOR OF THE PIPE BARREL, BUT IN NO CASE SHALL BELLHOLES BE SMALLER THAN REQUIRED TO FACILITATE PLACING OF THE PIPE OR PROPER JOINING OF THE PIPE.
- MINIMUM 3-INCH DEEP LAYER OF SCARIFIED MATERIAL WHEN IN HARD GROUND CONDITIONS. IN ROCKY AREAS, OVEREXCAVATE AS DIRECTED BY THE ENGINEER (6" MIN) AND REPLACE WITH COMPACTED BEDDING MATERIAL.
- FOR VERTICAL TRENCH WALLS AND COMBINATION VERTICAL & SLOPING WALLS, THE NEED FOR PROTECTIVE SYSTEMS SHALL BE DETERMINED IN ACCORDANCE WITH CAL-OSHA STANDARDS. PROTECTIVE SYSTEMS SHALL BE DESIGNED AND BUILT IN ACCORDANCE WITH CAL-OSHA STANDARDS.
- EXCESS MATERIAL FROM TRENCH EXCAVATION SHALL BE DEPOSITED WITHIN OR ADJACENT TO THE CONTRACT WORK AREA, WITH THE EXACT LOCATION AND GRADING REQUIREMENTS PROVIDED BY THE ENGINEER IN THE FIELD.



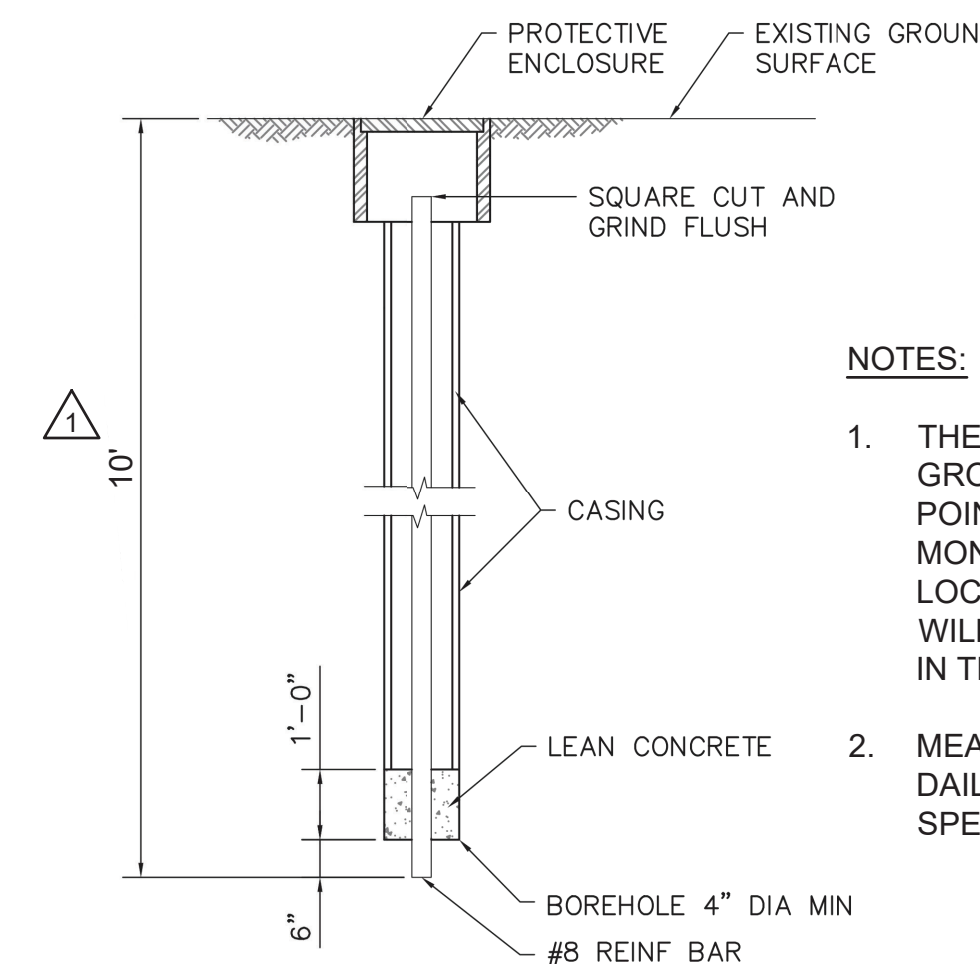
2 BOLLARD
- NTS



CURB AND GUTTER NOTES:

- CURB SHALL BE FINISHED ON TOP, 8" DOWN FRONT FACE, AND 2" DOWN BACK.
- EXPANSION JOINTS SHALL BE PLACED AT END OF CONCRETE PLACEMENT, AT POINTS OF CURVATURE, BOTH SIDES OF DRIVEWAYS AND WALKWAYS, CURB RETURNS, STRUCTURES, AND AT MAXIMUM DISTANCE OF 30 FEET. EXPANSION JOINTS SHALL BE 3/4" THICK WITH 1/4" RADIUS EDGES AT BOTH SIDES OF JOINT. USE BITUMINOUS EXPANSION JOINT MATERIAL.
- REINFORCING STEEL SHALL NOT PASS THROUGH EXPANSION JOINTS.
- WEAKENED PLANE JOINTS SHALL BE INSTALLED AT 15 FEET OC.
- CURB SHALL BE DEPRESSED FOR DRIVEWAYS, ROADWAYS, SIDEWALKS FOR HANDICAPPED ACCESS, AND WHERE INDICATED ON THE DRAWINGS.

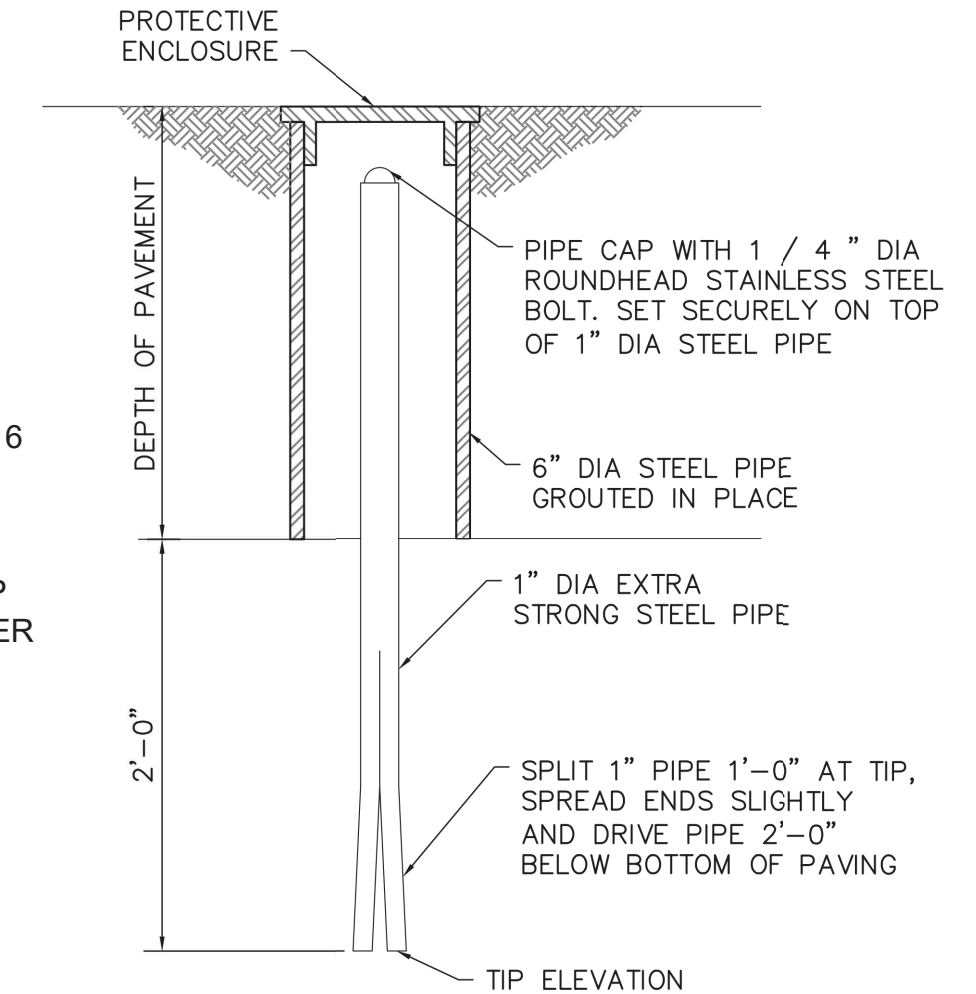
3 CURB AND GUTTER
- NTS



NOTES:

- THE CONTRACTOR SHALL PROVIDE 6 GROUND MOVEMENT MONITORING POINTS (GMMP) AND 8 SURFACE MONITORING POINTS (SMP). LOCATIONS OF THE GMMP AND SMP WILL BE DIRECTED BY THE ENGINEER IN THE FIELD.
- MEASUREMENTS SHALL BE TAKEN DAILY UNLESS OTHERWISE SPECIFIED BY DWR.

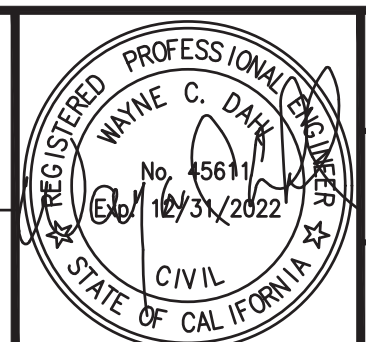
4 GROUND MOVEMENT MONITORING POINT (GMMP)
- NTS



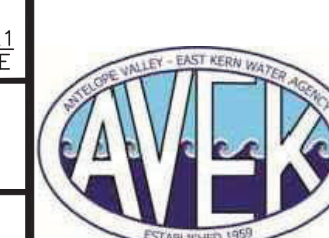
5 SURFACE MONITORING POINT (SMP)
- NTS

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NO.	DATE	REVISIONS	APPROVED
1	12/22/21	ADDENDUM NO. 1	



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NAME R.C.E. 45611 DATE
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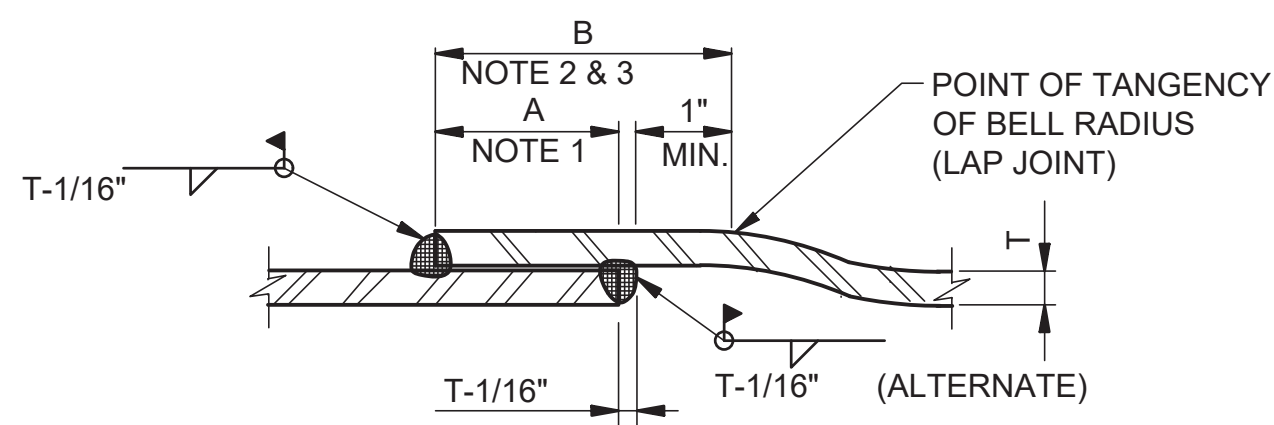
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

CIVIL
TYPICAL DETAILS
SHEET 1 OF 3

SHEET
CG-01
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SHEETS

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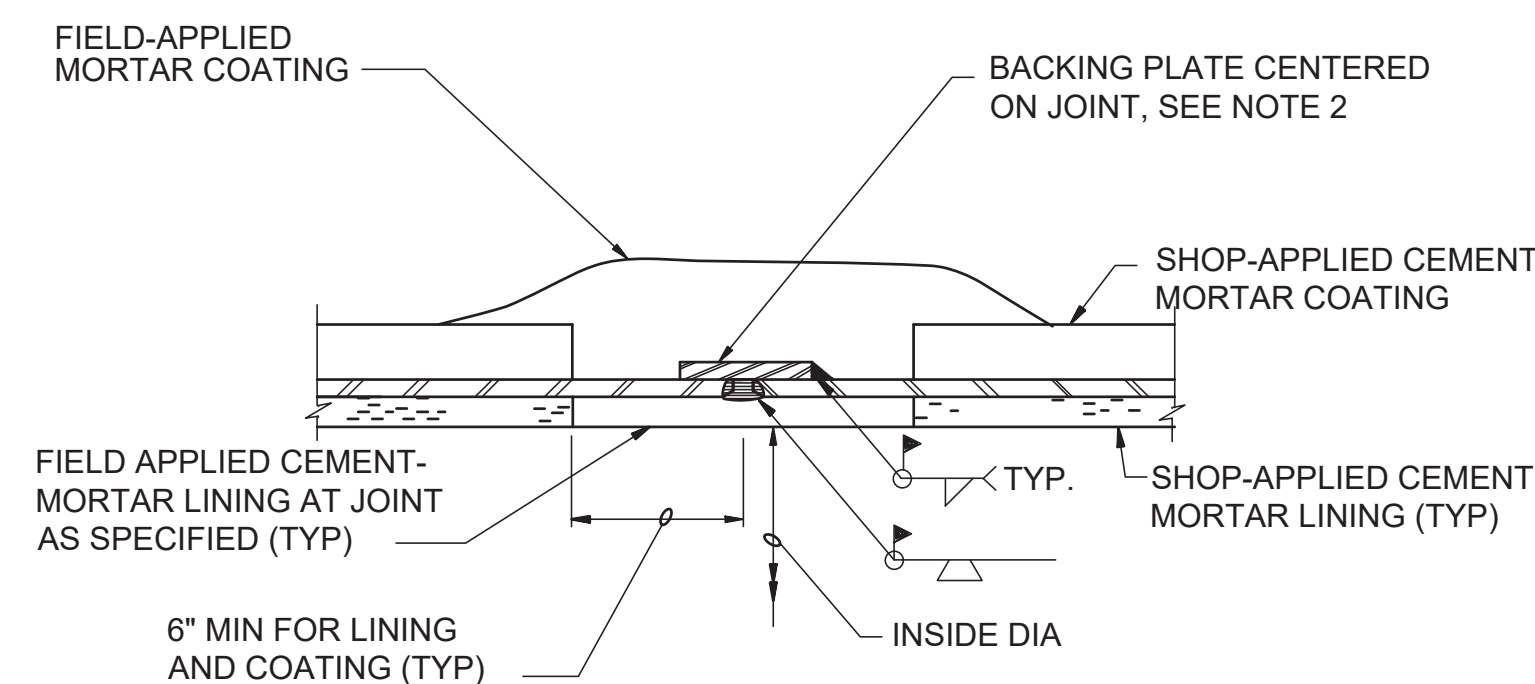
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



NOTES:

- DIMENSION "A" CORRESPONDS TO THE COMPLETED JOINT OVERLAP AFTER WELDING. DIMENSION "A" IS THE GREATER OF 3 INCHES OR 5T, MINIMUM FOR STANDARD JOINTS. INCREASE DIMENSION "A" FOR SPECIAL TEMPERATURE CONTROL JOINTS AS FURTHER DISCUSSED IN NOTE 3
- PROVIDE THE MINIMUM OVERLAP DIMENSION "A" AND MAINTAIN THE INDICATED HOLDBACK FOR THE WELD AS REQUIRED FOR THE MINIMUM DIMENSION "B" FOR STANDARD JOINTS.
- INCREASE DIMENSION "B" BY 3 INCHES FOR SPECIAL TEMPERATURE CONTROL JOINTS AS FURTHER DISCUSSED. AT THE TIME OF INSTALLATION AND PRIOR TO WELDING, INSERT THE SPIGOT INTO THE LENGTHENED BELL TO PROVIDE "A"+3 INCHES MINIMUM OVERLAP. SEE SPECIFICATIONS FOR SPECIAL TEMPERATURE CONTROL JOINT WELDING REQUIREMENTS.
- CONFIGURATION FOR BELL AND SPIGOT LAP JOINTS SHOWN. CONFIGURATION ON BUTT STRAP JOINTS ARE SIMILAR.
- PERFORM WELD TESTS IN ACCORDANCE WITH SPECIFICATIONS.
- FABRICATE AND INSTALL JOINTS WITHIN THE TOLERANCES INDICATED. TOLERANCE REQUIREMENT APPLY TO BOTH WELDS AND TO BOTH STRAIGHT AND DEFLECTED JOINTS.

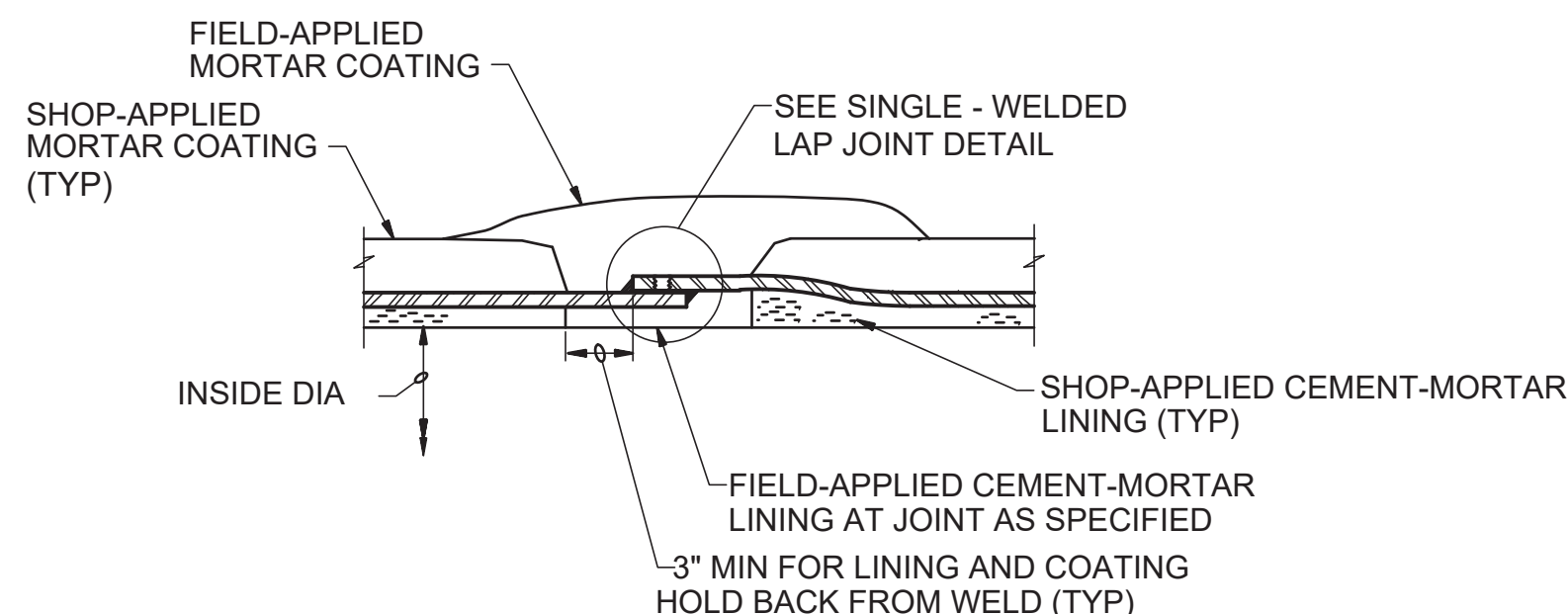
1 SINGLE - WELDED LAP JOINT
- NTS



NOTES:

- HOLIDAY TEST AFTER INSTALLATION AS SPECIFIED.
- CONTRACTOR HAS THE OPTION TO INSTALL THE BACKING PLATE, AS SHOWN, INSIDE THE PIPE AND PERFORM THE BUTT WELDING FROM THE OUTSIDE.

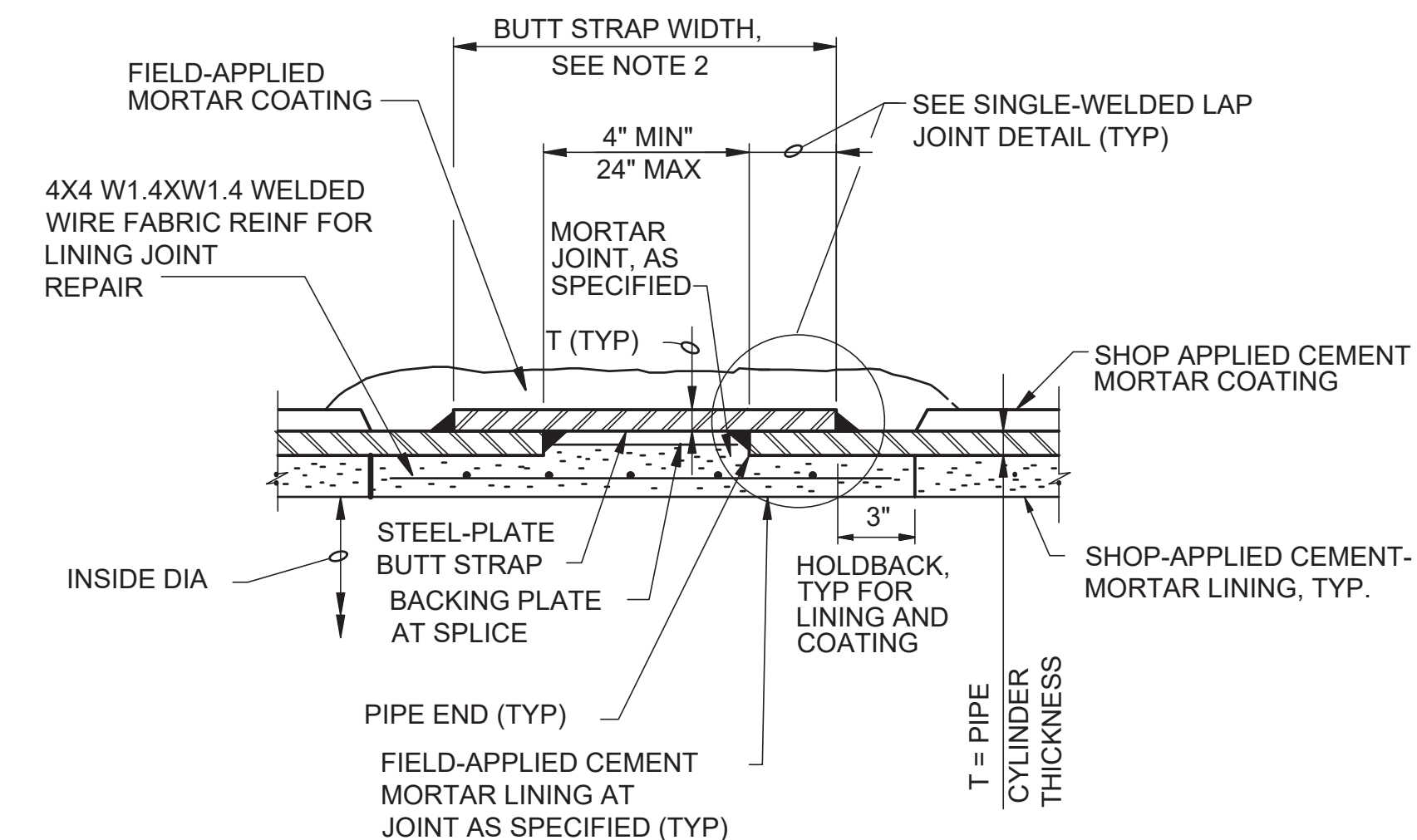
4 BUTT WELD
- NTS



NOTES:

- HOLIDAY TEST AFTER INSTALLATION AS SPECIFIED.

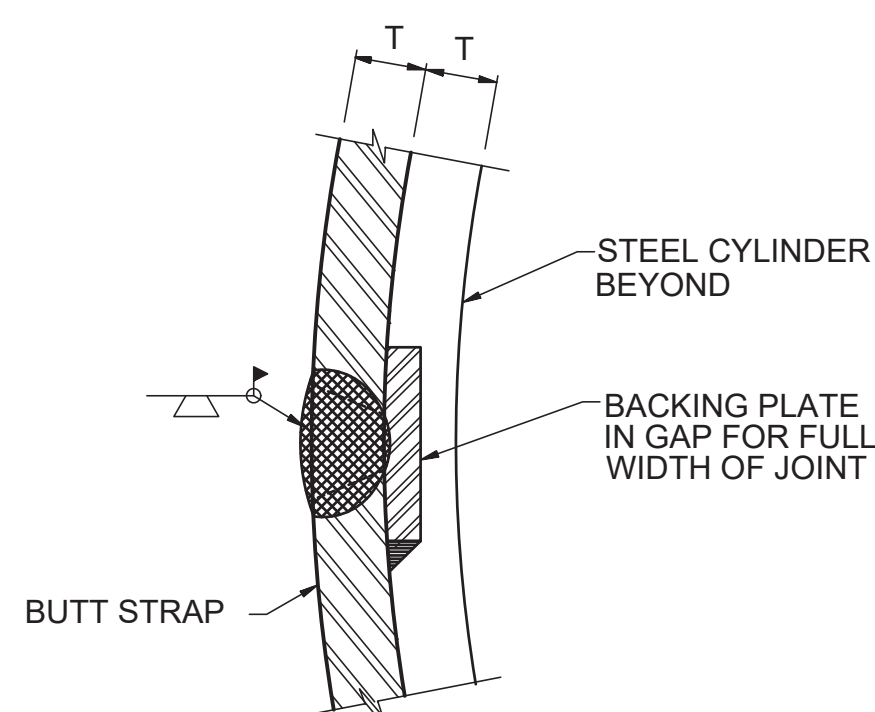
2 FIELD - APPLIED COATING AND LINING FOR LAP WELDED JOINT
- NTS



NOTES:

- FOR FIELD WELDING OF INDIVIDUAL BUTT STRAP PIECES TO EACH OTHER, SEE BUTT STRAP SPLICE DETAIL.
- UNLESS OTHERWISE NOTED, CONFORM BUTT STRAP WIDTH TO THE LIMITATIONS SHOWN FOR PIPE END SEPARATION AND OVERLAP REQUIREMENTS. THIS INCLUDES THE ADDITIONAL 3-INCH INCREASE IF A TEMPERATURE CONTROL JOINT IS REQUIRED AT A BUTT STRAP JOINT.
- HOLIDAY TEST AFTER INSTALLATION AS SPECIFIED.

3 BUTT STRAP JOINT
- NTS



NOTES:

- LINING AND COATINGS ARE NOT SHOWN FOR CLARITY.
- LEVEL ENDS OF BACKING PLATE AT BUTT STRAP PRIOR TO WELDING OR BACK GOUGE AT CONTACT WITH ADJACENT CYLINDER PRIOR TO COMPLETING INSIDE FILLET WELD.

5 BUTT STRAP SPLICE
- NTS

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IRVINE, CA 92618
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stantec.com

DAHL
consultants

REGISTERED PROFESSIONAL ENGINEER
WAYNE C. DAHL
No. 45611
Exp. 12/31/2022
CIVIL
STATE OF CALIFORNIA

WAYNE C. DAHL DESIGN TEAM LEAD 11/10/21
NAME R.C.E. 45611 DATE

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ANTELOPE VALLEY - EAST KERN WATER AGENCY

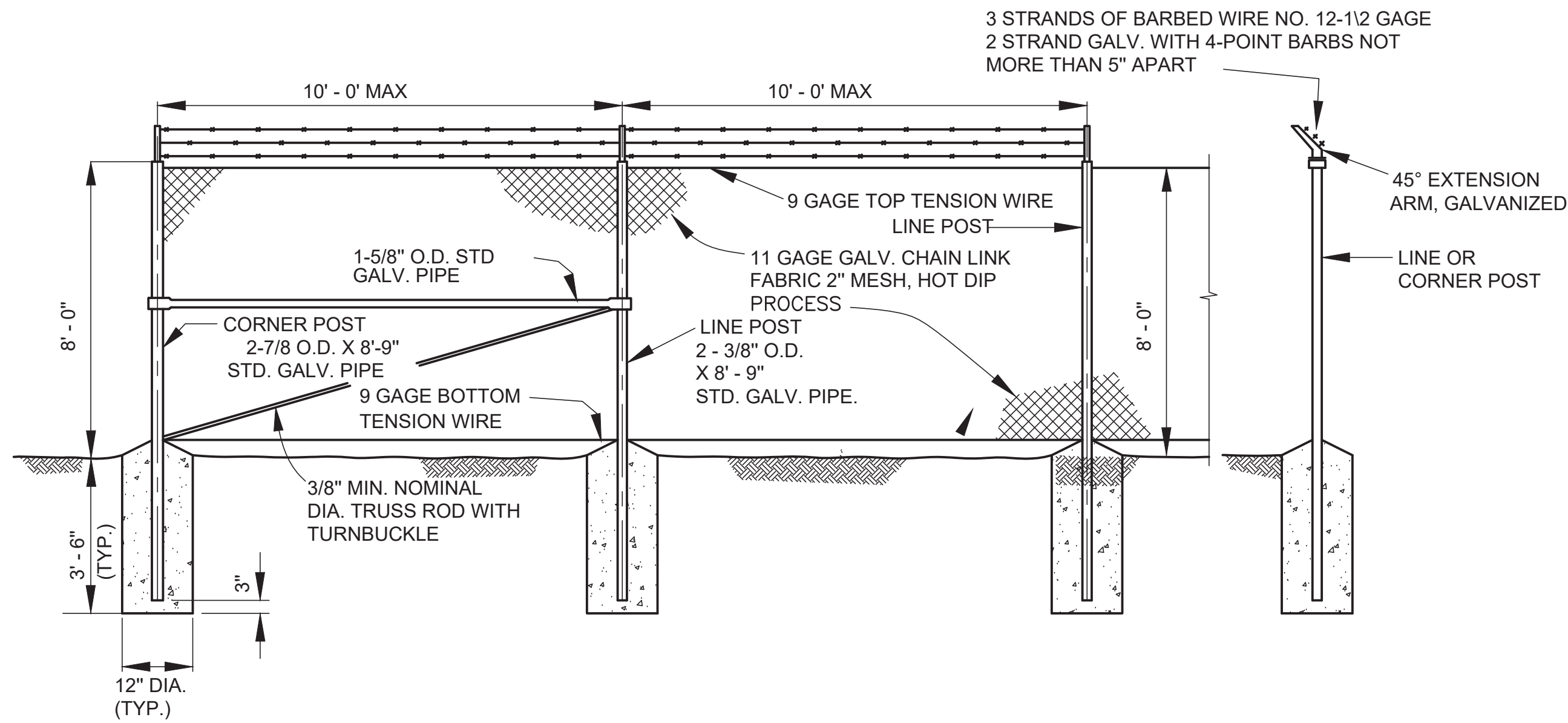
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

CIVIL
TYPICAL DETAILS
SHEET 2 OF 3

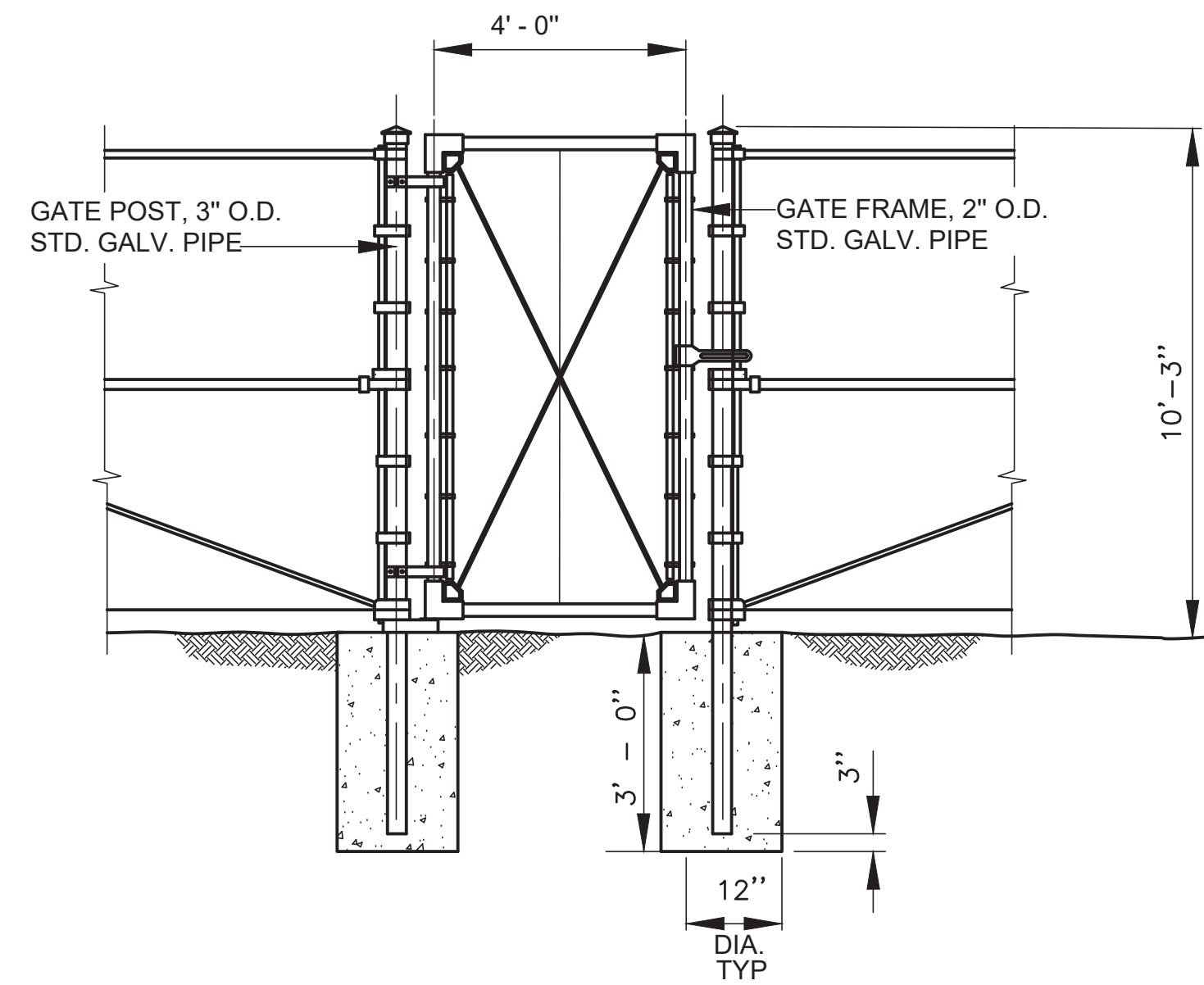
SHEET
CG-02
6 of 54
SHEETS

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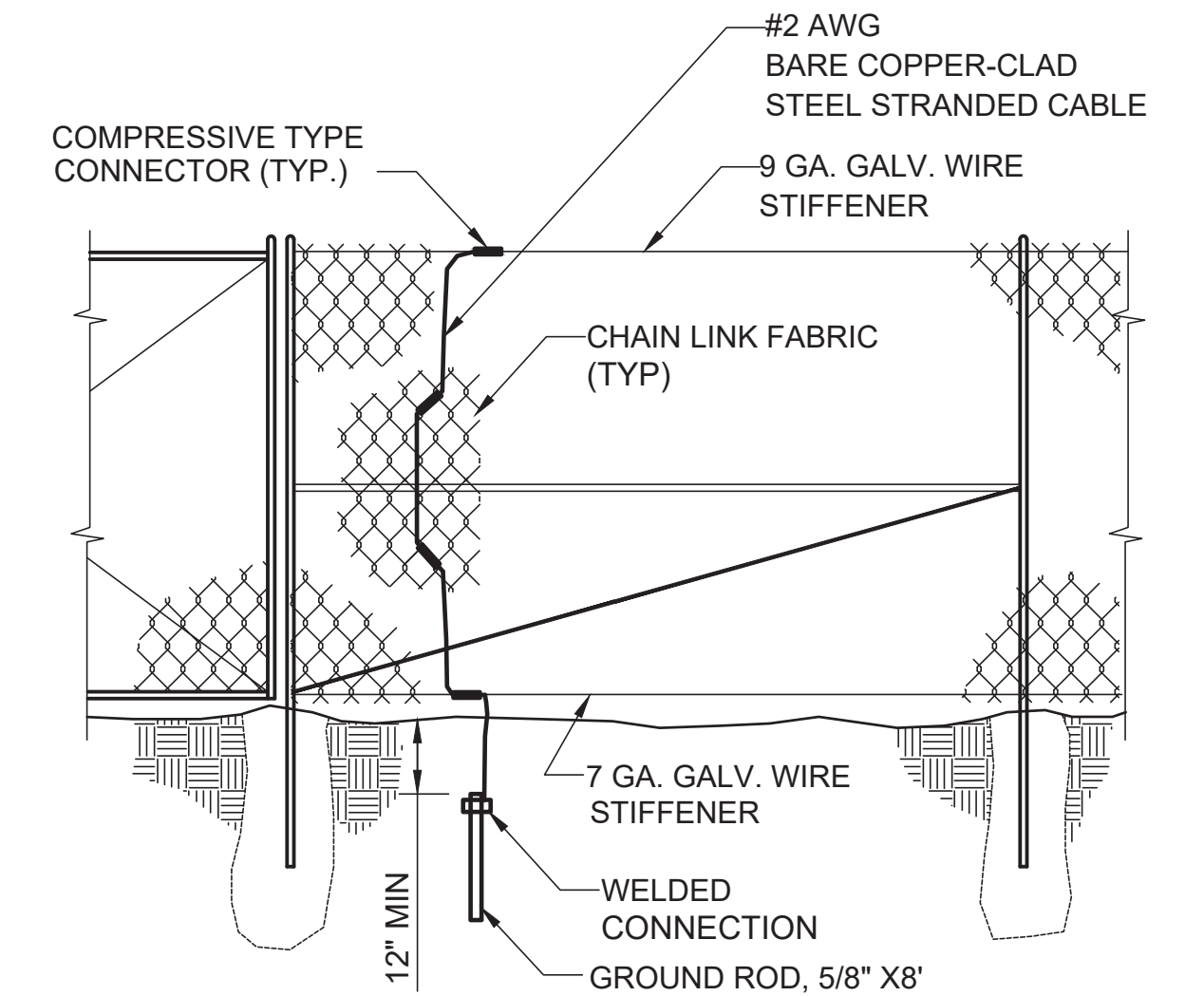
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



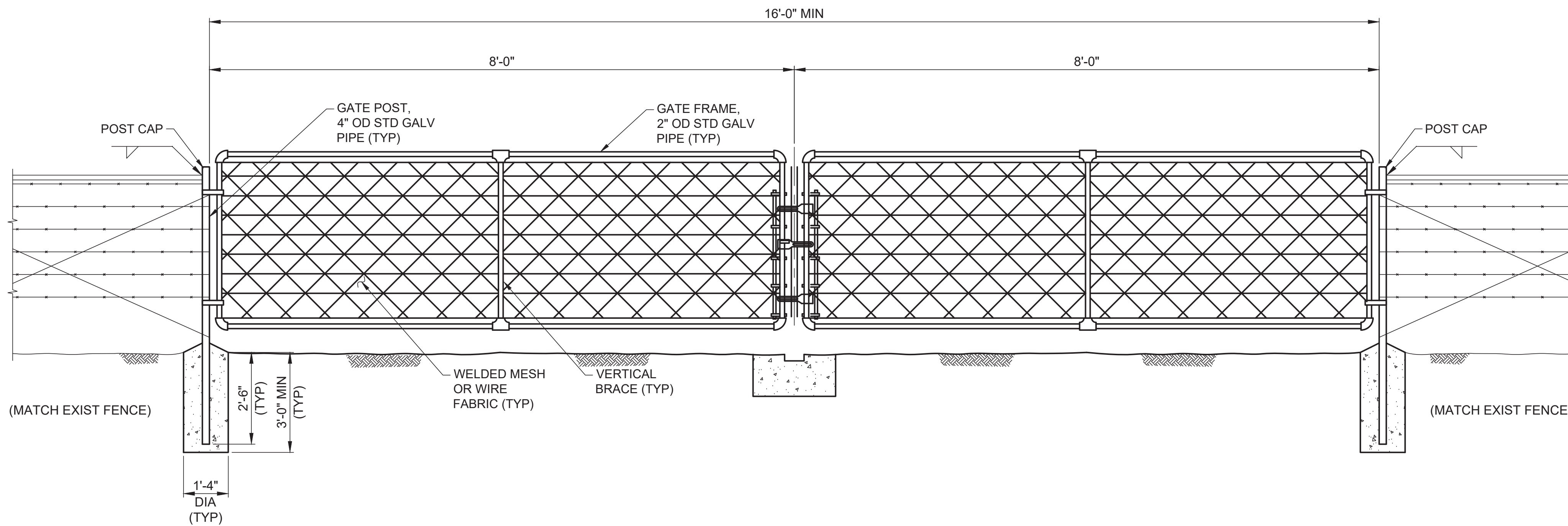
1 8' HIGH CHAIN LINK FENCE
- NTS



2 METAL FRAME WALK GATE
- NTS



3 GROUNDING DETAIL
- NTS



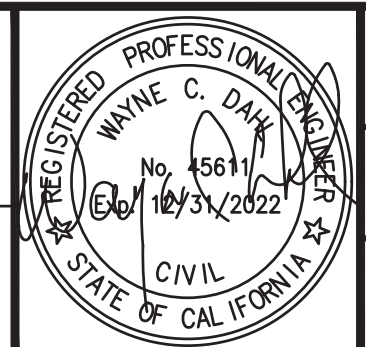
4 TUBULAR METAL FRAME GATE
- NTS

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stantec.com

DAHL
consultants



WAYNE C. DAHL
NAME
DESIGN TEAM LEAD
R.C.E. 45611
11/10/21
DATE

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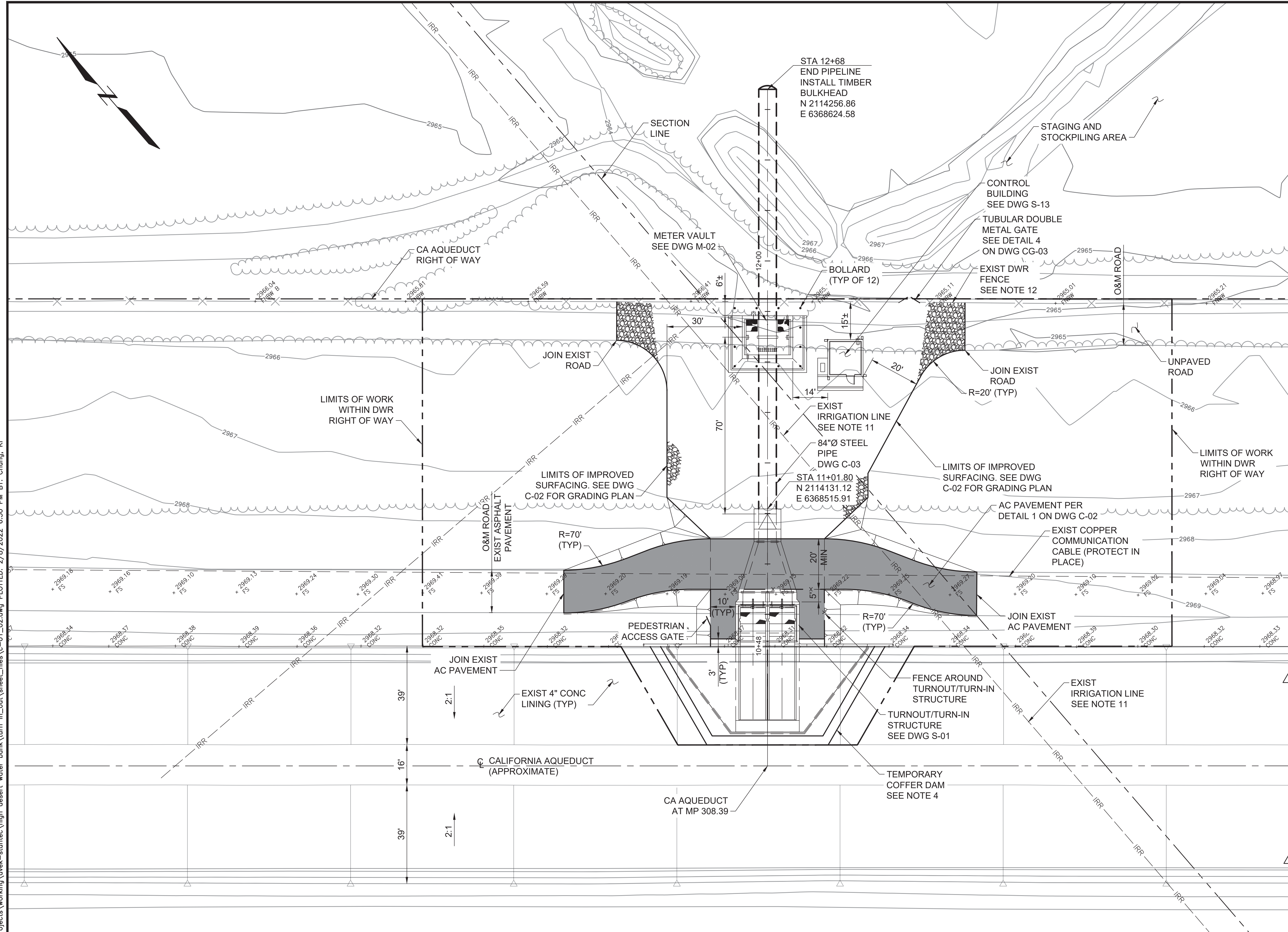
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

CIVIL
TYPICAL DETAILS
SHEET 3 OF 3

SHEET
CG-03
7 of 54
SHEETS

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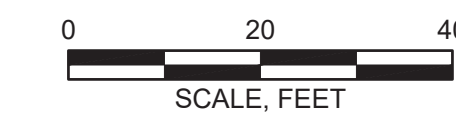
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



- CONSTRUCTION NOTES:**
1. THE CONTRACTOR SHALL VERIFY ALL CANAL DIMENSIONS, SLOPES, LINING THICKNESS, ELEVATIONS, AND JOINT LOCATIONS PRIOR TO CONSTRUCTION AND SHALL IMMEDIATELY NOTIFY THE ENGINEER OF ANY DISCREPANCIES.
 2. COMMUNICATION AND CONTROL CABLES CONNECTED WITH THE OPERATION OF THE STATE WATER PROJECT ARE BURIED ALONG EITHER OR BOTH SIDES OF THE AQUEDUCT WITHIN DWR RIGHT OF WAY. COMMUNICATION AND CONTROL CABLES SHALL BE PROTECTED IN PLACE AND REMAIN OPERATIONAL DURING CONSTRUCTION.
 3. THE CONTRACTOR SHALL CONTACT UNDERGROUND SERVICE ALERT (USA) AT (800) 422-4133 FOR SOUTHERN CA AND MCI TELECOMMUNICATIONS CORPORATION AT (800) 624- 9675 FOR INFORMATION REGARDING THE LOCATION OF THE PIPELINE AND THE COMMUNICATION AND CONTROL CABLES.
 4. CONTRACTOR SHALL USE A COFFERDAM WHEN EXCAVATING WITHIN THE CALIFORNIA AQUEDUCT PRISM, TO MINIMIZE DISRUPTION OF DWR'S ONGOING OPERATIONS AND MAINTENANCE ACTIVITIES. THE CONTRACTOR SHALL SUBMIT DETAILED DESIGN, EXCAVATION PLAN, AND INSTALLATION PROCEDURE OF COFFERDAM FOR APPROVAL PRIOR TO THE START OF CONSTRUCTION IN ACCORDANCE WITH THE SPECIFICATIONS.
 5. DETECTABLE WARNING TAPE SHALL BE INSTALLED OVER ALL BURIED UTILITIES (A MINIMUM OF 18-INCHES ABOVE PIPE) WITHIN DWR'S RIGHT OF WAY.
 6. INSTALL ONE PIPELINE MARKER POST WITH SIGN AT FENCELINE. MARKER POST SHALL BE B.W. LINE POST (7'-6" LENGTH) WITH 5 FEET EXTENDING ABOVE GRADE. SIGN SHALL BE SECURELY ATTACHED TO POST, MINIMUM 1.5 SQUARE FOOT IN AREA, AND SHALL CONTAIN THE FOLLOWING INFORMATION:

ANTELOPE VALLEY-EAST KERN WATER AGENCY
IRRIGATION WATER
EMERGENCY CONTACT TELEPHONE NO. (661) 816-3464 OR (661) 943-3201
 7. EXCESS SPOIL MATERIAL SHALL BE DEPOSITED WITHIN OR ADJACENT TO THE CONTRACT WORK AREA, WITH THE EXACT LOCATION AND GRADING REQUIREMENTS PROVIDED BY THE ENGINEER IN THE FIELD.
 8. ALL WASTE MATERIAL AND DEBRIS SHALL BE REMOVED FROM DWR RIGHT OF WAY AND DISPOSE OF IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS.
 9. PROVISIONS SHALL BE MADE BY THE CONTRACTOR TO PREVENT CONTAMINATION OF CANAL WATER DURING CONSTRUCTION.
 10. DWR'S ONGOING OPERATIONS AND MAINTENANCE ACTIVITIES SHALL NOT BE DISRUPTED DURING CONSTRUCTION. THE PRIMARY OR SECONDARY OPERATING ROAD MUST BE KEPT AVAILABLE FOR DWR USE AT ALL TIMES.
 11. TEMPORARY CUT AND CAP EXISTING 12" CONCRETE IRRIGATION LINE AS REQUIRED FOR THE INSTALLATION OF THE 84-INCH PIPELINE. AFTER INSTALLATION OF THE 84-INCH PIPELINE, REPLACE AND RELOCATE EXISTING 12" CONCRETE IRRIGATION LINE ABOVE OR BELOW 84-INCH PIPELINE DEPENDING ON LANDOWNER'S NEEDS.
 12. REMOVE AS NECESSARY DURING CONSTRUCTION AND REINSTALL UPON COMPLETION OF WORK. THE CONTRACTOR SHALL CLOSE OFF AND PROTECT DWR RIGHT-OF-WAY OUTSIDE OF WORKING HOURS.
 13. FURNISH AND INSTALL "REDUCED SPEED 10 AHEAD" SIGNS ALONG THE O&M ROAD ON EACH SIDE OF THE TURNOUT/TURN-IN STRUCTURE. THE SIGN AND LOCATION SHALL MEET THE REQUIREMENTS OF THE MUTCD.
 14. THE CONTRACTOR MAY MODIFY THE LOCATION OF THE CONTROL BUILDING (AT NO ADDITIONAL COST TO THE AGENCY) TO ACCOMMODATE ITS CONSTRUCTION PRIOR TO THE INSTALLATION OF THE 84-INCH DIAMETER PIPELINE AND CONSTRUCTION OF THE METER VAULT. IN THE EVENT THIS OPTION IS USED, THE CONTRACTOR SHALL SUBMIT A REVISED SITE PLAN FOR REVIEW AND ACCEPTANCE.

TURNOUT/TURN-IN GENERAL SITE PLAN
SCALE: 1"=20'

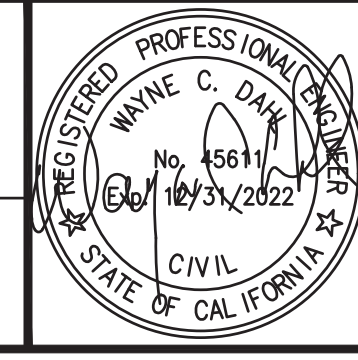


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NO.	DATE	REVISIONS	APPROVED
2	1/06/22	ADDENDUM NO. 3	
1	12/22/21	ADDENDUM NO. 1	

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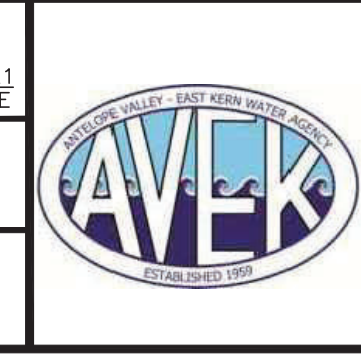


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NAME

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R.C.E. 45611

11/10/21
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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

CIVIL

AQUEDUCT TURNOUT/TURN-IN
GENERAL SITE PLAN

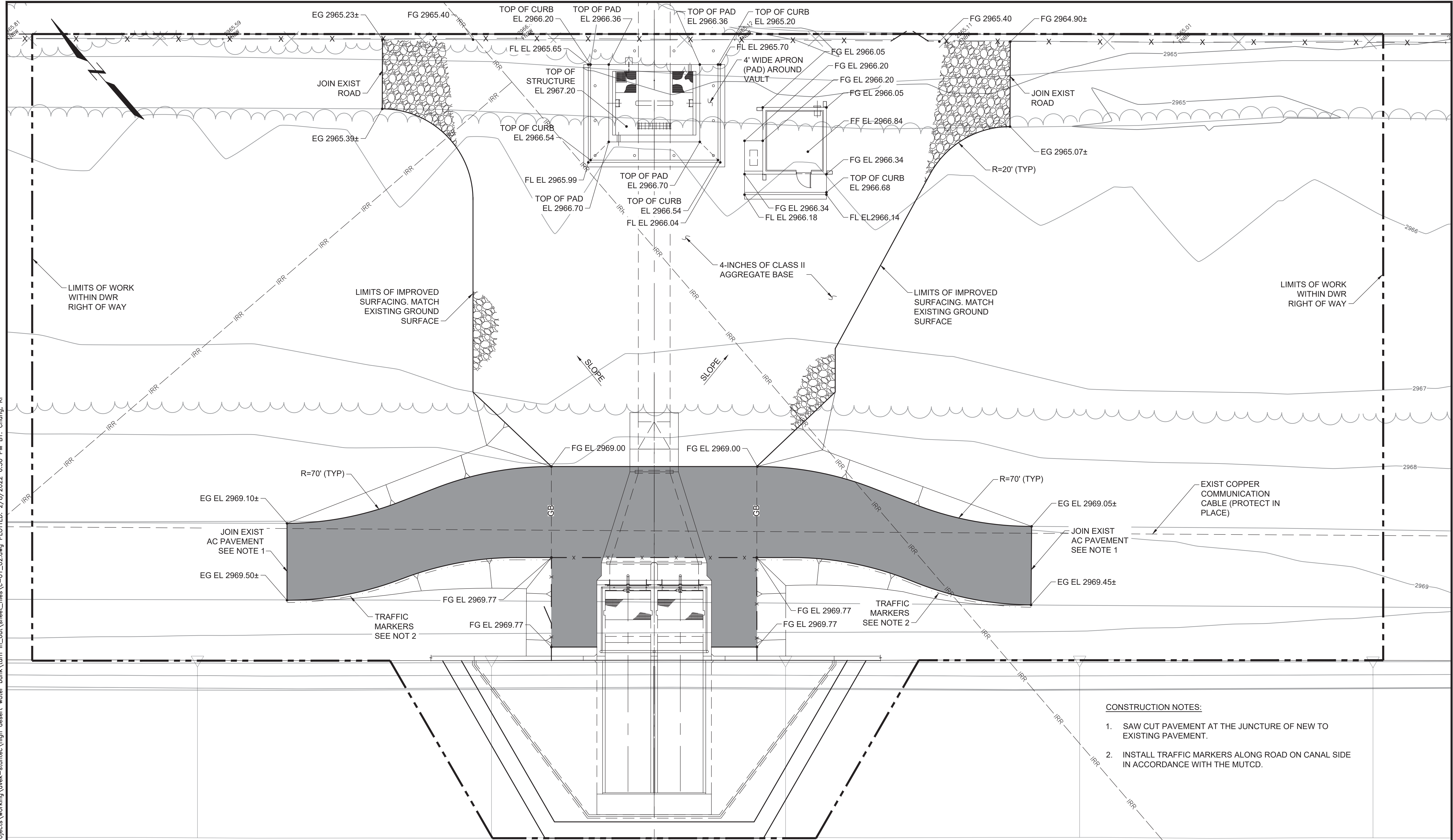
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C-01

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SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

APPENDIX G



- CONSTRUCTION NOTES:**
1. SAW CUT PAVEMENT AT THE JUNCTURE OF NEW TO EXISTING PAVEMENT.
 2. INSTALL TRAFFIC MARKERS ALONG ROAD ON CANAL SIDE IN ACCORDANCE WITH THE MUTCD.

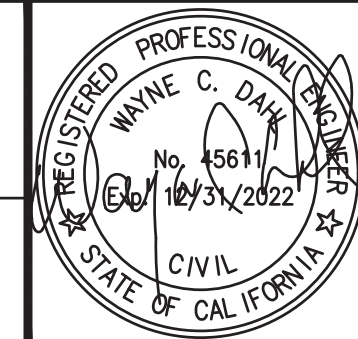
TURNOUT/TURN-IN SITE GRADING PLAN
SCALE: 1"=10'

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

CIVIL

AQUEDUCT TURNOUT/TURN-IN
SITE GRADING PLAN

SHEET
C-02

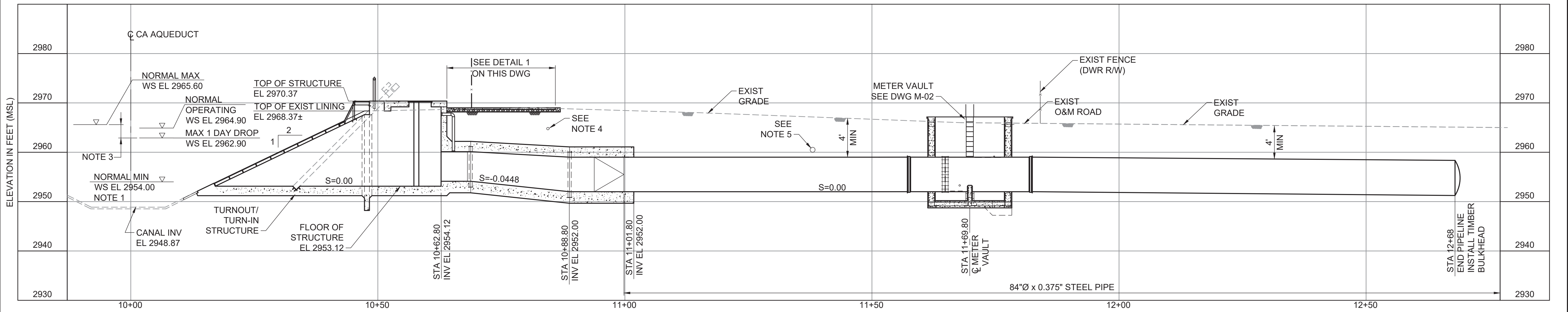
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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

NOVEMBER 2021

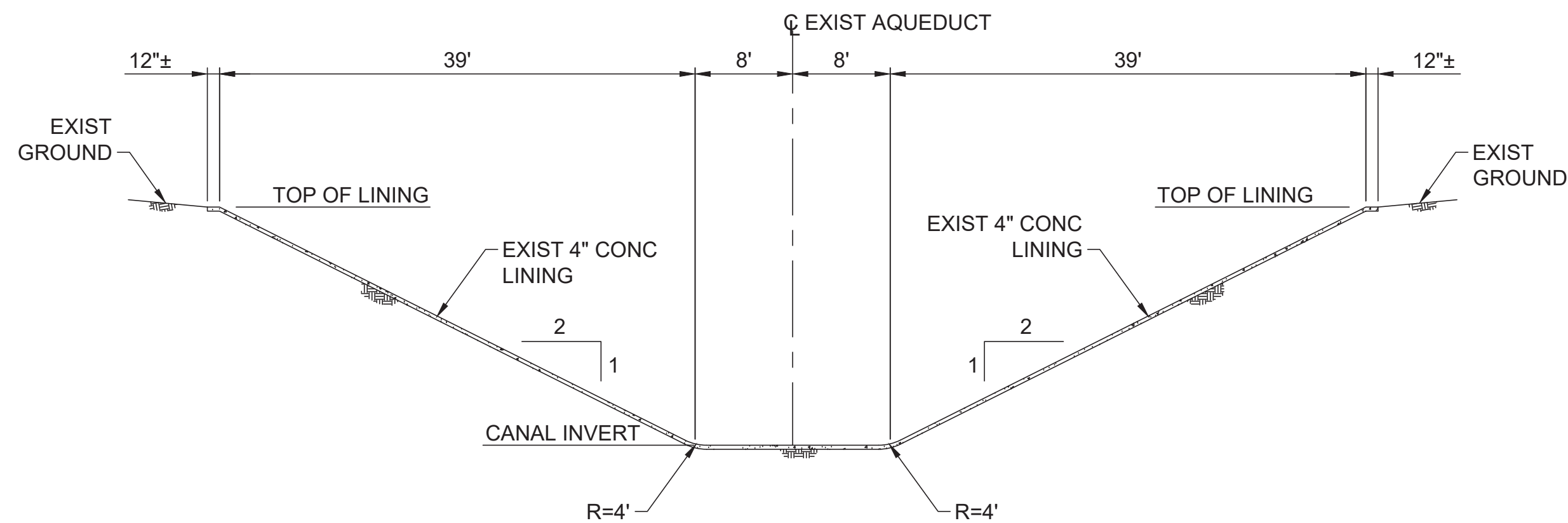
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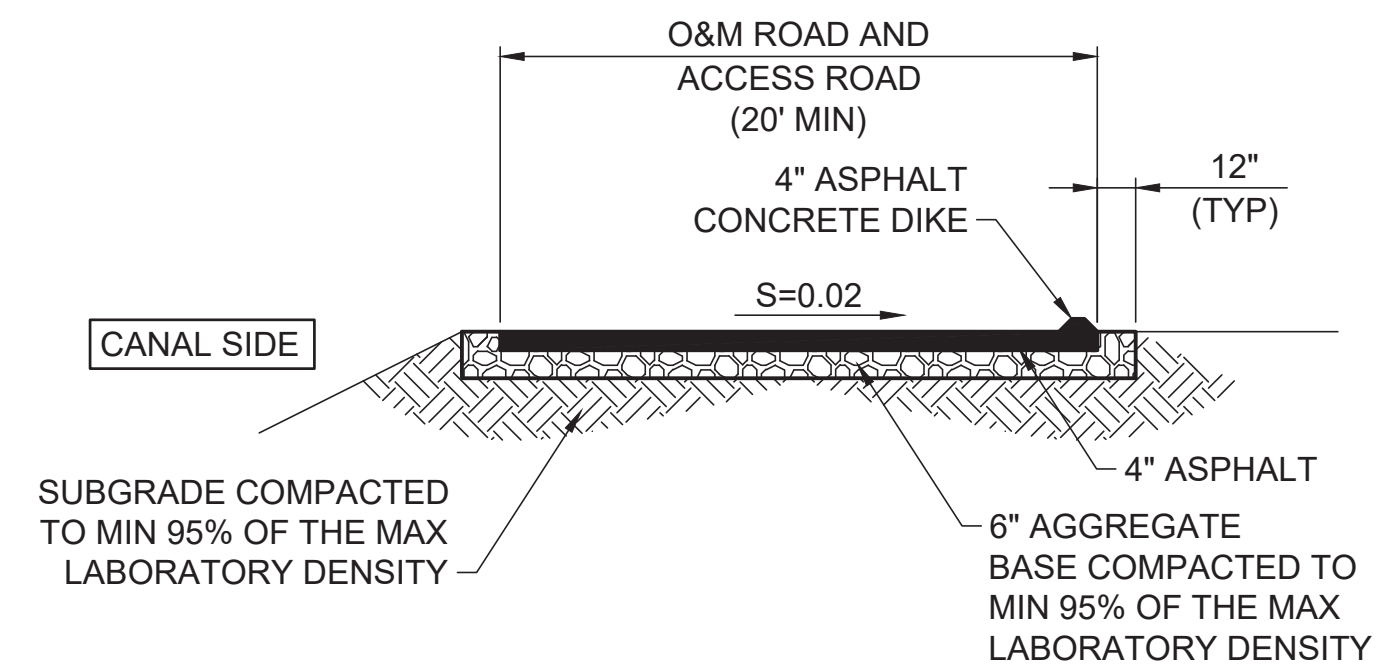
NOTES:

1. MINIMUM WATER LEVEL IN POOL 43 WHERE DELIVERIES CAN BE MAINTAINED TO ALL EXISTING TURNOUTS.
2. WATER LEVELS ARE BASED ON THE LEVEL (DEPTH) AT CHECK 43 AND A LEVEL POOL.
3. NORMAL OPERATING BAND.
4. EXISTING COPPER COMMUNICATIONS CABLE SHALL BE PROTECTED IN PLACE AND REMAIN OPERATIONAL DURING CONSTRUCTION. PRIOR TO ANY EXCAVATION, THE CONTRACTOR SHALL POT HOLE AND FIELD VERIFY LOCATION AND DEPTH.
5. EXISTING 12" IRRIGATION LINE. THE CONTRACTOR SHALL POT HOLE AND FIELD VERIFY LOCATION AND DEPTH

1
C-01 **PROFILE**
SCALE: 1" = 10'



A
- **EXISTING AQUEDUCT SECTION**
SCALE: 1"=10'



NOTES:

1. CONTRACTOR SHALL REPLACE DWR ROAD SURFACES THAT ARE REMOVED OR DAMAGED DURING CONSTRUCTION ACTIVITIES PER CALTRANS STANDARD SPECIFICATIONS, LATEST EDITION.
2. CONTRACTOR SHALL REPLACE EXIST PAVEMENT MARKERS REMOVED AND OR DAMAGED DURING CONSTRUCTION.

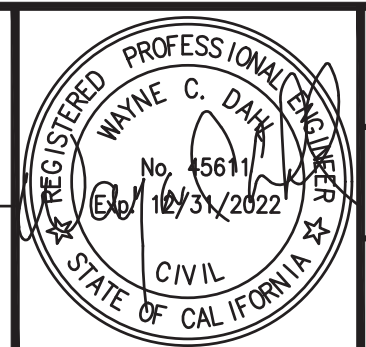
1
- **TYPICAL PAVING DETAIL**
SCALE: NTS

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

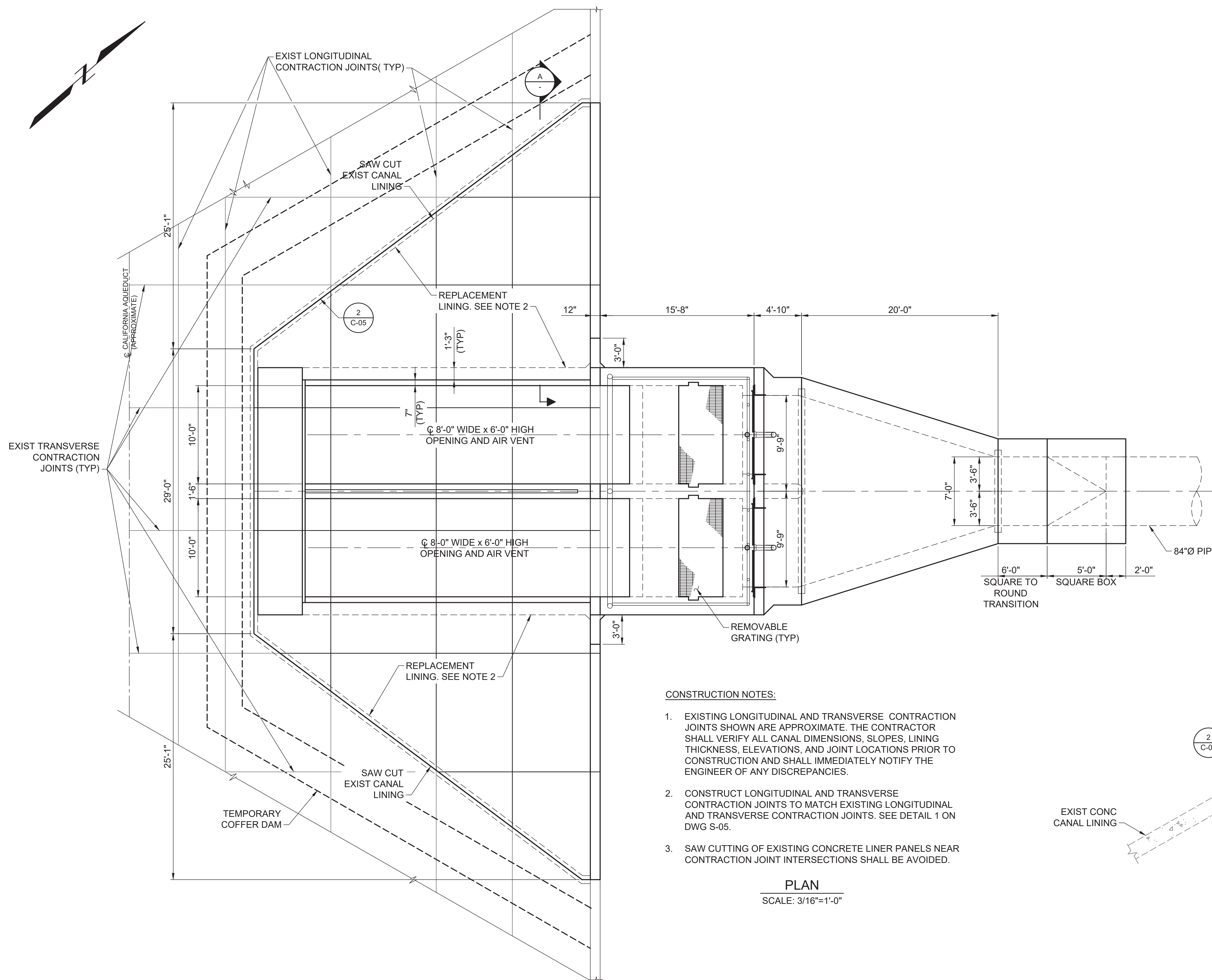
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AQUEDUCT TURNOUT/TURN-IN
PROFILE VIEW, SECTION, AND DETAIL

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C-03

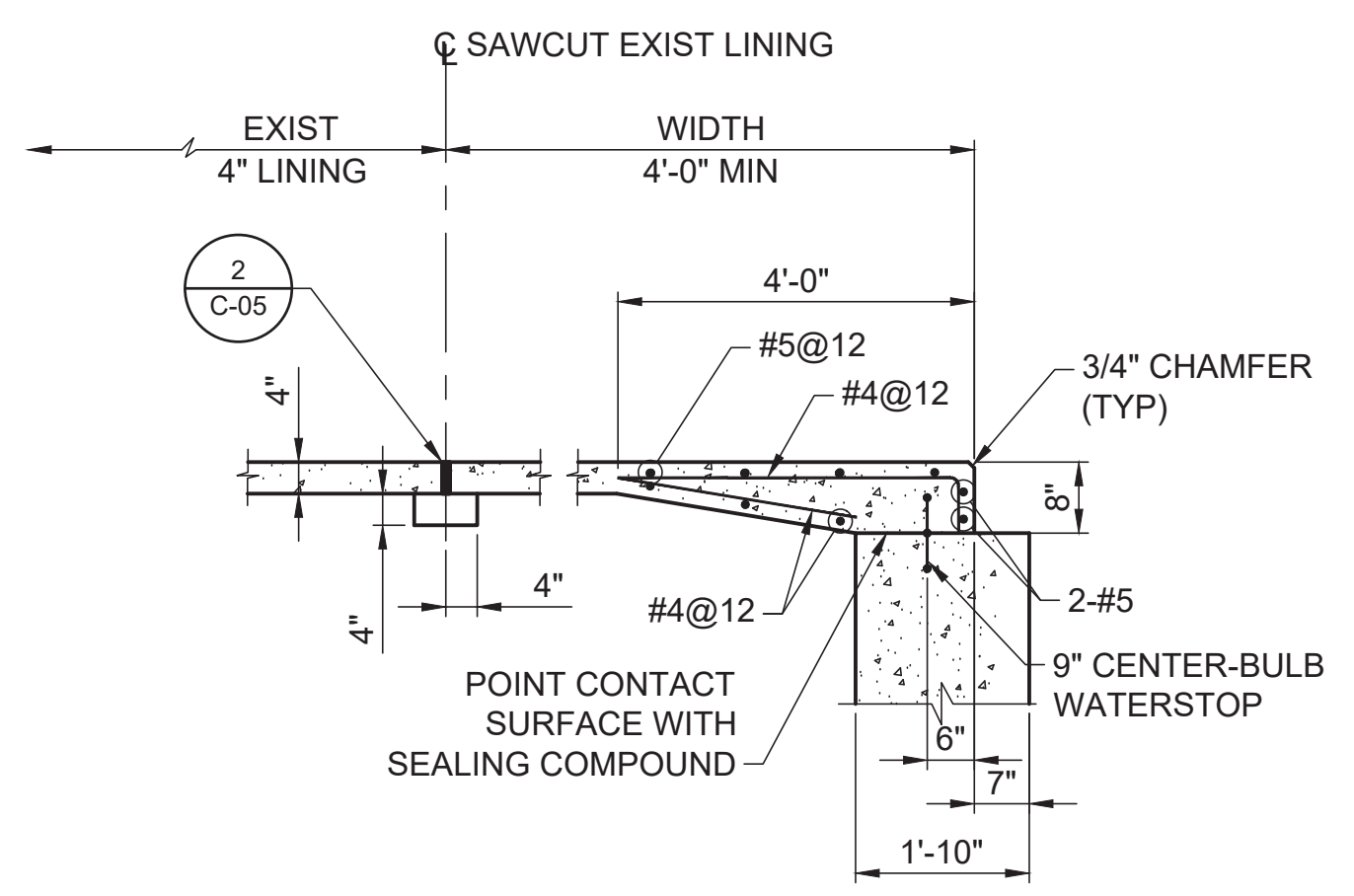
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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

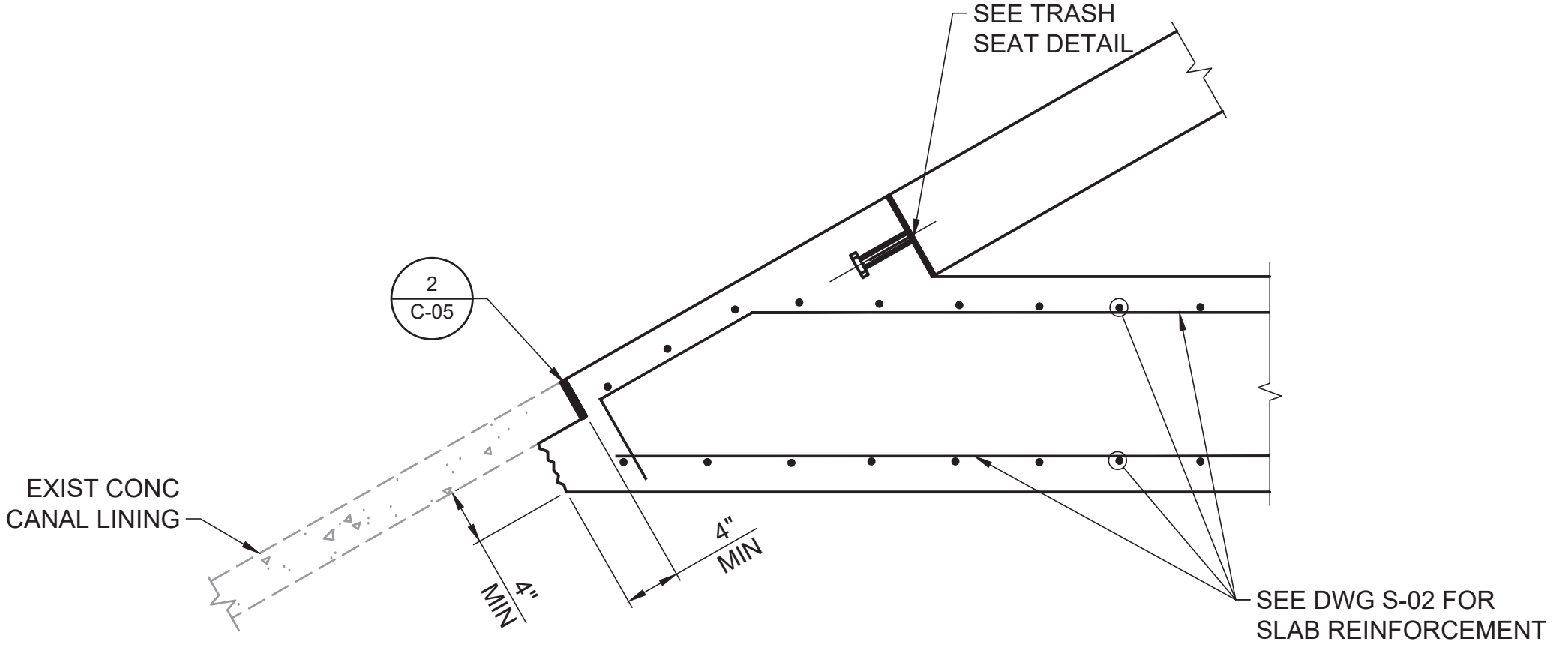


- CONSTRUCTION NOTES:**
- EXISTING LONGITUDINAL AND TRANSVERSE CONTRACTION JOINTS SHOWN ARE APPROXIMATE. THE CONTRACTOR SHALL VERIFY ALL CANAL DIMENSIONS, SLOPES, LINING THICKNESS, ELEVATIONS, AND JOINT LOCATIONS PRIOR TO CONSTRUCTION AND SHALL IMMEDIATELY NOTIFY THE ENGINEER OF ANY DISCREPANCIES.
 - CONSTRUCT LONGITUDINAL AND TRANSVERSE CONTRACTION JOINTS TO MATCH EXISTING LONGITUDINAL AND TRANSVERSE CONTRACTION JOINTS. SEE DETAIL 1 ON DWG S-05.
 - SAW CUTTING OF EXISTING CONCRETE LINER PANELS NEAR CONTRACTION JOINT INTERSECTIONS SHALL BE AVOIDED.

PLAN
SCALE: 3/16"=1'-0"



A SECTION
SCALE: 1/2"=1'-0"



1 DETAIL
SCALE: NTS

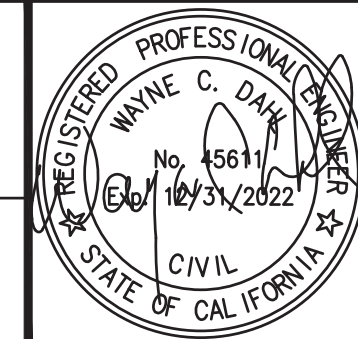
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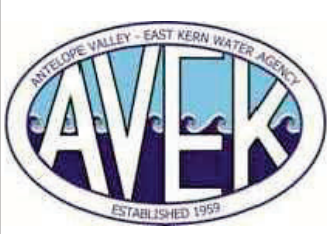


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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

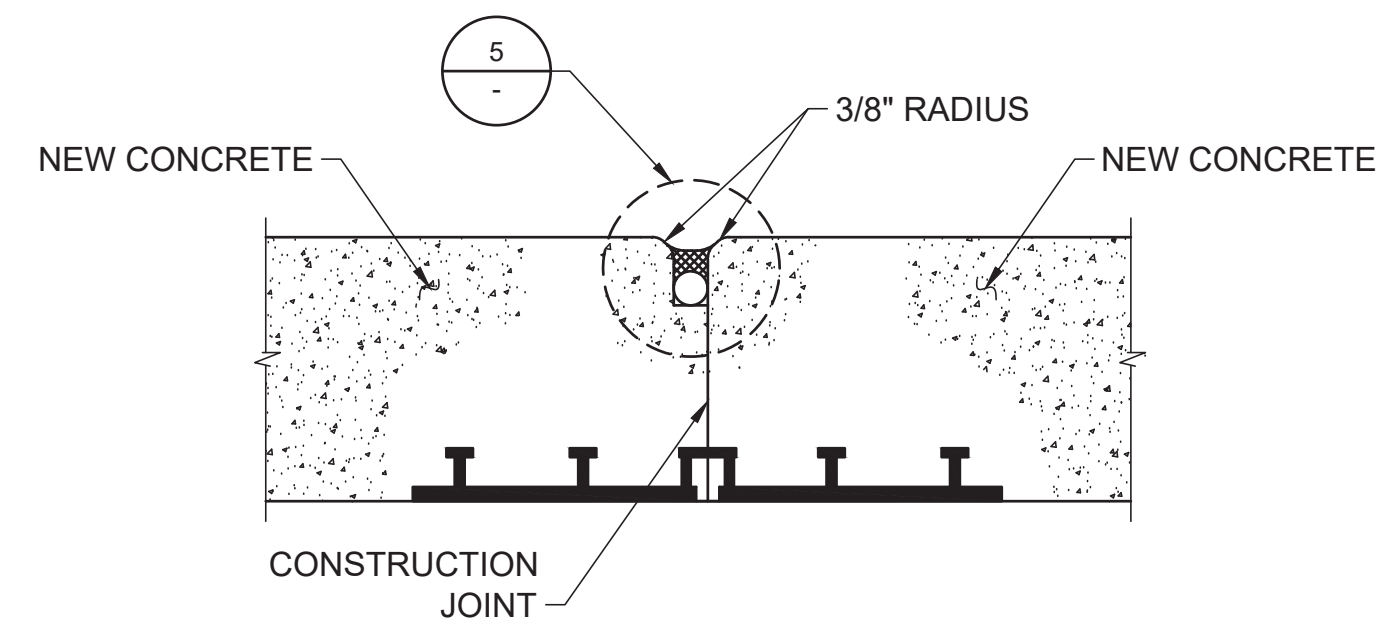
CIVIL

AQUEDUCT TURNOUT/TURN-IN
CANAL LINING REMOVAL/REPLACEMENT

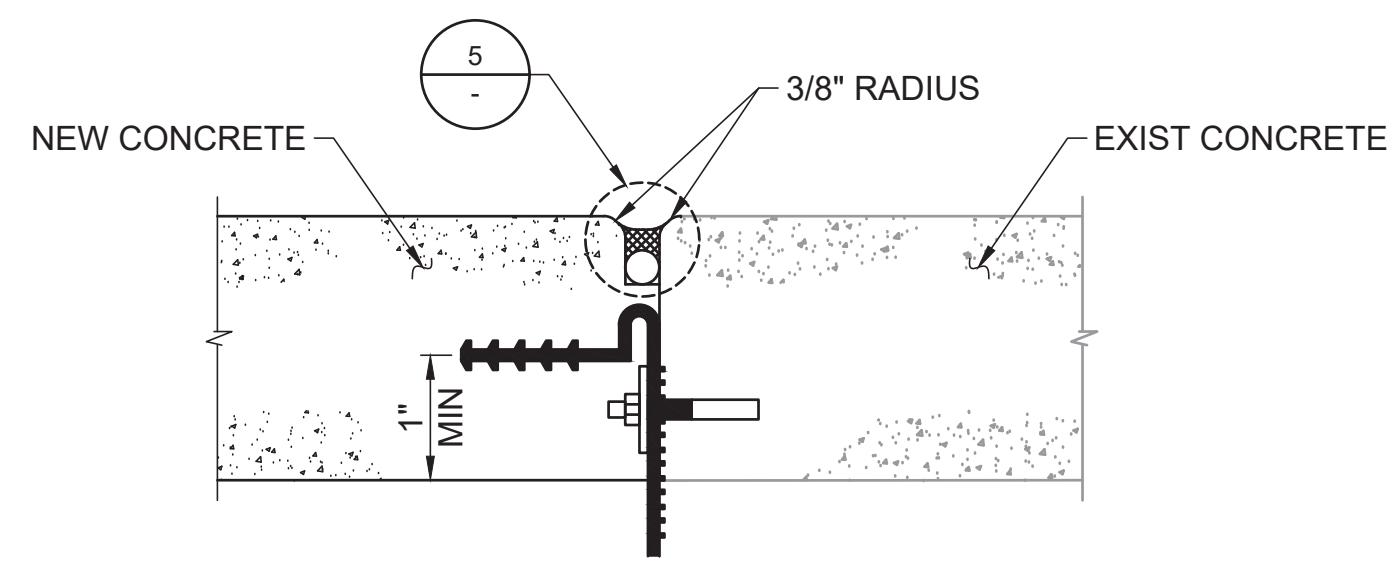
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SHEETS

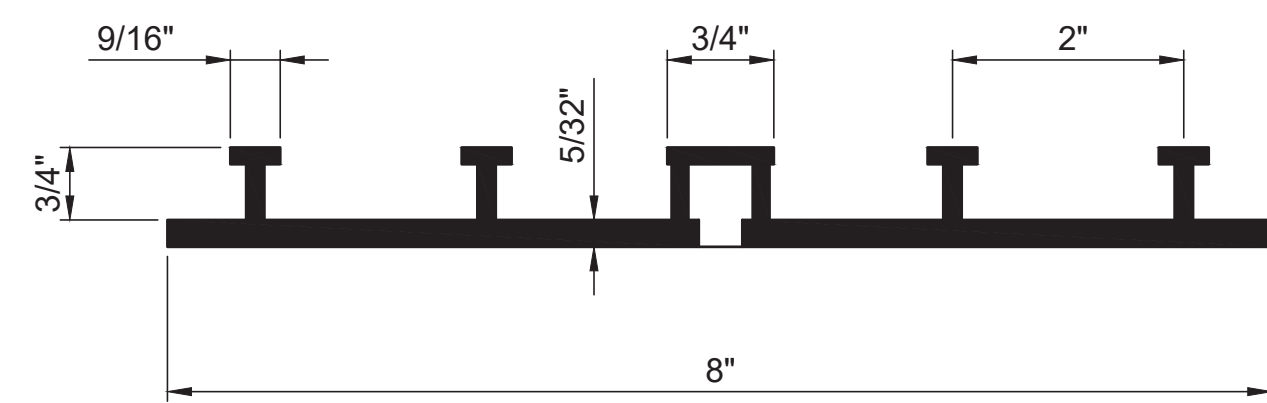
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



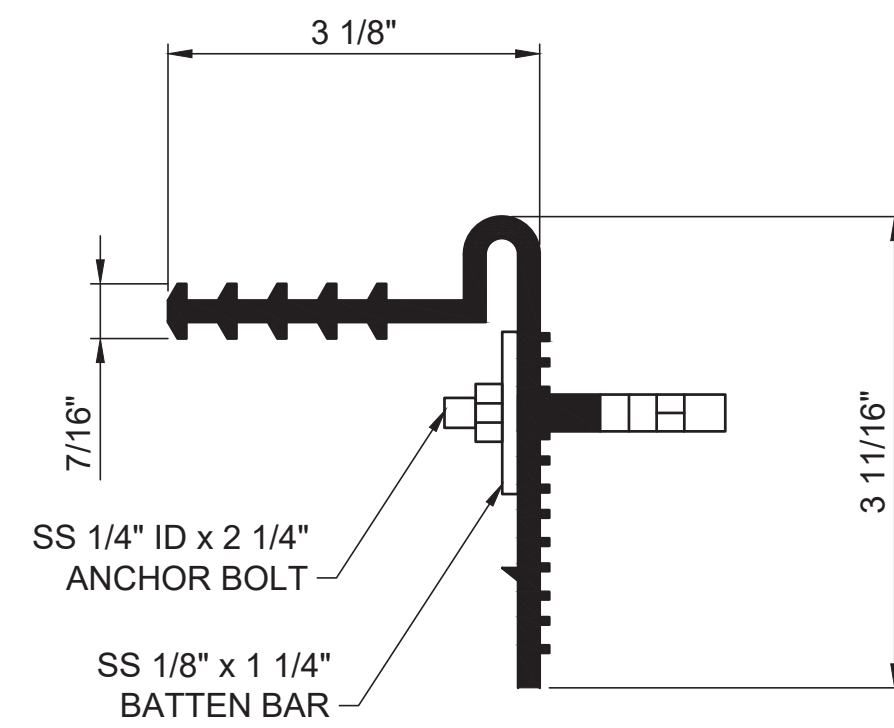
1 CONSTRUCTION JOINT SECTION
SCALE: NTS



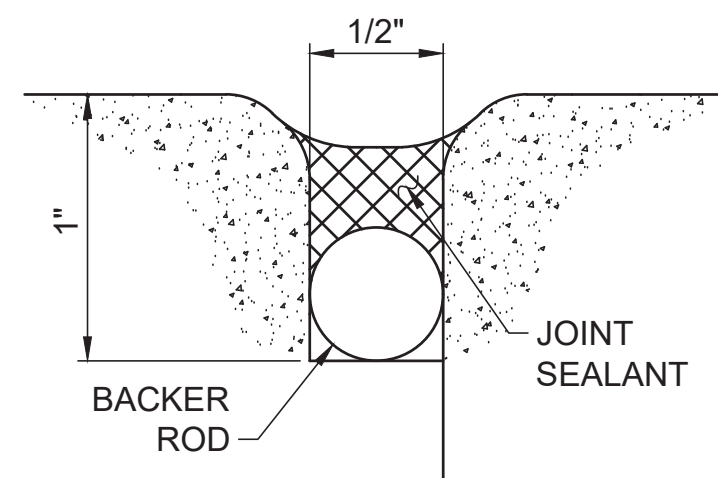
2 CONSTRUCTION JOINT SECTION
SCALE: NTS



3 WATER STOP DETAIL
SCALE: NTS



4 RETROFIT WATERSTOP DETAIL
SCALE: NTS



5 CONSTRUCTION JOINT DETAL
SCALE: NTS

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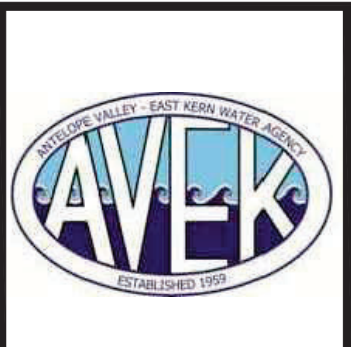


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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN


CIVIL

TYPICAL WATERSTOP DETAILS

SHEET
C-05

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SHEETS

GENERAL NOTES:

1. THESE NOTES ARE GENERAL AND APPLY TO THE ENTIRE PROJECT EXCEPT WHERE SPECIFICALLY INDICATED OTHERWISE.
2. STRUCTURAL DIMENSIONS CONTROLLED BY OR RELATED TO MECHANICAL EQUIPMENT, INCLUDING ANCHORAGE AND RECESSES FOR SUCH EQUIPMENT NOT SHOWN ON THE STRUCTURAL DRAWINGS, SHALL BE COORDINATED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. ANCHOR BOLT SIZES AND PLACEMENT, RECESSES, AND EMBEDS REQUIRED BY MECHANICAL AND ELECTRICAL EQUIPMENT SHALL BE VERIFIED WITH THE EQUIPMENT MANUFACTURER.
3. STRUCTURAL DRAWINGS SHALL BE USED IN CONJUNCTION WITH CIVIL, MECHANICAL, AND ELECTRICAL DRAWINGS AND WITH SHOP DRAWINGS PROVIDED BY THE EQUIPMENT MANUFACTURERS.
4. STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ON THE COMPLETED STRUCTURES. DURING CONSTRUCTION THE STRUCTURES SHALL BE PROTECTED BY BRACING AND BALANCING WHEREVER EXCESSIVE CONSTRUCTION LOADS MAY OCCUR. OVERSTRESSING OF ANY STRUCTURAL ELEMENT IS PROHIBITED.
5. UNLESS OTHERWISE INDICATED, FINISHED GRADE IS SHOWN THUS  ON ALL STRUCTURAL DRAWINGS INDICATING GROUND SURFACE, TOP OF CONCRETE SLAB, OR TOP OF AC PAVEMENT. FOR DETAILS OF FINISHED SURFACES SEE CIVIL DRAWINGS.

STRUCTURAL NOTES:

1. DESIGN IS IN ACCORDANCE WITH THE 2018 INTERNATIONAL BUILDING CODE AND THE 2019 CALIFORNIA BUILDING CODE, EXCEPT WHERE OTHER APPLICABLE CODES OR THE FOLLOWING NOTES ARE MORE RESTRICTIVE.
2. LOADINGS:

ELEVATED SLAB/WALKWAY/METER VAULT COVER LIVE LOAD - 100 PSF + EQUIPMENT LOAD
ADDITIONAL DEAD AND LIVE LOADS PER 2018 IBC & 2019 CBC

LATERAL SOIL PRESSURES DRY SOIL:
ACTIVE - 40 PCF
AT-REST - 60 PCF

LATERAL SOIL PRESSURES SATURATED SOIL (NO DRAINAGE PROVIDED):
ACTIVE - 82.4 PCF
AT-REST - 92.4 PCF
PASSIVE PRESSURE - 350 PCF W/ MAX OF 3500 PSF

SEISMIC - 25 PCF

COEFFICIENT OF FRICTION - 0.35 (SOIL/CONCRETE)
WEIGHT OF SOIL - 120 PCF
EQUIPMENT LIVE LOAD SURCHARGE - 2 FT OF SOIL
FOR SATURATED CONDITION 30PCF ADDED TO DRY PRESSURE

THE GEOTECHNICAL REPORT IS INCLUDED IN THE SPECIFICATIONS.

BOX/TRANSITION DESIGNED FOR HS20-44 LOADING.
3. CONSTRUCTION JOINTS FOR STRUCTURES SHALL BE LOCATED AS INDICATED ON THE DRAWINGS OR APPROVED BY THE ENGINEER. ALL CONSTRUCTION JOINTS IN MEMBERS IN CONTACT WITH WATER SHALL HAVE A 6-INCH FLATSTRIP WATERSTOP UNLESS OTHERWISE INDICATED. IN ADDITION, JOINTS IN SLABS COVERED WITH WATER SHALL HAVE A 6-INCH FLATSTRIP WATERSTOP AND A SEALANT GROOVE. MAXIMUM SPACING BETWEEN CONSTRUCTION JOINTS SHALL BE 40 FT.

STRUCTURAL STEEL NOTES:

1. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS OF THE AISC "MANUAL OF STEEL CONSTRUCTION, LATEST EDITION".
2. ALL WELDING SHALL BE BY THE SHIELDED ARC METHOD AND SHALL CONFORM TO THE AWS CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION. QUALIFICATIONS OF WELDERS SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS FOR STANDARD QUALIFICATION PROCEDURES OF THE AWS.
3. ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION UNLESS OTHERWISE NOTED.

CONCRETE NOTES:

1. ALL STRUCTURAL CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 4000 P.S.I. AT 28 DAYS, UNLESS OTHERWISE NOTED.
2. ALL REINFORCING STEEL SHALL BE DEFORMED BARS CONFORMING TO THE REQUIREMENTS OF ASTM A-615, GRADE 60, UNLESS OTHERWISE NOTED.
3. ALL DETAILING, FABRICATION, AND PLACING OF REINFORCING STEEL SHALL BE IN ACCORDANCE WITH ACI-315, "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES", LATEST EDITION.
4. THE FIRST AND LAST BARS IN SLABS AND WALLS, STIRRUPS IN BEAMS, AND TIES IN COLUMNS SHALL START AND END A MAXIMUM OF ONE HALF OF THE ADJACENT BAR SPACING OR 3-INCHES, WHICHEVER IS LESS, FROM THE START OR END OF THE MEMBER, UNLESS OTHERWISE NOTED.
5. ALL CONSTRUCTION JOINTS SHALL BE ROUGH AND THOROUGHLY CLEANED FOR BOND PRIOR TO PLACING CONCRETE.
6. TOLERANCES FOR PLACING REINFORCING STEEL SHALL BE: ± 3/8 INCH FOR MEMBERS </ = 8 INCHES THICK. ± 1/2 INCH FOR MEMBERS > 8 INCHES THICK.
7. DOWELS, PIPING, WATERSTOPS, AND OTHER EMBEDS SHALL BE HELD SECURELY IN PLACE WHILE THE CONCRETE IS BEING POURED.
8. ALL GROUT SHALL BE NON-SHRINK, UNLESS OTHERWISE NOTED.
9. BAR SUPPORTS, SPACERS, AND OTHER ACCESSORIES ARE NOT SHOWN ON THE DESIGN DRAWINGS.
10. METAL CLIPS OR SUPPORTS SHALL NOT BE PLACED IN CONTACT WITH THE FORMS OR SUBGRADE. CONCRETE BLOCKS OR DOBIES SHALL BE IN SUFFICIENT NUMBERS TO SUPPORT THE BARS ON THE SUBGRADE WITHOUT SETTLEMENT. IN NO CASE SHALL SUCH SUPPORT BE CONTINUOUS.
11. UNLESS OTHERWISE INDICATED, THE FOLLOWING SHALL BE USED IN ADDITION TO THE NORMAL ACCESSORIES USED TO HOLD REINFORCING BARS FIRMLY IN POSITION:

A. IN SLABS #5 RISER BARS @ 36" O.C.. MAX. TO SUPPORT REINFORCING BARS.
B. IN WALLS WITH 2 CURTAINS #3 U OR Z SHAPE SPACERS @ 6'-0" O.C. MAX EACH WAY.
12. VERTICAL REINFORCEMENT SHALL BE SPLICED WITH DOWEL BARS OF THE SAME SIZE AND SPACING FROM THE FOUNDATION USING A STANDARD SPLICE LENGTH UNLESS OTHERWISE INDICATED.
13. DOWELS SHALL BE SET AND WIRED OR OTHERWISE HELD IN PLACE PRIOR TO PLACING THE CONCRETE. DOWELS SHALL NOT BE INSERTED INTO FRESHLY PLACED CONCRETE.
14. A MINIMUM CLEAR DISTANCE OF 2 INCHES SHALL BE MAINTAINED BETWEEN THE REINFORCING STEEL AND ALL PIPES, PIPE FLANGES, OR OTHER METAL PARTS EMBEDDED IN THE CONCRETE.
15. ALL ITEMS EMBEDDED IN THE CONCRETE SHALL BE SPACED AT NO LESS THAN 4 TIMES THE OUTSIDE DIMENSION OF THE LARGEST ITEM. THE OUTSIDE DIMENSION SHALL NOT EXCEED ONE THIRD THE CONCRETE MEMBER THICKNESS.
16. UNLESS OTHERWISE SHOWN ON THE DRAWINGS, CONCRETE COVER FOR REINFORCING BARS SHALL BE AS FOLLOWS:

CONCRETE PLACED AGAINST EARTH.....3"

FOR SURFACES IN CONTACT WITH WATER OR WEATHER AND FORMED SURFACES IN CONTACT WITH EARTH.....3"

FOR CONCRETE NOT EXPOSED TO WEATHER OR CONTACT WITH WATER OR EARTH.....2"
17. UNLESS OTHERWISE NOTED, WHERE A SINGLE LAYER OF REINFORCING STEEL IS SHOWN IN A WALL OR SLAB THE REINFORCING SHALL BE CENTERED.
18. SLAB THICKNESS CALLED OUT ON THE DRAWINGS ARE MINIMUMS. WHERE SLABS HAVE A SLOPING SURFACE THE SLAB BOTTOM MAY BE FLAT OR IT MAY BE SLOPED TO MAINTAIN A CONSTANT THICKNESS. REINFORCING STEEL IN SLABS WITH SLOPING SURFACES SHALL BE PLACED AT THE REQUIRED DISTANCES FROM THE SLAB SURFACES.

TYPICAL DETAIL NOTES:

1. DETAILS ON DRAWINGS SG-02 THROUGH SG-05 ARE TYPICAL DETAILS. THESE DETAILS ARE TO BE USED WHEN REFERRED TO OR WHEN NO OTHER MORE RESTRICTIVE OR DIFFERENT DETAILS ARE SHOWN ON THE DRAWINGS.

SPECIAL INSPECTION:

1. SPECIAL INSPECTION AS REQUIRED BY CHAPTER 17 OF THE CBC.

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

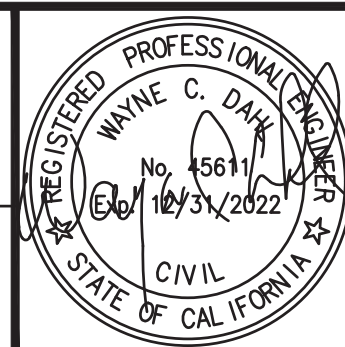
NOVEMBER 2021

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NO.	DATE	REVISIONS	APPROVED

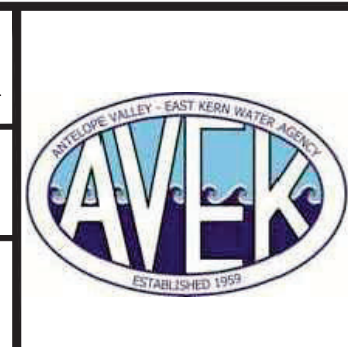


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WAYNE C. DAHL DESIGN TEAM LEAD 11/10/21
NAME R.C.E. 45611 DATE

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

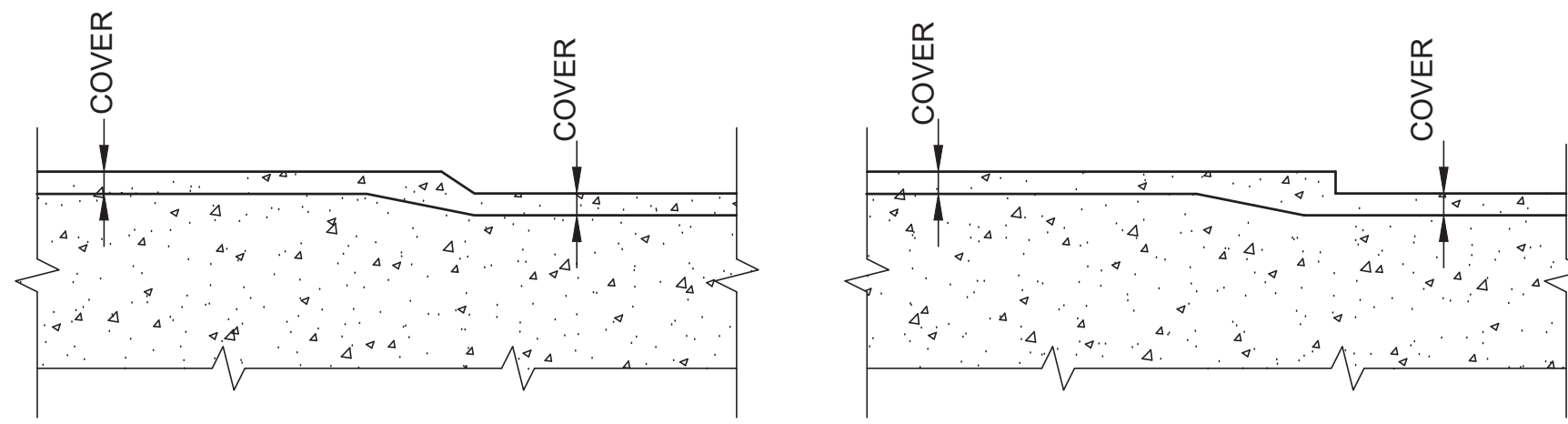
STRUCTURAL

GENERAL STRUCTURAL NOTES

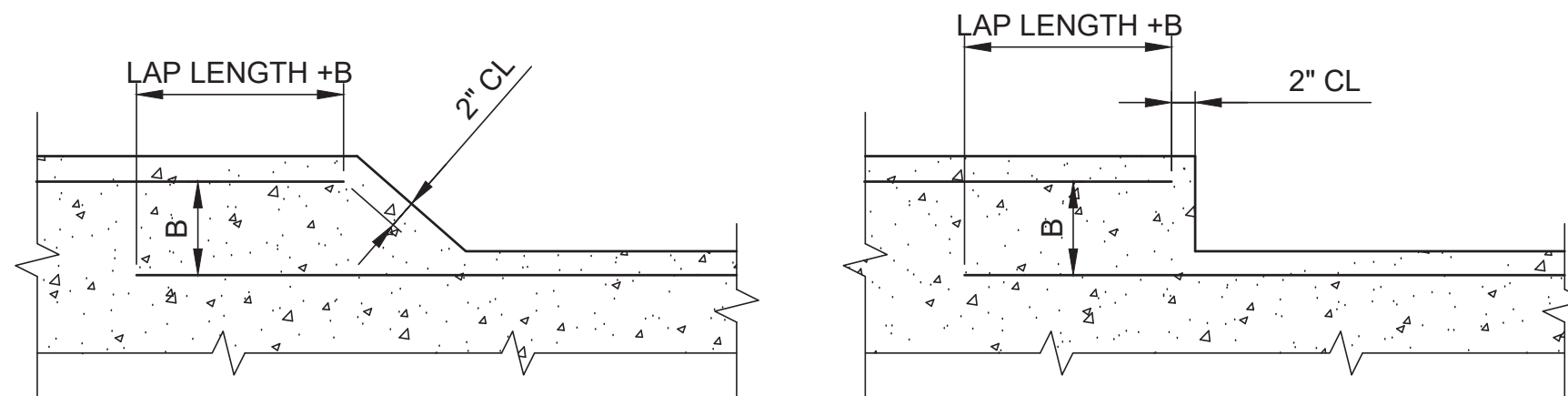
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SHEETS

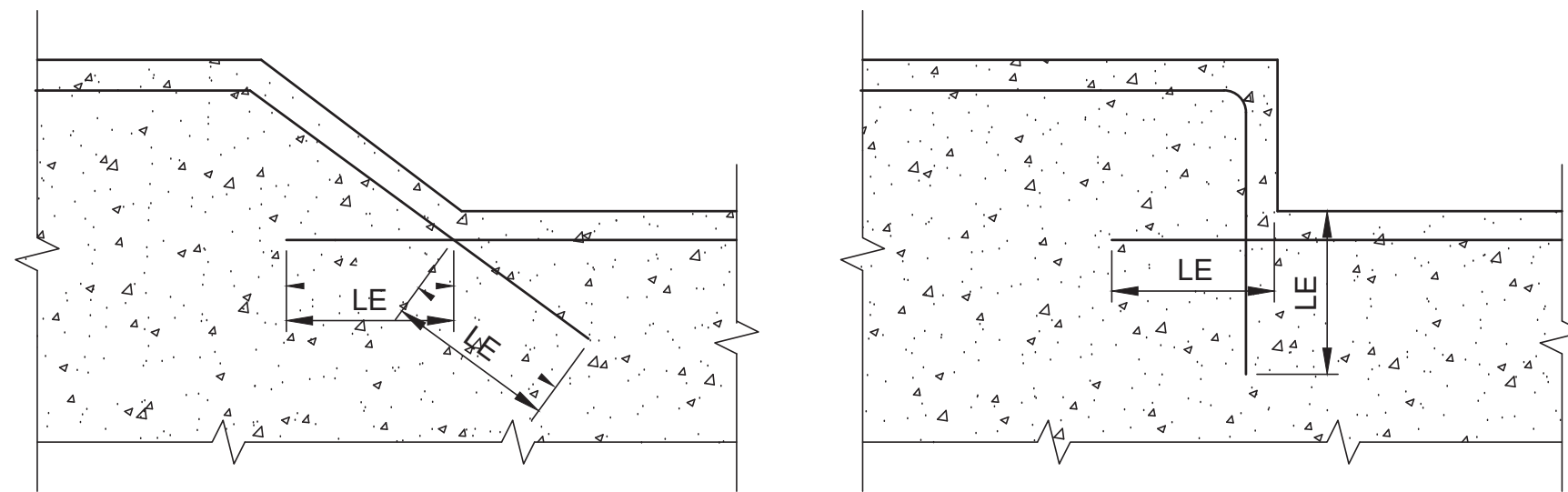
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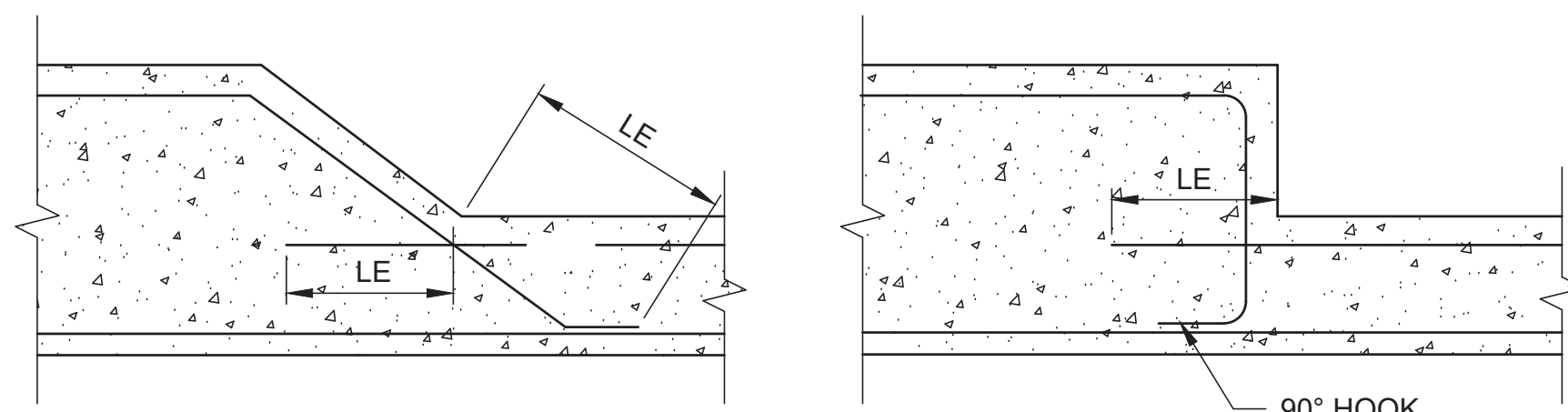
OFFSET LESS THAN 3"



OFFSET 3" TO 8"

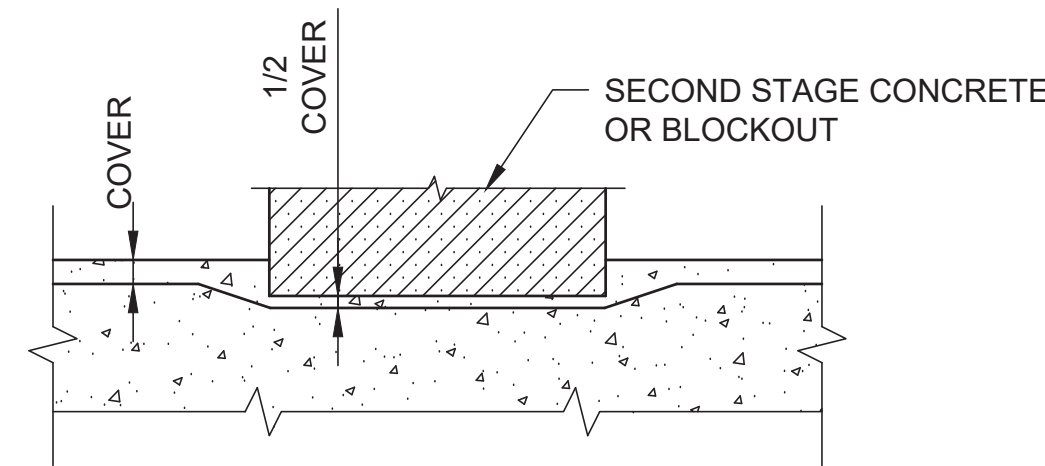


OFFSET GREATER THAN 8"

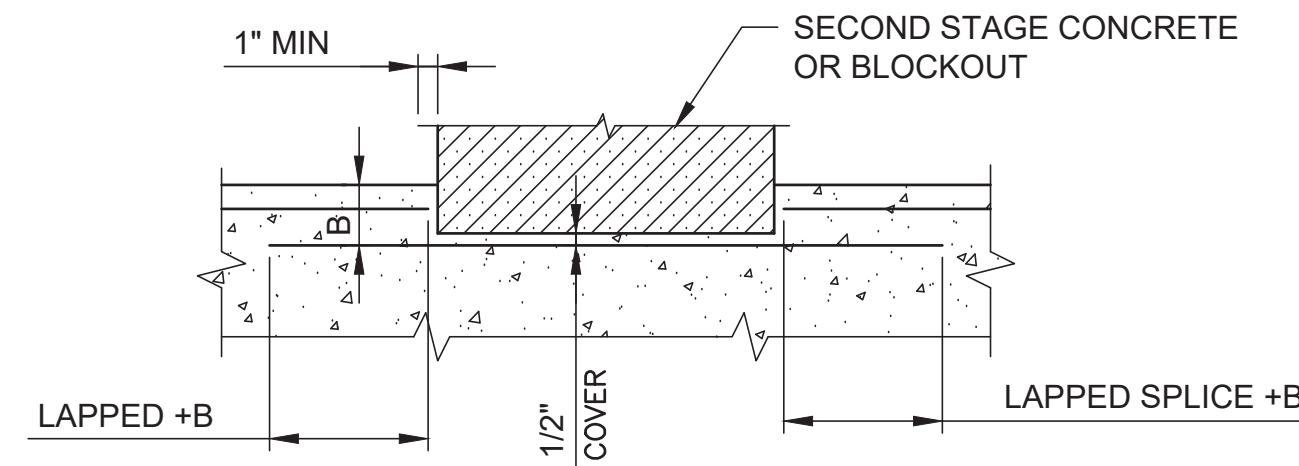


OFFSET GREATER THAN 8"
RESTRICTED MEMBER THICKNESS

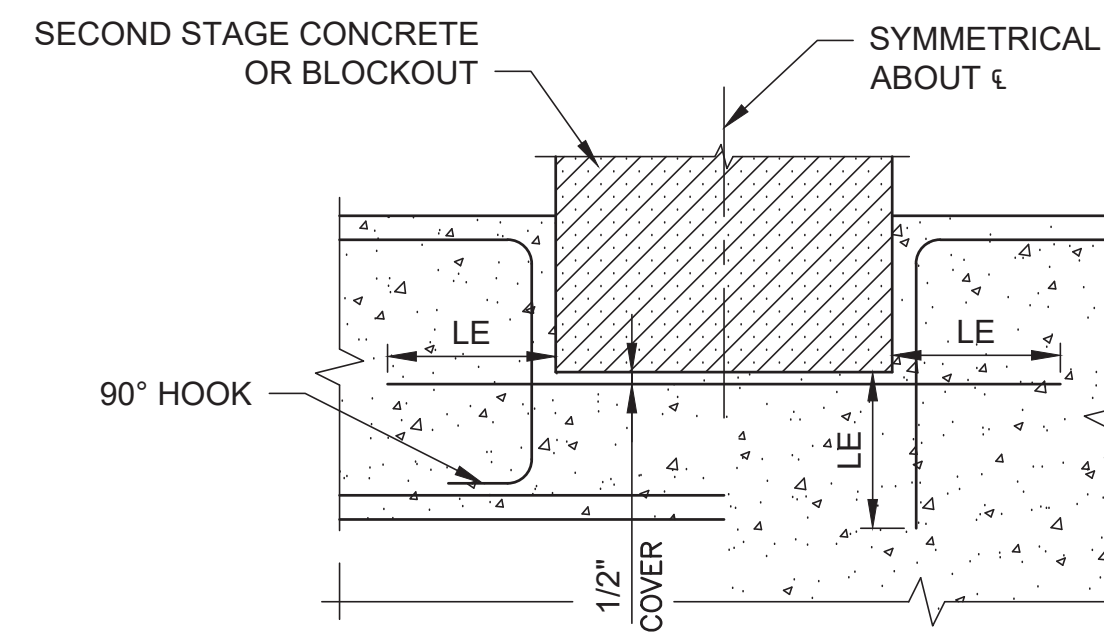
TYPICAL OFFSET DETAILS
NOT TO SCALE



RECESS LESS THAN 3" DEEP



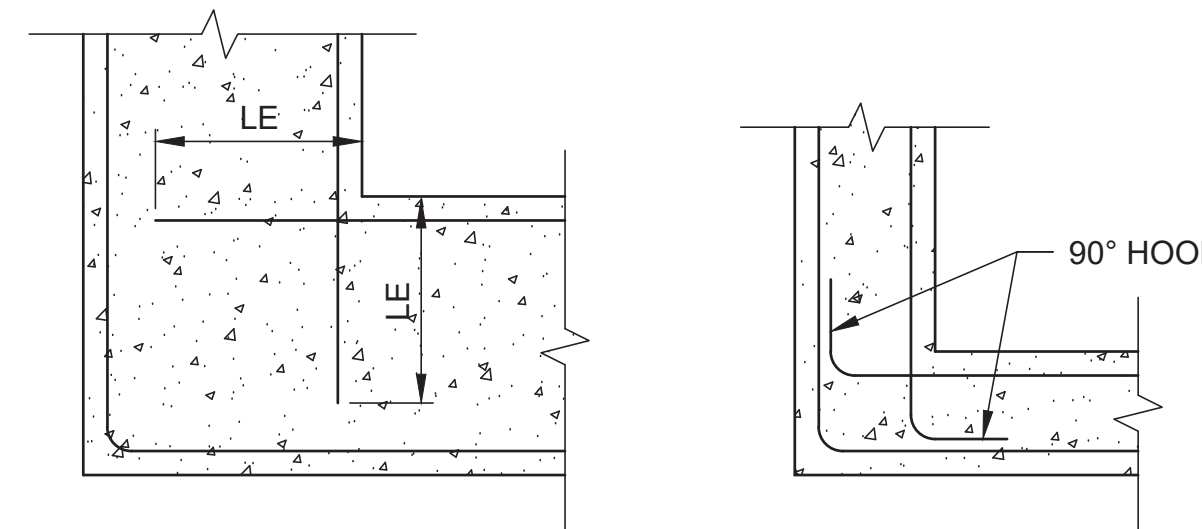
RECESS 3" TO 8" DEEP



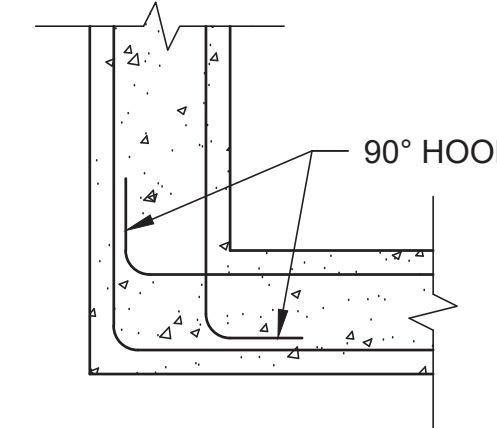
RECESS GREATER THAN 8"

TYPICAL BLOCKOUT RECESS DETAILS

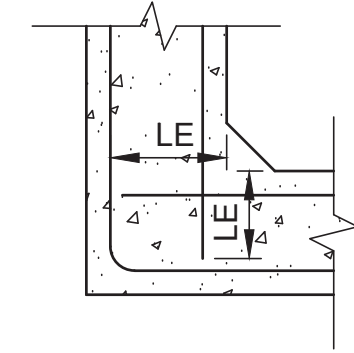
NOT TO SCALE



RESTRICTED MEMBER THICKNESS



FILLET LESS THAN 1'-0"



FILLET 1'-0" OR GREATER

TYPICAL CORNER DETAILS

NOT TO SCALE

BAR SIZE	* LENGTH					
	FOR 1" TO < 2" CONCRETE COVER		FOR 2" TO < 3" CONCRETE COVER		FOR 3" AND LARGER CONCRETE COVER	
	REBAR SPACING (CENTER TO CENTER)		REBAR SPACING (CENTER TO CENTER)		REBAR SPACING (CENTER TO CENTER)	
	< 8"	≥ 8"	< 8"	≥ 8"	< 8"	≥ 8"
LAP (L _L)						
#8	62" (81")	62" (81")	37" (49")	37" (49")	37" (49")	37" (49")
#9	99" (129")	79" (103")	69" (90")	55" (72")	49" (64")	42" (55")
#10	125" (163")	100" (130")	88" (115")	70" (91")	63" (82")	50" (65")
#11	154" (201")	123" (160")	108" (141")	86" (112")	77" (101")	62" (81")
EMBEDMENT (L _E)						
#8	48" (63")	48" (63")	29" (38")	29" (38")	29" (38")	29" (38")
#9	77" (101")	61" (80")	54" (71")	43" (56")	38" (50")	33" (53")
#10	97" (127")	77" (101")	68" (89")	54" (71")	49" (64")	39" (51")
#11	119" (155")	95" (124")	84" (110")	67" (88")	60" (78")	48" (63")

* USE LENGTH IN PARENTHESIS FOR WALL HORIZONTAL REBARS AND SLAB BARS WITH 12" OR MORE OF FRESH CONCRETE UNDERNEATH.

NOTES:

1. USE LENGTHS IN THESE TABLES UNLESS OTHERWISE INDICATED ON DESIGN DRAWINGS.
2. TABLES ARE FOR CONCRETE WITH A COMPRESSIVE STRENGTH f_c OF 4,000 PSI AND GRADE 60 REINFORCING STEEL (f_y=60,000 PSI) ONLY.
3. IF REINFORCING STEEL IS EPOXY COATED MULTIPLY THE LAP AND EMBEDMENT LENGTHS IN THE TABLES BY 1.5.
4. TO SPLICE BARS OF DIFFERENT SIZES USE A LAP LENGTH EQUAL TO THE LARGER OF THE EMBEDMENT LENGTH OF THE LARGER BAR AND THE LAP LENGTH OF THE SMALLER BAR.
5. SPLICE BARS LARGER THAN #11 WITH REBAR COUPLERS.
6. EXTEND DOWEL BARS AN EMBEDMENT LENGTH INTO THE SECOND MEMBER OR ACROSS THE CONSTRUCTION JOINT UNLESS IT IS SHOWN TO SPLICE WITH THE OTHER BARS OR EXTEND TO THE FAR FACE OF THE MEMBER AND END WITH A STANDARD HOOK.

STANDARD 90° HOOKS,
EMBEDMENT LENGTHS AND LAP LENGTHS

NOT TO SCALE

BAR SIZE	HOOK	* LENGTH	
		LAP (L _L)	EMBEDMENT (L _E)
#4	8"	18" (24")	14" (19")
#5	10"	23" (30")	18" (24")
#6	12"	28" (37")	22" (29")
#7	14"	33" (43")	25" (33")
#8	16"	SEE TABLE BELOW	SEE TABLE BELOW
#9	19"		
#10	22"		
#11	24"		

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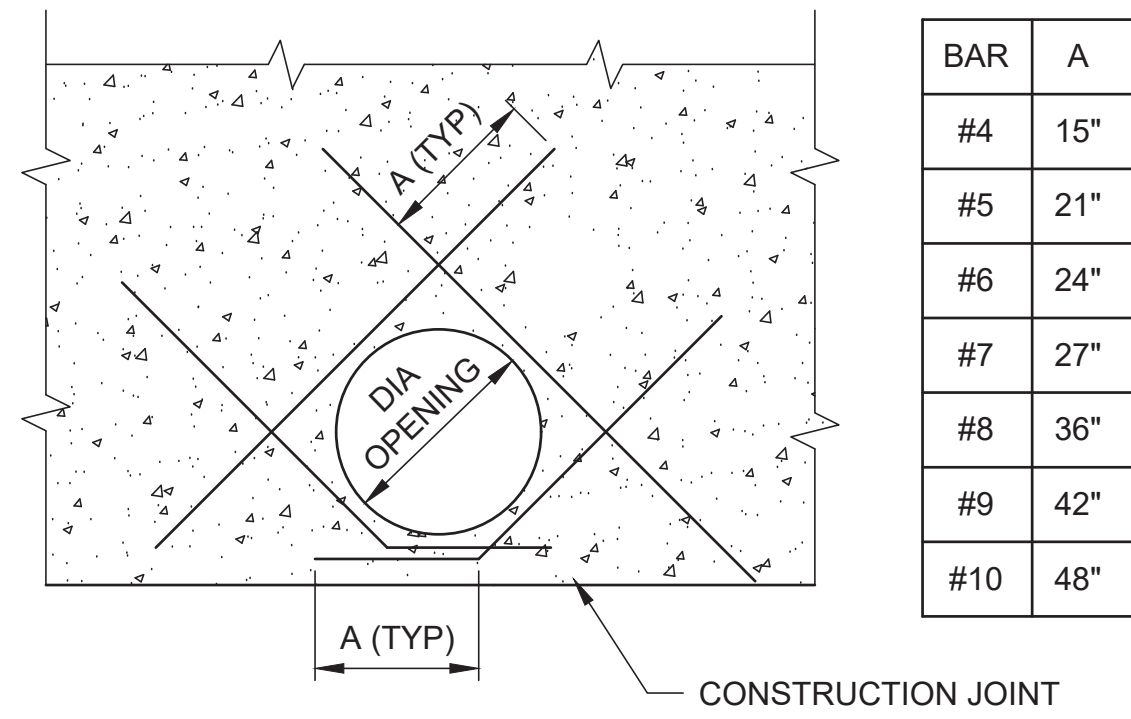
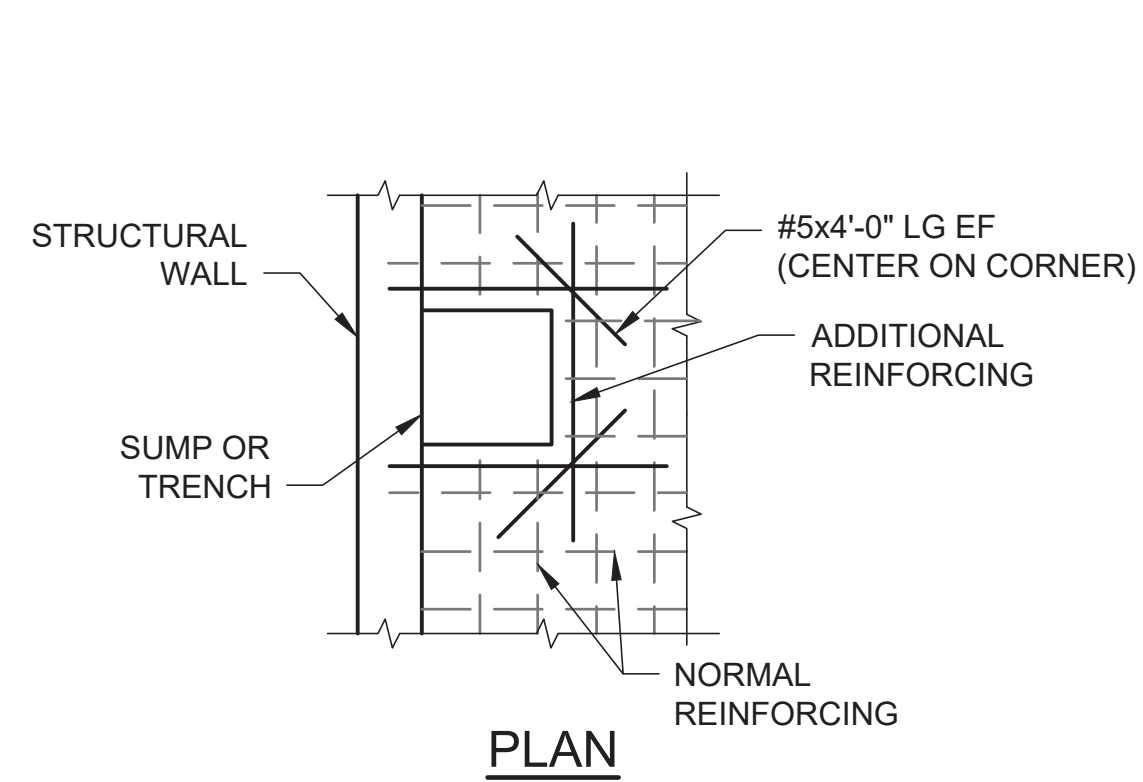
AVEK
ANTELOPE VALLEY - EAST KERN WATER AGENCY

ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
TYPICAL DETAILS
SHEET 1 OF 4

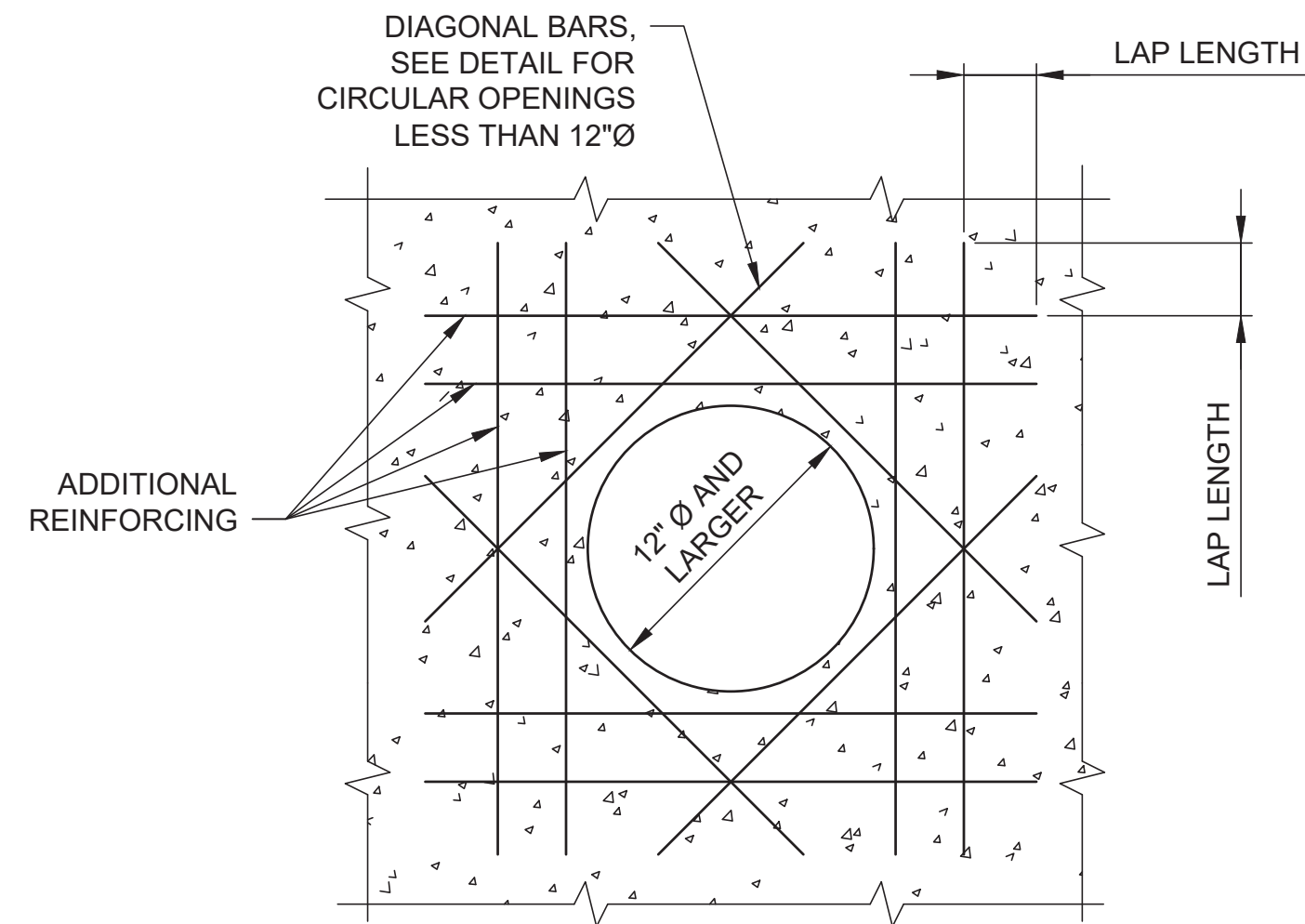
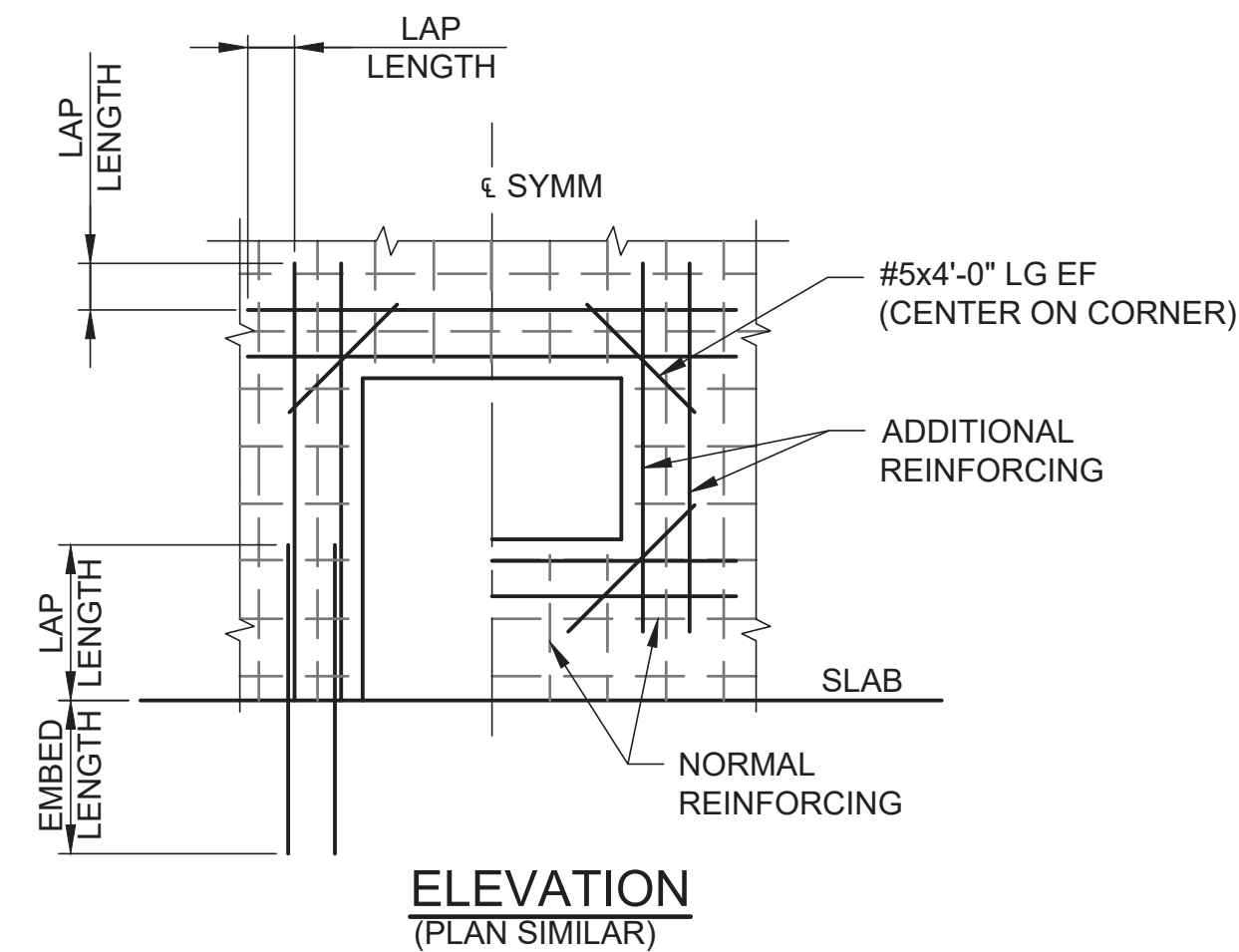
SHEET
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SHEETS

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



NOTES:

- LENGTHS APPLY TO GRADE 60 REINFORCING ONLY.
- PLACE DIAGONAL BARS AT CENTERLINE OF WALL WHERE ONLY ONE LAYER OF REINFORCING IS PROVIDED AND AT EACH FACE WHERE TWO LAYERS OF REINFORCING ARE PROVIDED.
- DIAGONAL BARS SHALL MATCH THE SIZE OF THE LARGEST OF THE NORMAL WALL (SLAB) BARS.
- BEND DIAGONAL BARS AS REQUIRED AT CONSTRUCTION JOINTS OR OTHER OBSTRUCTIONS.



NOTES:

- CUT NORMAL REINFORCING AT OPENING.
- PLACE ADDITIONAL VERTICAL BARS WITH AN AREA OF STEEL (A_s) EQUAL TO 1/2 THE A_s OF THE VERTICAL BARS CUT EACH SIDE OF THE OPENING. A_s OF ADDITIONAL BARS EQUALS A_s OF VERTICAL BARS CUT.
- PLACE ADDITIONAL HORIZONTAL BARS WITH AN AREA OF STEEL (A_s) EQUAL TO 1/2 THE A_s OF THE HORIZONTAL BARS CUT ON EACH SIDE OF THE OPENING. A_s OF ADDITIONAL HORIZONTAL BARS EQUALS A_s OF HORIZONTAL BARS CUT.
- INCREASE BAR SIZE AS REQUIRED TO FIT ADDITIONAL BARS WITHIN A DISTANCE OF 2 x WALL (SLAB) THICKNESS FROM THE OPENING. MAINTAIN A MINIMUM OF 2" CLEAR BETWEEN BARS.
- IF WALL OR SLAB INTERSECTS THE WALL WITH THE OPENING WITHIN ONE WALL THICKNESS OF THE OPENING THE ADDITIONAL BARS MAY BE OMITTED ON THAT SIDE.

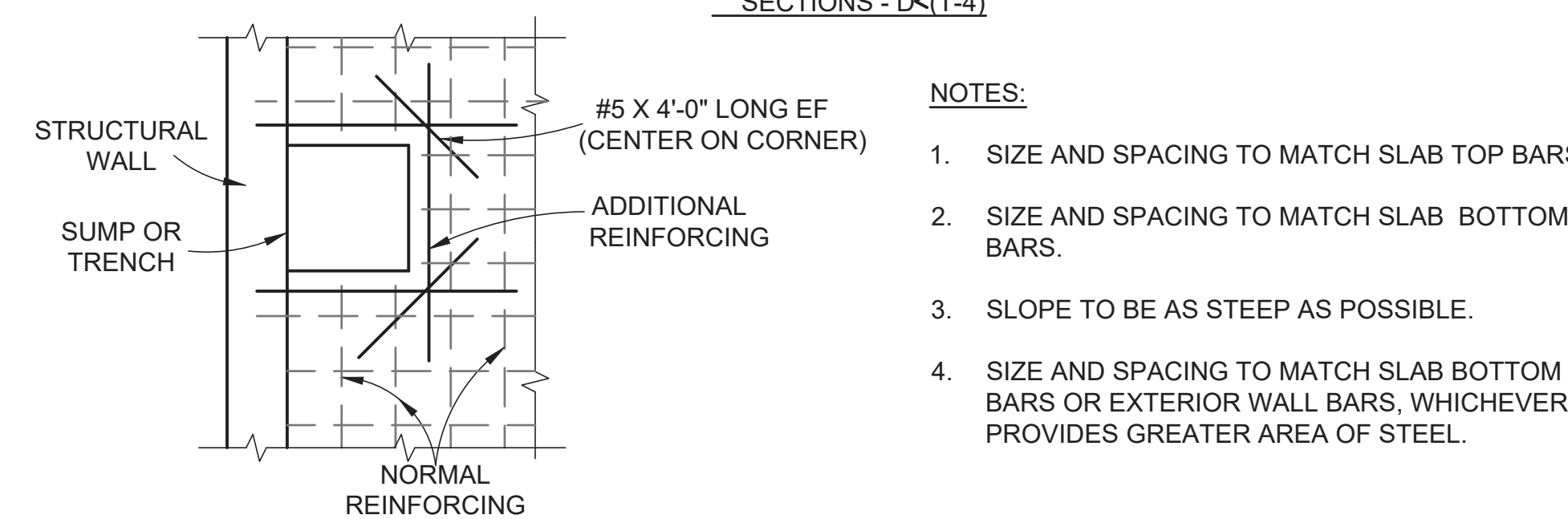
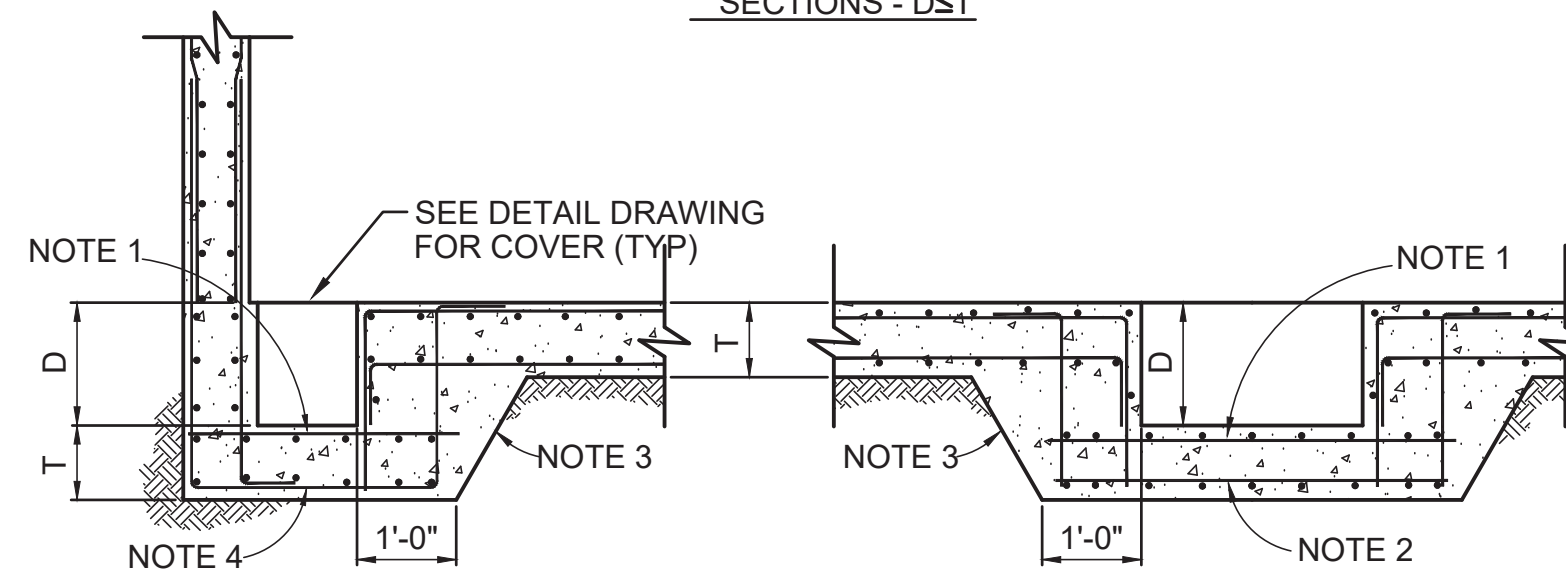
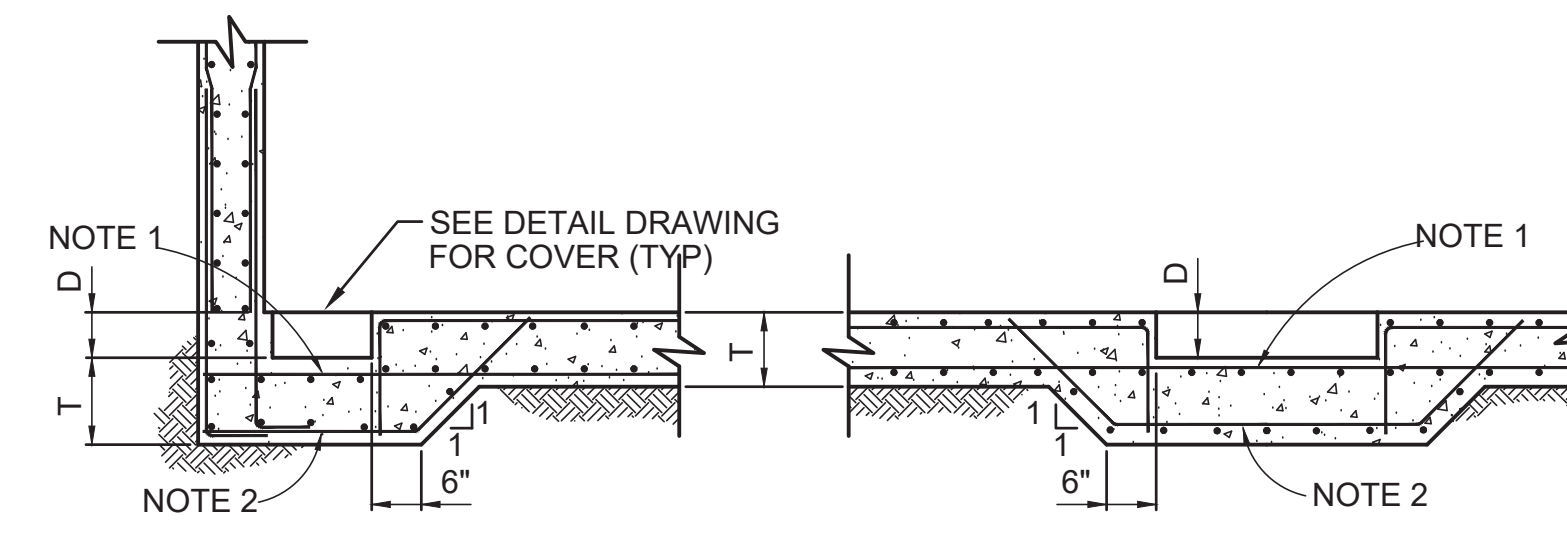
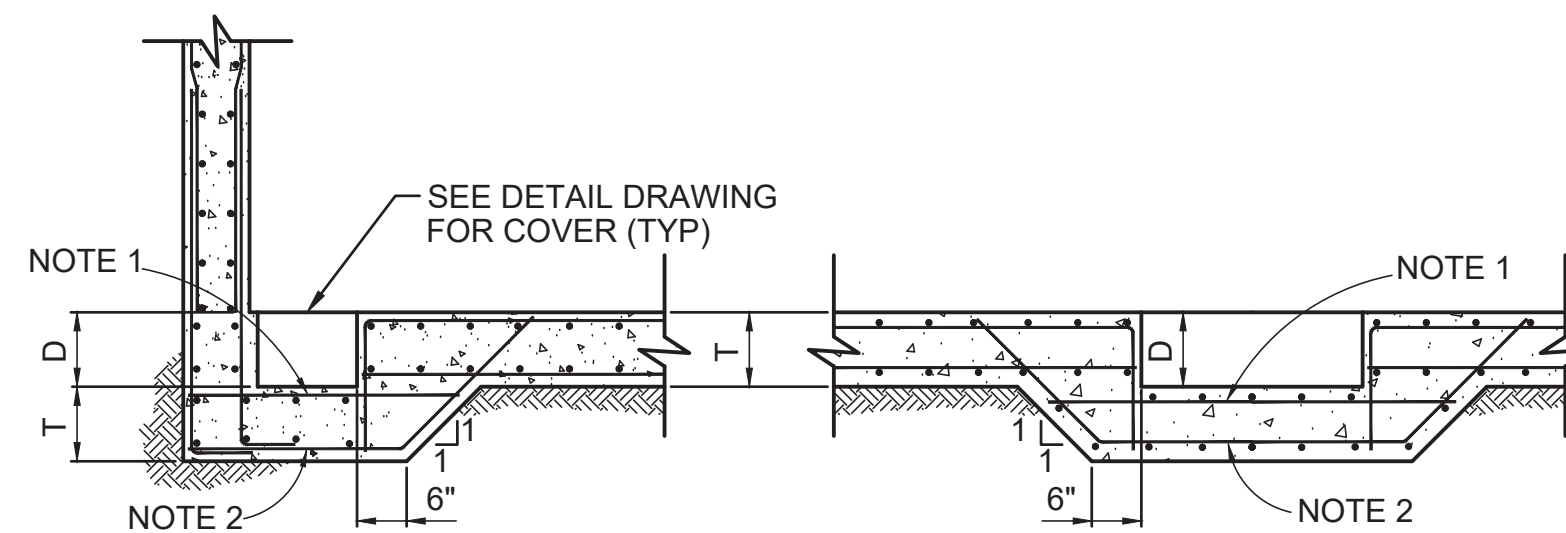
NOTES:

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- PLACE ADDITIONAL HORIZONTAL BARS WITH AN AREA OF STEEL (A_s) EQUAL TO 1/2 THE A_s OF THE HORIZONTAL BARS CUT ON EACH SIDE OF THE OPENING. A_s OF ADDITIONAL BARS EQUALS A_s OF HORIZONTAL BARS CUT.
- INCREASE BAR SIZE AS REQUIRED TO FIT ADDITIONAL BARS WITHIN A DISTANCE OF 2 x WALL (SLAB) THICKNESS FROM THE OPENING. MAINTAIN A MINIMUM OF 2" CLEAR BETWEEN BARS.
- IF WALL OR SLAB INTERSECTS THE WALL WITH THE OPENING WITHIN ONE WALL THICKNESS OF THE OPENING THE ADDITIONAL BARS MAY BE OMITTED ON THAT SIDE.

OPENINGS GREATER THAN OR EQUAL TO 12"

ADDITIONAL REINFORCING AT CIRCULAR OPENINGS

NOT TO SCALE



NOTES:

- SIZE AND SPACING TO MATCH SLAB TOP BARS.
- SIZE AND SPACING TO MATCH SLAB BOTTOM BARS.
- SLOPE TO BE AS STEEP AS POSSIBLE.
- SIZE AND SPACING TO MATCH SLAB BOTTOM BARS OR EXTERIOR WALL BARS, WHICHEVER PROVIDES GREATER AREA OF STEEL.

ADDITIONAL REINFORCING AT RECTANGULAR OPENINGS
NOT TO SCALE

SUMP OR TRENCH DETAIL
NOT TO SCALE

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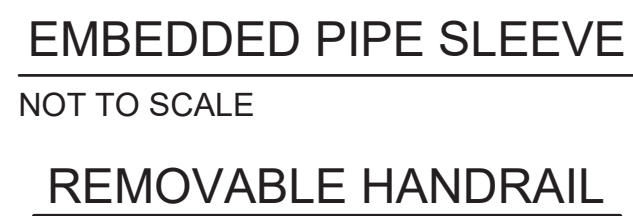
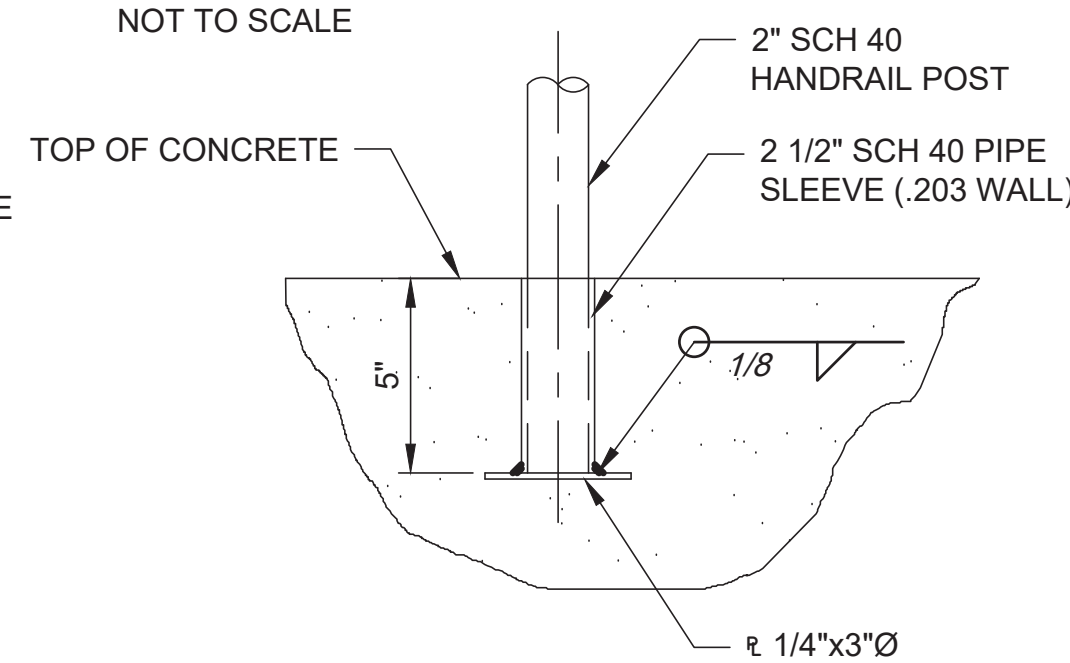
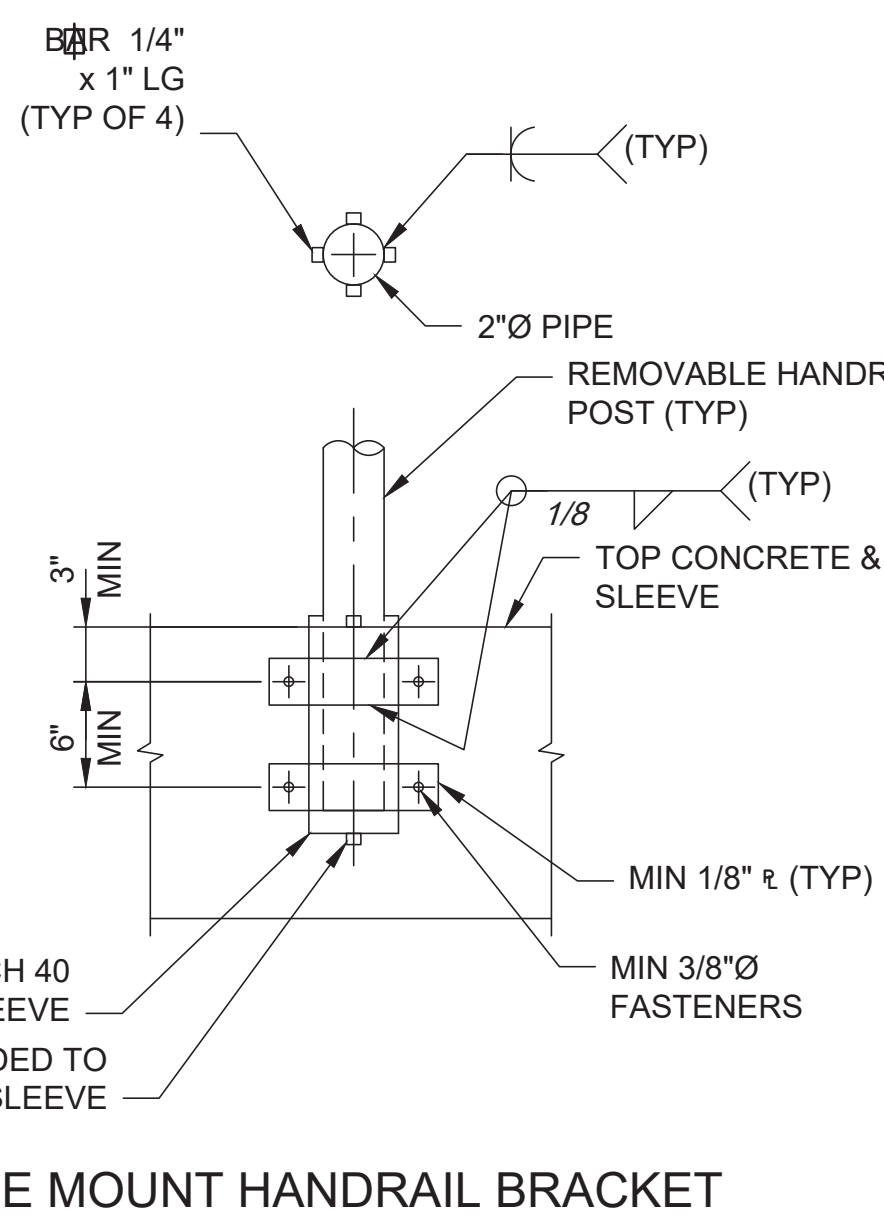
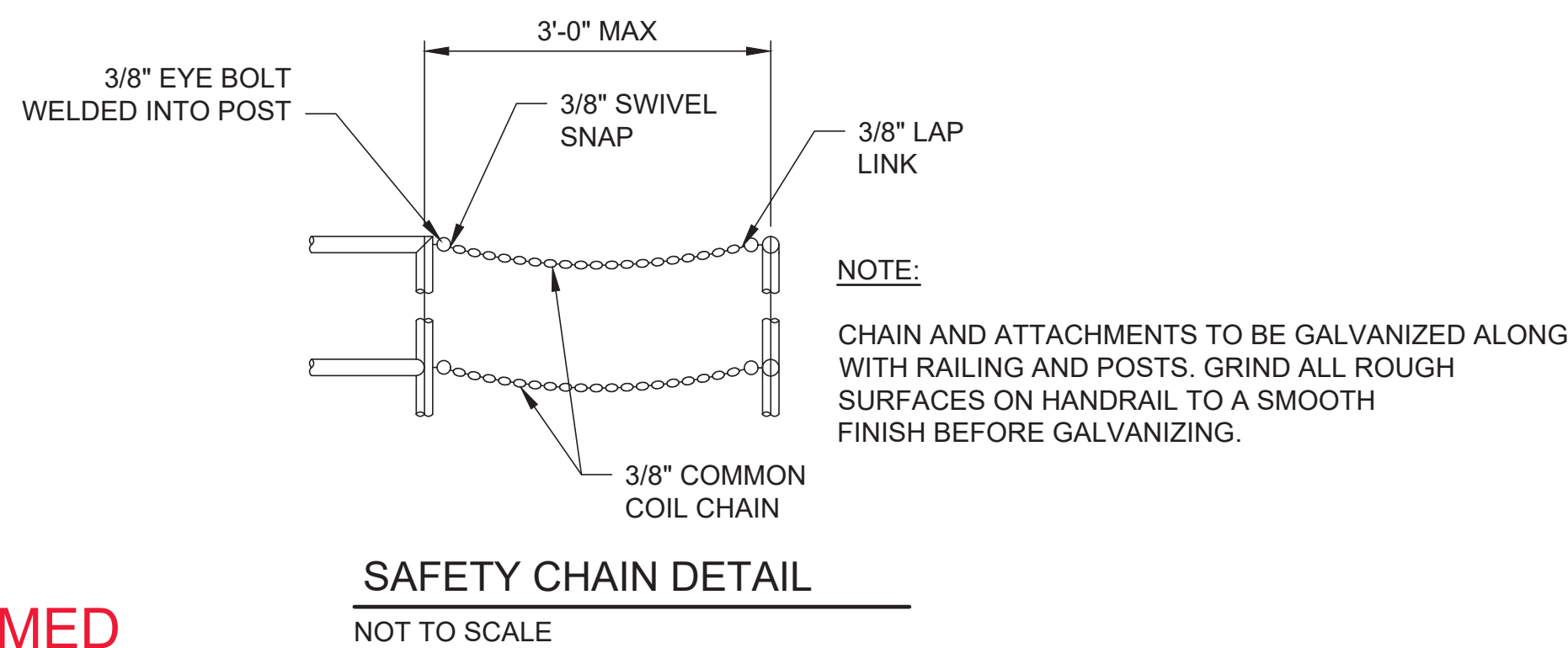
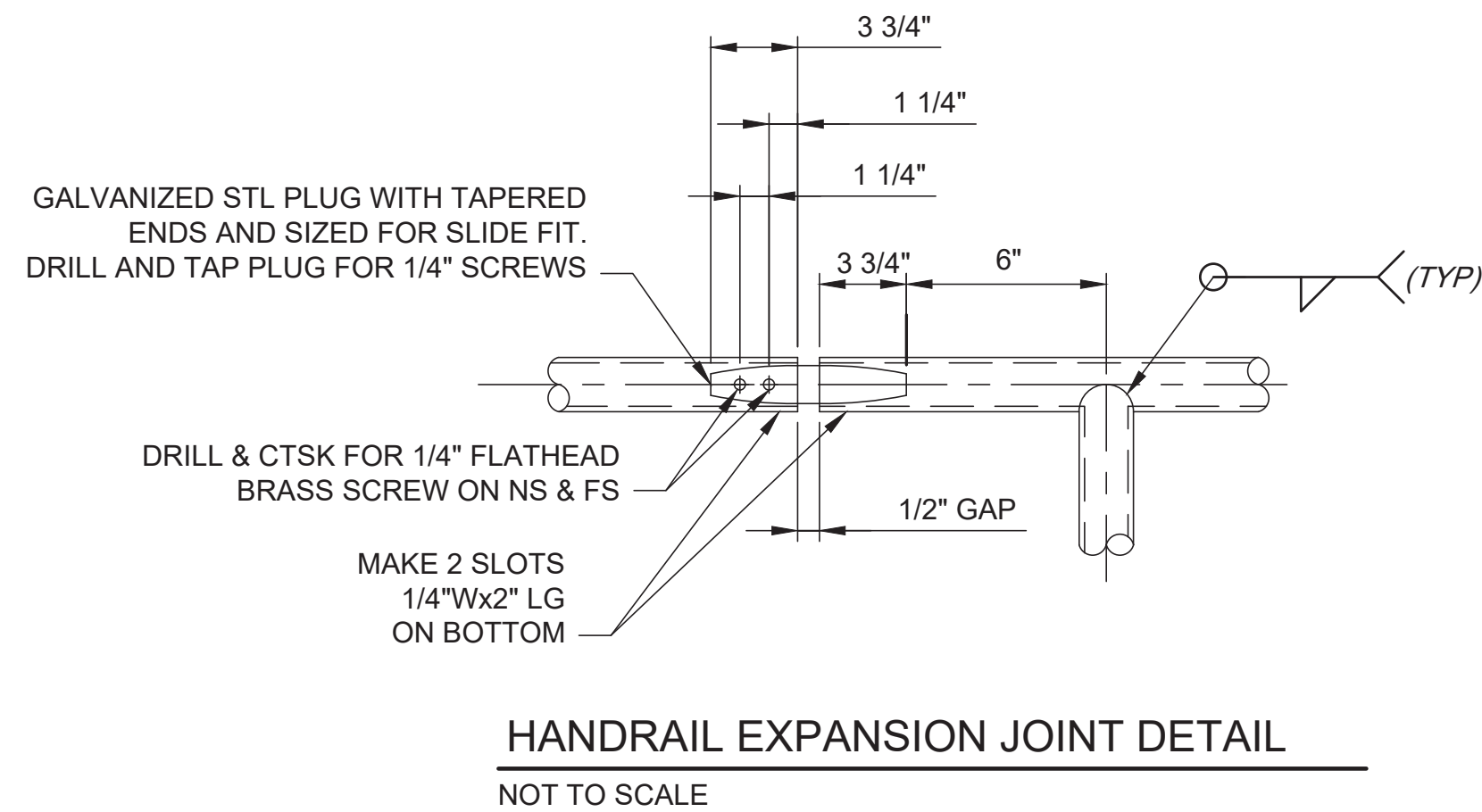
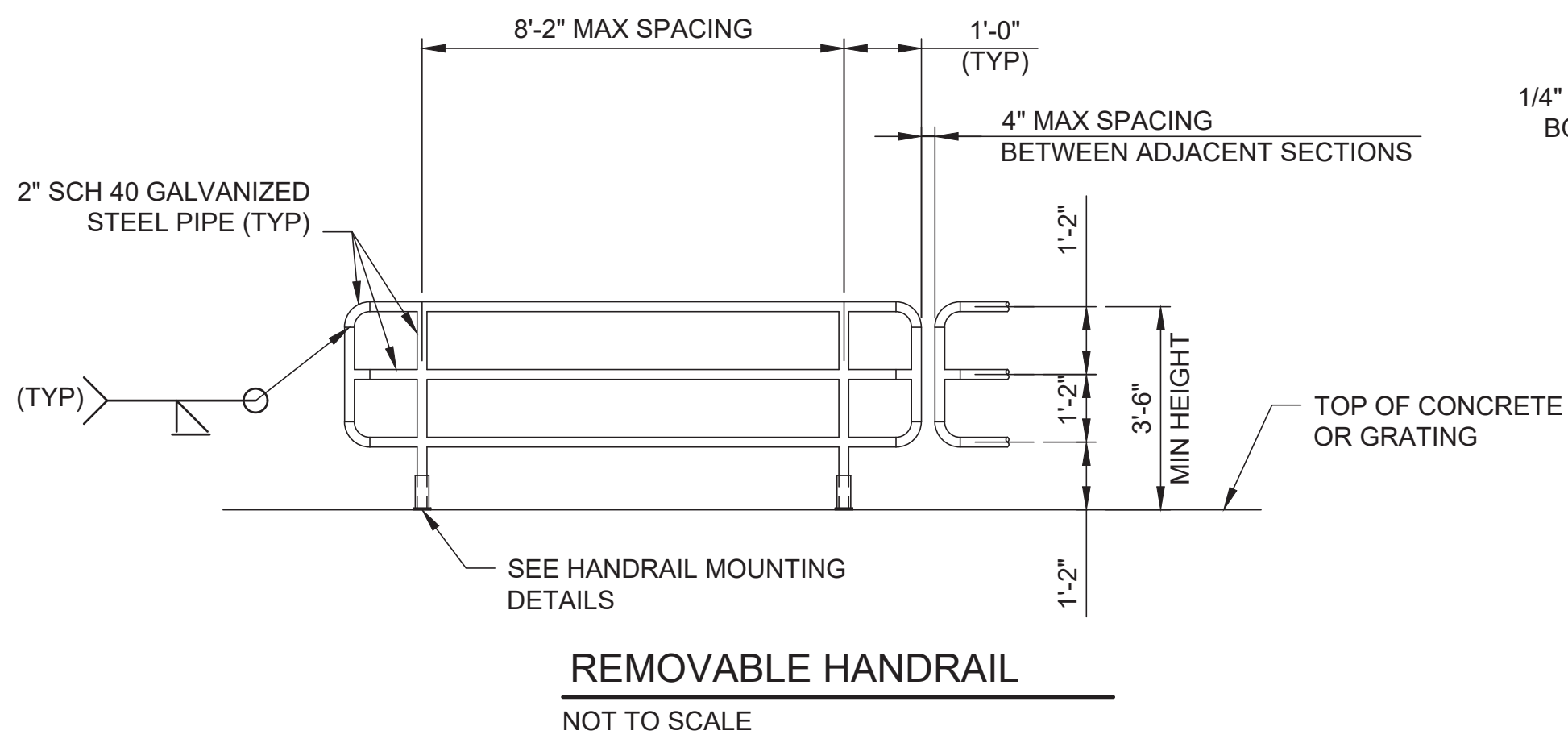
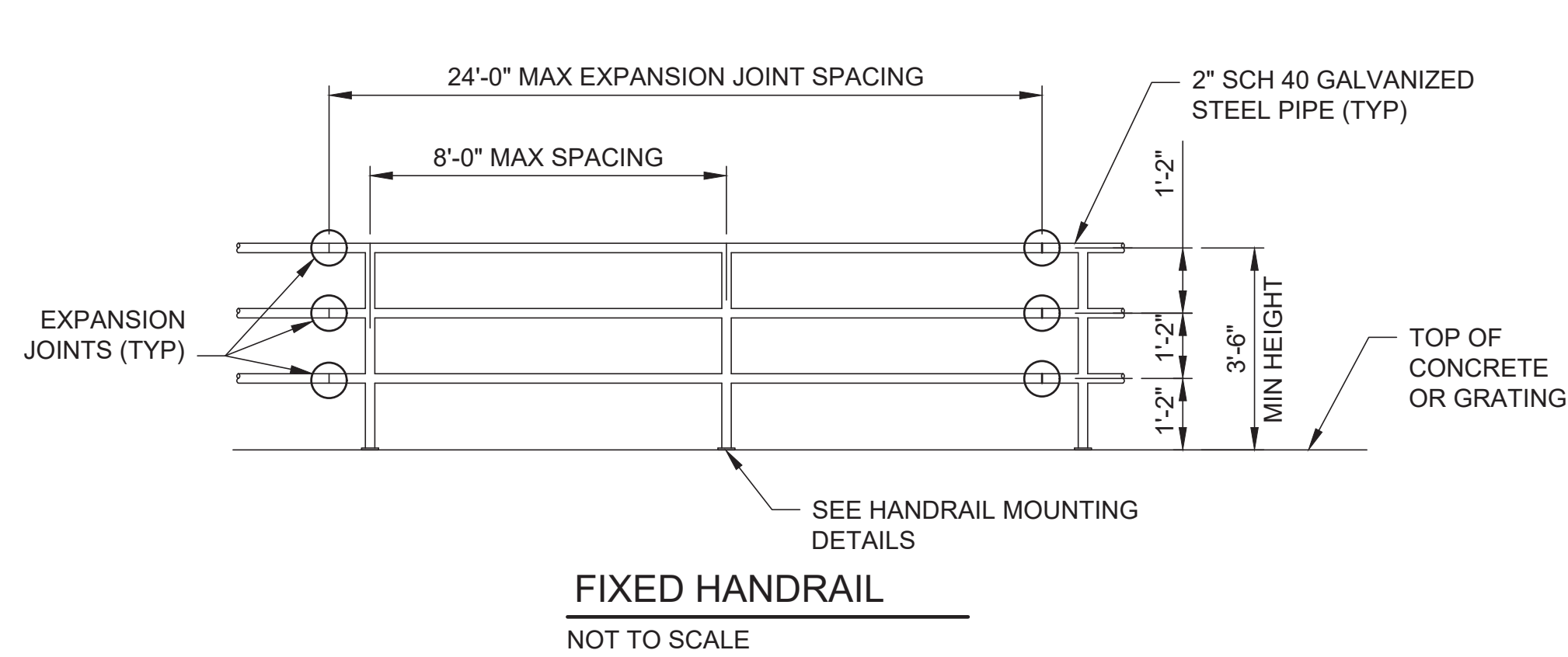
ANTHELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
TYPICAL DETAILS
SHEET 2 OF 4

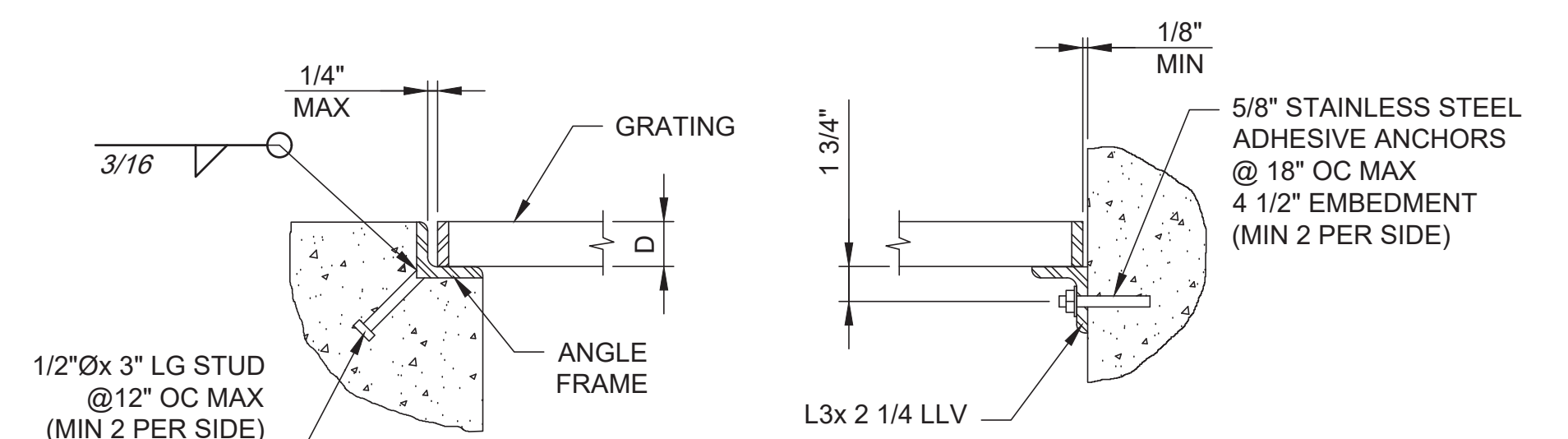
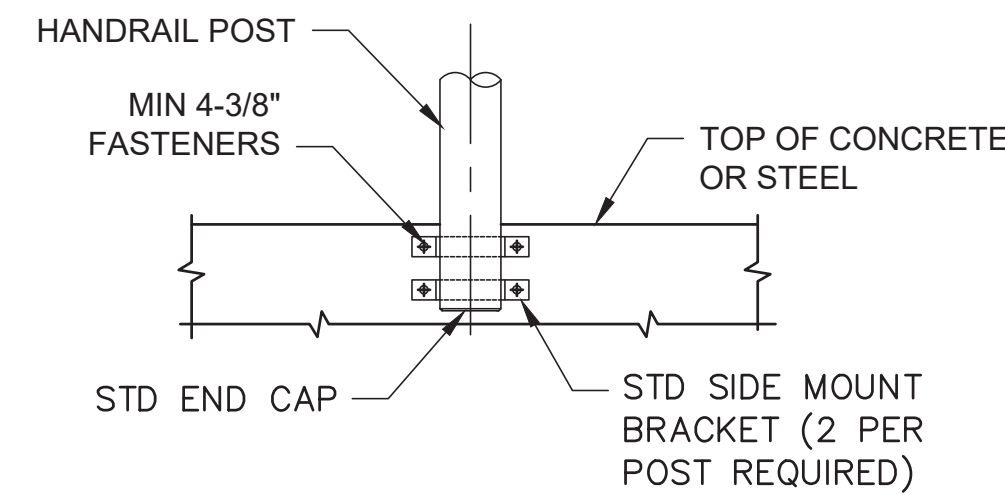
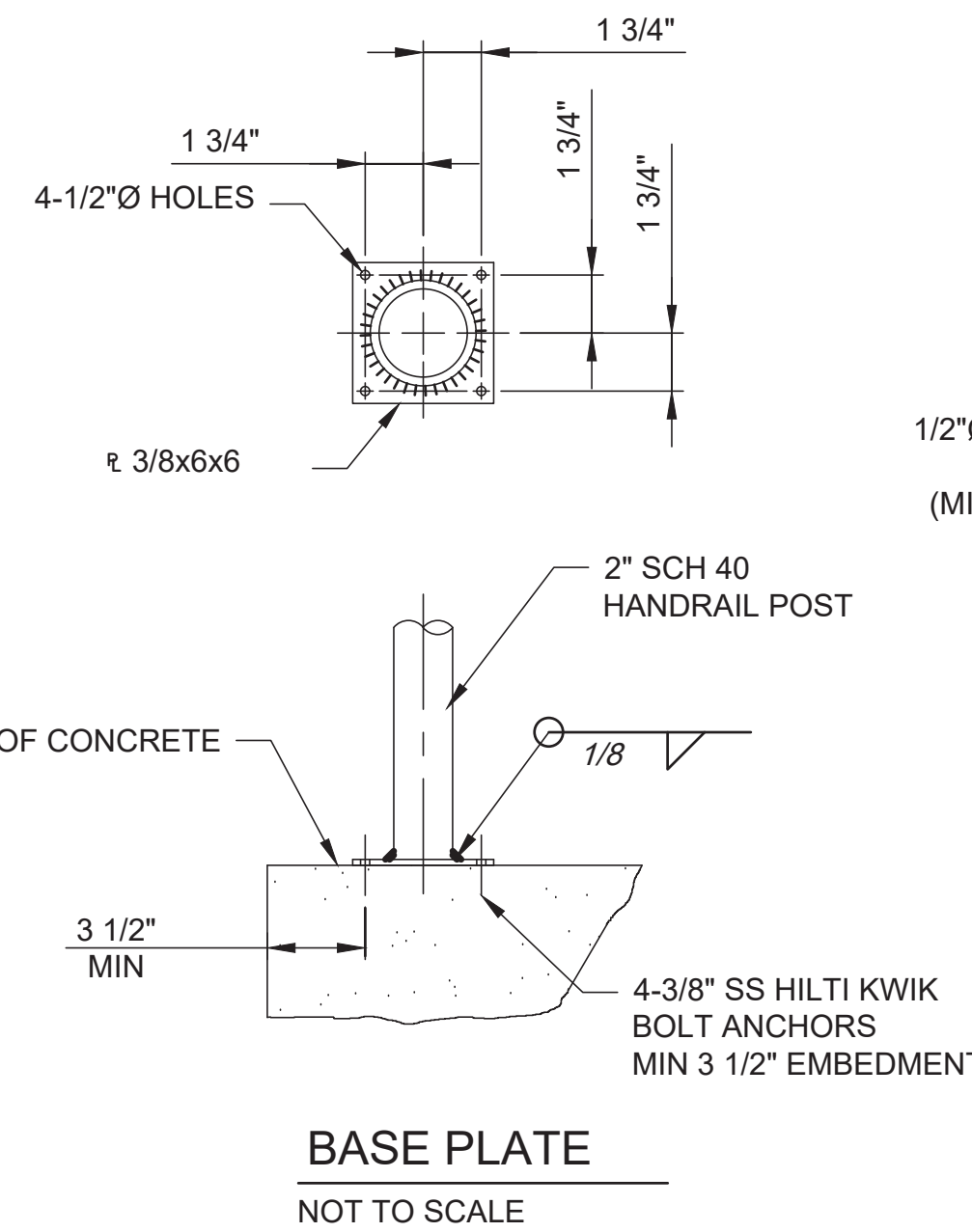
SHEET
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SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



HANDRAIL MOUNTING DETAILS



GRATING DEPTH D	ANGLE FRAME SIZE
1"	L 1 3/4 x 1 1/4 x 1/4 LLH
1 1/4"	L 2 x 1 1/2 x 1/4 LLH
1 1/2"	L 1 3/4 x 1 3/4 x 1/4
1 3/4"	L 2 x 2 x 1/4
2"	* L 2 1/2 x 2 1/2 x 1/2

* MAY SUBSTITUTE L 2 1/2 X 2 1/2 X 1/4 WITH BAR 1 3/4 X 1/4 WELDED TO THE TOP OF THE HORIZONTAL LEG WITH 3/16 CONTINUOUS FILLET WELD ALL AROUND.

NOTES:

- ALL GRATING AND ANGLES SHALL BE GALVANIZED STEEL UNLESS OTHERWISE NOTED.
- GRATING SHALL BE WELDED BAR GRATING WITH BEARING BARS "D" X 3/16" @ 1 3/16" CTRS. AND CROSS BARS @ 4" CTRS. "D" SHALL BE AS INDICATED ON THE DESIGN DRAWINGS OR AS DETERMINED BY THE GRATING MANUFACTURER AND APPROVED BY THE ENGINEER.
- BOTH ENDS OF EACH GRATING PANEL AND ALL OPENINGS SHALL BE BANDED. BANDING BAR DEPTH AND THICKNESS SHALL MATCH BEARING BARS. WELD END BARS AND EVERY 4TH INTERIOR BAR TO BANDING WITH DOUBLE 1/8" FILLET WELD FULL HEIGHT.
- FASTEN GRATING TO SUPPORTS WITH A MINIMUM OF 4 SADDLE CLIPS 4" FROM CORNERS OF PANEL, MAXIMUM SPACING 3'-0".
- THE PORTION OF THE REMOVABLE HANDRAIL THAT WAS RELOCATED OVER THE STEEL GRATING WAS ATTACHED TO THE CONCRETE STRUCTURE USING 10" x 36" x 3/8" SS PLATE, AND 3" DIA x 6" LONG SS SLEEVES.

GRATING SUPPORT DETAIL
NOT TO SCALE

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

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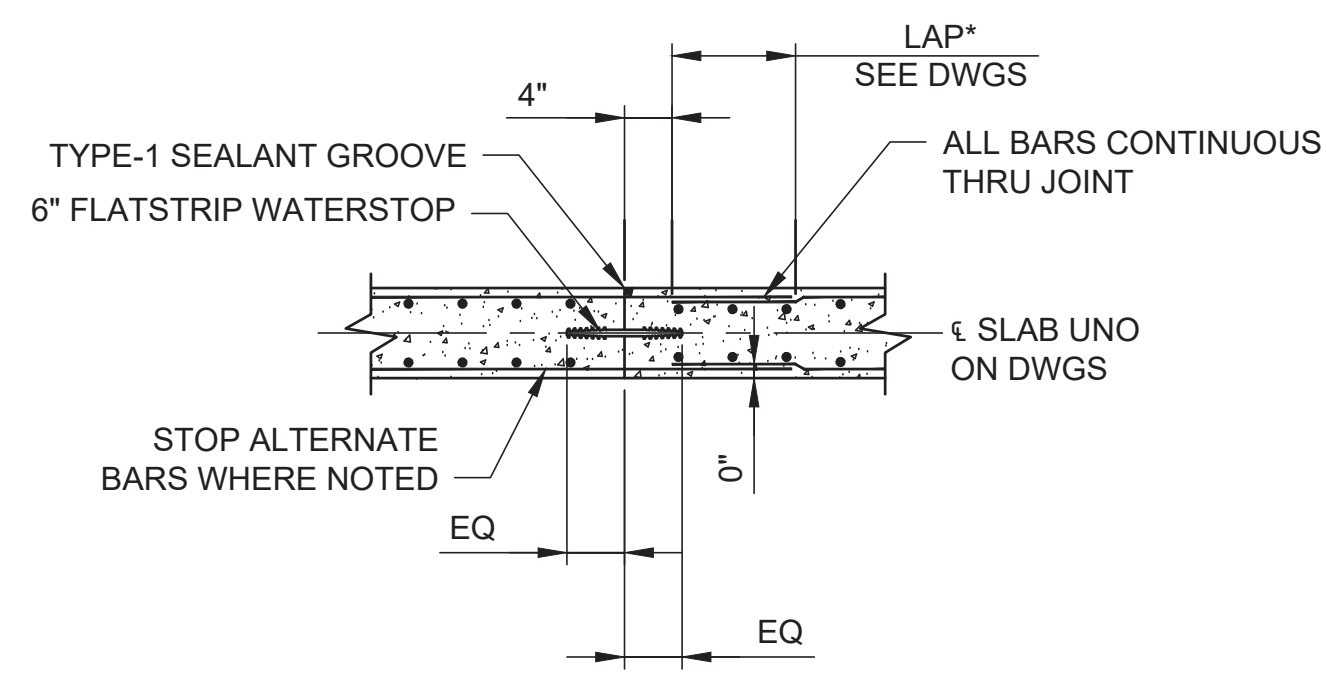
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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

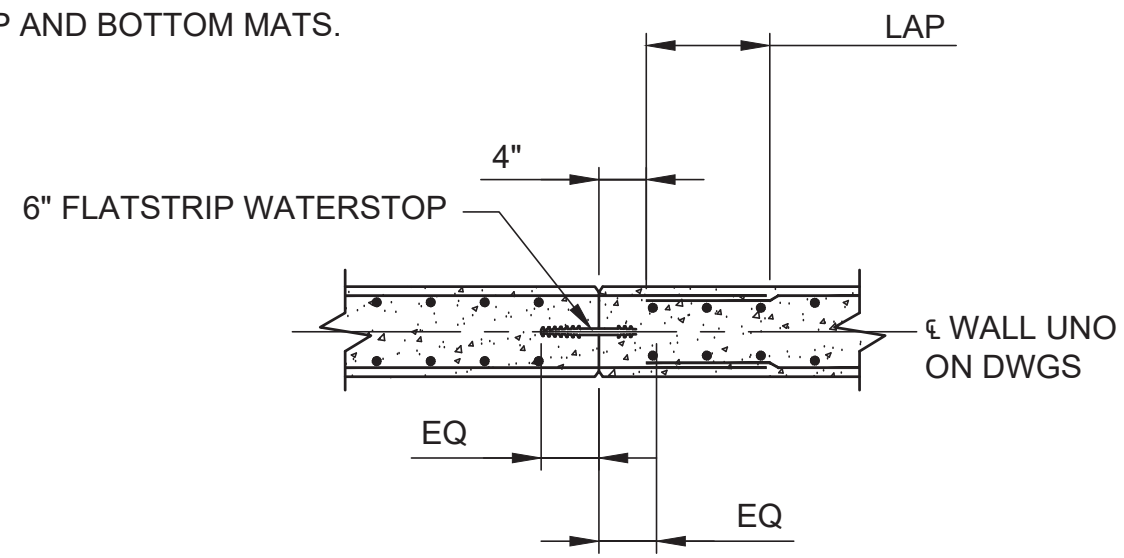
STRUCTURAL
TYPICAL DETAILS
SHEET 3 OF 4

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SHEETS



SLAB ON GRADE

* SEE DWGS FOR LAP LOCATIONS, IF NOT SPECIFIED PLACE LAP AS SHOWN FOR TOP AND BOTTOM MATS.



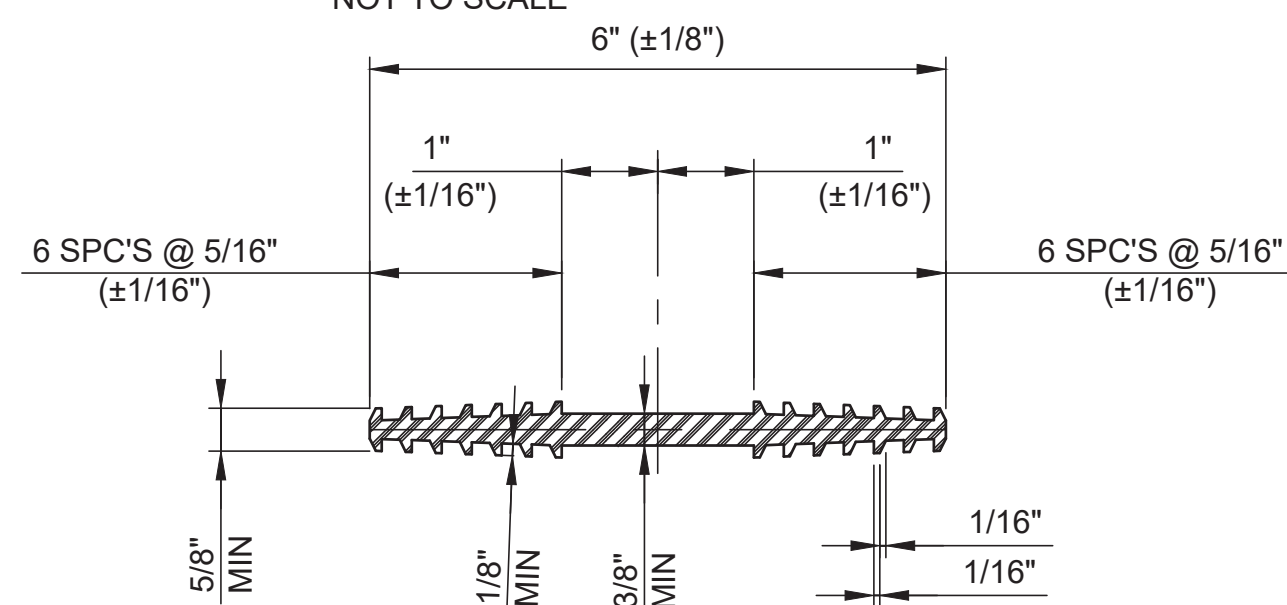
VERTICAL WALL

NOTES:

1. CONTINUE ALL BARS THROUGH JOINT, UNLESS OTHERWISE NOTED.
2. UNLESS OTHERWISE NOTED 3/4" CHAMFERS SHALL BE OMITTED IN SURFACES TO RECEIVE ARCHITECTURAL TREATMENT.
3. STAGGER SPLICES UNLESS NOTED OTHERWISE.
4. ALL FLOOR JOINTS OF HYDRAULIC STRUCTURES (MEMBERS COVERED WITH WATER) SHALL HAVE A SEALANT GROOVE.
5. WHERE FACE OF JOINT IS TO BE COATED WITH BOND BREAKER AVOID COATING SEALANT GROOVE.
6. SANDBLASTING REQUIRED PRIOR TO APPLICATION OF PRIMER.

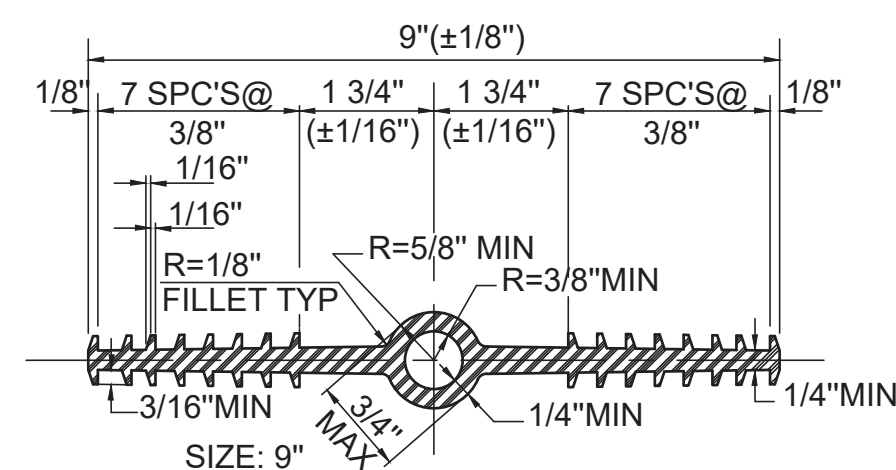
CONSTRUCTION JOINTS

NOT TO SCALE



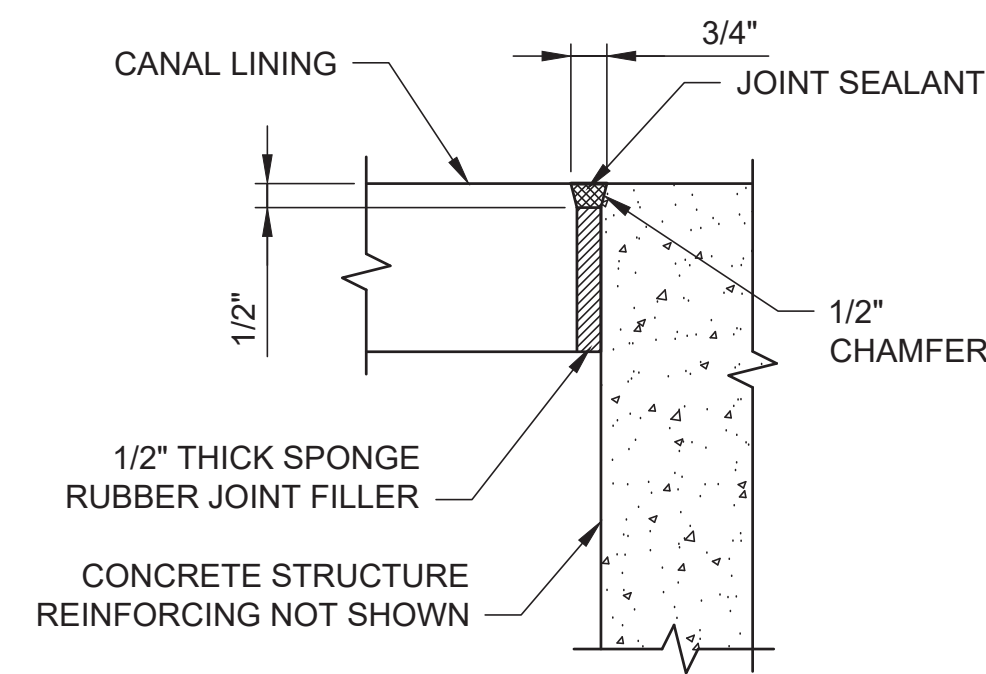
6" FLATSTRIP WATERSTOP

NOT TO SCALE



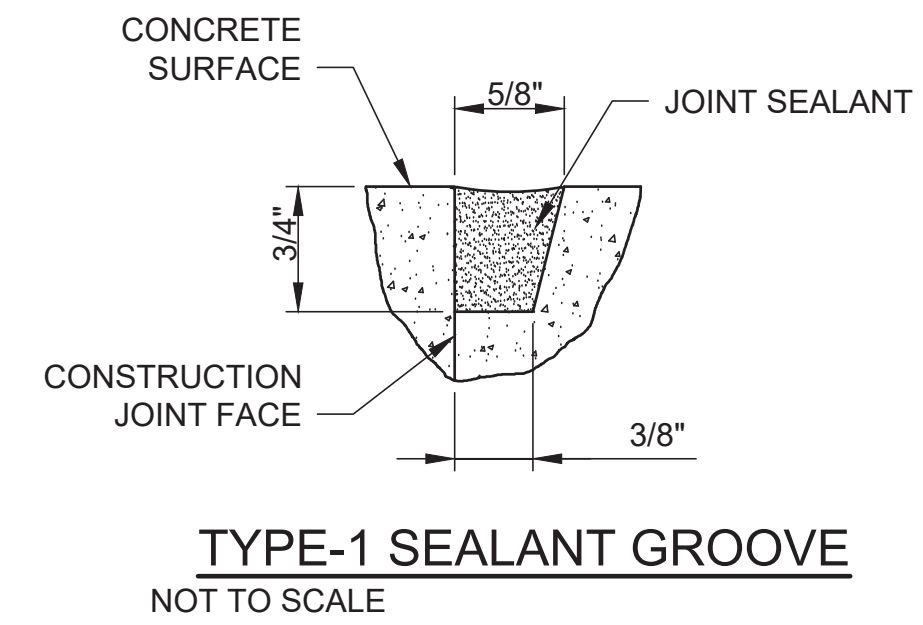
PVC WATERSTOP

NOT TO SCALE



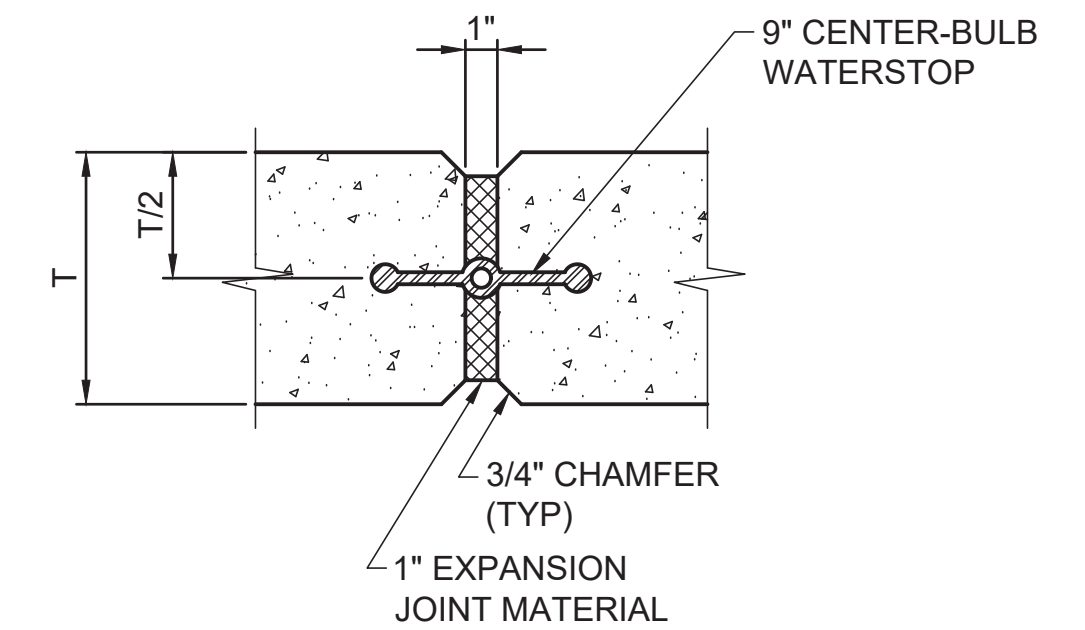
RESERVOIR & CANAL LINING TO STRUCTURE EXPANSION JOINT

NOT TO SCALE



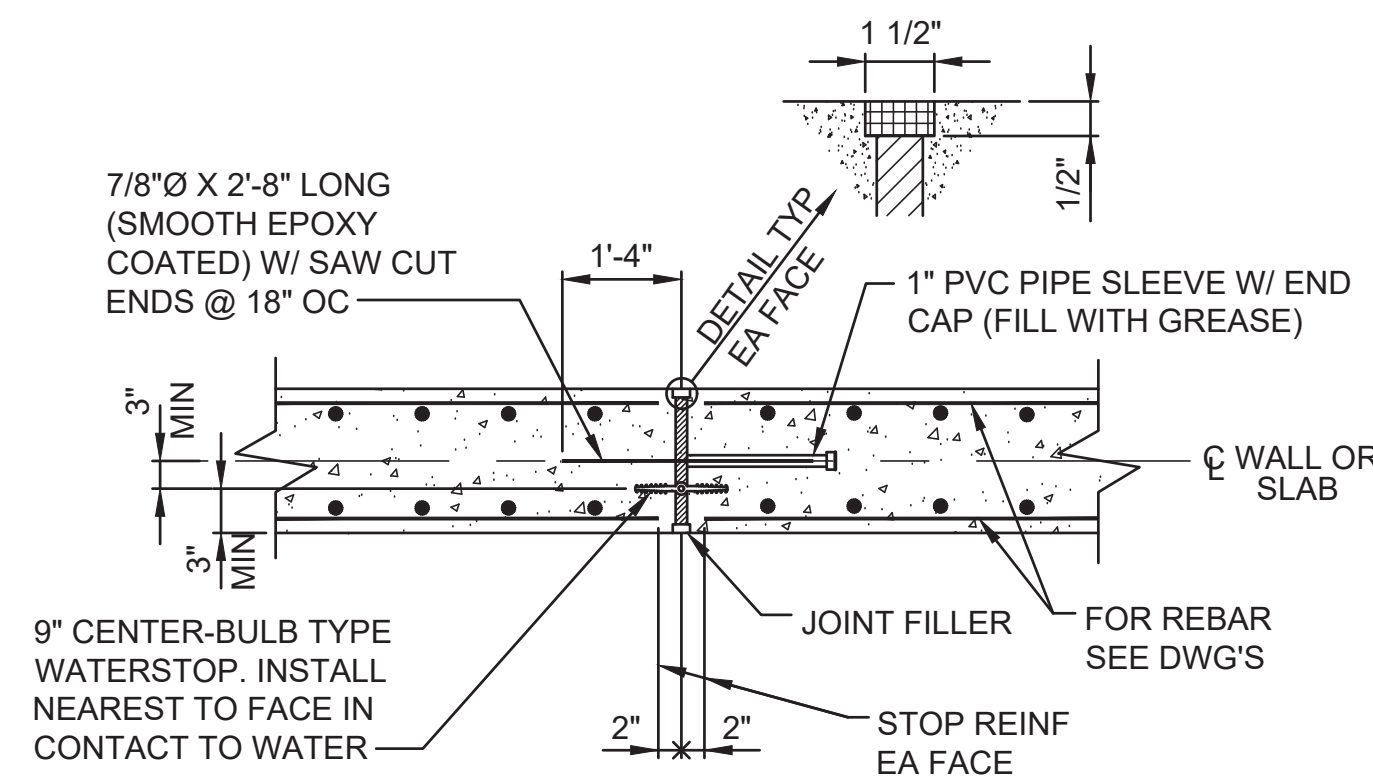
TYPE-1 SEALANT GROOVE

NOT TO SCALE



EXPANSION JOINT (FOR UNREINFORCED CONCRETE)

NOT TO SCALE



EXPANSION JOINT

NOT TO SCALE

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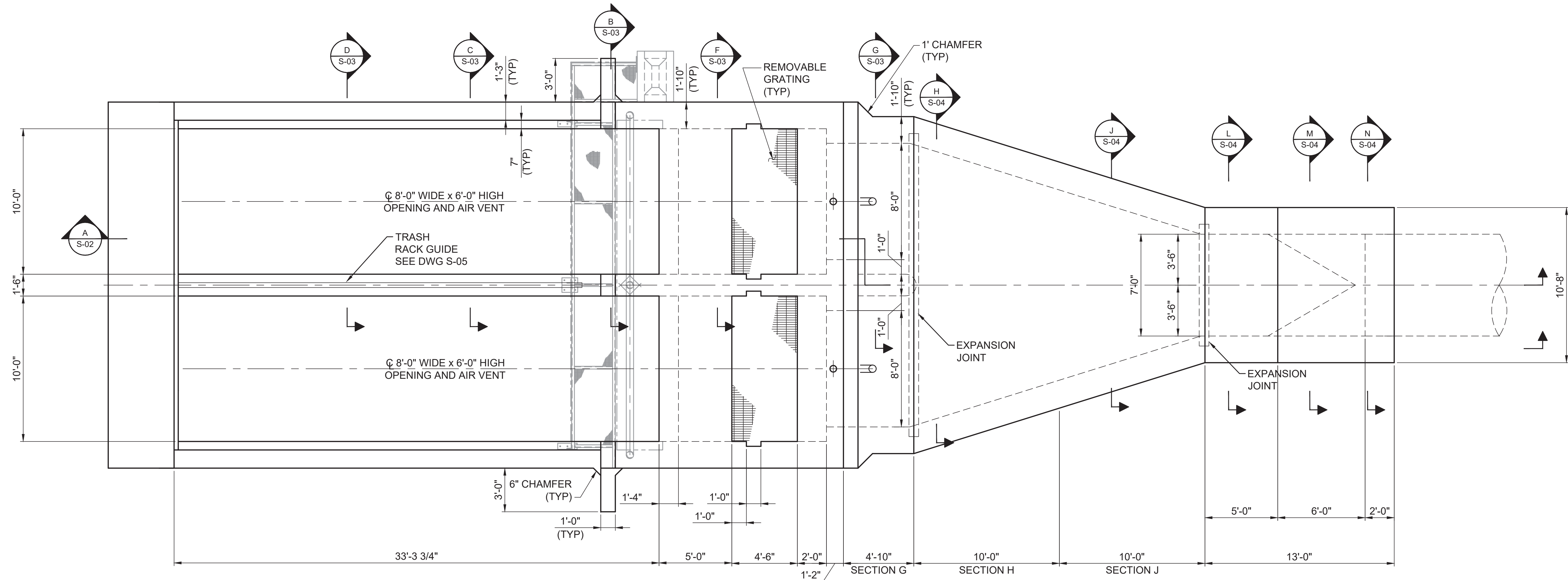
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
TYPICAL DETAILS
SHEET 4 OF 4

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SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



PLAN
SCALE: 1/4"=1'-0"

NOTES:

- FOR HANDRAIL, SEE DRAWING S-08.
- OVEREXCAVATE 12 INCHES BELOW (AND EXTEND 12 INCHES BEYOND) STRUCTURE BASE SLAB. IF UNSUITABLE SOILS ARE ENCOUNTERED AT THE SUBGRADE LEVEL, ADDITIONAL REMOVALS MAY BE REQUIRED BY THE GEOTECHNICAL ENGINEER OF RECORD. ADDITIONAL REMOVALS SHALL NOT UNDERMINE THE EXISTING AQUEDUCT LINING. SUBGRADE SOILS SHALL BE SCARIFIED, MOISTURE CONDITIONED, AND RECOMPACTED TO AT LEAST 90 PERCENT RELATIVE COMPACTION PRIOR TO PLACEMENT OF STRUCTURAL FILL. STRUCTURAL FILL SHALL BE COMPACTED TO AT LEAST 95 PERCENT RELATIVE COMPACTION IN ACCORDANCE WITH ASTM D1557. AS AN OPTION, CLSM MAY BE USED FOR STRUCTURAL FILL.

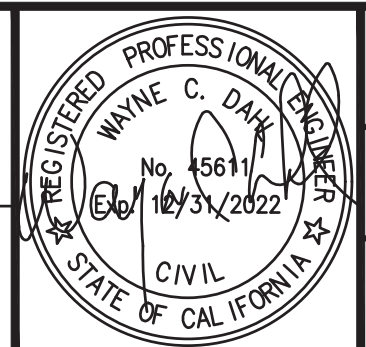
GEOTECHNICAL ASPECTS OF THE PLAN HAVE BEEN REVIEWED BY THE UNDERSIGNED AND IS IN GENERAL CONFORMANCE WITH THE RECOMMENDATIONS CONTAINED IN KLEINFELDER'S GEOTECHNICAL STUDY PROPOSED HIGH DESERT WATER BANK PROJECT DATED MAY 13, 2021. WE MAKE NO REPRESENTATION AS TO THE ACCURACY OF DIMENSIONS, MEASUREMENTS, CALCULATIONS, OR ANY PORTION OF THE DESIGN.

Jeff Woon
NAME _____ DATE _____

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NAME R.C.E. 45611 DATE

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

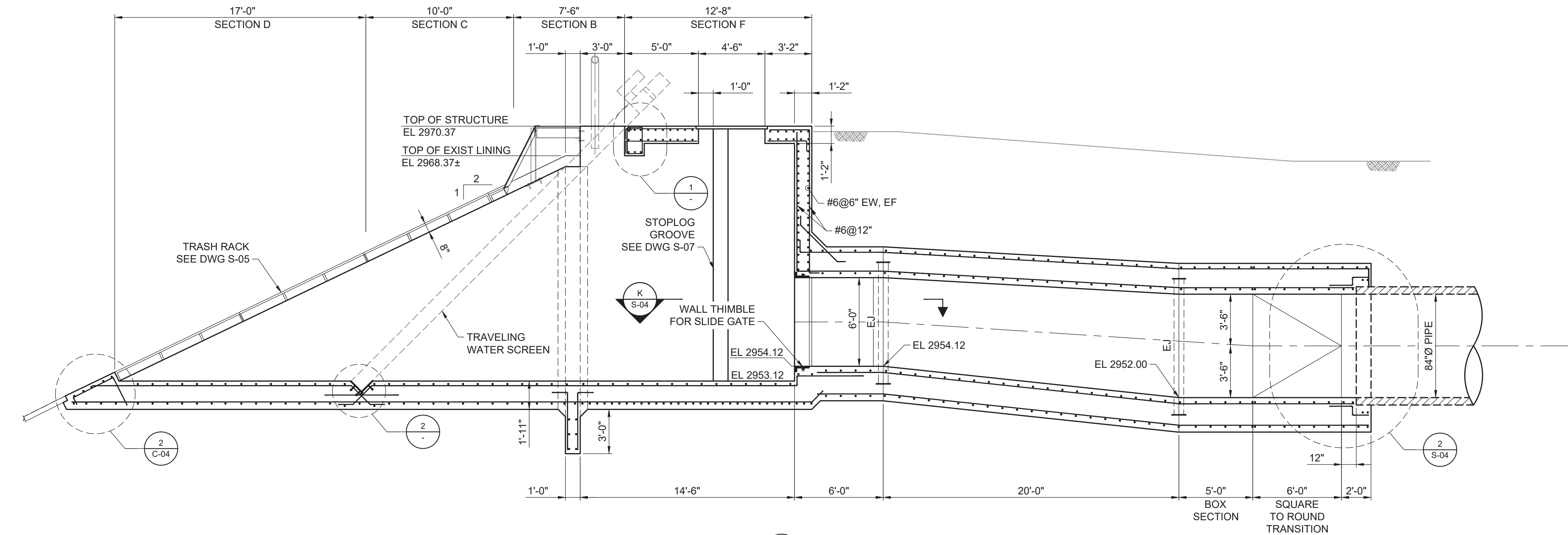
STRUCTURAL
AQUEDUCT TURNOUT/TURN-IN
STRUCTURAL PLAN

CONFORMED

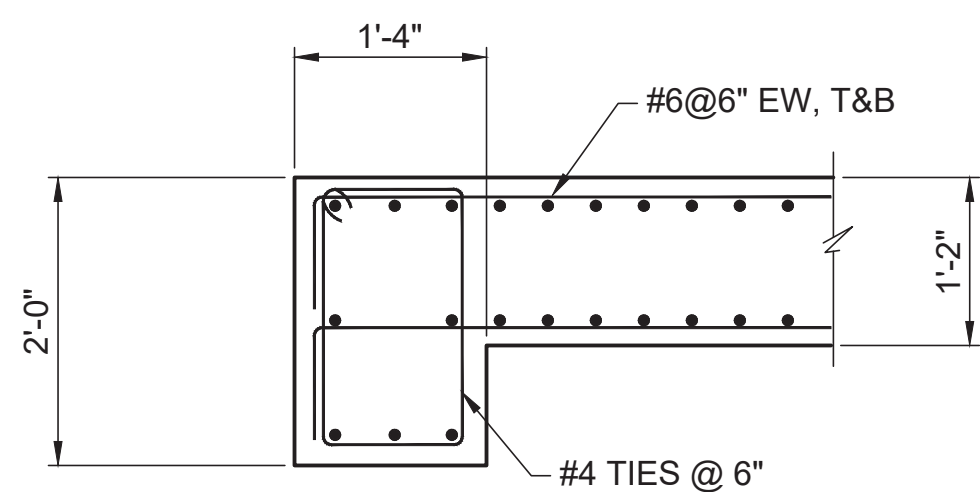
SHEET
S-01
18 of 54
SHEETS

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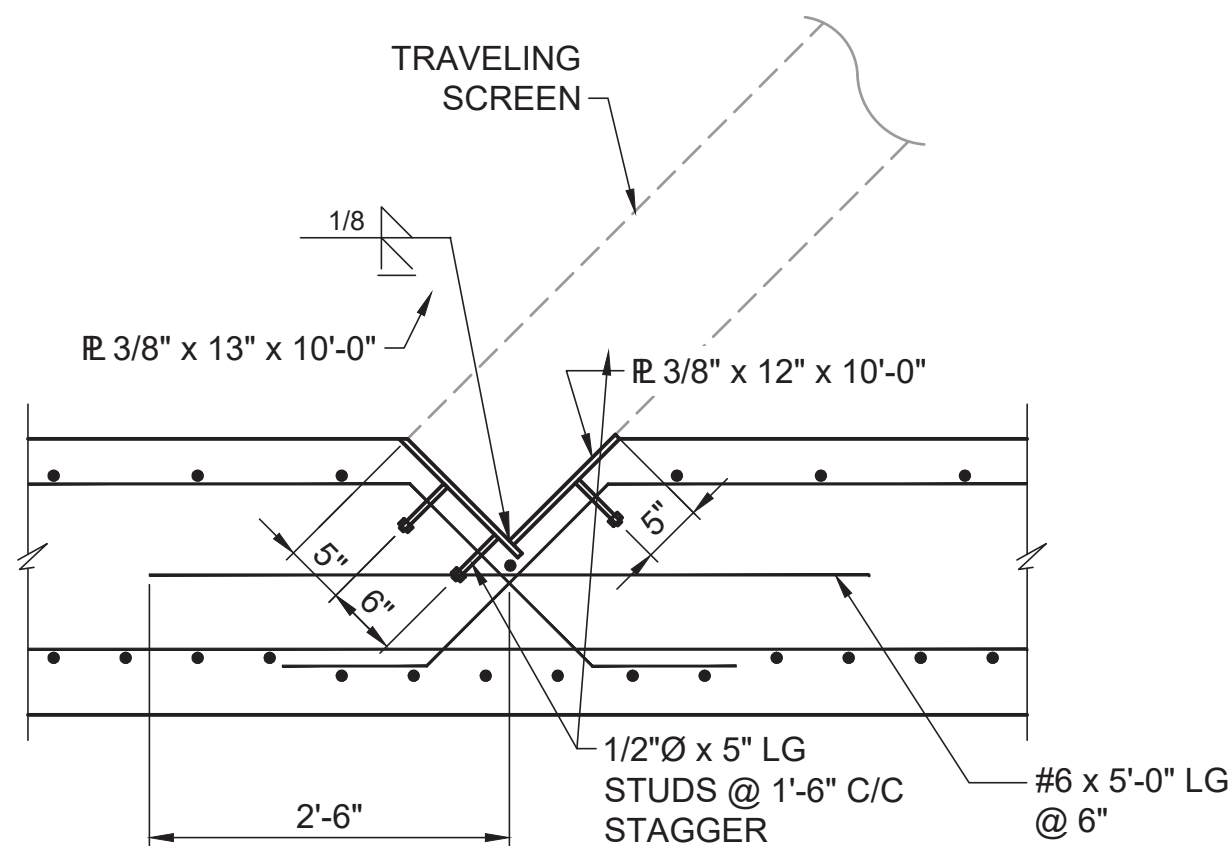
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



A SECTION
S-01 SCALE: 1/4"=1'-0"



1 DETAIL
SCALE: NTS



2 DETAIL
SCALE: NTS

NOTES:

- FOR GENERAL STRUCTURAL NOTES AND STANDARD DETAILS, SEE DWG SG-01 AND SG-04.
- OVEREXCAVATE 12 INCHES BELOW (AND EXTEND 12 INCHES BEYOND) STRUCTURE BASE SLAB. IF UNSUITABLE SOILS ARE ENCOUNTERED AT THE SUBGRADE LEVEL, ADDITIONAL REMOVALS MAY BE REQUIRED BY THE GEOTECHNICAL ENGINEER OF RECORD. ADDITIONAL REMOVALS SHALL NOT UNDERMINE THE EXISTING AQUEDUCT LINING. SUBGRADE SOILS SHALL BE SCARIFIED, MOISTURE CONDITIONED, AND RECOMPACTED TO AT LEAST 90 PERCENT RELATIVE COMPACTION PRIOR TO PLACEMENT OF STRUCTURAL FILL. STRUCTURAL FILL SHALL BE COMPACTED TO AT LEAST 95 PERCENT RELATIVE COMPACTION IN ACCORDANCE WITH ASTM D1557. AS AN OPTION, CLSM MAY BE USED FOR STRUCTURAL FILL.

GEOTECHNICAL ASPECTS OF THE PLAN HAVE BEEN REVIEWED BY THE UNDERSIGNED AND IS IN GENERAL CONFORMANCE WITH THE RECOMMENDATIONS CONTAINED IN KLEINFELDER'S GEOTECHNICAL STUDY PROPOSED HIGH DESERT WATER BANK PROJECT DATED MAY 13, 2021. WE MAKE NO REPRESENTATION AS TO THE ACCURACY OF DIMENSIONS, MEASUREMENTS, CALCULATIONS, OR ANY PORTION OF THE DESIGN.

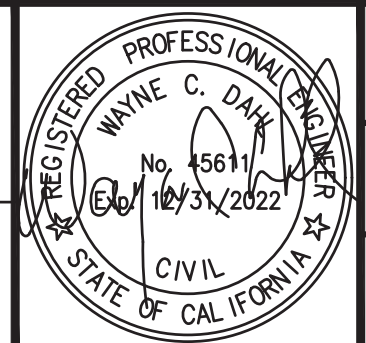
Jeff Woon
NAME _____ DATE _____

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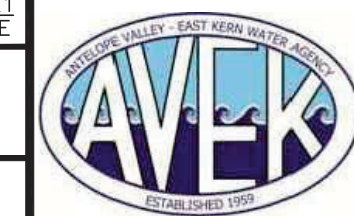
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R.C.E. 45611
11/10/21
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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

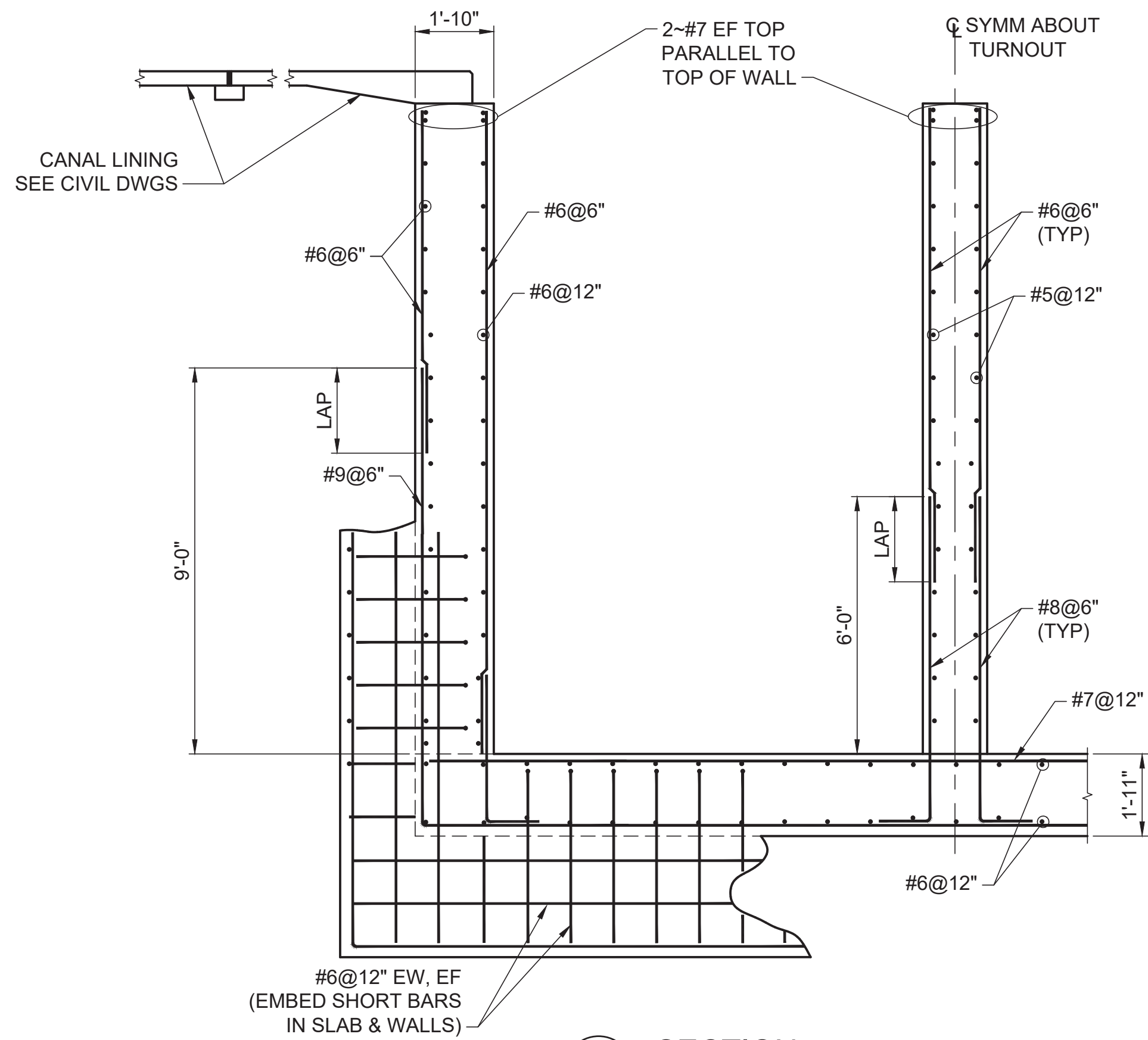
STRUCTURAL
AQUEDUCT TURNOUT/TURN-IN
STRUCTURAL SECTIONS AND DETAILS
SHEET 1 OF 3

SHEET
S-02
19 of 54
SHEETS

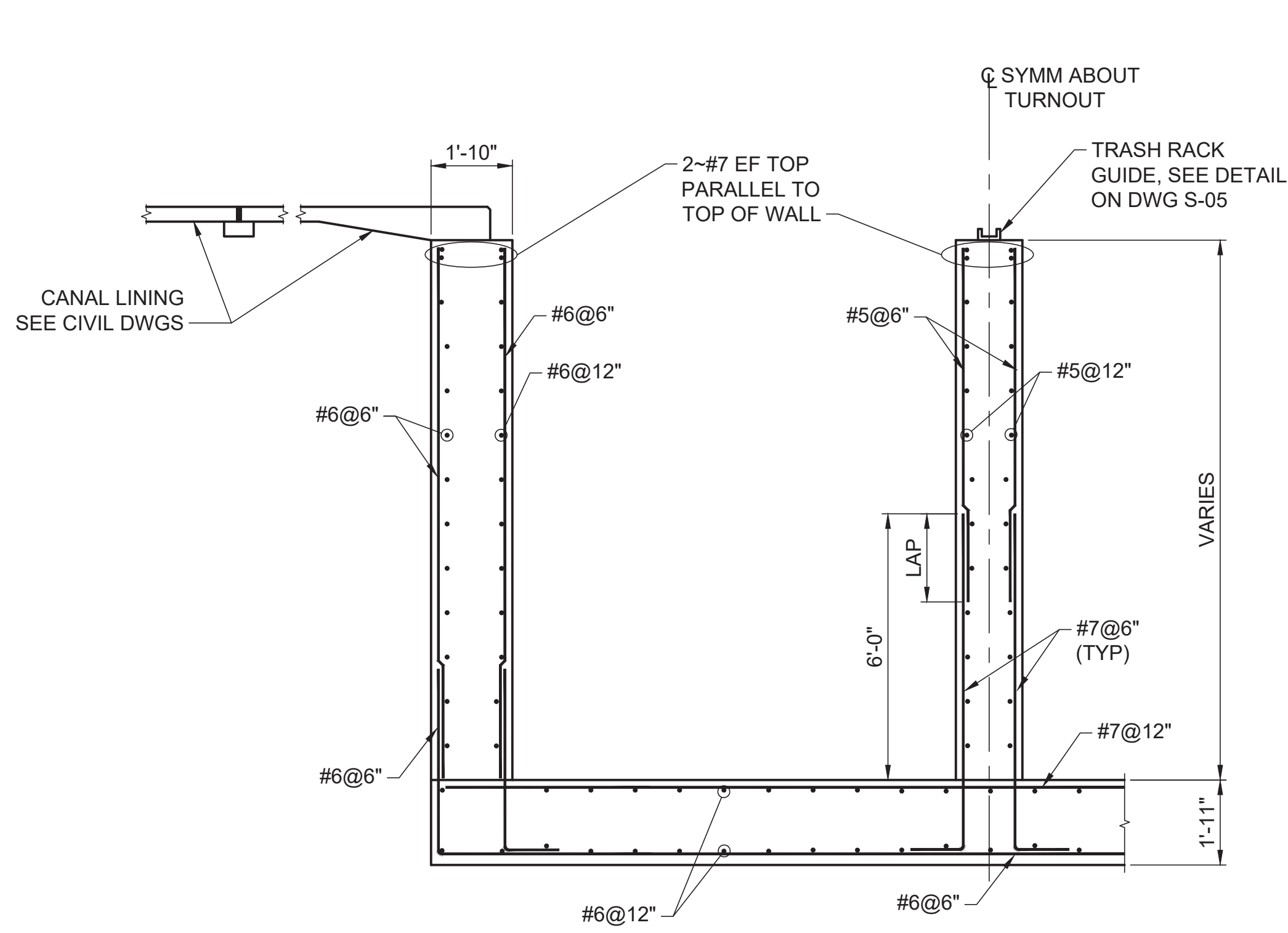
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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

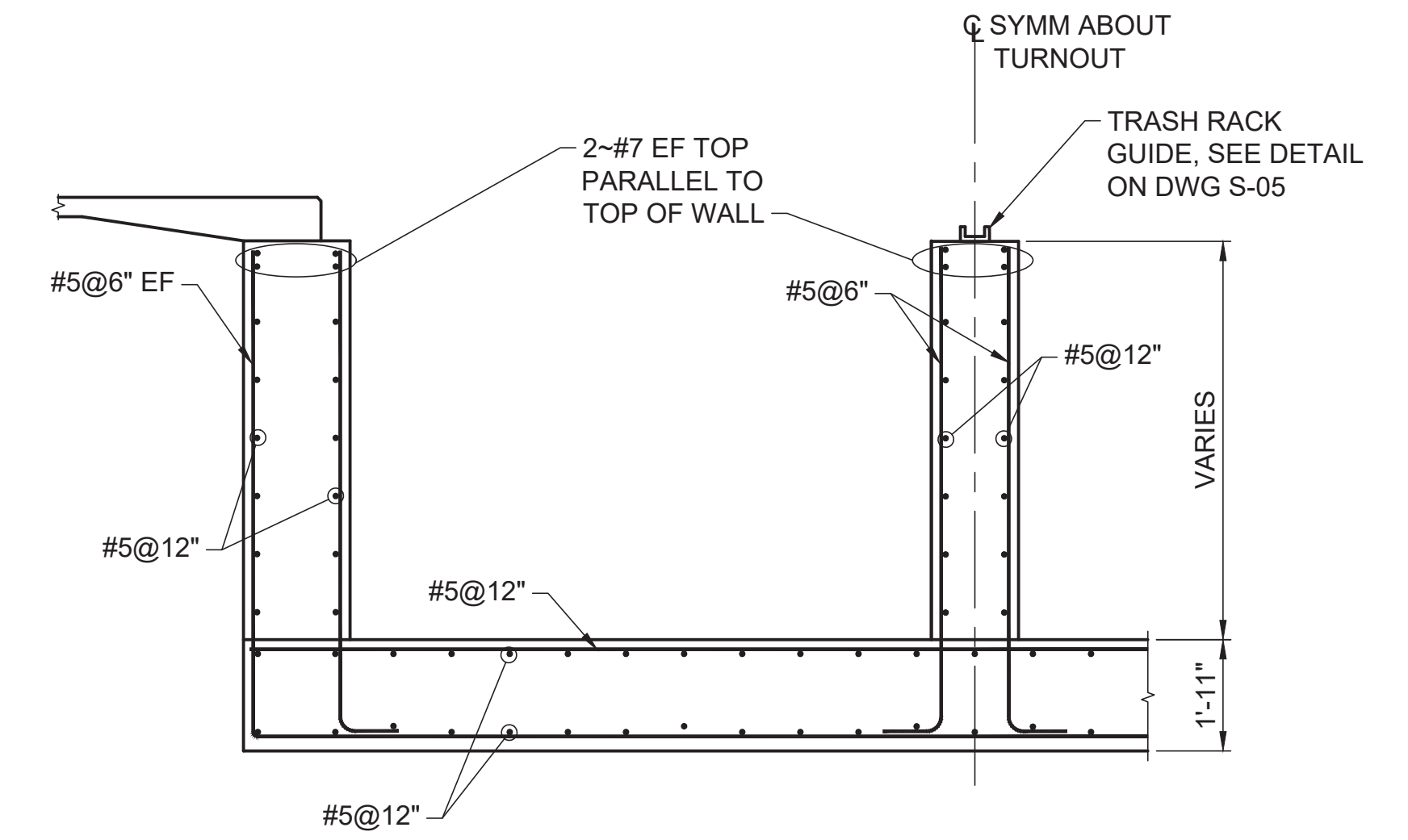
APPENDIX G



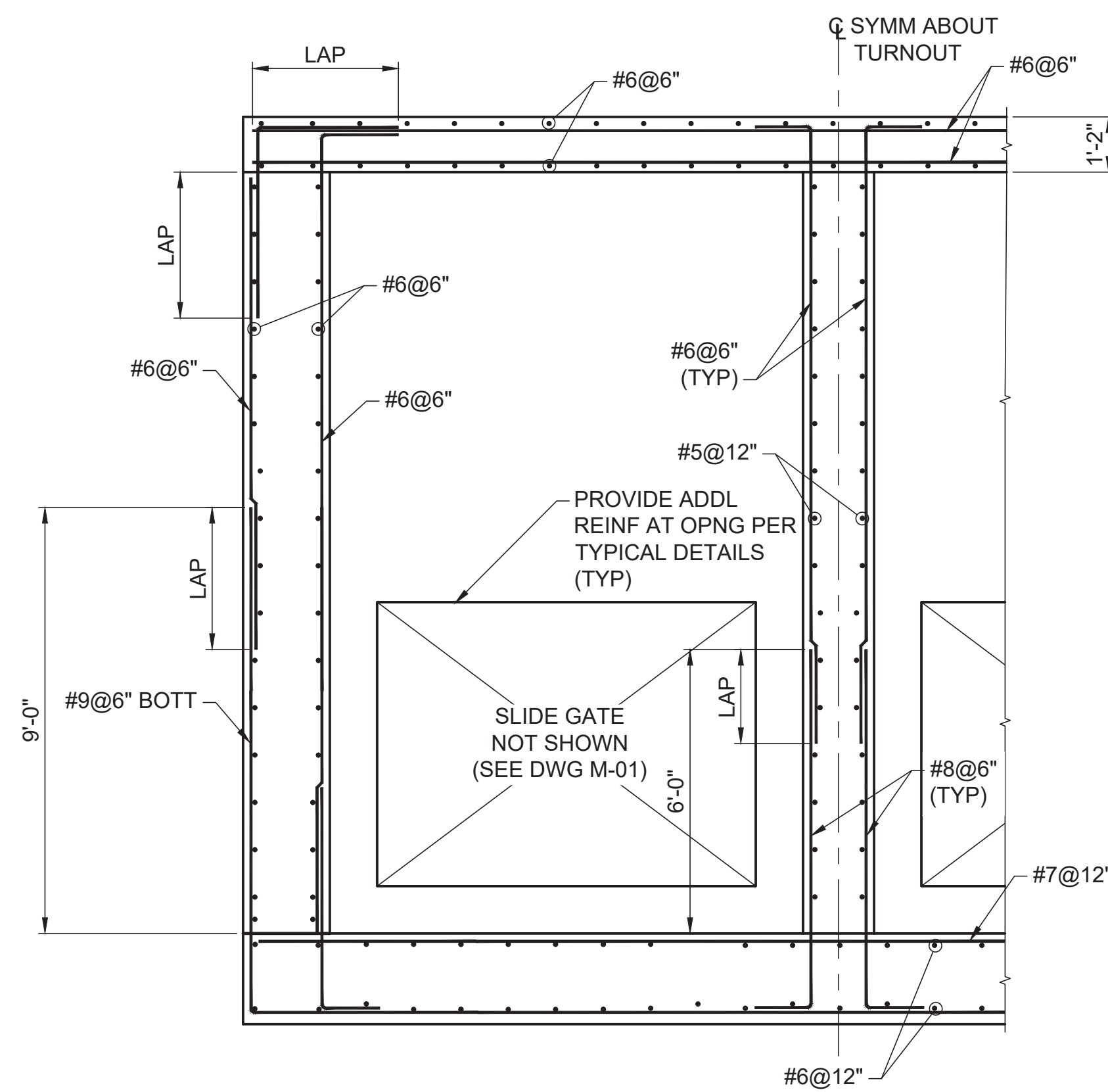
B SECTION
S-01 SCALE: 3/8"=1'-0"



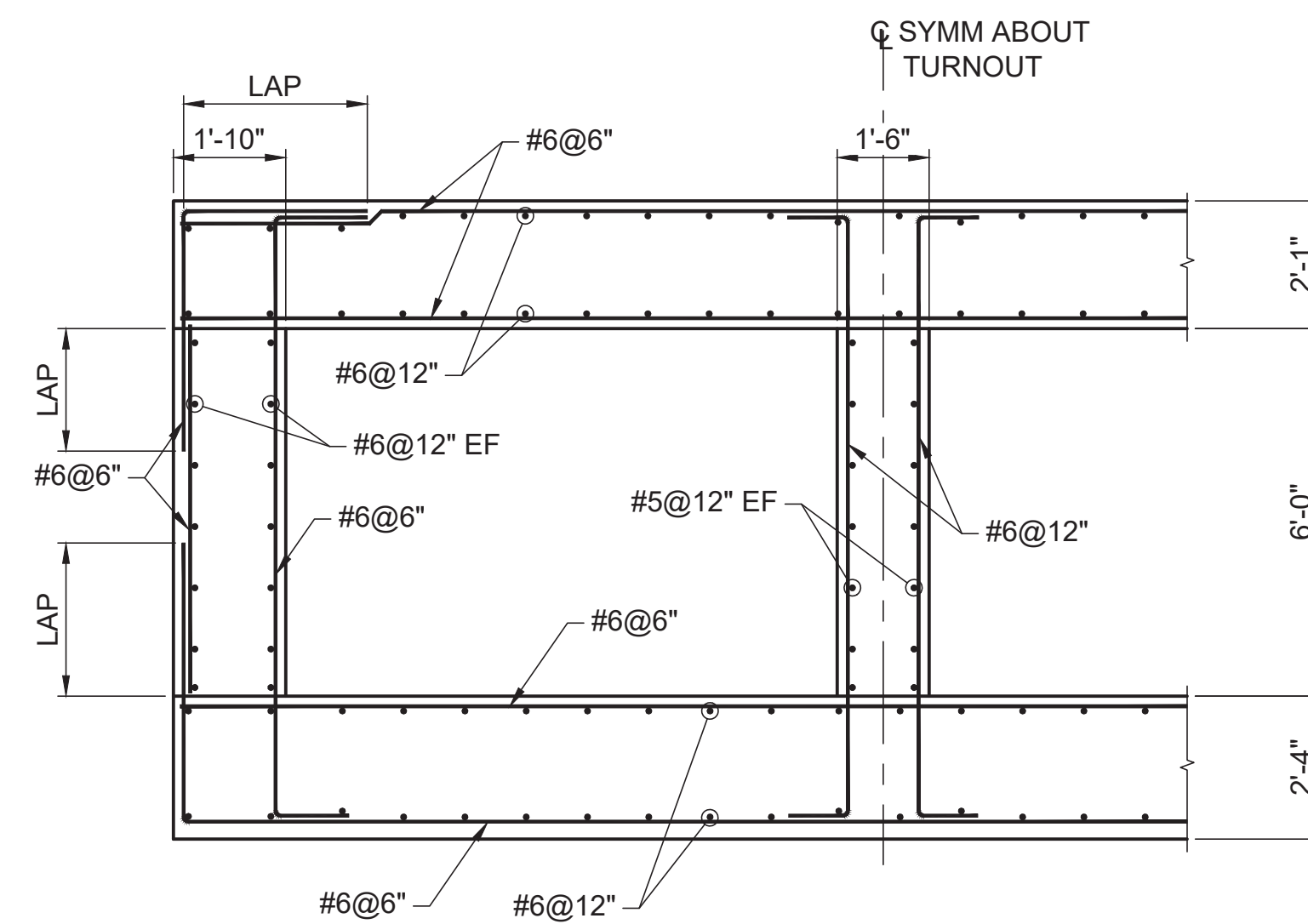
C SECTION
S-01 SCALE: 3/8"=1'-0"



D SECTION
S-01 SCALE: 3/8"=1'-0"



F SECTION
S-01 SCALE: 3/8"=1'-0"



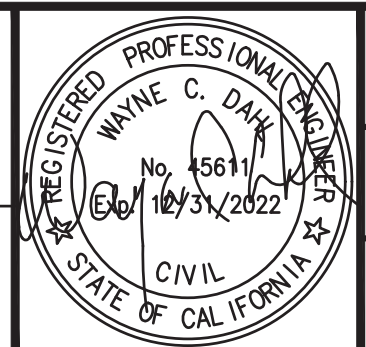
G SECTION
S-01 SCALE: 3/8"=1'-0"

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NO.	DATE	REVISIONS	APPROVED

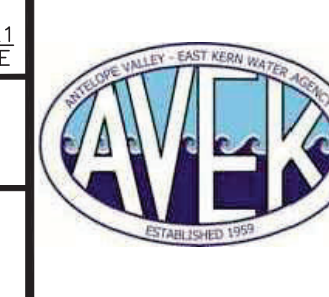
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11/10/21
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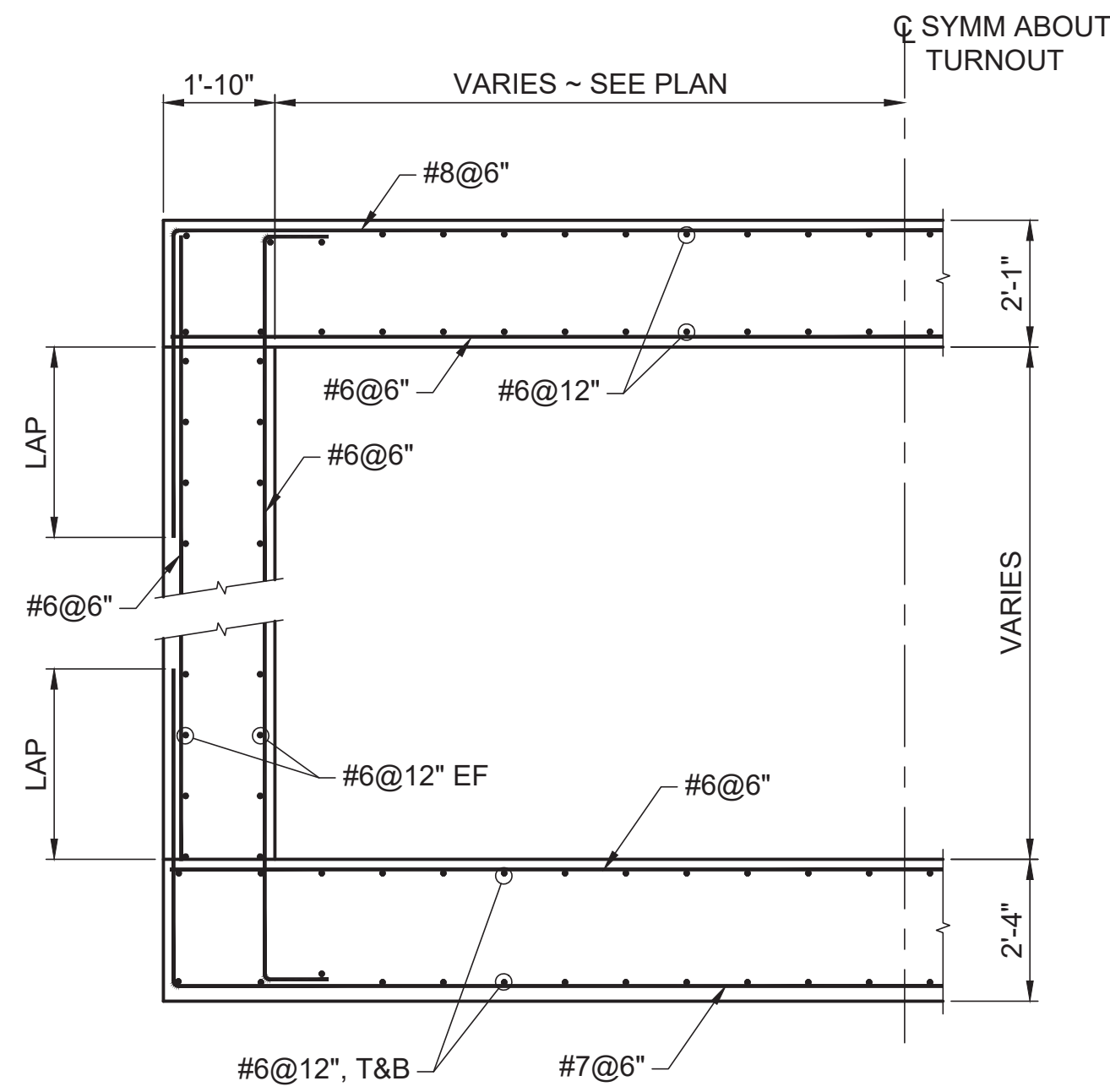
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
AQUEDUCT TURNOUT/TURN-IN
STRUCTURAL SECTIONS AND DETAILS
SHEET 2 OF 3

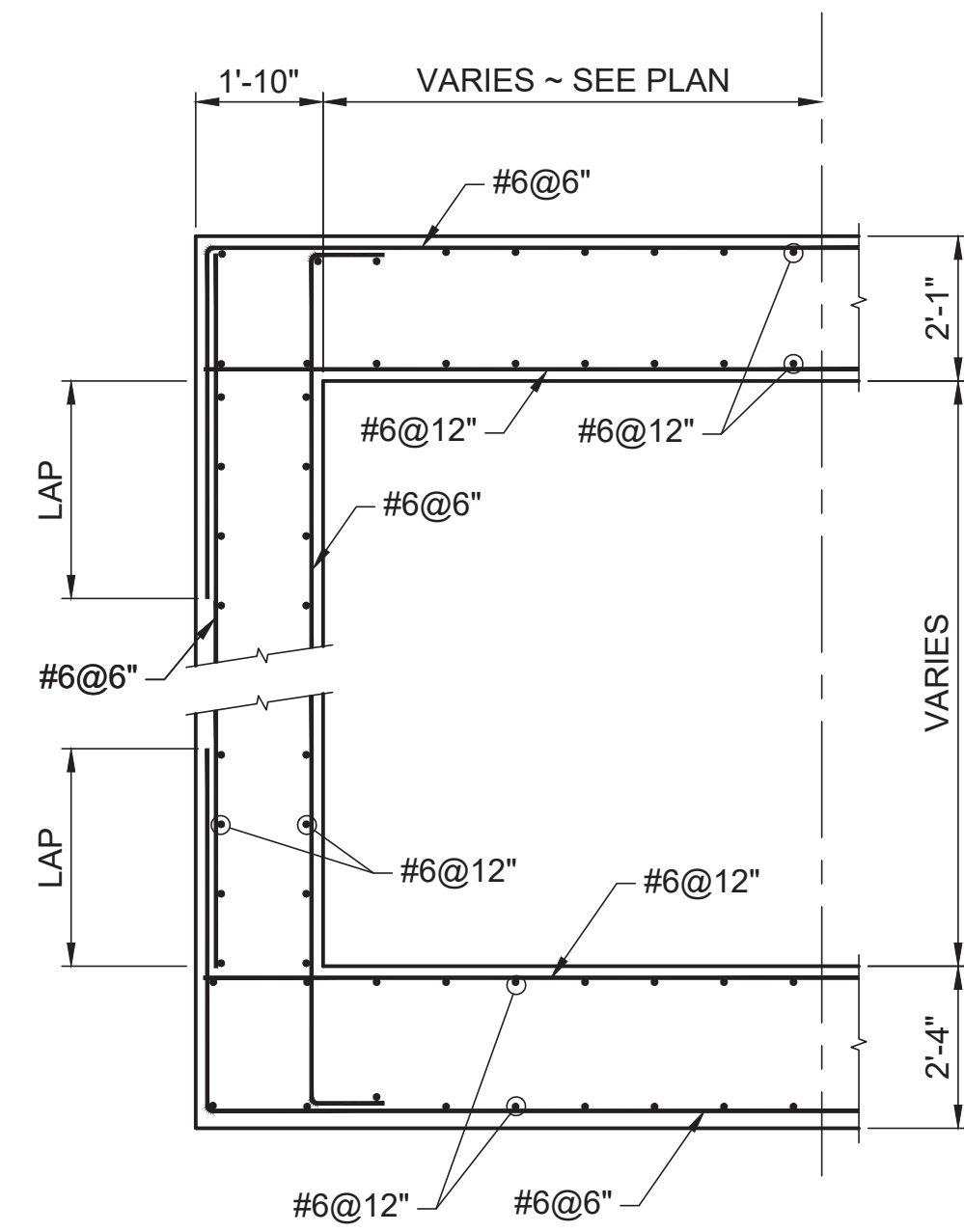
SHEET
S-03
20 of 54
SHEETS

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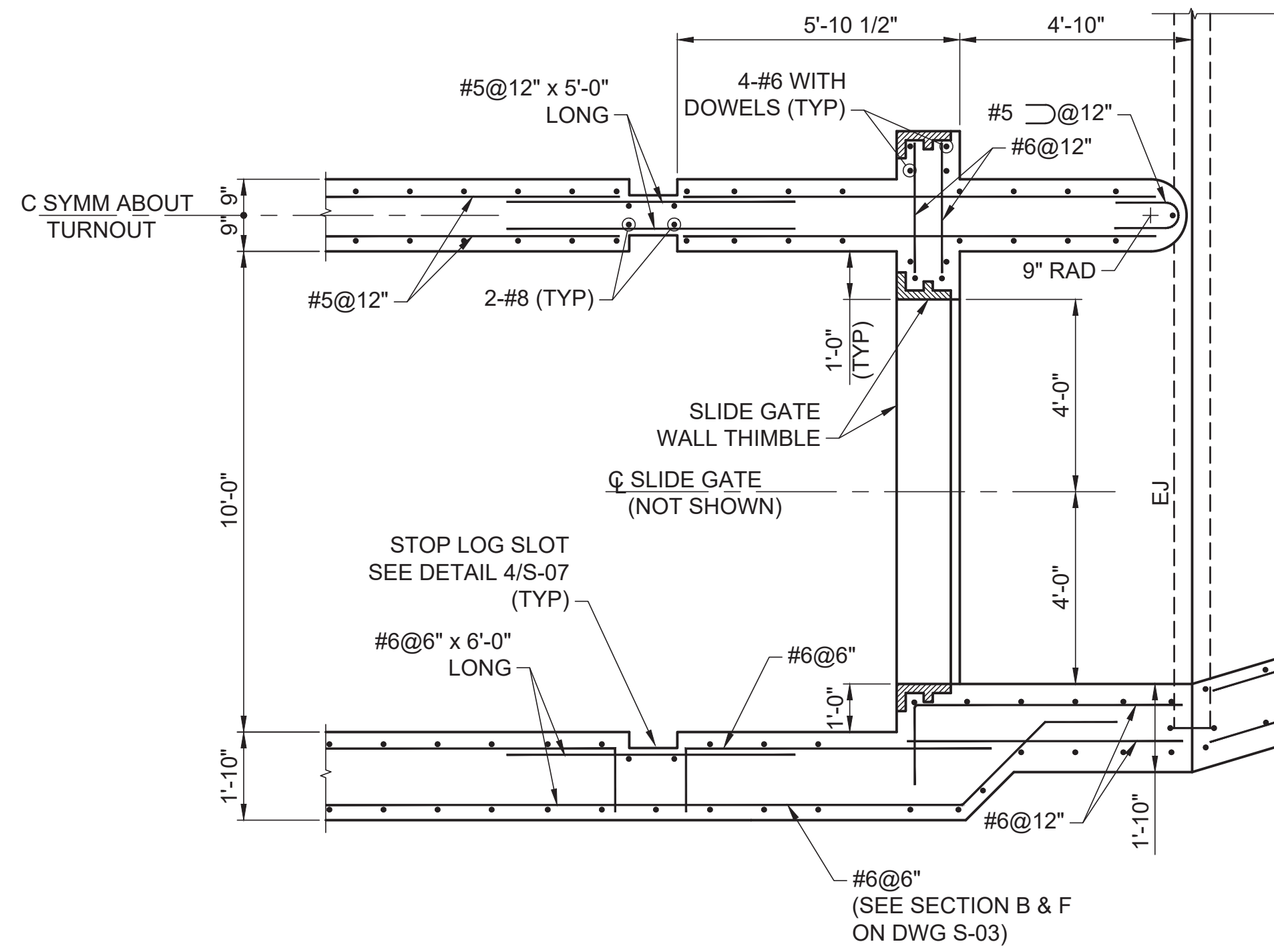
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



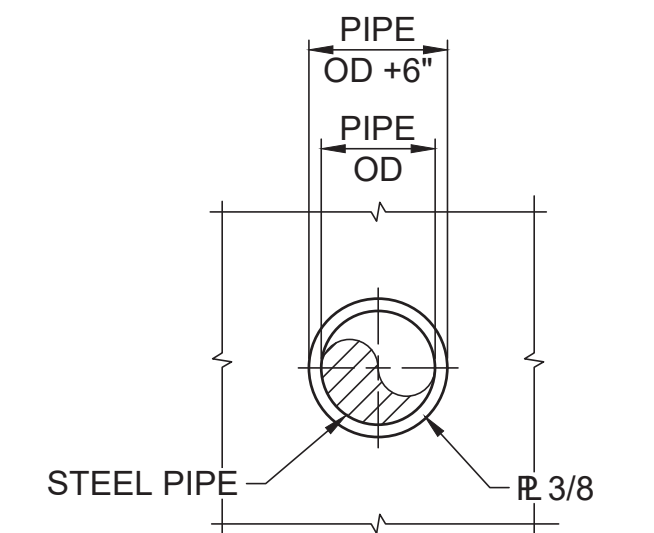
H SECTION
S-01 SCALE: 3/8"=1'-0"



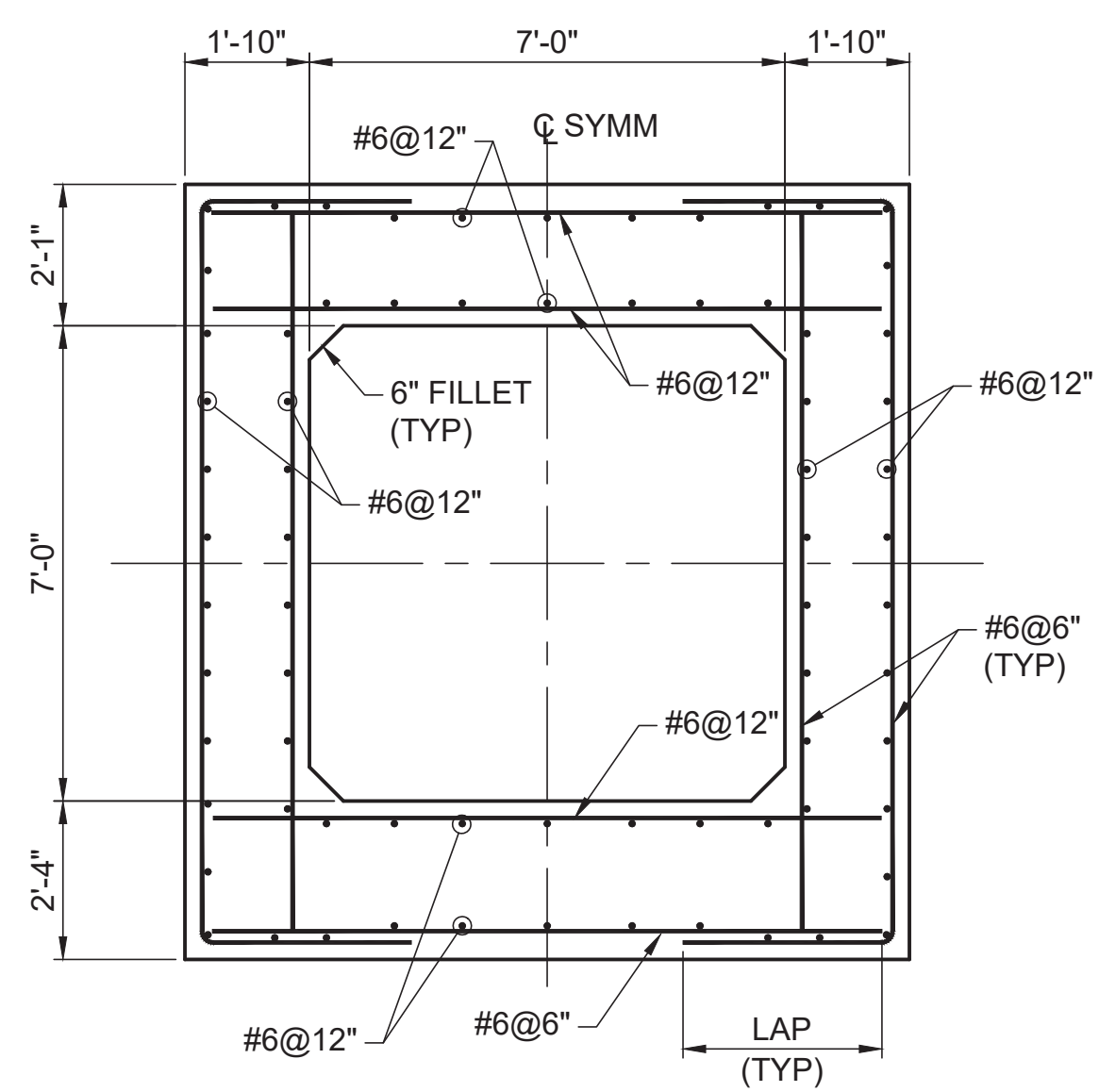
J SECTION
S-01 SCALE: 3/8"=1'-0"



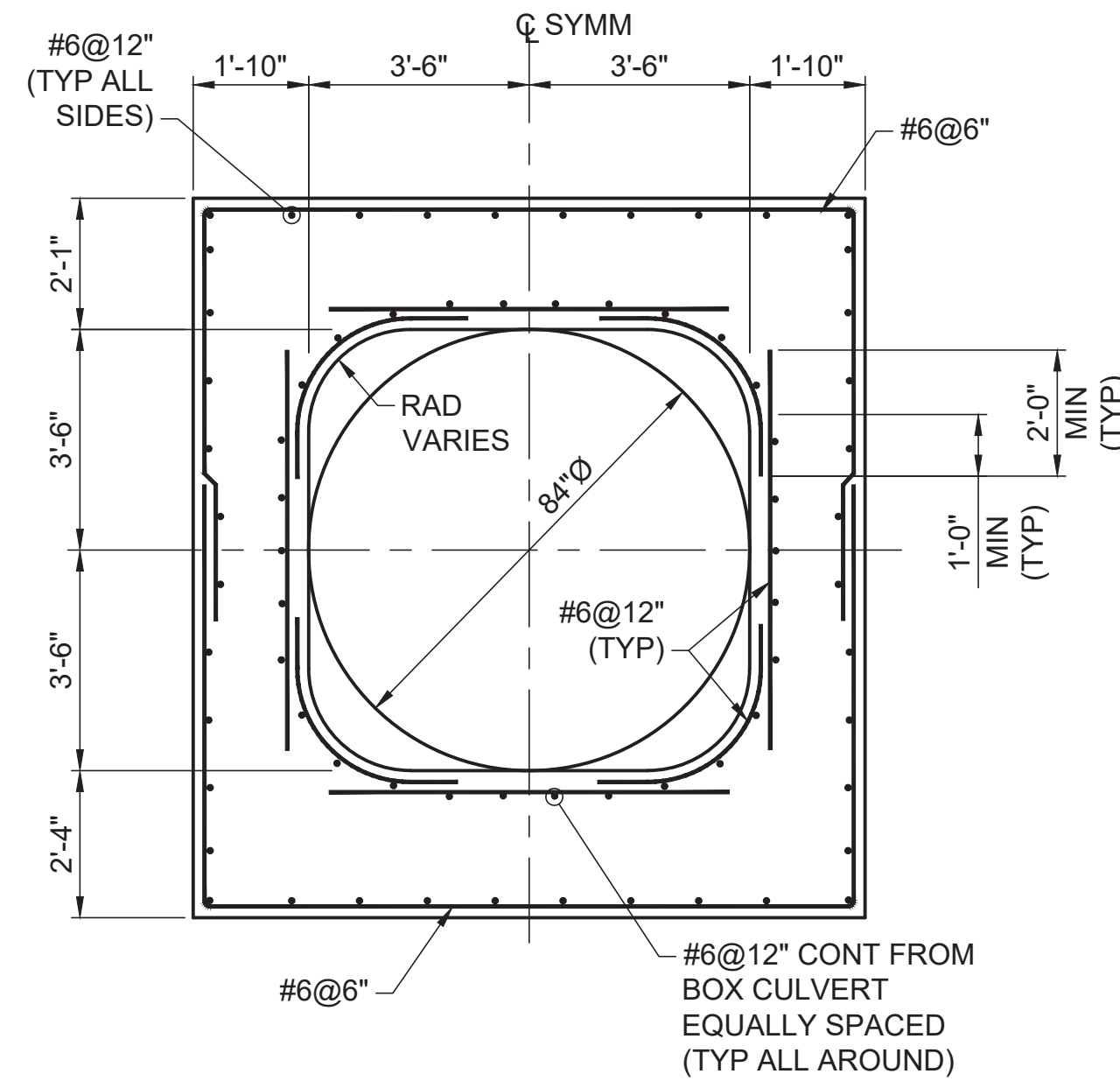
K SECTION (PARTIAL PLAN)
S-02 SCALE: 3/8"=1'-0"



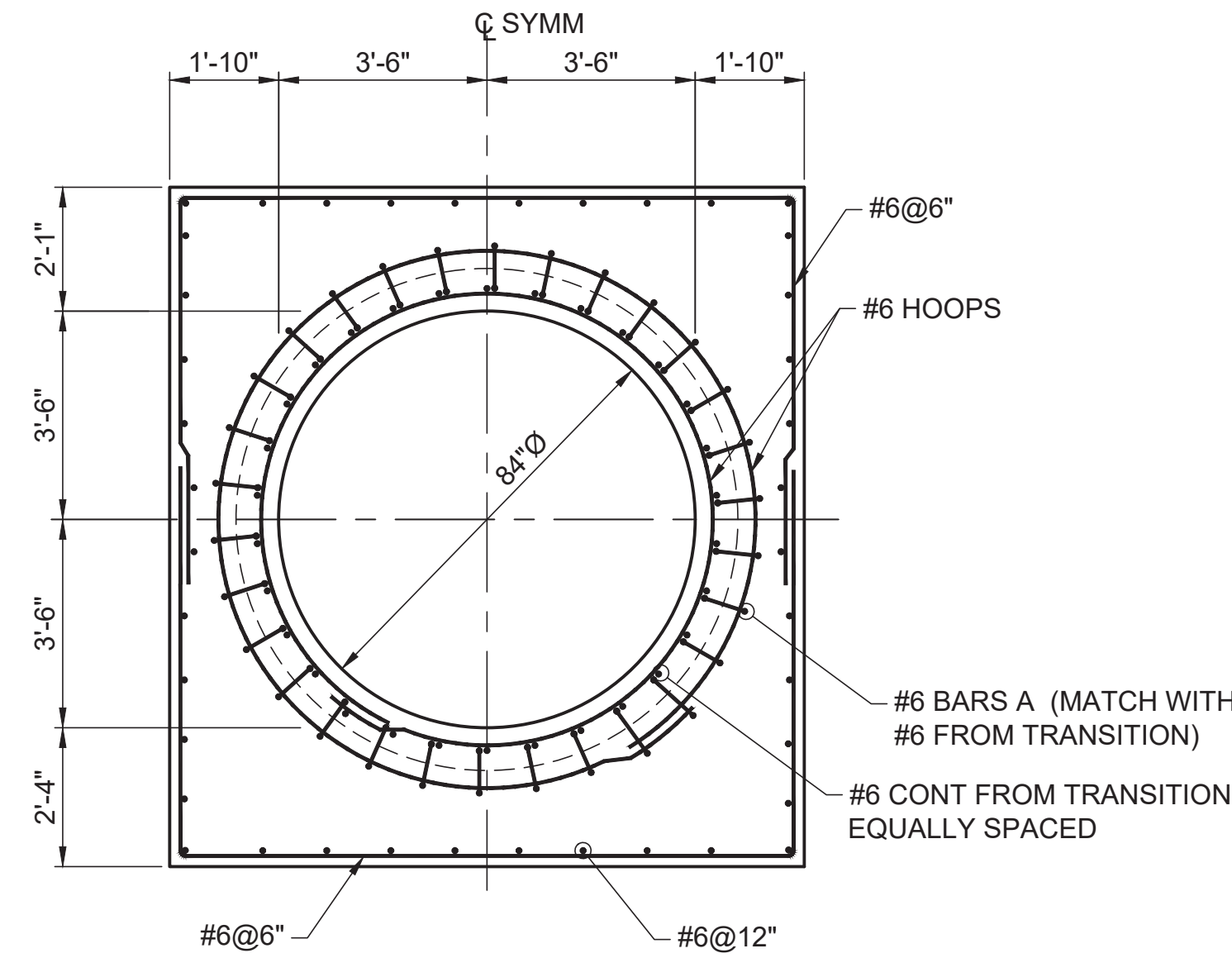
1 STEEL WEEP RING
NO SCALE



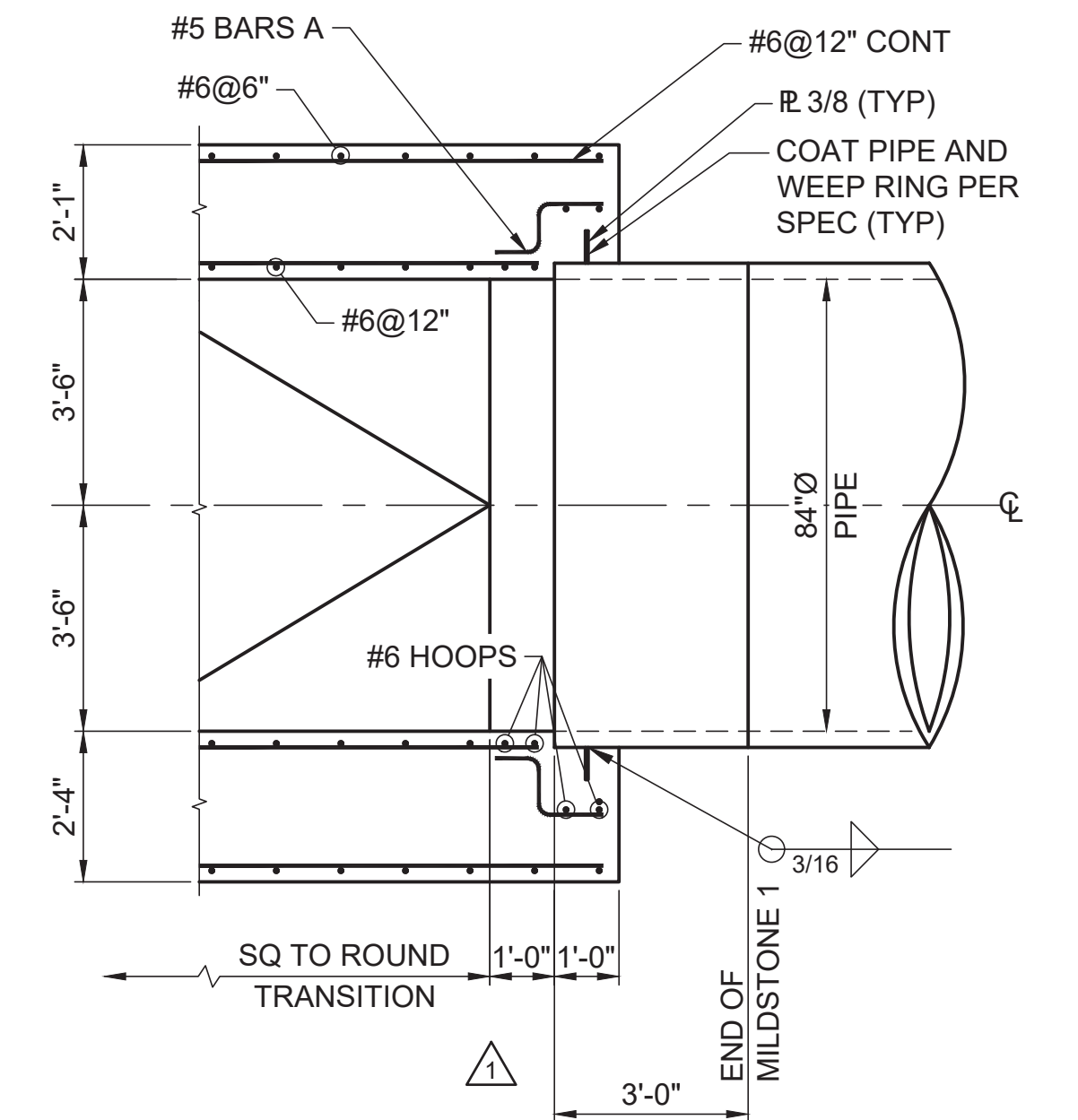
L SECTION
S-01 SCALE: 3/8"=1'-0"



M SECTION
S-01 SCALE: 3/8"=1'-0"



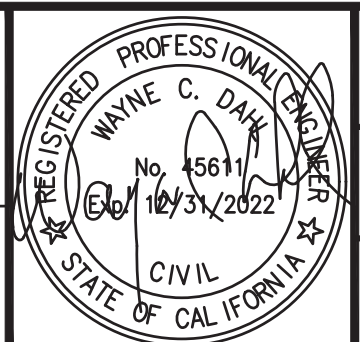
N SECTION
S-01 SCALE: 3/8"=1'-0"



2 DETAIL
S-01 SCALE: 3/8"=1'-0"

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NO.	DATE	REVISIONS	APPROVED
1	1/5/21	ADDENDUM NO. 3	



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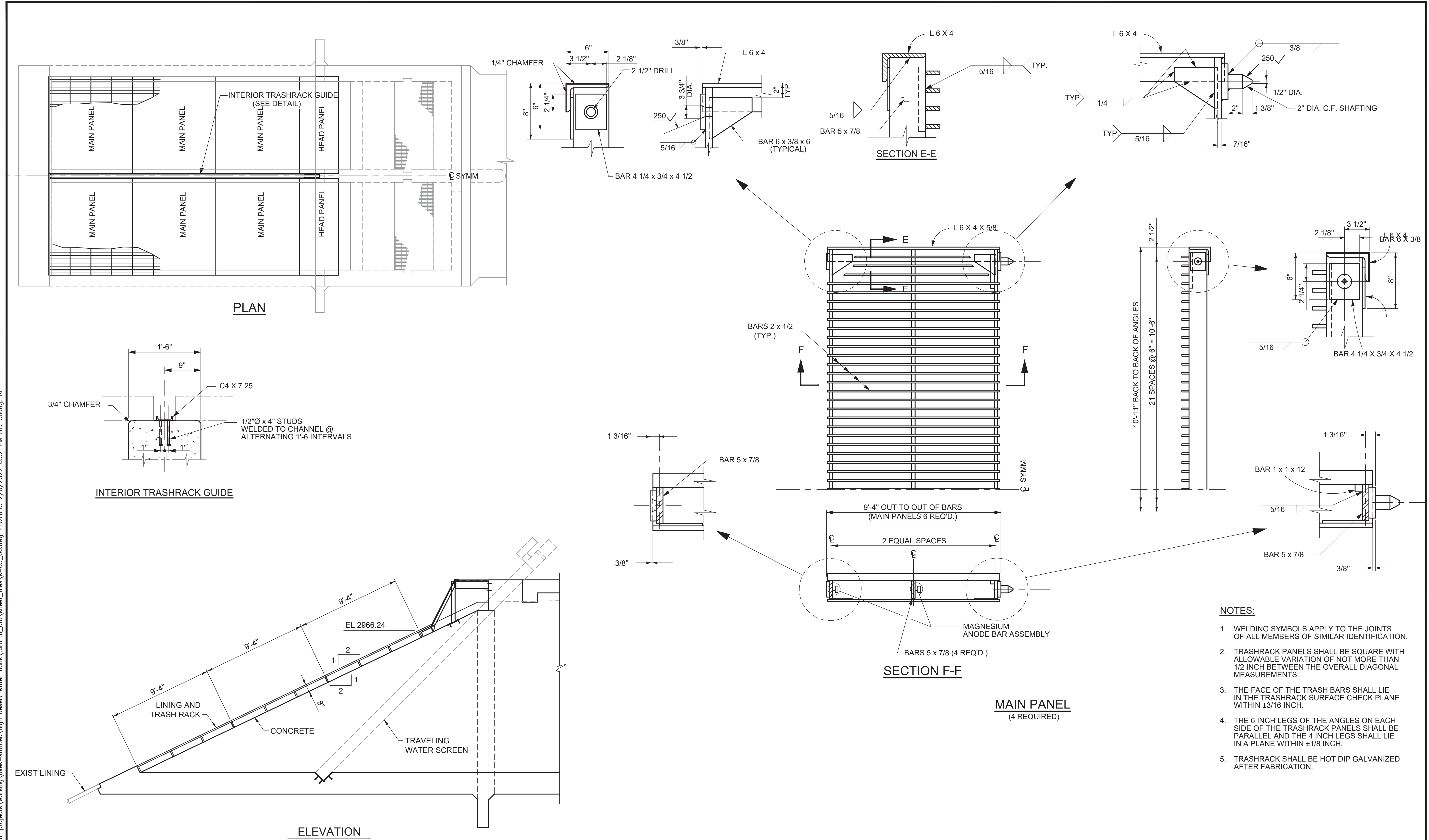
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
AQUEDUCT TURNOUT/TURN-IN
STRUCTURAL SECTIONS AND DETAILS
SHEET 3 OF 3

SHEET
S-04
21 of 54
SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



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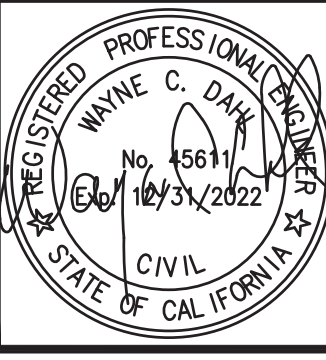
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

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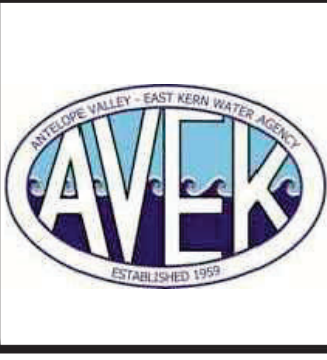
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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL

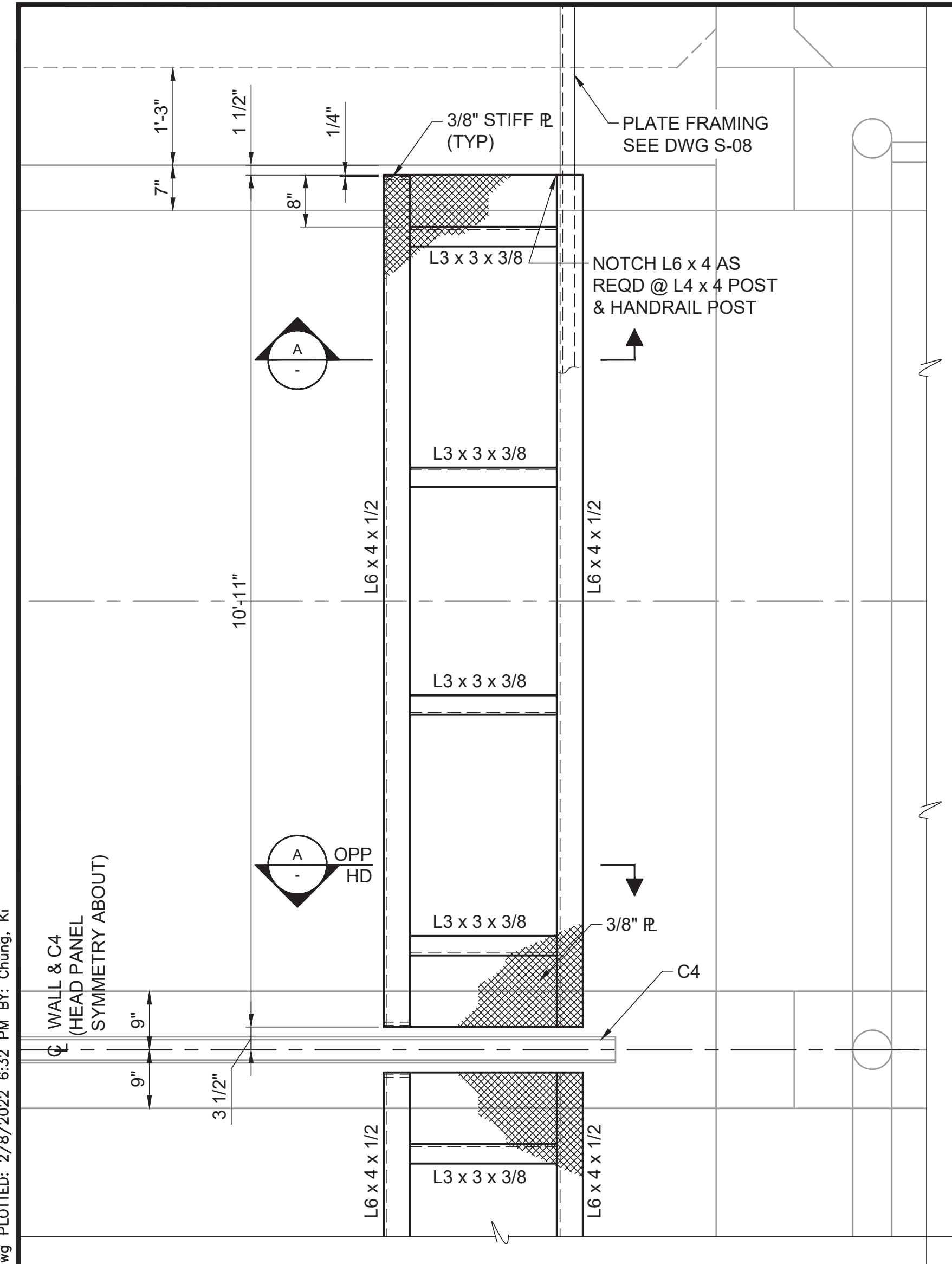
TRASHRACK DETAILS
SHEET 1 OF 2

SHEET
S-05

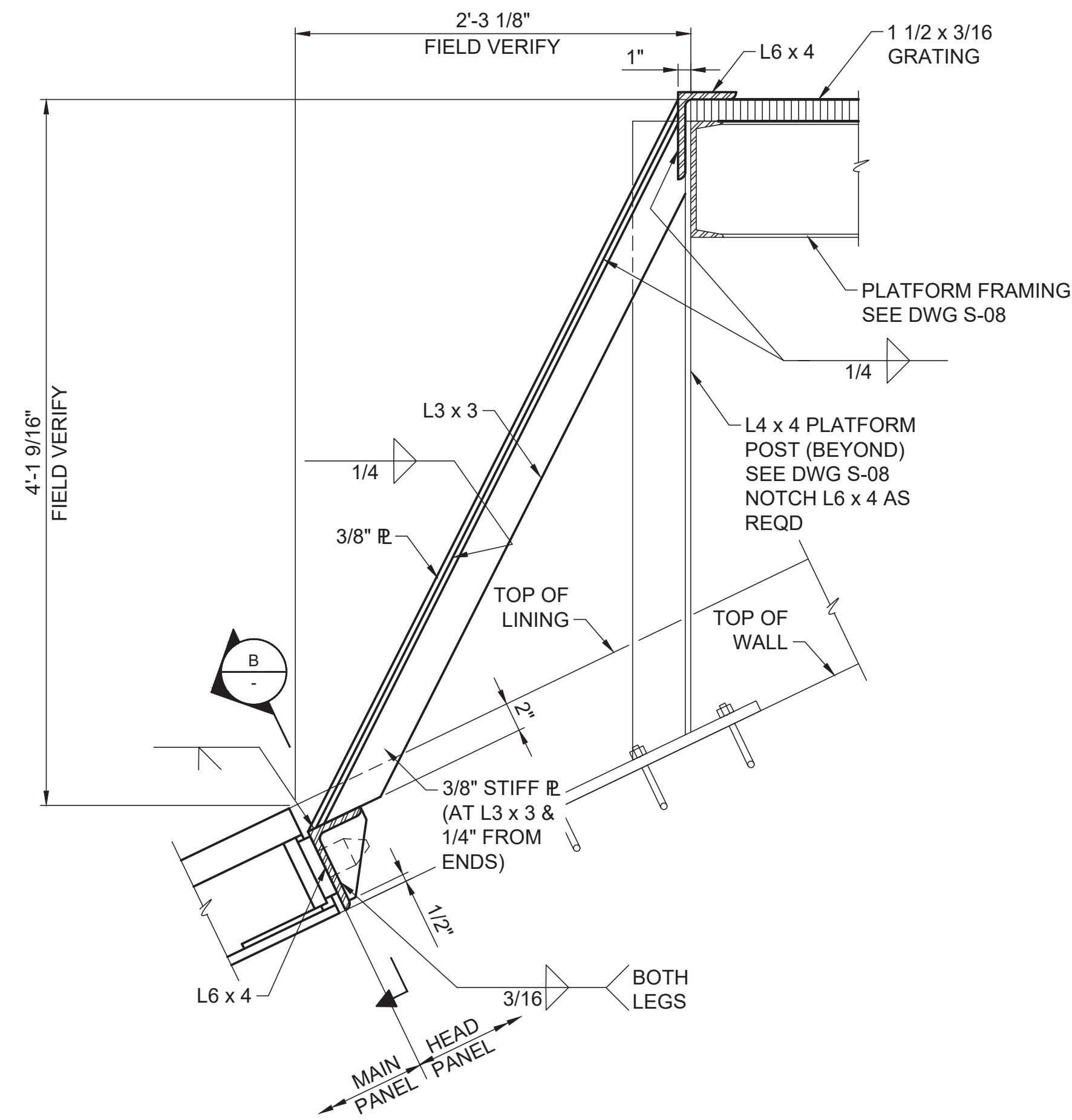
22 of 54
SHEETS

NOVEMBER 2021

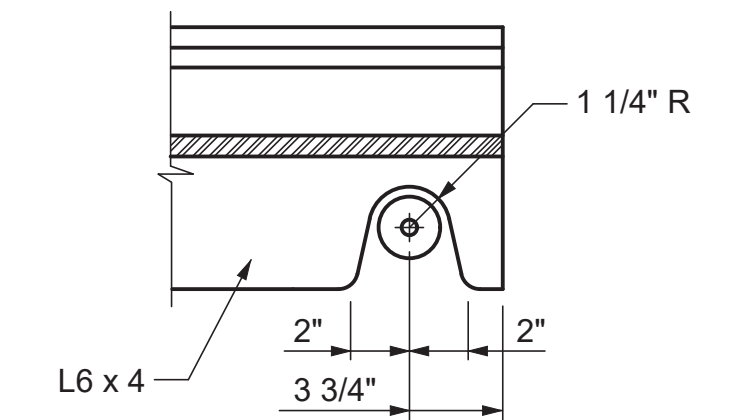
APPENDIX G



HEAD PANEL PLAN (2 REQD)
SCALE: 3/4" = 1'-0"

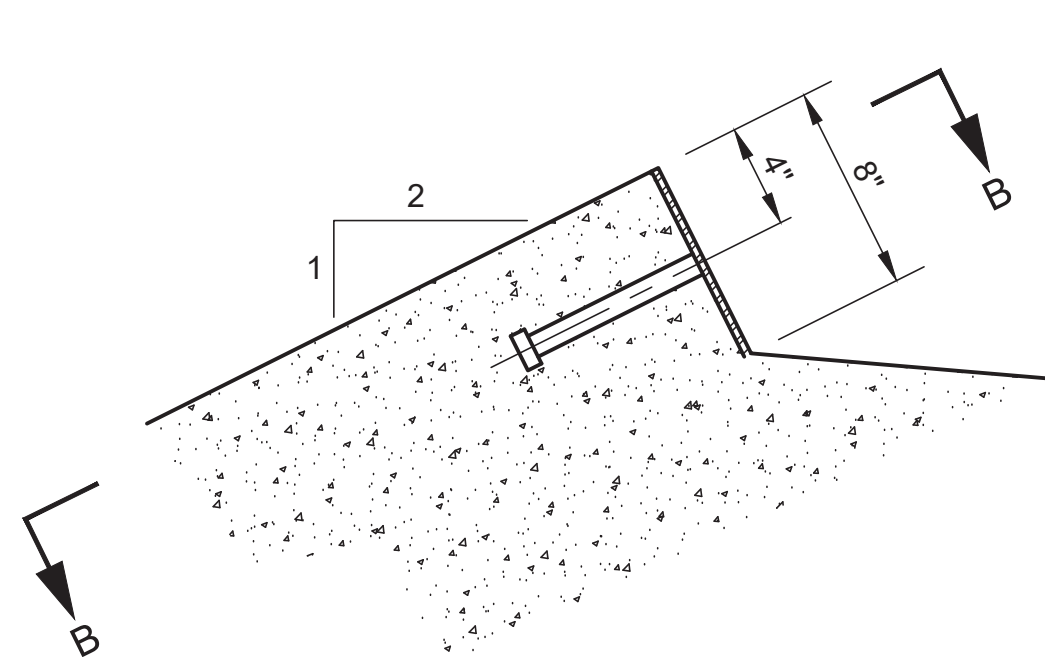


SECTION A
SCALE: 3"=1'-0"

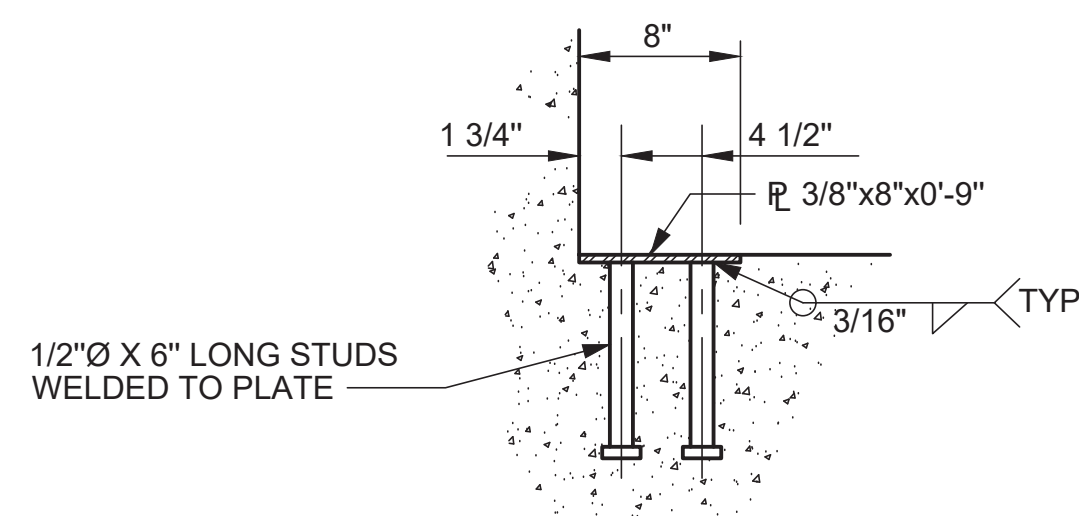


NOTE: MAKEUP PANEL FRAMING NOT SHOWN FOR CLARITY.

SECTION B
NO SCALE



TRASHRACK SEAT DETAIL



TRASHRACK SEAT

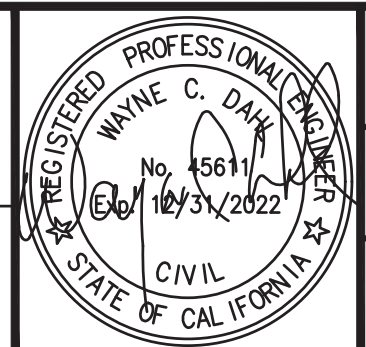
SECTION B-B

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL

TRASHRACK DETAILS
SHEET 2 OF 2

SHEET
S-06

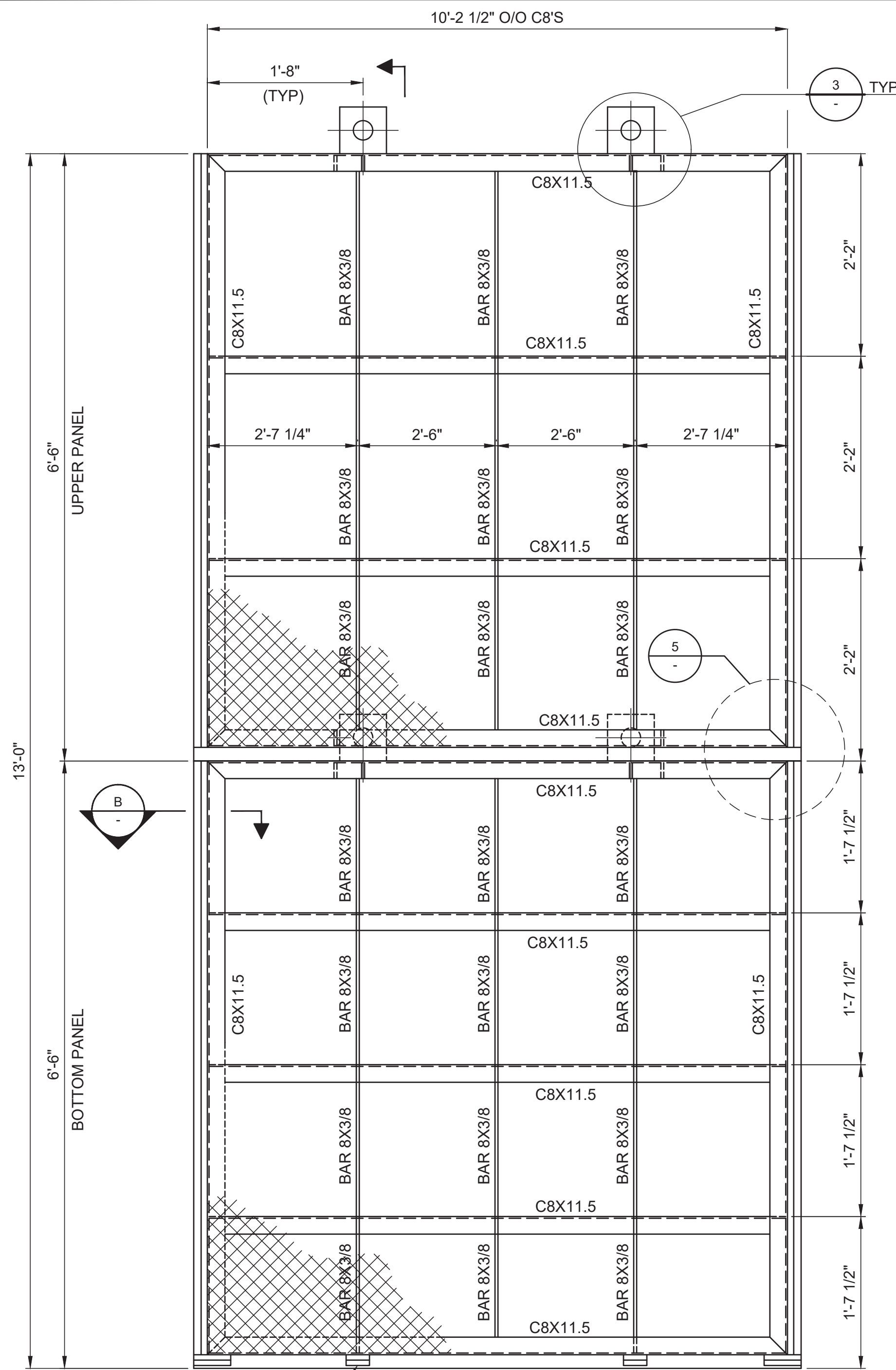
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SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

NOVEMBER 2021

APPENDIX G

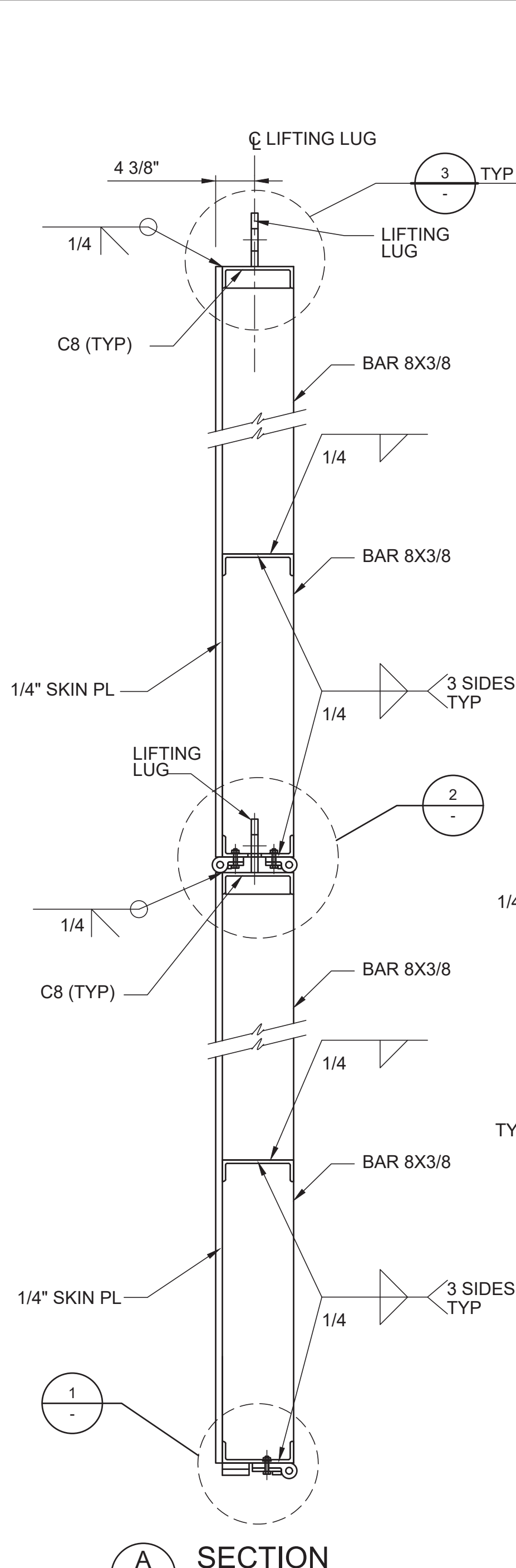


2 PL 11/16 X 3 X 0'-6"
(TYP 4 PLACES)

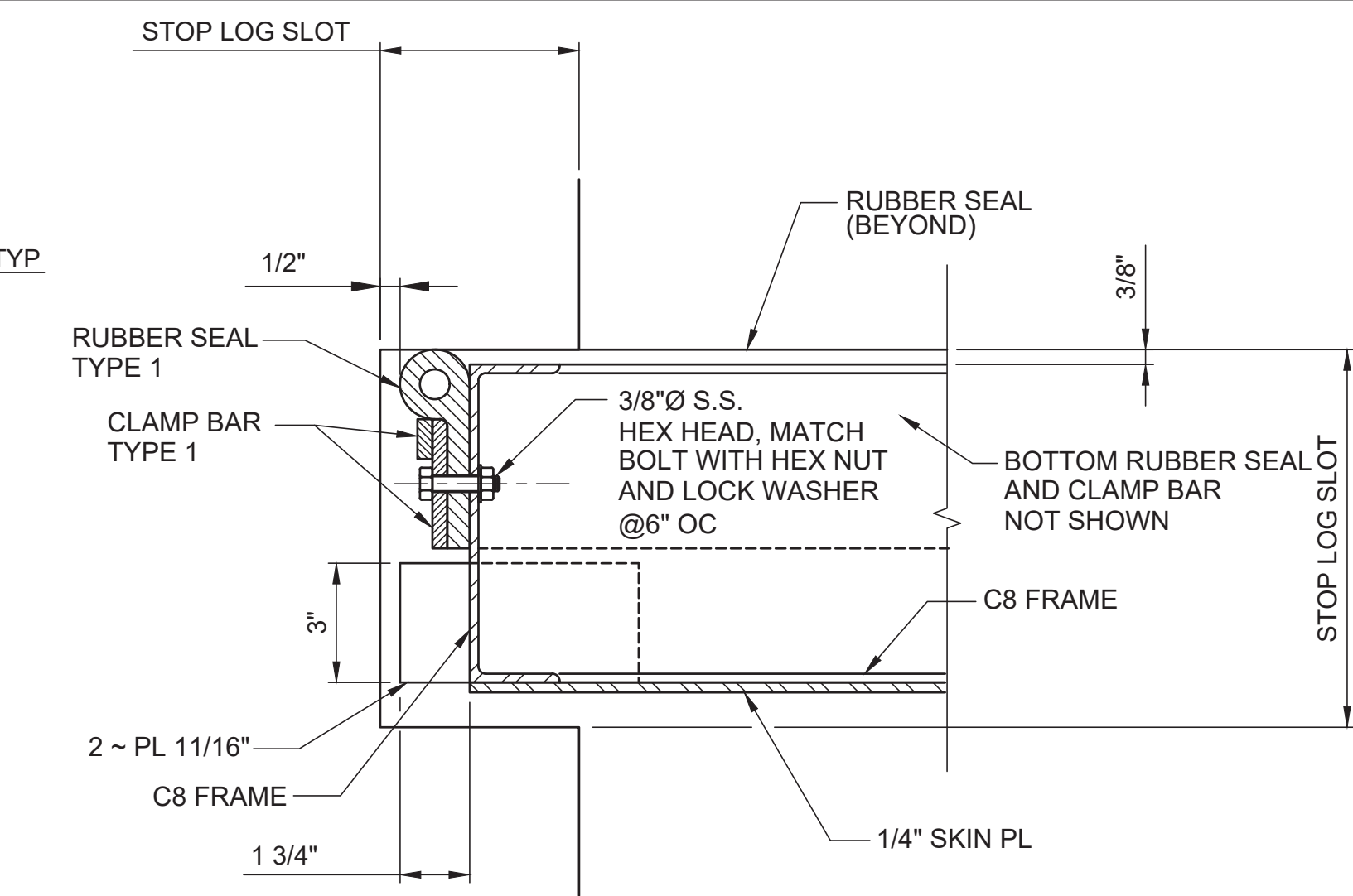
STOP LOG ELEVATION
NO SCALE

NOTES:

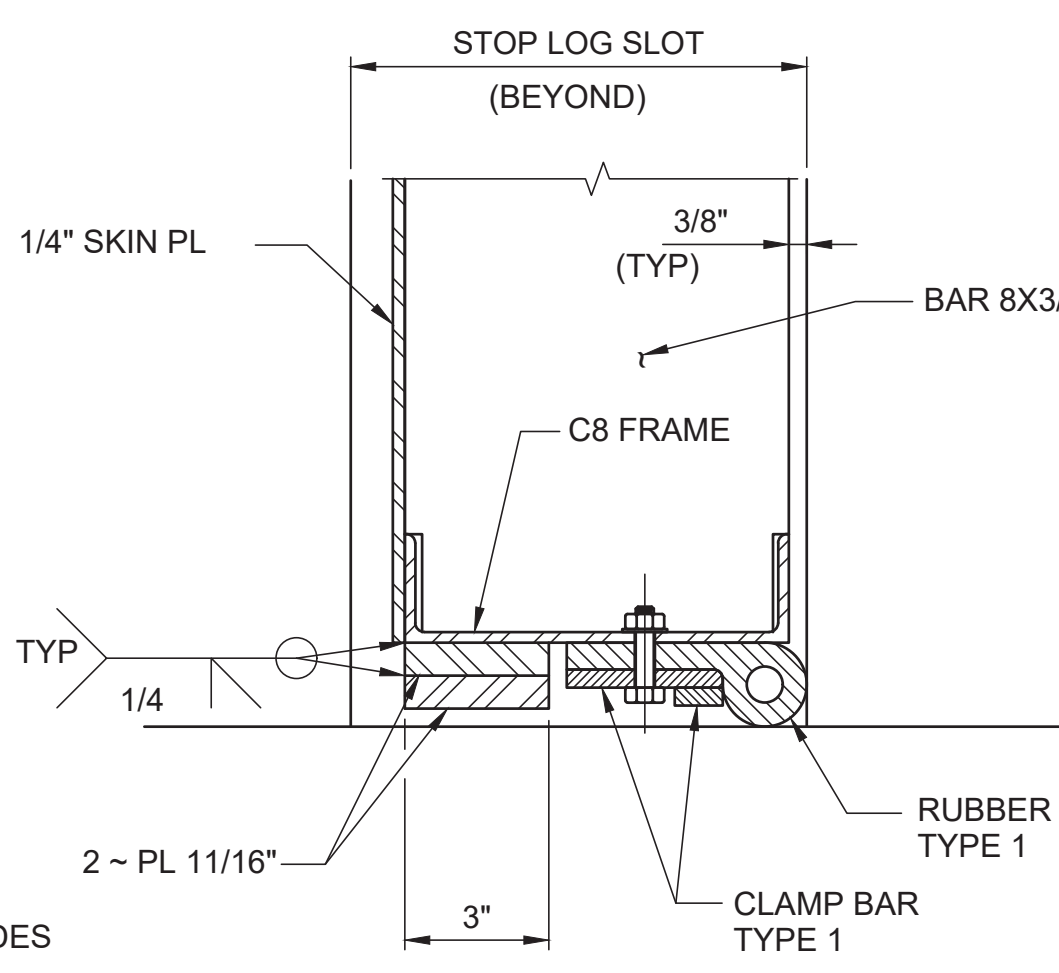
1. ALL PLATES AND SHAPES SHALL BE ASTM A36 STEEL AND SHALL BE HOT DIP GALVANIZED AFTER FABRICATION UNLESS NOTED OTHERWISE.
2. SKIN PLATE JOINTS SHALL BE WATER TIGHT WITH FULL PENETRATION BUTT WELDS.
3. WELDS SHALL BE GROUND FLUSH WHERE IN CONTACT WITH SEALS.
4. RUBBER SEAL SHALL HAVE CONTINUOUS WATER TIGHT JOINTS. JOINTS SHALL BE VULCANIZED.
5. SEAL CLAMP BARS SHALL HAVE CONTINUOUS WATER TIGHT JOINTS WITH FULL PENETRATION BUTT WELDS.
6. ALL BOLTS, NUTS, AND WASHERS SHALL BE TYPE 316 STAINLESS STEEL, CLASS 2, CONFORMING TO ASTM A193 FOR BOLTS AND TO ASTM A194 FOR NUTS. ALL WELDS TO BE CONTINUOUS, WITH E70XX WELD ELECTRODE.



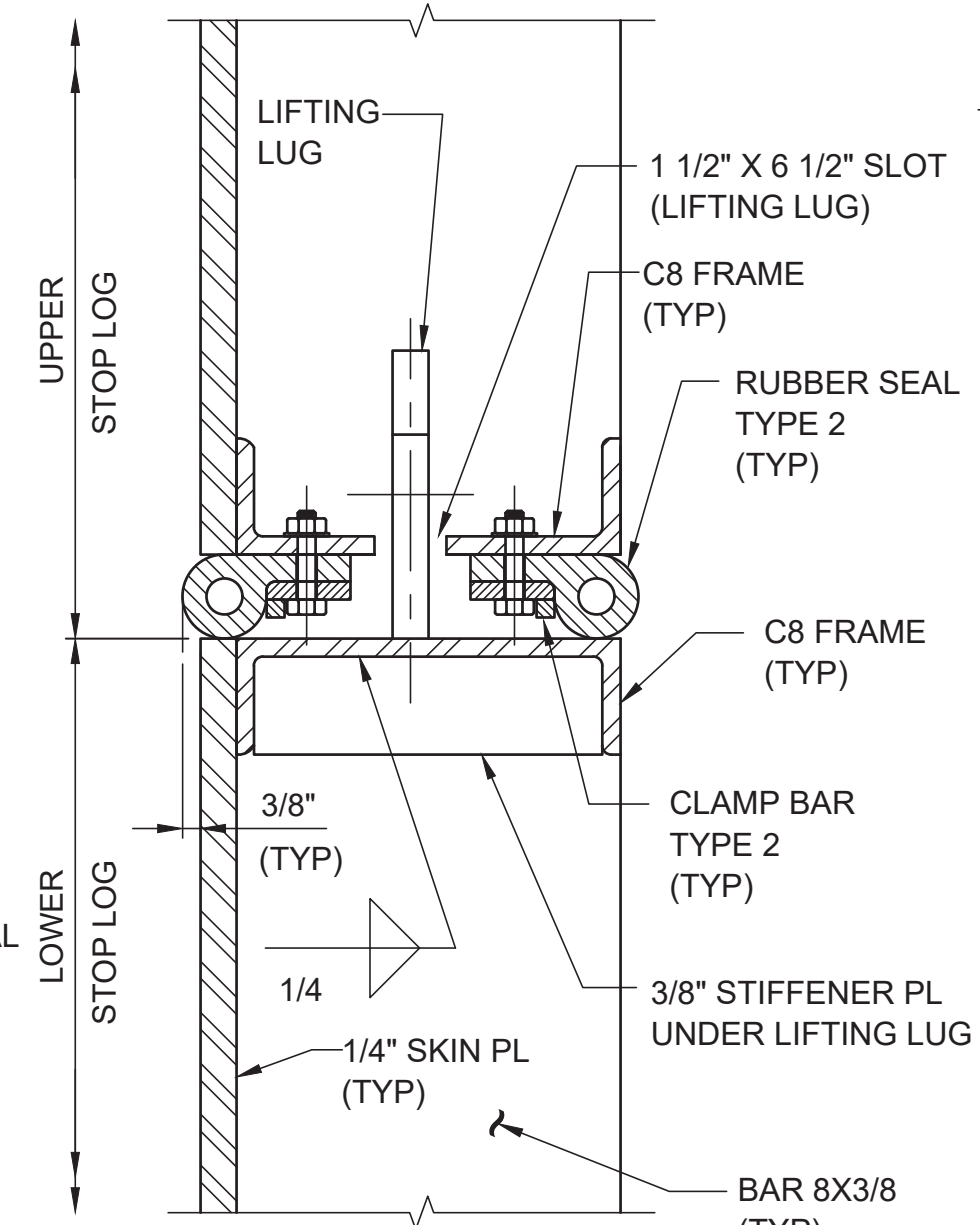
A SECTION
NO SCALE



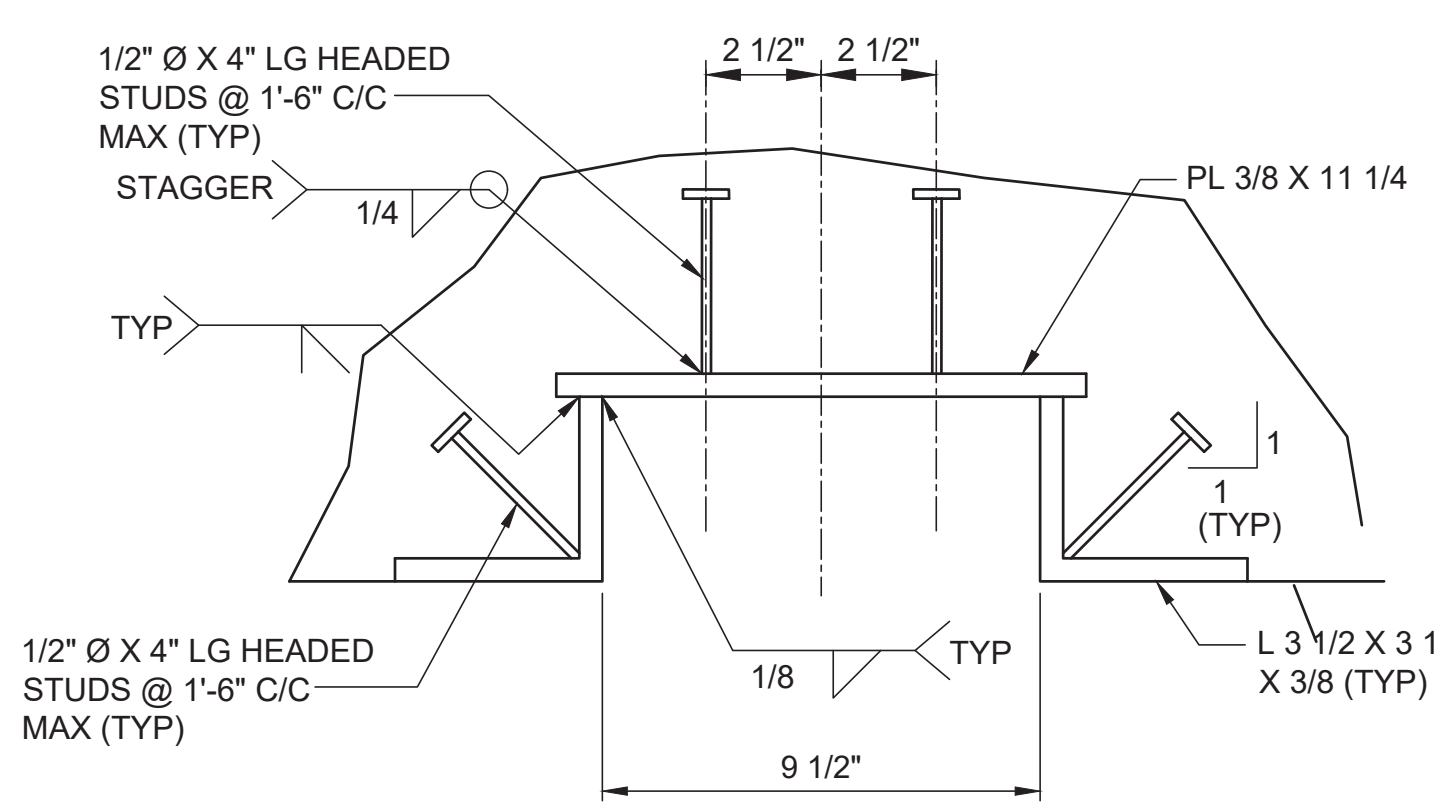
B SECTION
NO SCALE



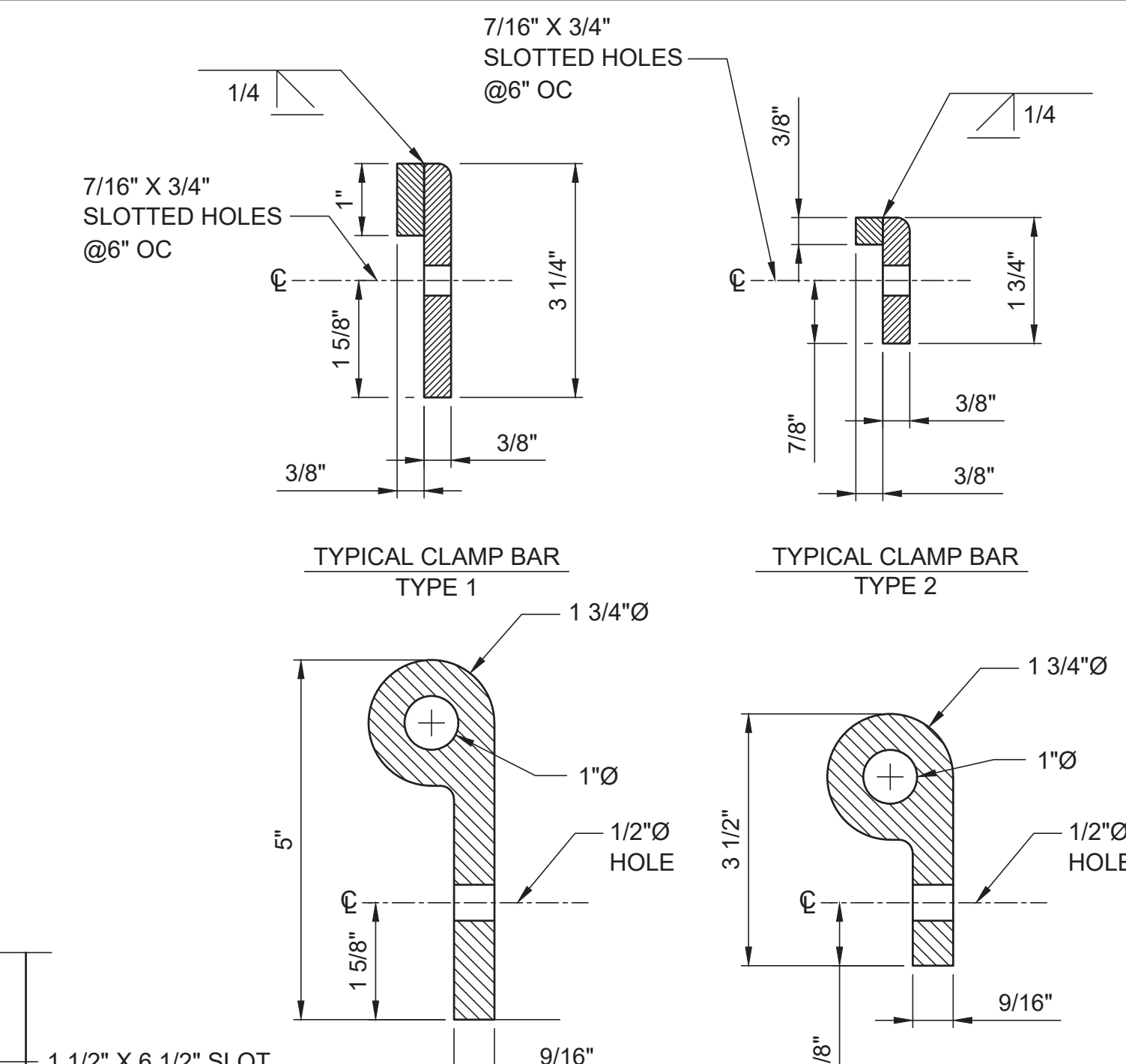
1 DETAIL
NO SCALE



2 DETAIL
NO SCALE



4 DETAIL
NO SCALE

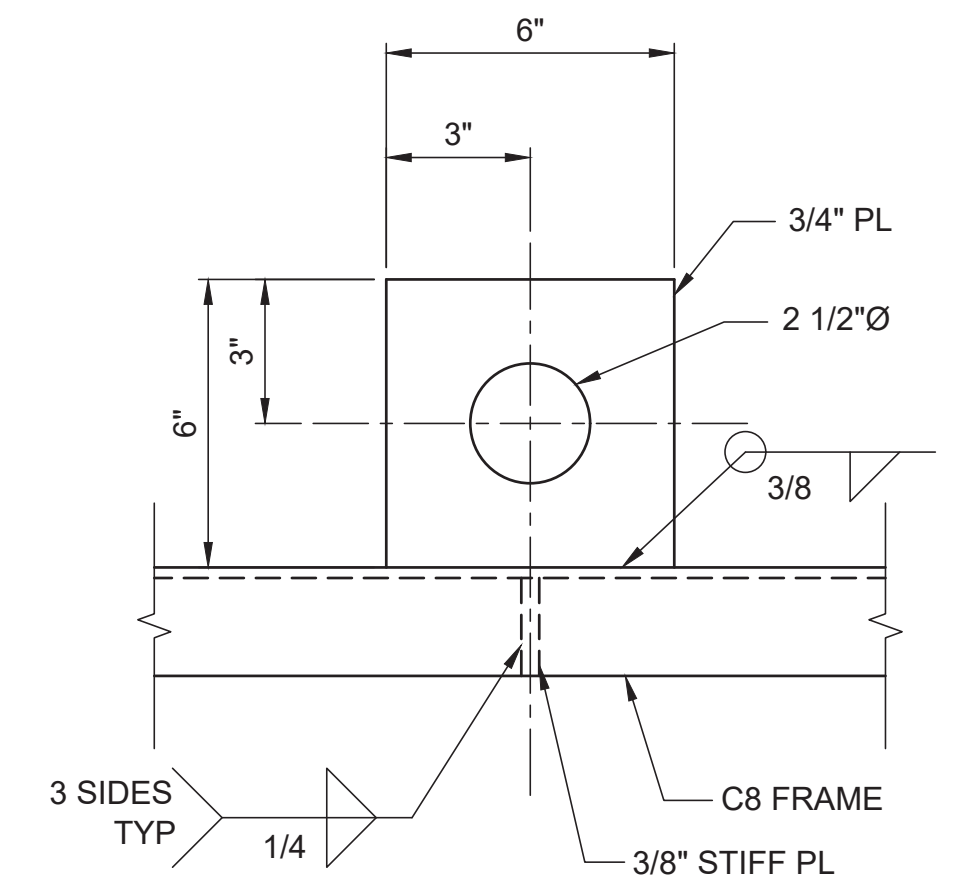


TYPICAL CLAMP BAR TYPE 1

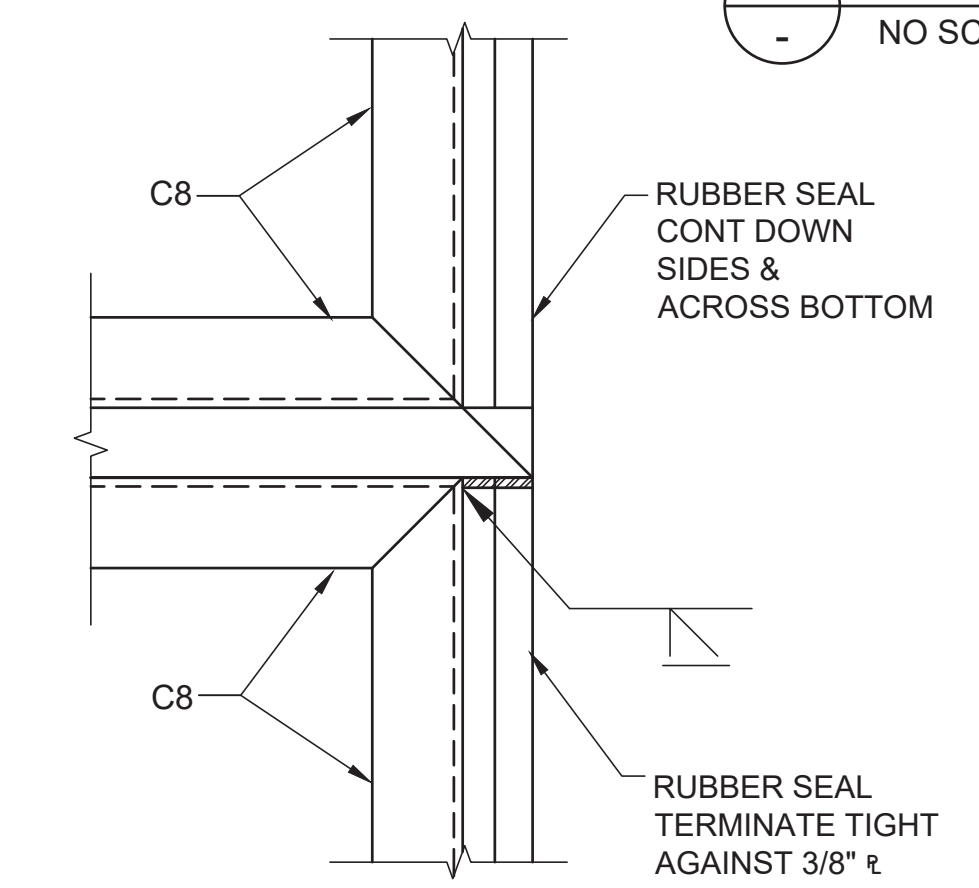
TYPICAL CLAMP BAR TYPE 2

TYPICAL RUBBER SEAL TYPE 1

TYPICAL RUBBER SEAL TYPE 2



3 DETAIL
NO SCALE



4 DETAIL
NO SCALE

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REGISTERED PROFESSIONAL ENGINEER
WAYNE C. DAHL
No. 45611
Exp. 10/31/2022
CIVIL
STATE OF CALIFORNIA

WAYNE C. DAHL
NAME
DESIGN TEAM LEAD
R.C.E. 45611
11/10/21
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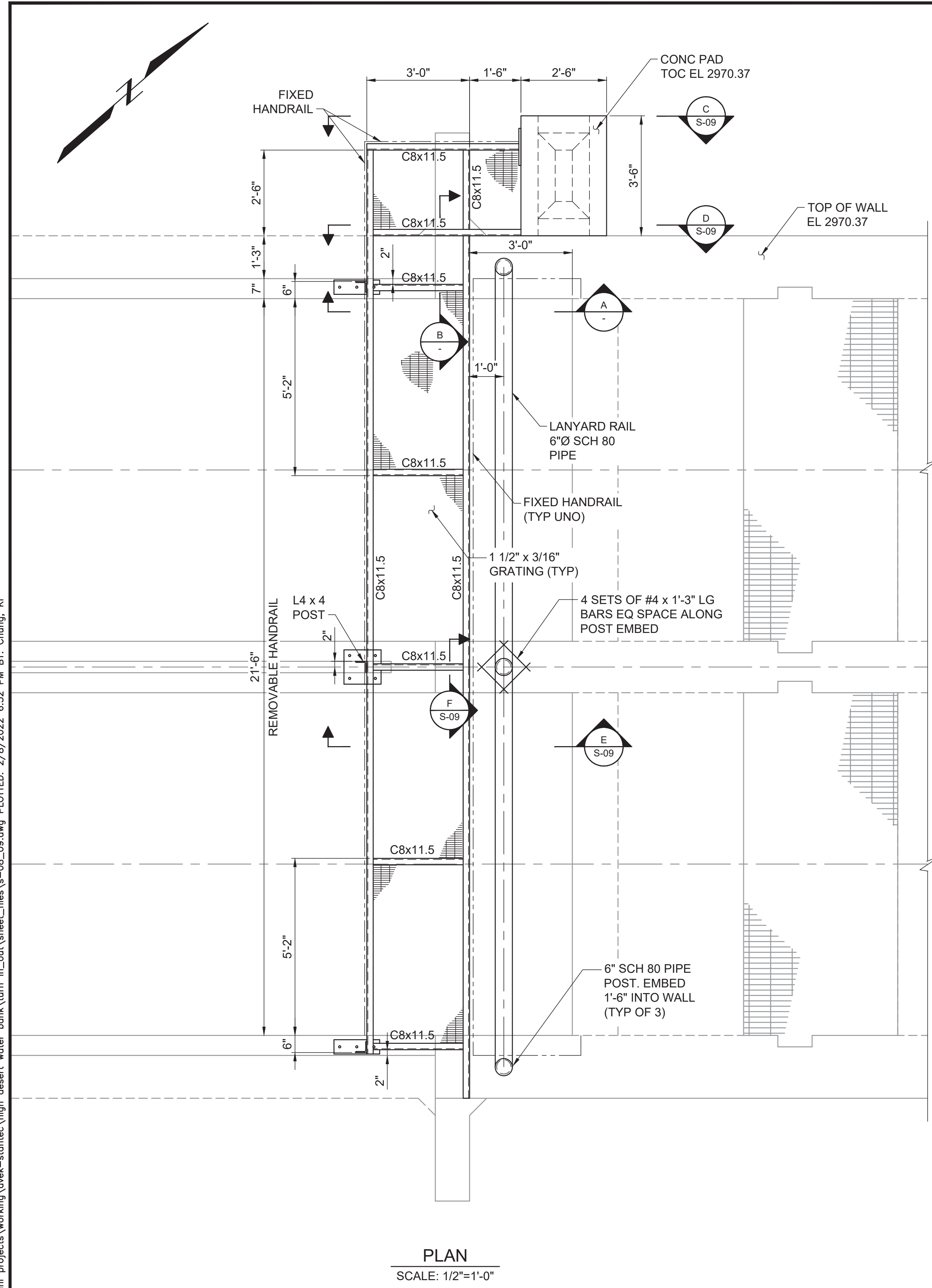
AVER
ANTHELOPE VALLEY - EAST KERN WATER AGENCY

ANTHELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

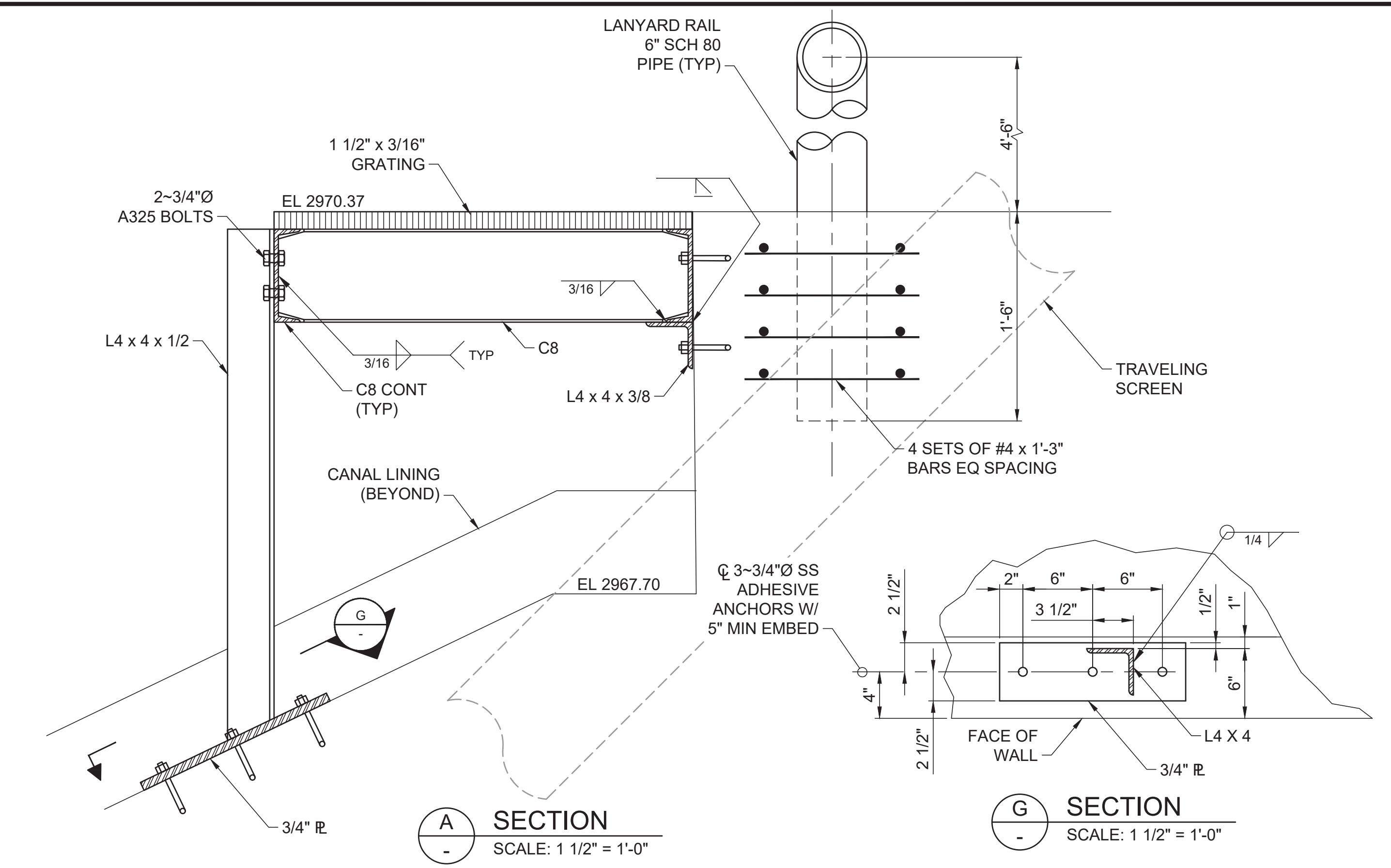
STRUCTURAL
STOP LOG ELEVATION, SECTIONS
AND DETAILS

SHEET
S-07
24 of 54
SHEETS

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN
NOVEMBER 2021

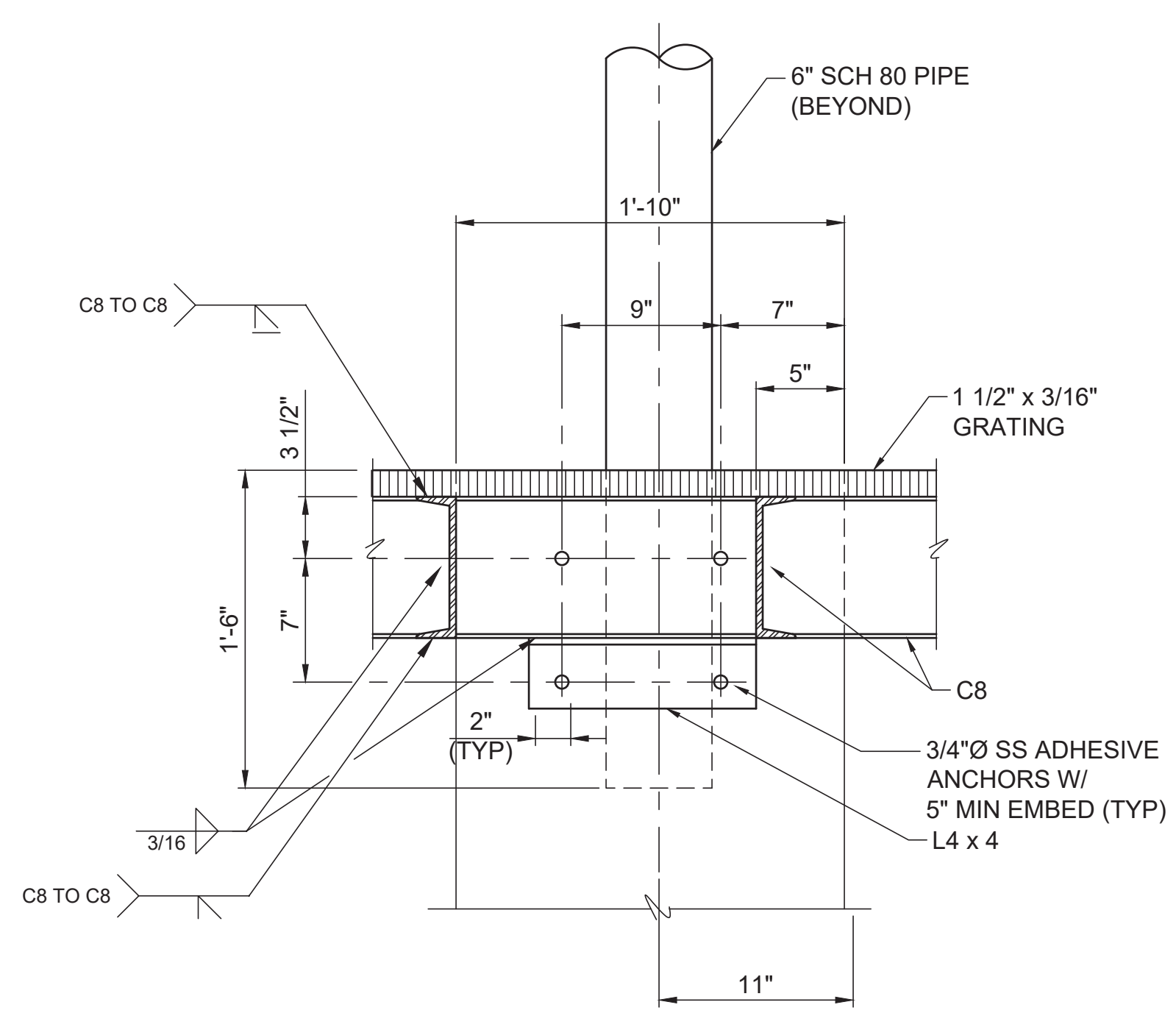


PLAN
SCALE: 1/2"=1'-0"



A SECTION
SCALE: 1 1/2" = 1'-0"

G SECTION
SCALE: 1 1/2" = 1'-0"



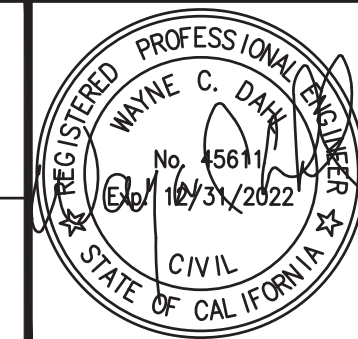
B SECTION
SCALE: 1 1/2" = 1'-0"

CONFORMED

NO.	DATE	REVISIONS	APPROVED

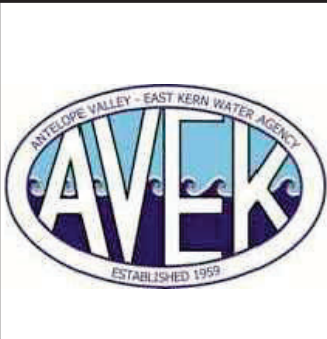
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R.C.E. 45611
11/10/21
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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL

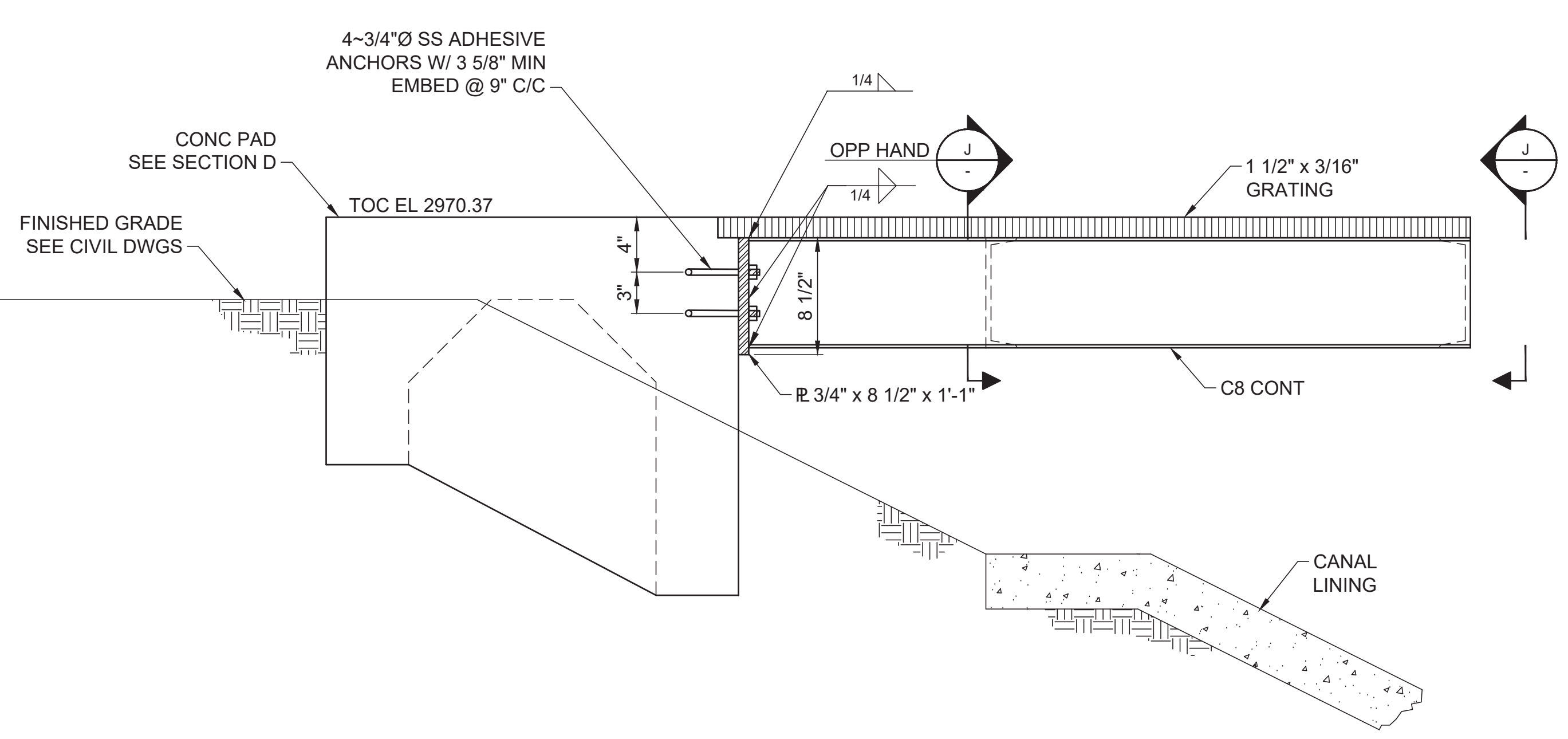
TRASH RACK ACCESS PLATFORM
PLAN AND SECTIONS

SHEET
S-08

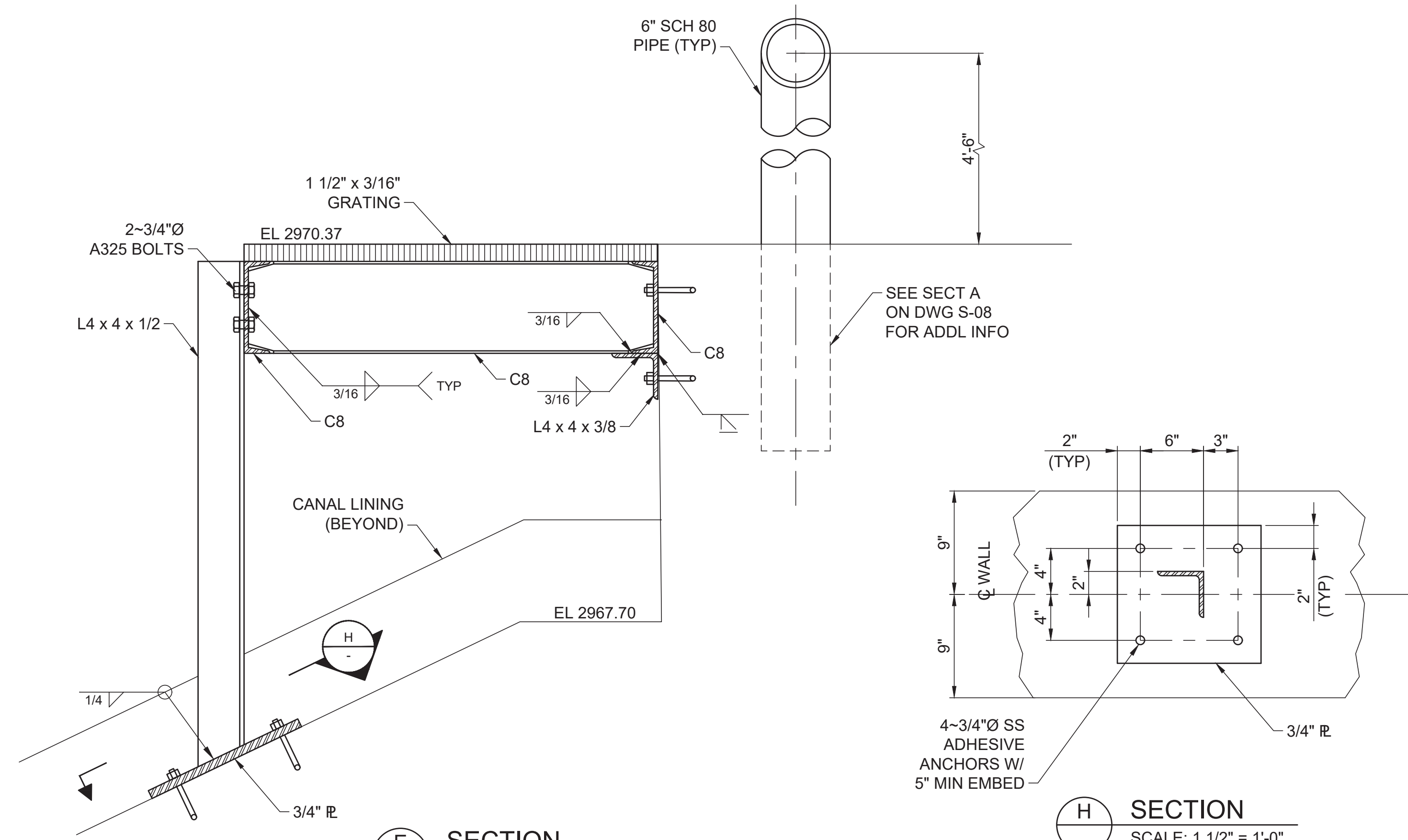
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SHEETS

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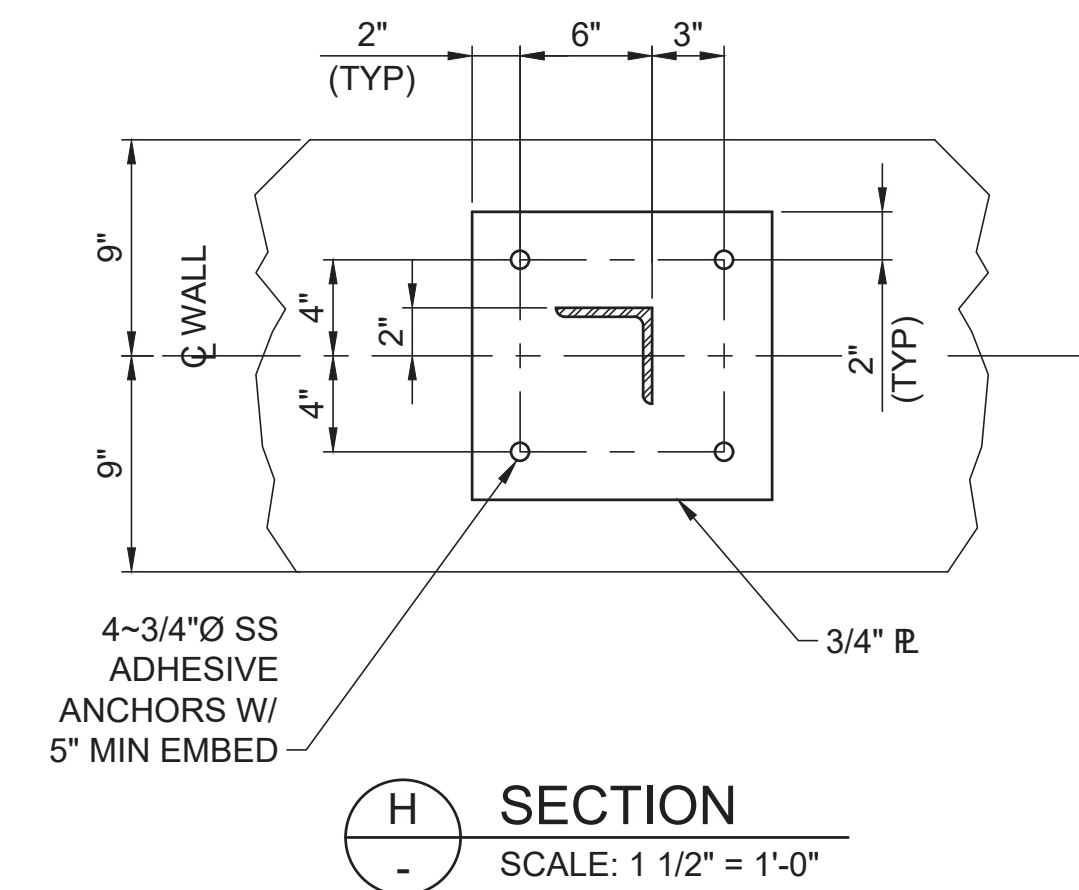
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



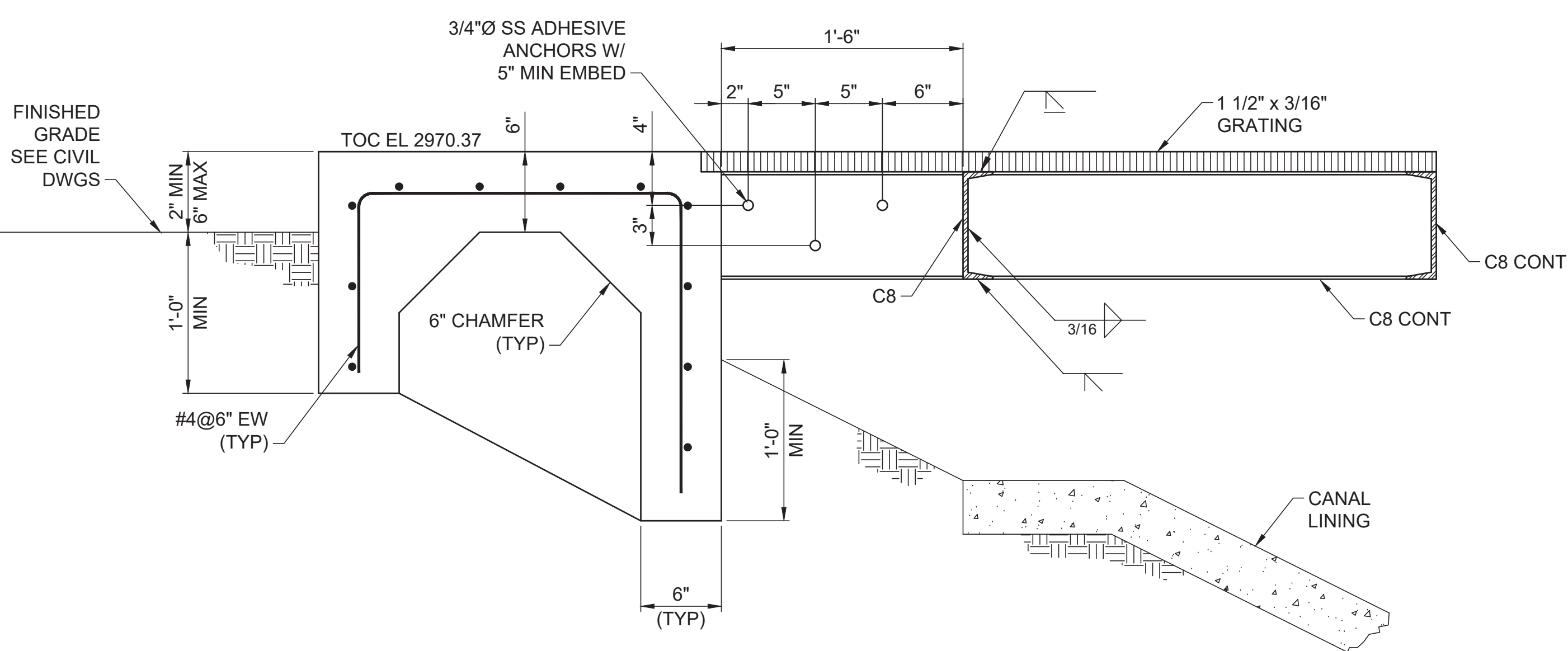
C
SECTION
S-08 SCALE: 1 1/2" = 1'-0"



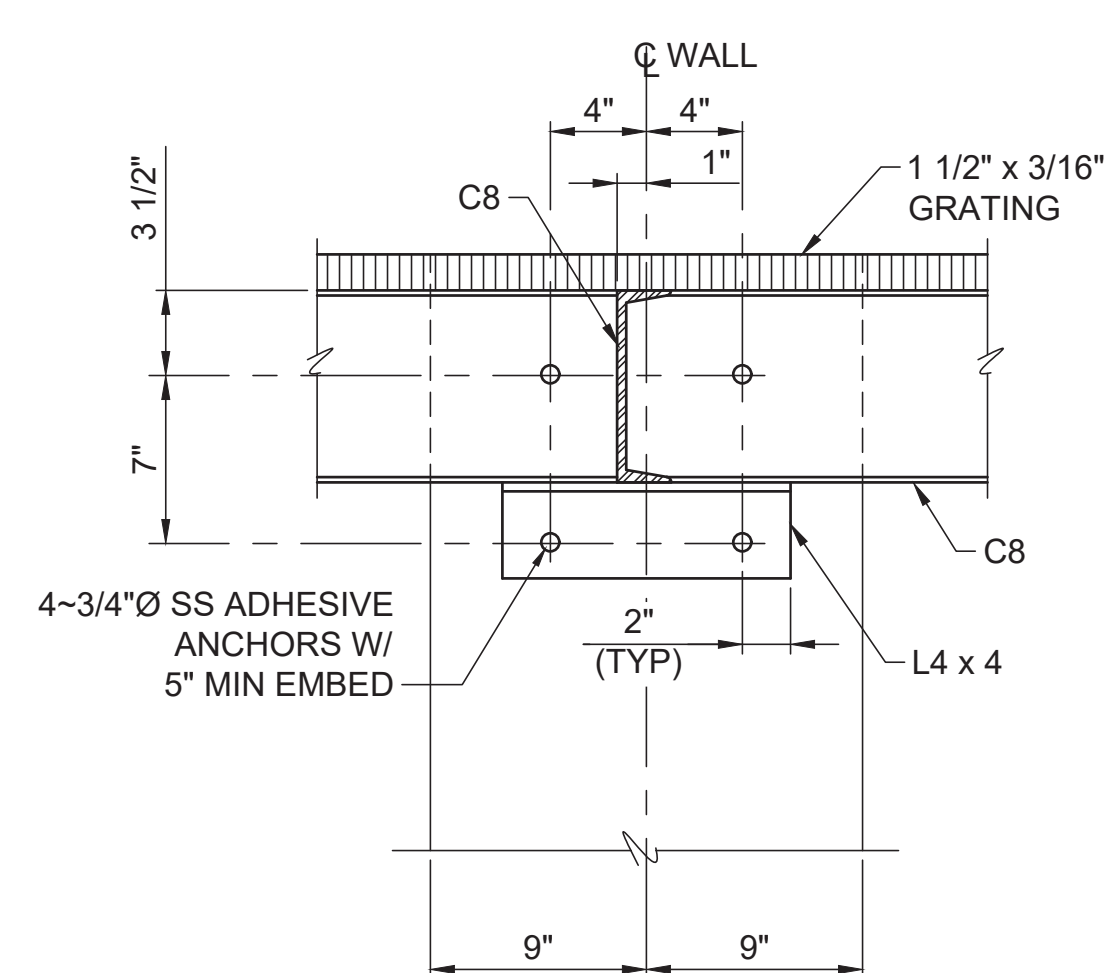
E
SECTION
S-08 SCALE: 1 1/2" = 1'-0"



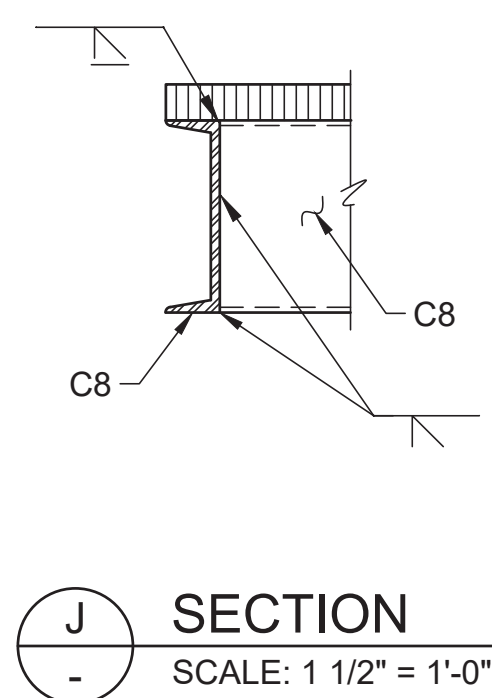
H
SECTION
SCALE: 1 1/2" = 1'-0"



D
SECTION
S-08 SCALE: 1 1/2" = 1'-0"



F
SECTION
S-08 SCALE: 1 1/2" = 1'-0"



J
SECTION
SCALE: 1 1/2" = 1'-0"

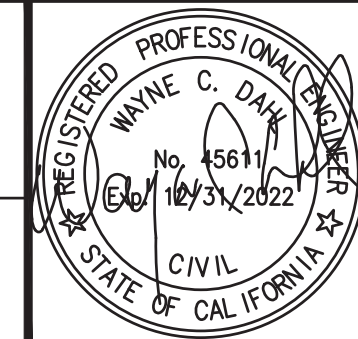
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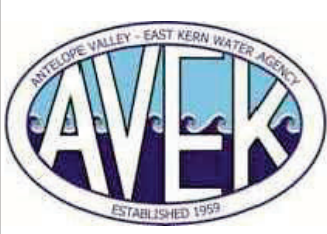
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949.923.6000
stantec.com

DAHL
consultants



WAYNE C. DAHL
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DESIGN TEAM LEAD
R.C.E. 45611
11/10/21
DATE

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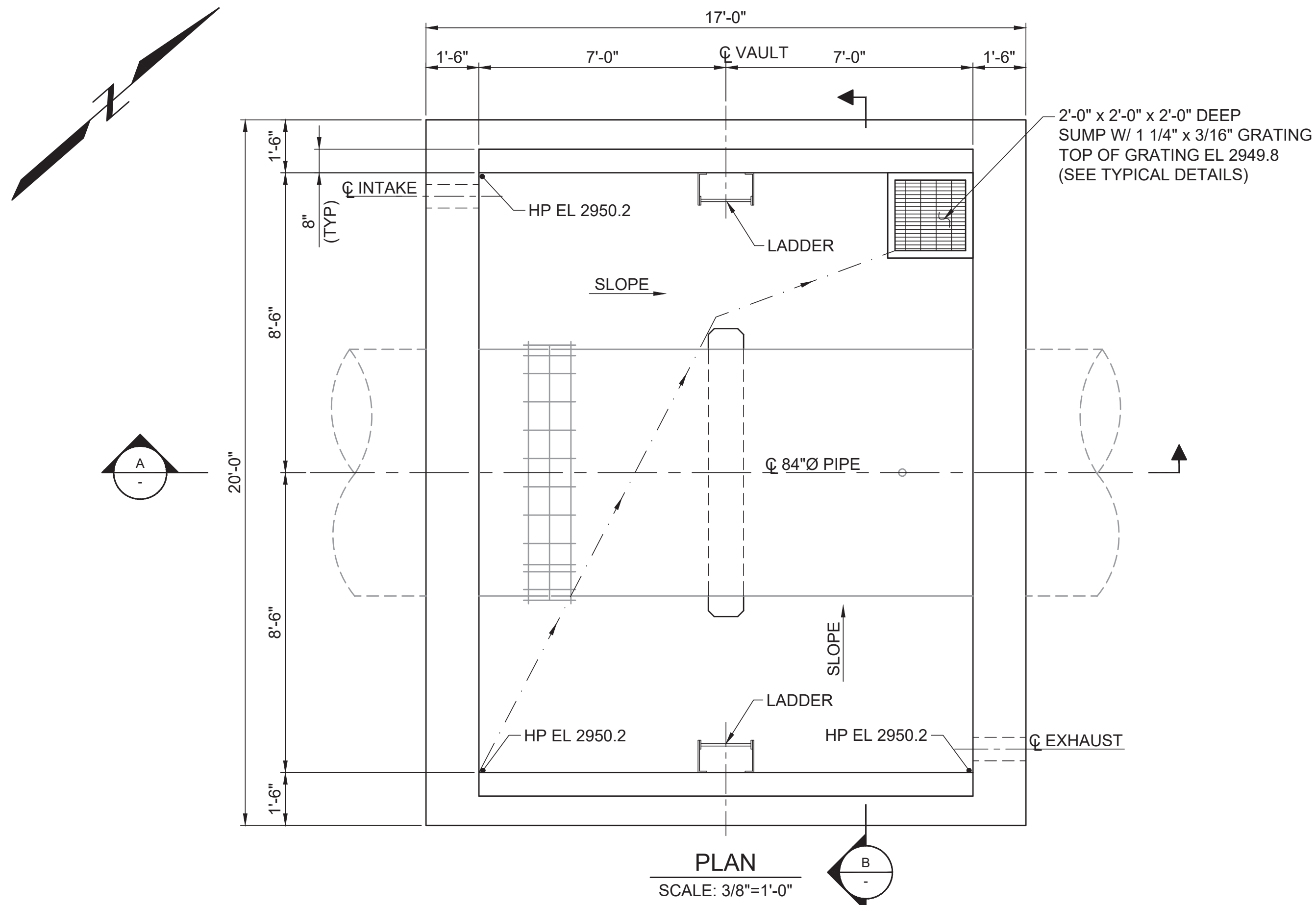


ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

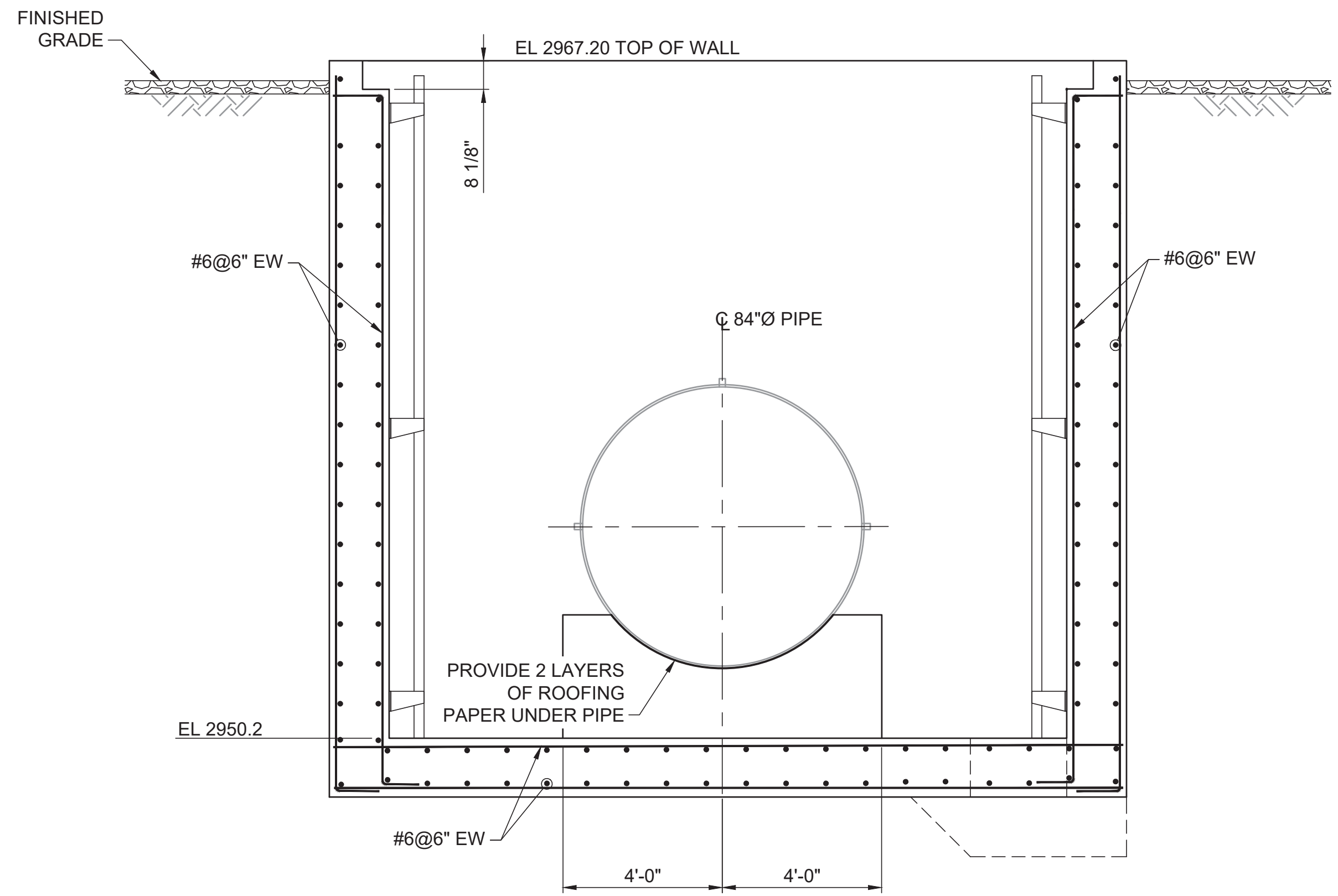
STRUCTURAL
TRASH RACK ACCESS PLATFORM
SECTIONS AND DETAILS

SHEET
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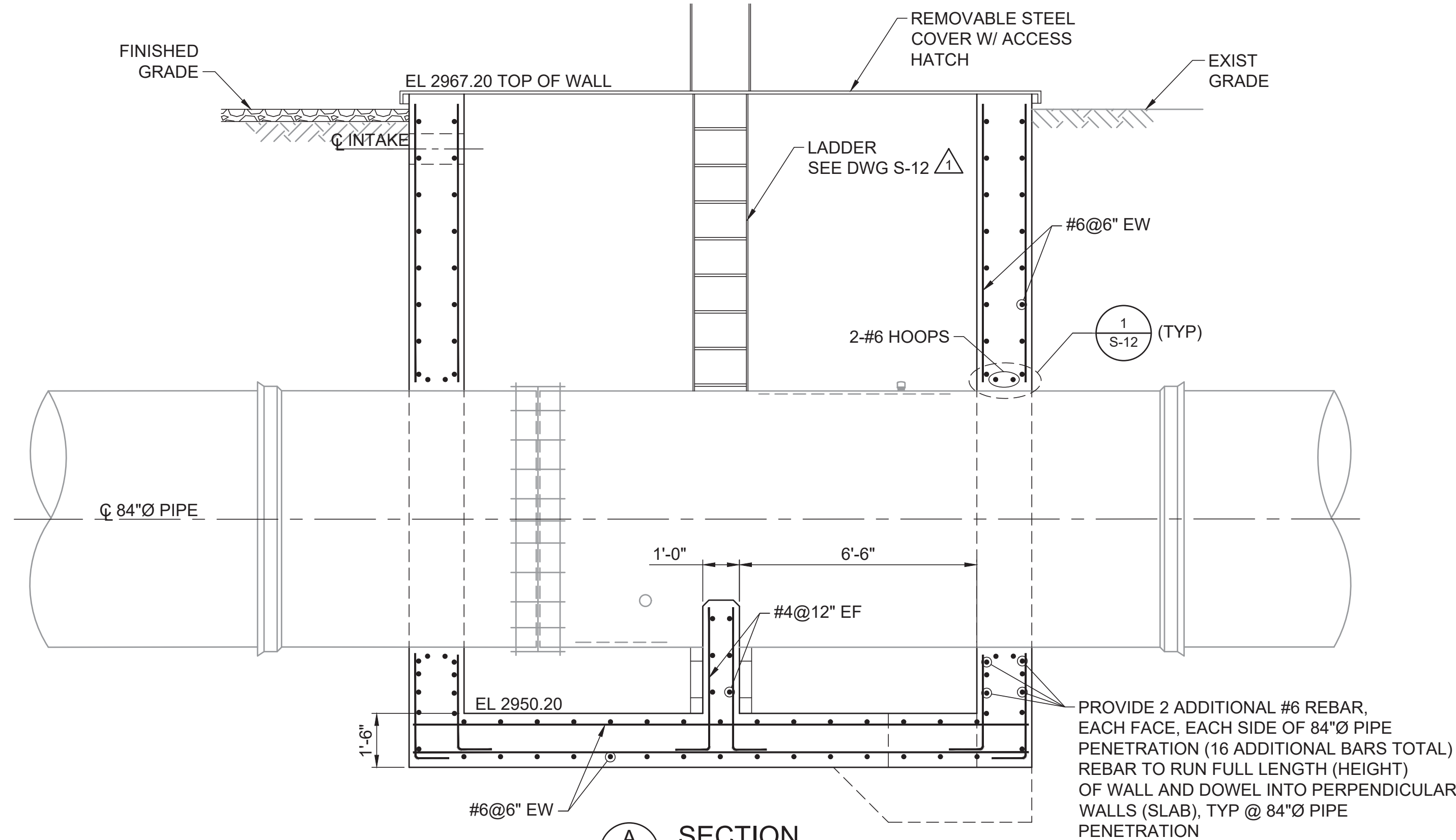
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



PLAN
SCALE: 3/8"=1'-0"



B SECTION
SCALE: 3/8"=1'-0"



A SECTION
SCALE: 3/8"=1'-0"

NOTES:

- FOR METER VAULT COVER, SEE DWG S-08.
- FOR GENERAL STRUCTURAL NOTES AND STANDARD DETAILS, SEE DWG SG-01 AND SG-04.
- WATERTIGHT SEAL SHALL BE LINK SEAL AS MANUFACTURED BY THUNDERLINE CORP. OR APPROVED EQUAL.
- WALL SLEEVE WITH WEEP RING SHALL BE SPECIFIED BY THE WATERTIGHT SEAL MANUFACTURER.
- FOR LOCATION OF AIR INTAKE AND EXHAUST VENTS, SEE DWG M-03.
- FOR ADDITIONAL REINFORCING AT PIPE PENETRATIONS SEE TYPICAL DETAILS.
- OVEREXCAVATE 12 INCHES BELOW (AND EXTEND 12 INCHES BEYOND) STRUCTURE BASE SLAB. IF UNSUITABLE SOILS ARE ENCOUNTERED AT THE SUBGRADE LEVEL, ADDITIONAL REMOVALS MAY BE REQUIRED BY THE GEOTECHNICAL ENGINEER OF RECORD. ADDITIONAL REMOVALS SHALL NOT UNDERMINE THE EXISTING AQUEDUCT LINING. SUBGRADE SOILS SHALL BE SCARIFIED, MOISTURE CONDITIONED, AND RECOMPACTED TO AT LEAST 90 PERCENT RELATIVE COMPACTION PRIOR TO PLACEMENT OF STRUCTURAL FILL. STRUCTURAL FILL SHALL BE COMPACTED TO AT LEAST 95 PERCENT RELATIVE COMPACTION IN ACCORDANCE WITH ASTM D1557. AS AN OPTION, CLSM MAY BE USED FOR STRUCTURAL FILL.

GEOTECHNICAL ASPECTS OF THE PLAN HAVE BEEN REVIEWED BY THE UNDERSIGNED AND IS IN GENERAL CONFORMANCE WITH THE RECOMMENDATIONS CONTAINED IN KLEINFELDER'S GEOTECHNICAL STUDY PROPOSED HIGH DESERT WATER BANK PROJECT DATED MAY 13, 2021. WE MAKE NO REPRESENTATION AS TO THE ACCURACY OF DIMENSIONS, MEASUREMENTS, CALCULATIONS, OR ANY PORTION OF THE DESIGN.

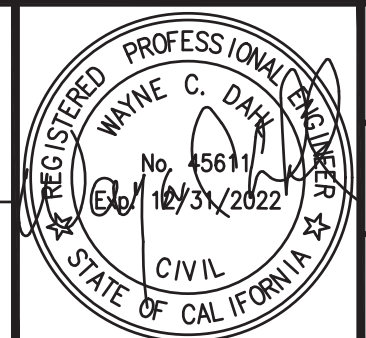
Jeff Woon
NAME _____ DATE _____

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1	12/22/21	ADDENDUM NO. 1	

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ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

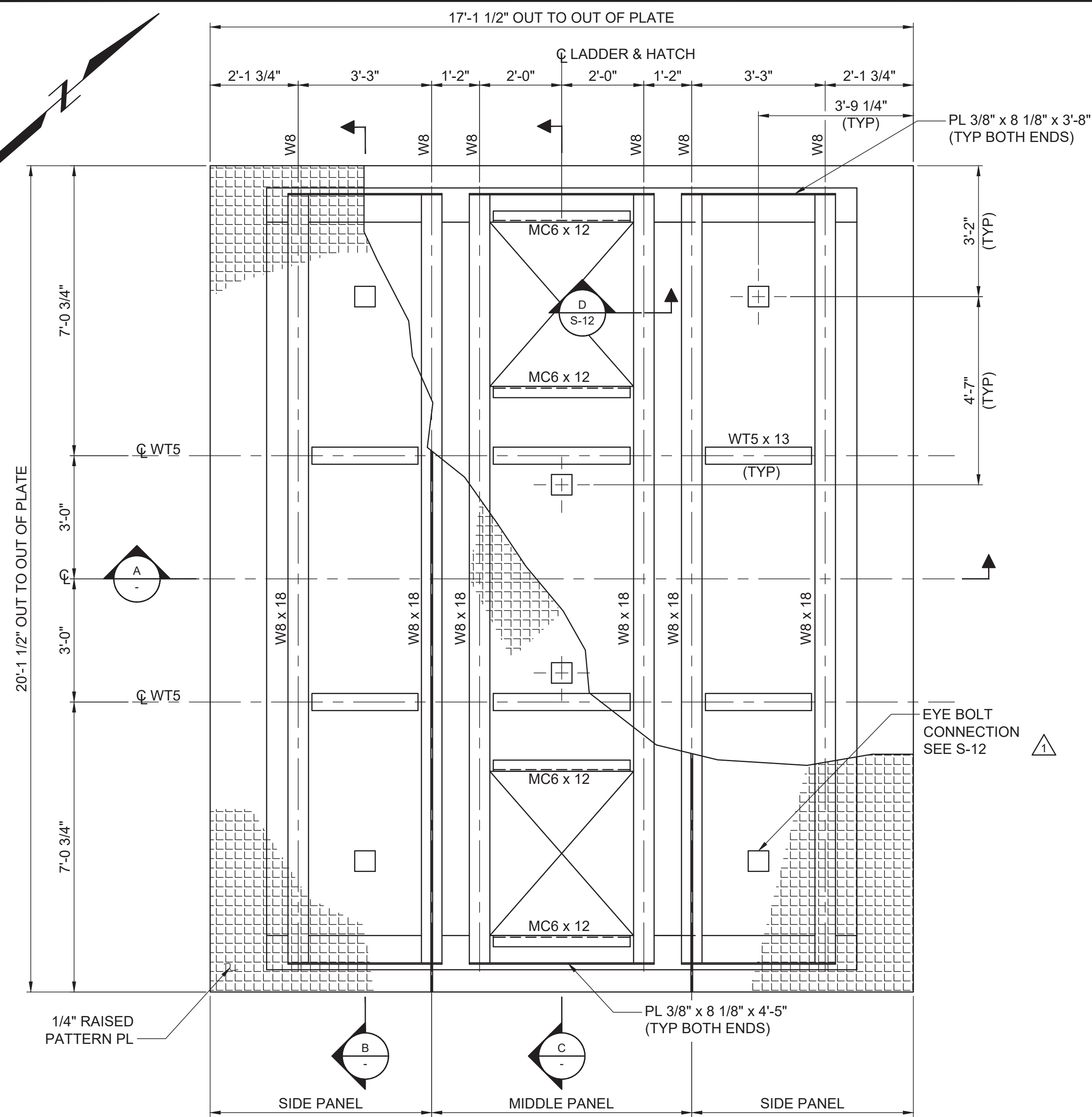
STRUCTURAL
METER VAULT PLAN AND SECTIONS

SHEET
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SHEETS

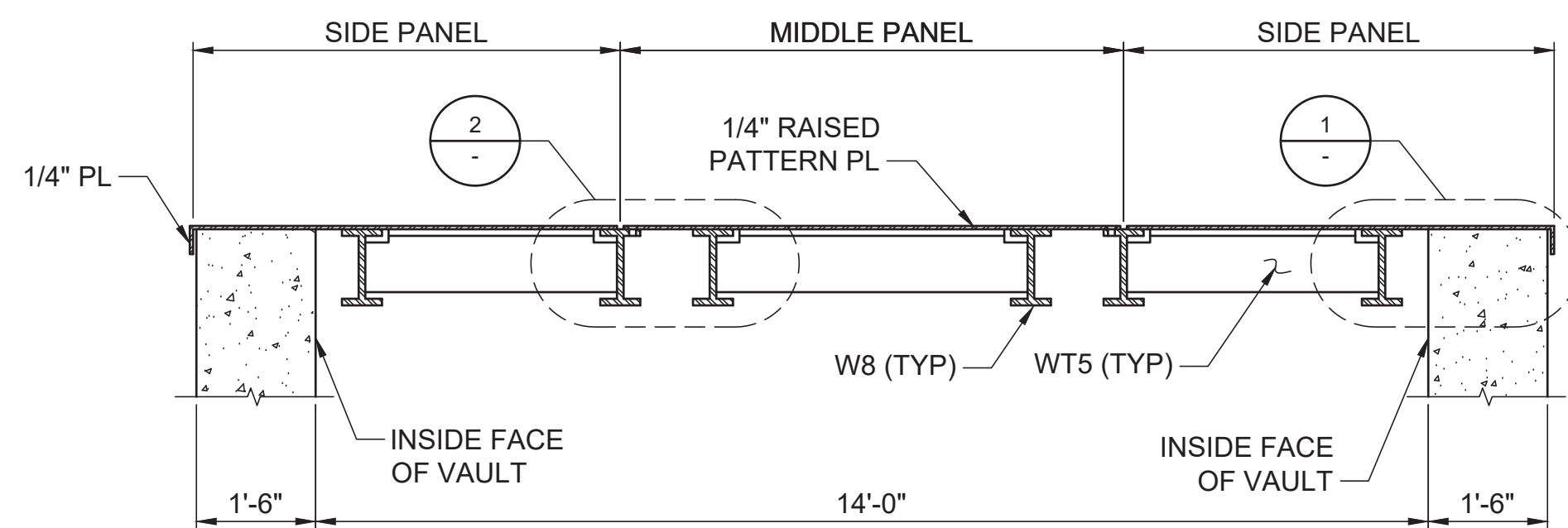
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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

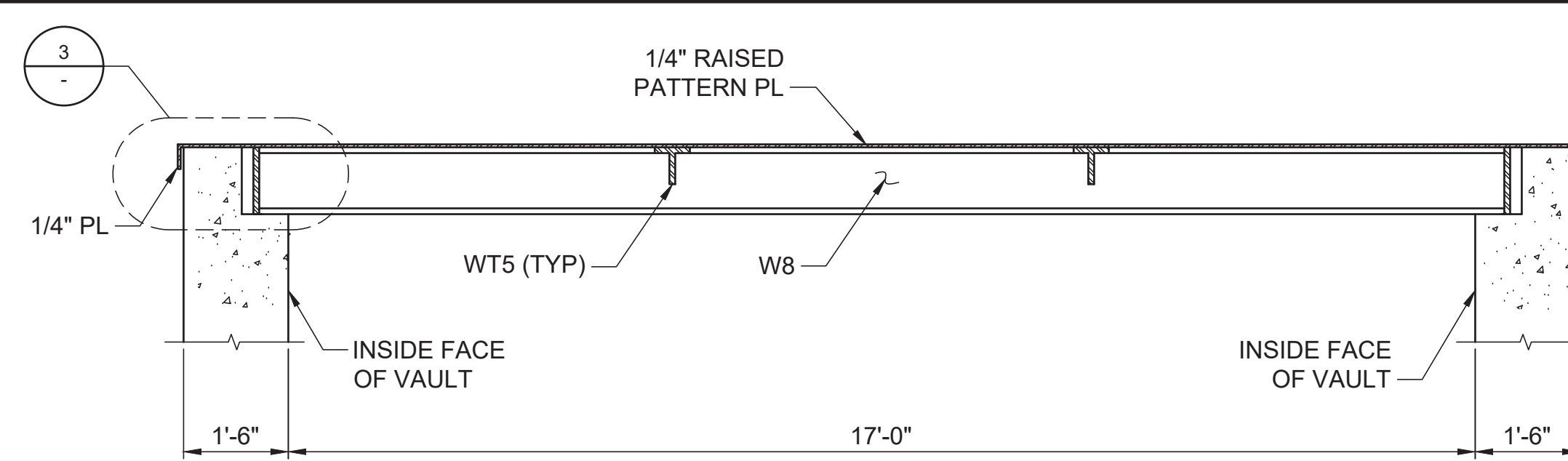
APPENDIX G



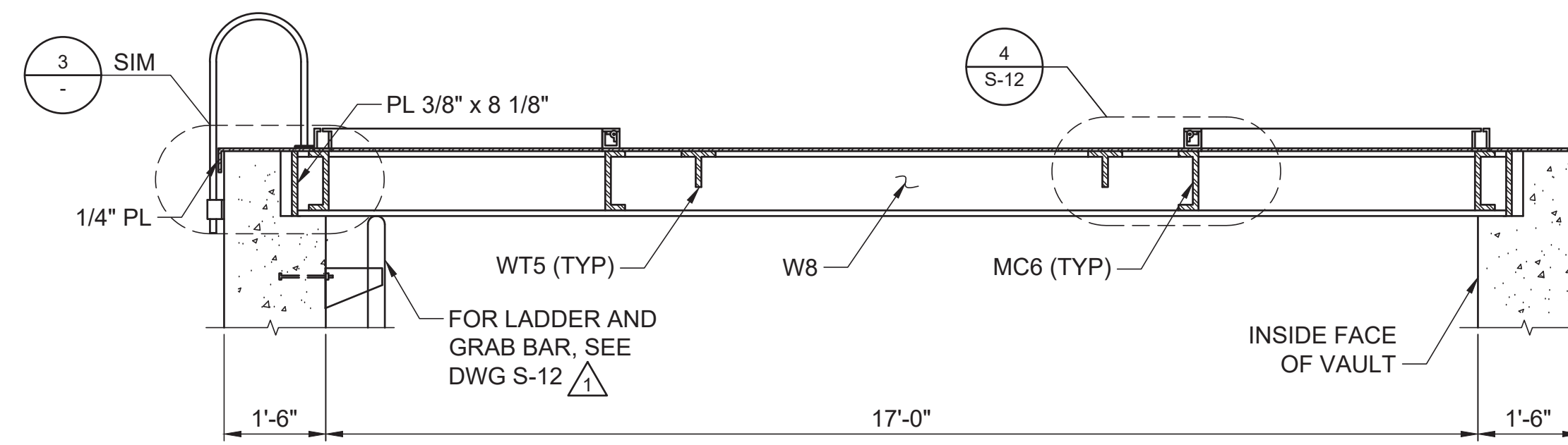
PLAN
SCALE: 1/2"=1'-0"



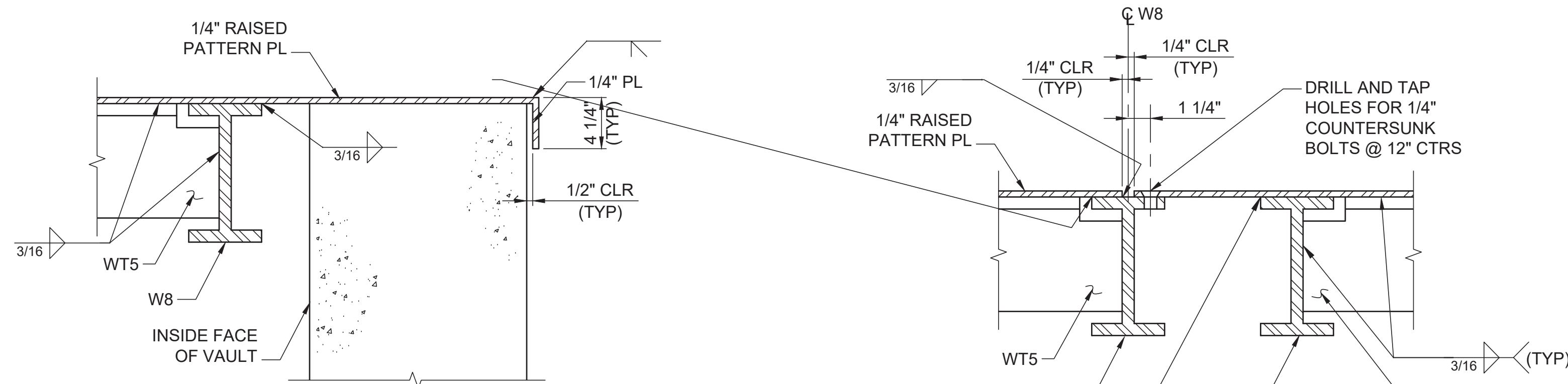
A SECTION
SCALE: 1/2"=1'-0"



B SECTION
SCALE: 1/2"=1'-0"

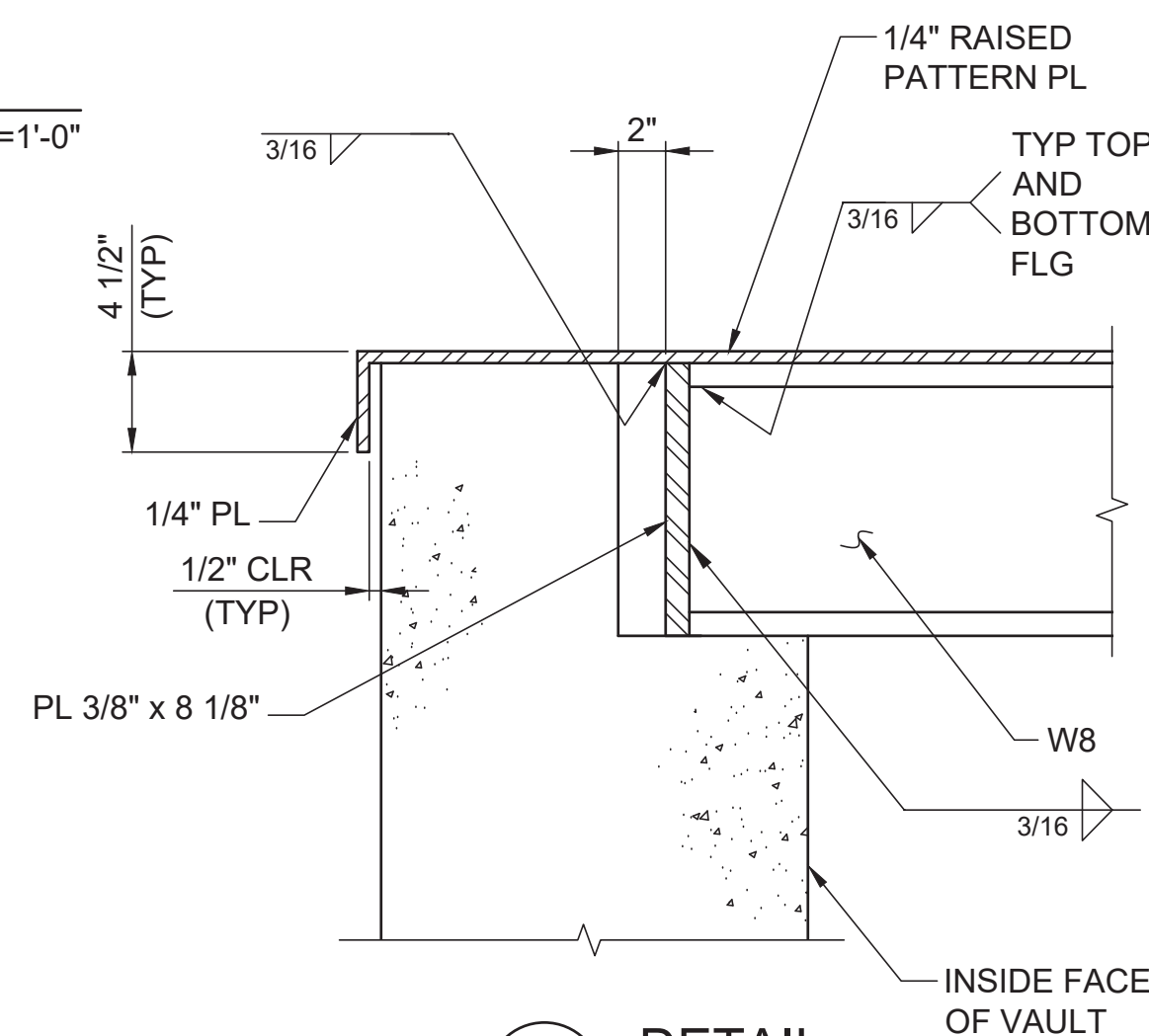


C SECTION
SCALE: 1/2"=1'-0"



1 DETAIL
SCALE: 1 1/2"=1'-0"

2 DETAIL
SCALE: 1 1/2"=1'-0"



3 DETAIL
SCALE: 1 1/2"=1'-0"

NOTES:

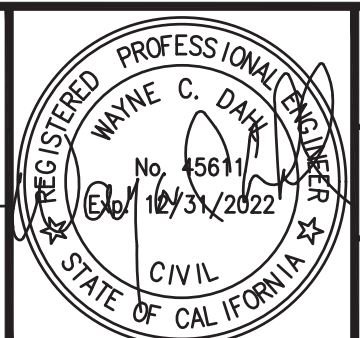
1. FIELD VERIFY VAULT DIMENSIONS PRIOR TO FABRICATION.
2. METER VAULT COVER AND FRAMING SHALL BE HOT DIP GALVANIZED AFTER FABRICATION. HATCH SHALL BE 3'-6" BY 4'-0" BILCO, TYPE J, OR EQUAL WITH HINGES ON THE 3'-6" SIDE.
3. HATCH FRAME SHALL BE GALVANIZED STEEL AND COVER SHALL BE ALUMINUM. A LOCKING DEVICE SHALL BE PROVIDED.

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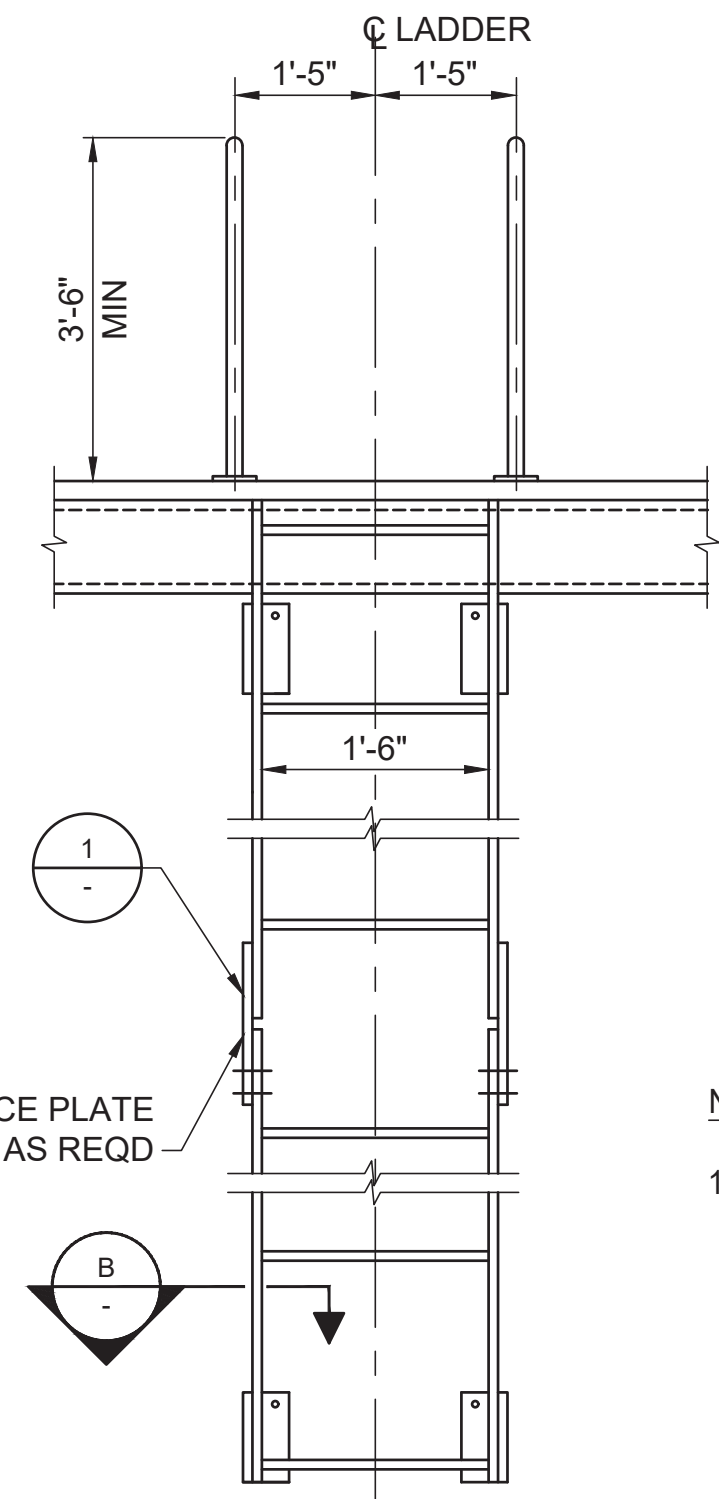
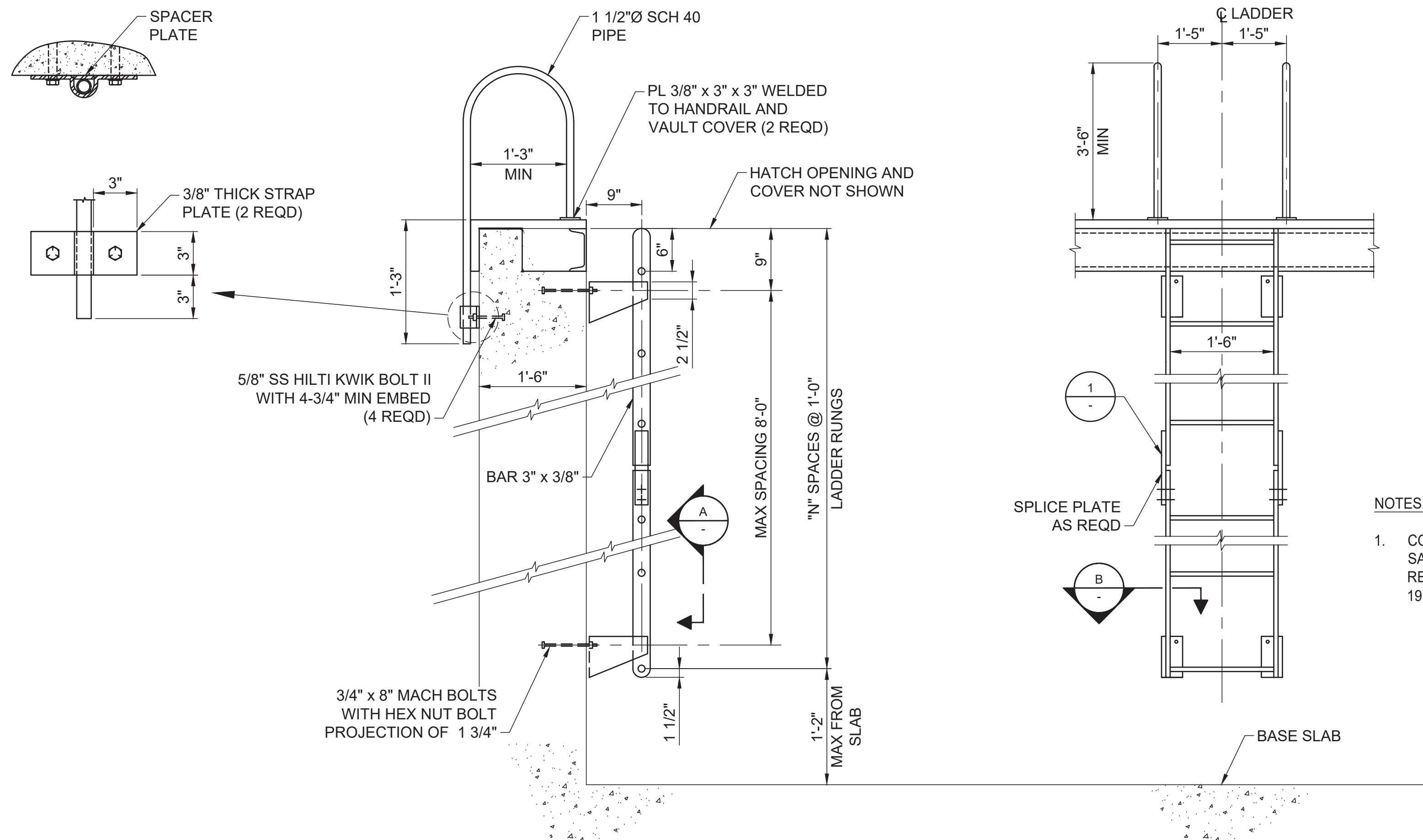
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
METER VAULT COVER PLAN, SECTIONS,
AND DETAILS

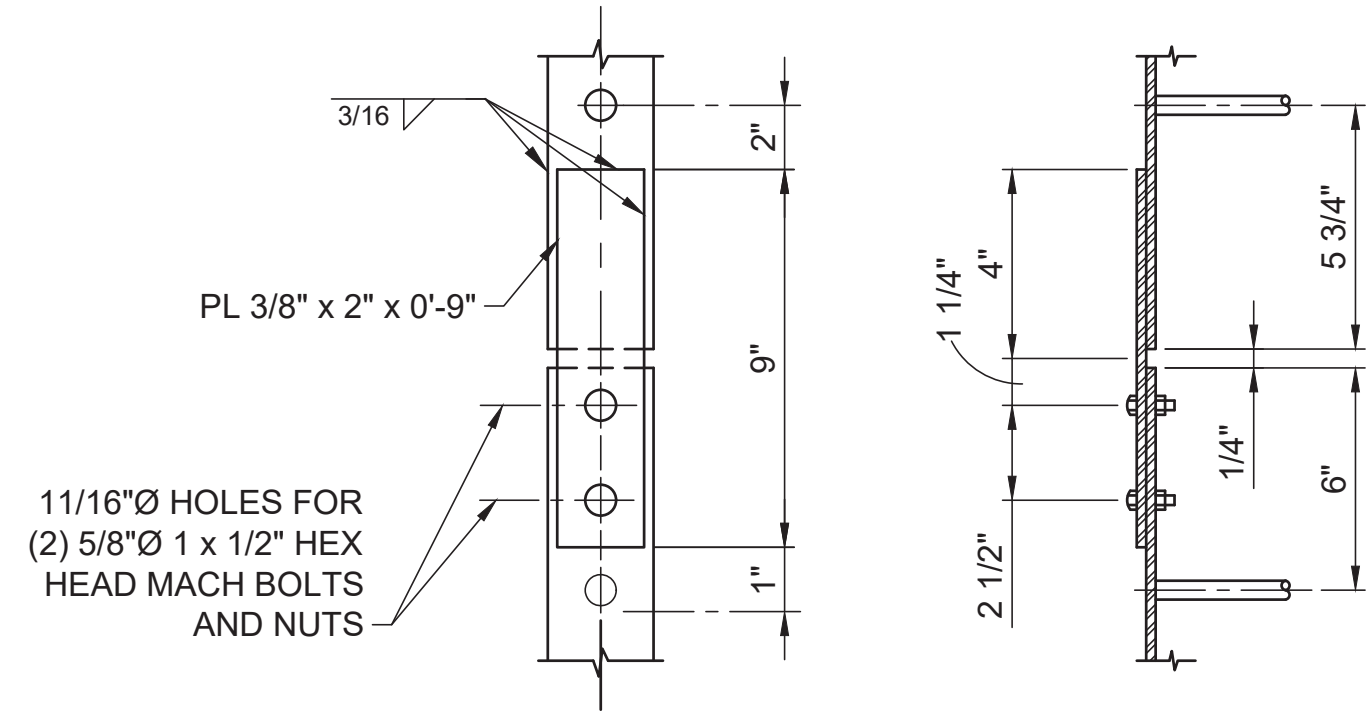
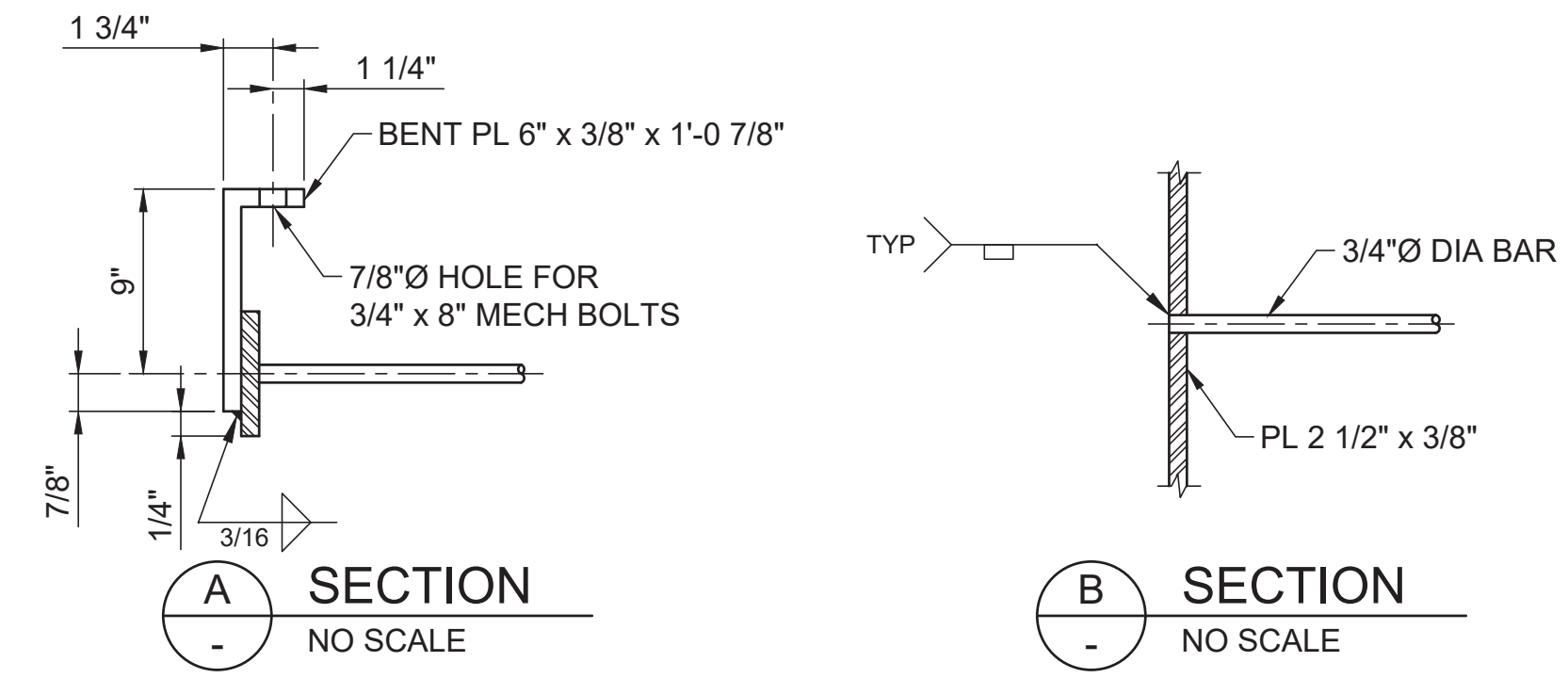
SHEET
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SHEETS

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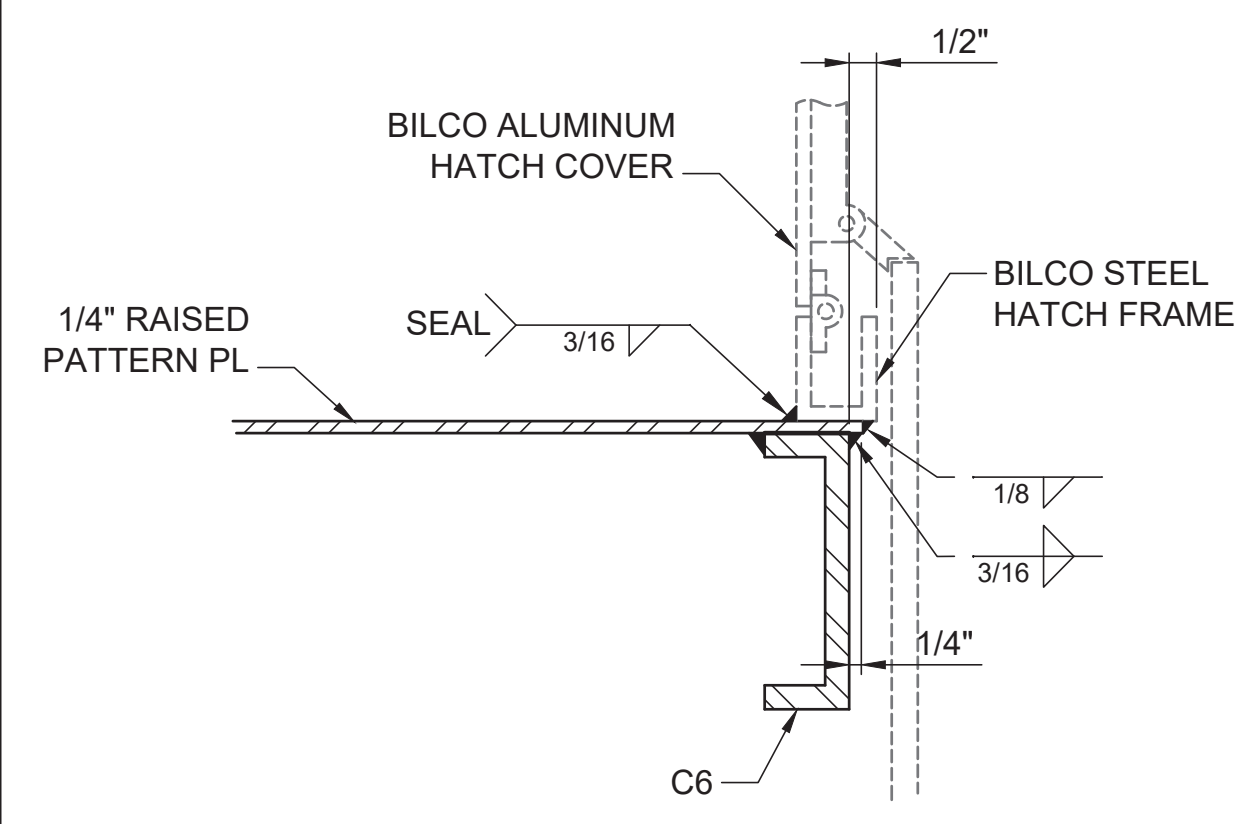
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



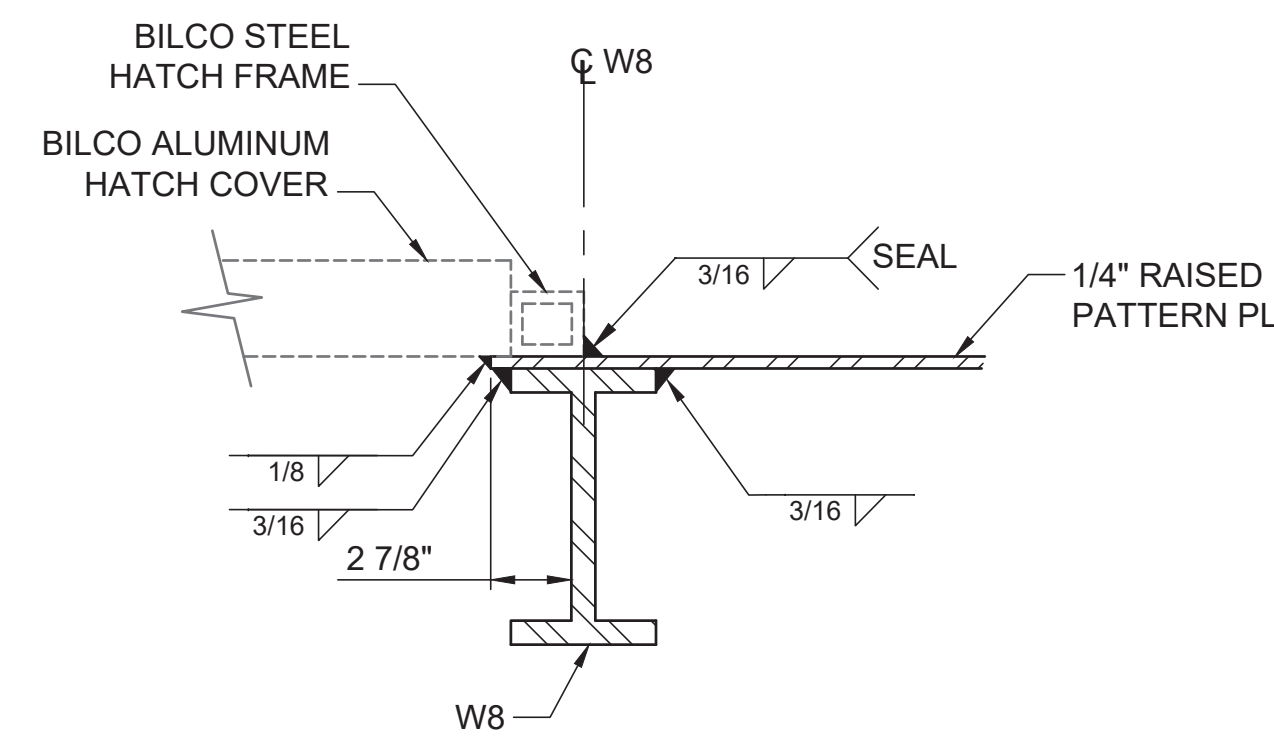
NOTES:
1. CONTRACTOR SHALL PROVIDE A LADDER SAFETY SYSTEM MEETING THE REQUIREMENTS OF OSHA REGULATION 1910.29 (i).



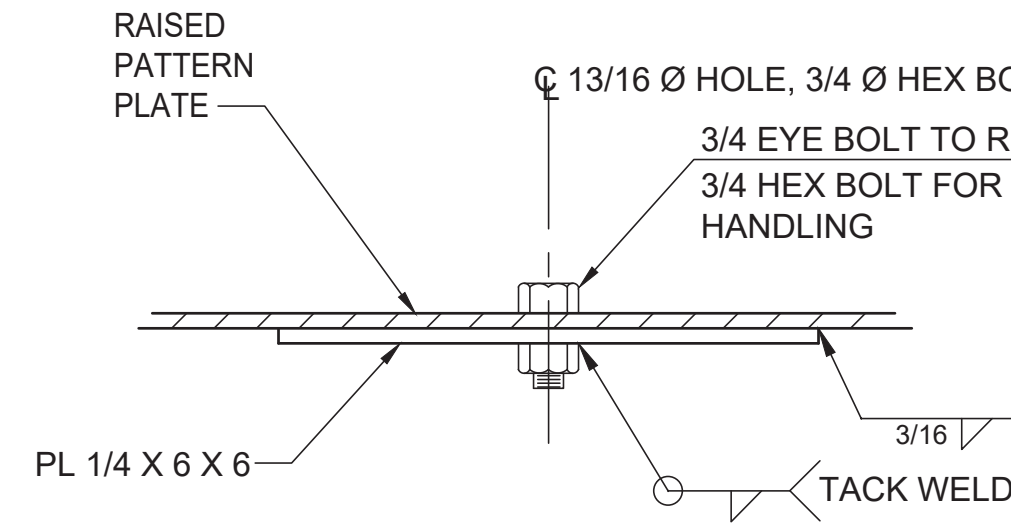
VERTICAL LADDER
NO SCALE



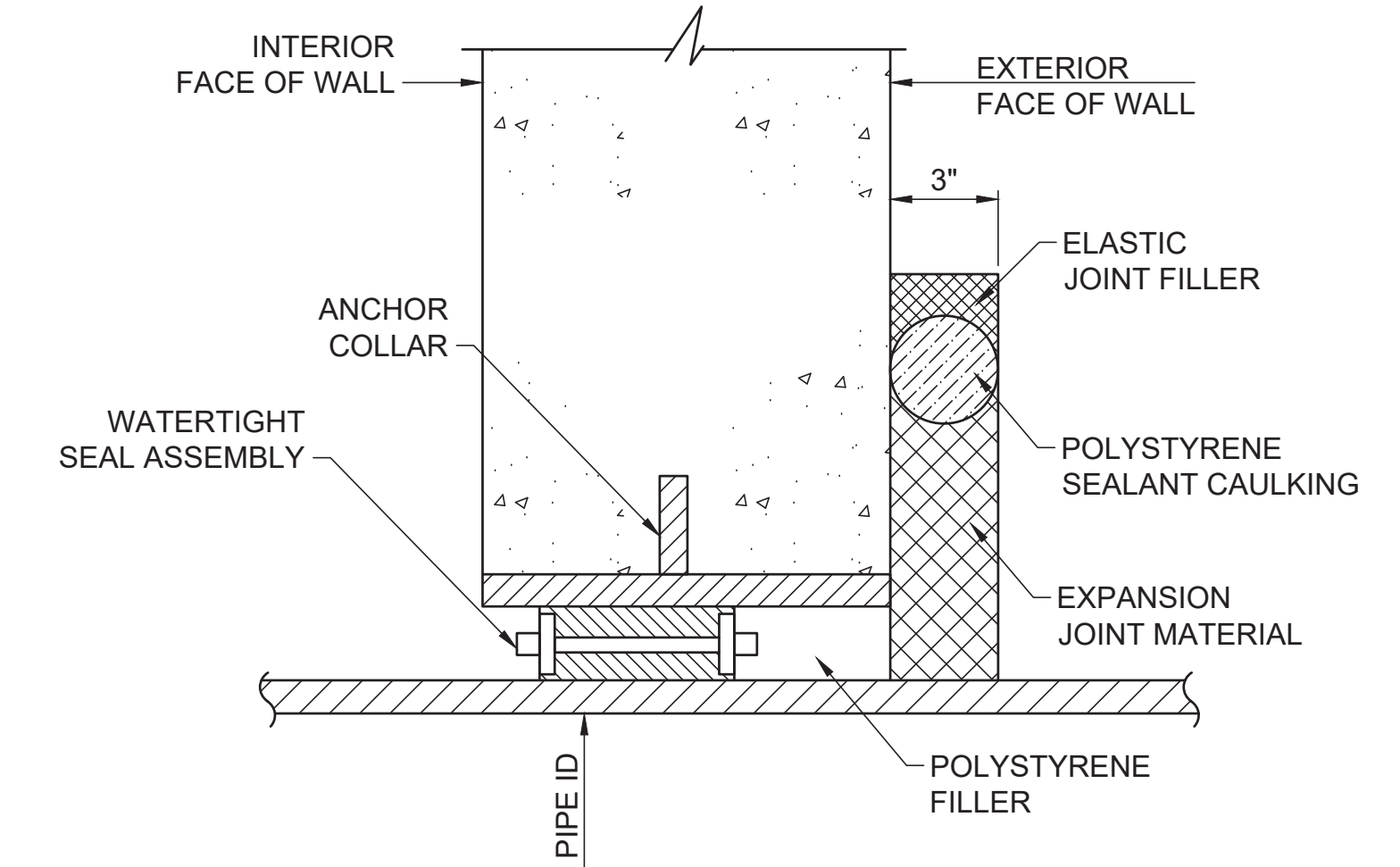
4
S-11
DETAIL
NO SCALE



D
S-11
SECTION
NO SCALE



EYE BOLT CONNECTION DETAIL



1
S-10
DETAIL
NO SCALE

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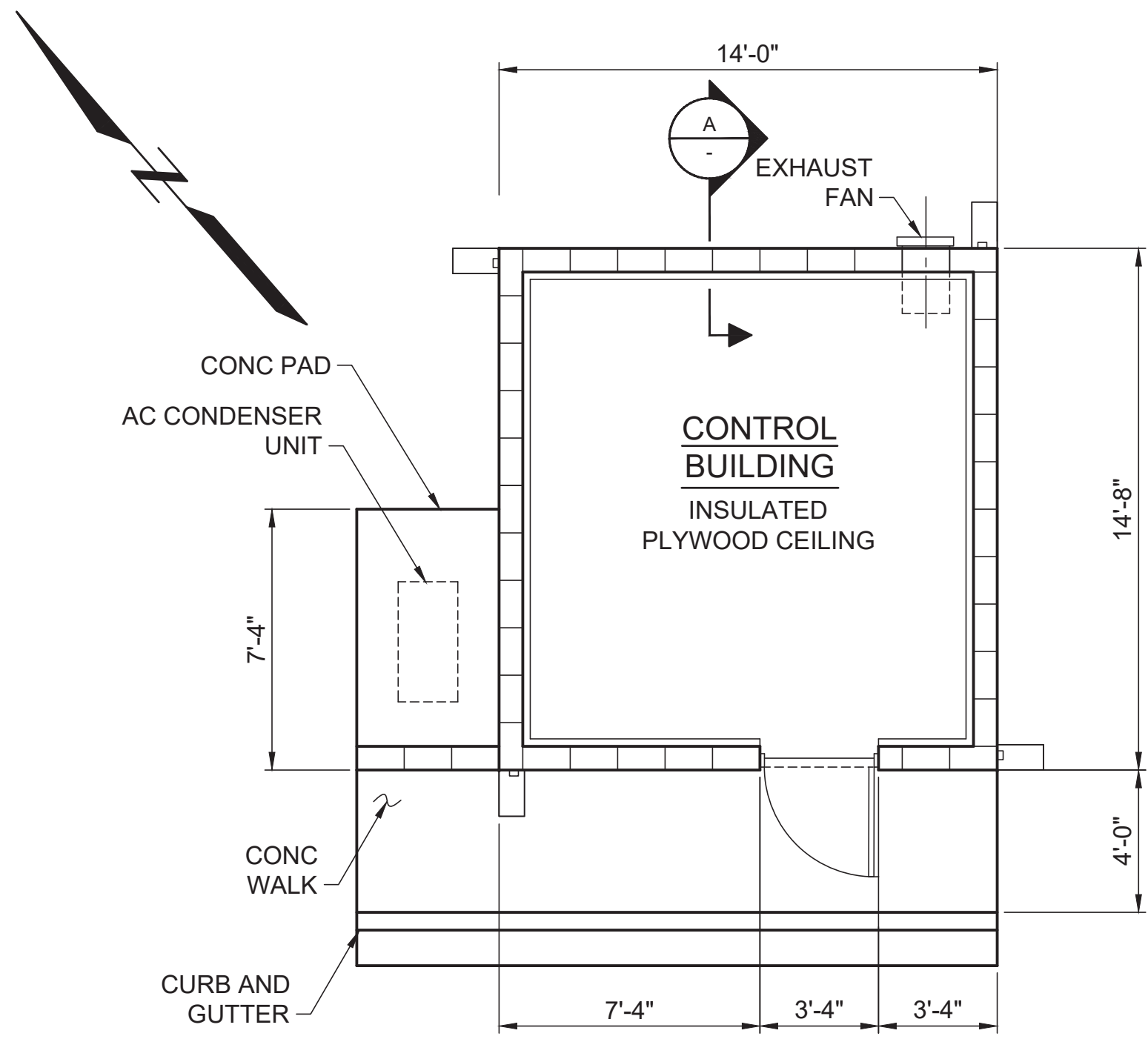
AVEK
ANTELOPE VALLEY - EAST KERN WATER AGENCY

ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

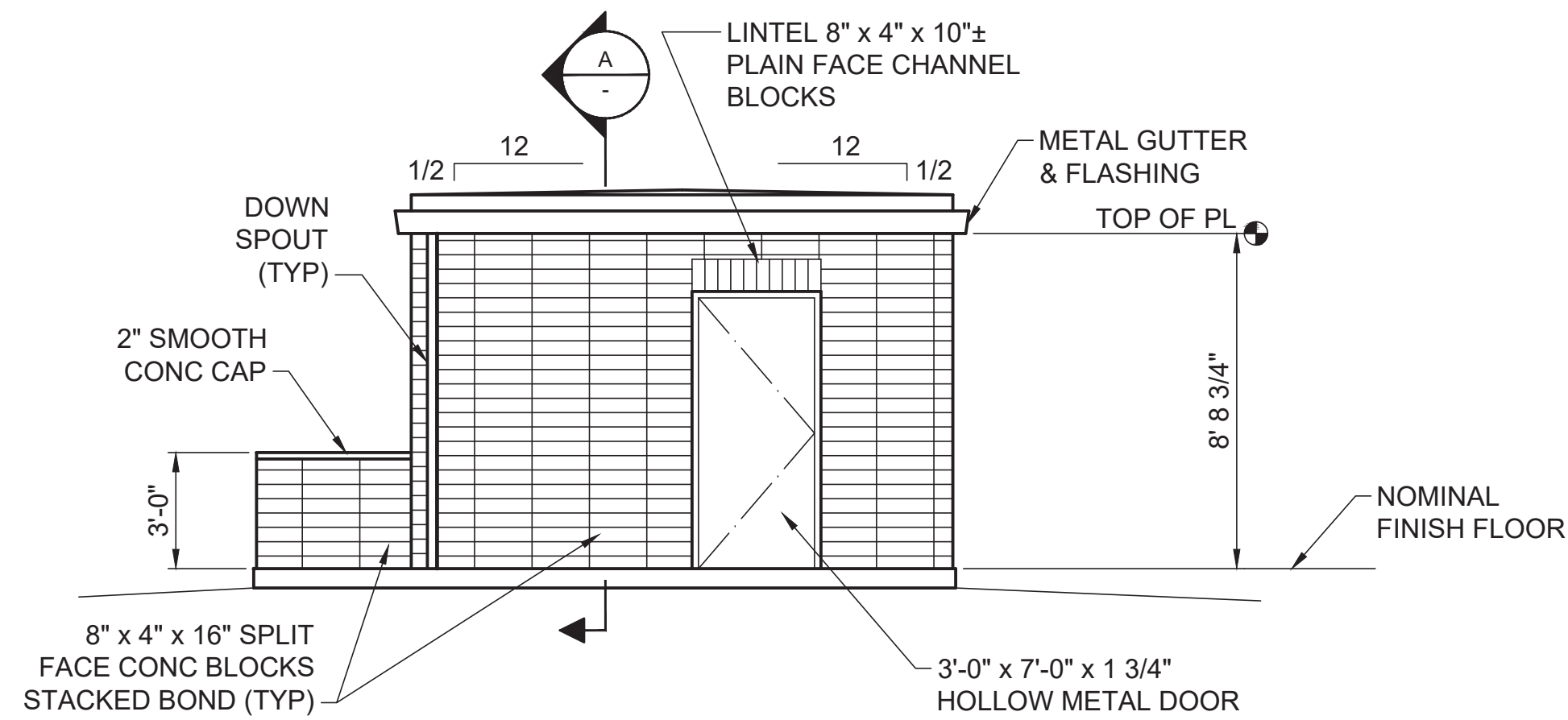
STRUCTURAL
METER VAULT LADDER
DETAILS AND SECTIONS

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SHEETS

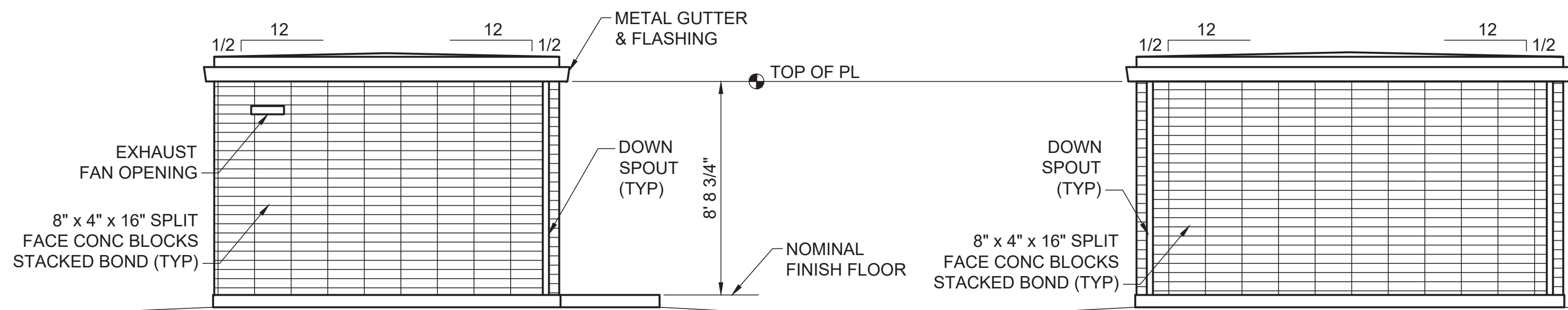
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



FLOOR PLAN
SCALE: 1/4"=1'-0"

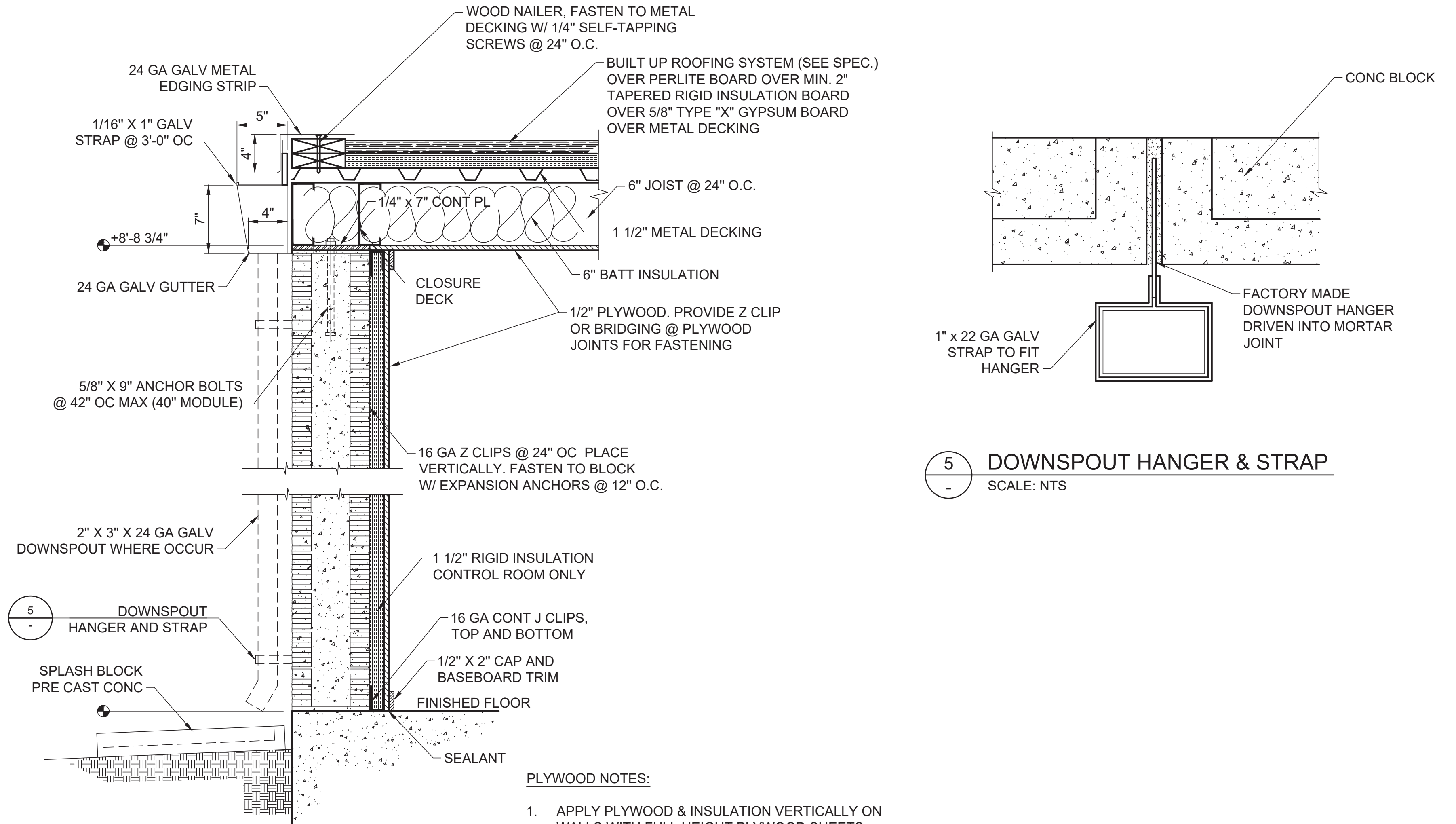


1 SOUTH ELEVATION
SCALE: 1/4" = 1'-0"



2 NORTH ELEVATION
SCALE: 1/4" = 1'-0"

3 EAST/WEST ELEVATION (SIMILAR)
SCALE: 1/4" = 1'-0"



A TYPICAL WALL SECTION
SCALE: 1 1/2" = 1'-0"

PLYWOOD NOTES:

1. APPLY PLYWOOD & INSULATION VERTICALLY ON WALLS WITH FULL HEIGHT PLYWOOD SHEETS.
2. ON CEILING, APPLY PLYWOOD PARALLEL TO JOISTS, SPLICE BELOW BRIDGING.
3. FASTEN AT 8" ON CENTER ALONG EDGES AND 12" ON CENTER AT FIELD BEARING.

5 DOWNSPOUT HANGER & STRAP
SCALE: NTS

COLOR SCHEDULE			
INTERIOR		EXTERIOR	
ITEMS	COLOR	ITEMS	COLOR
PLYWOOD WALLS & CEILING, BASEBOARD WOOD TRIM, EXPOSED METAL DECKING & JOISTS, PIPE BRACKETS	NEUTRAL H-106 SEMI-GLOSS FULLER O'BRIEN	CLOSURE TRACK, GUTTER, DOWNSPOUTS & STRAPS. DOOR FRAMES, METAL EDGING STRIPS & SHEET METAL	WOODBURN H-41 SEMI-GLOSS FULLER O'BRIEN
CONCRETE FLOOR	OTTER BE 42 TNEC	DOORS	AVALON BLUE D-129 SEMI-GLOSS FULLER O'BRIEN
		CONCRETE BLOCKS NATURAL TAN	CLEAR WATER-PROOFING

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ANTELOPE VALLEY - EAST KERN WATER AGENCY

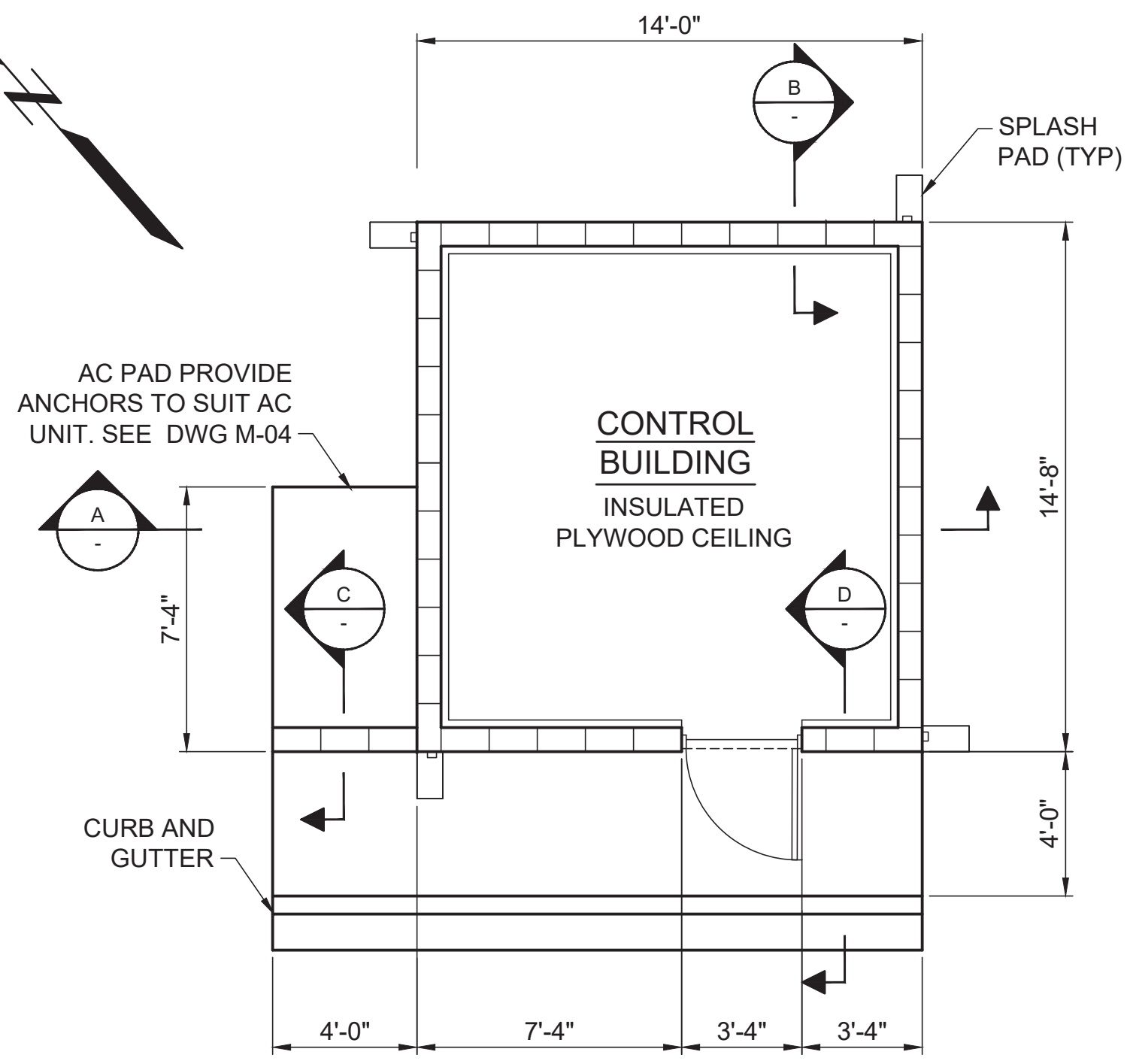
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
CONTROL BUILDING PLAN,
ELEVATIONS, AND SECTIONS

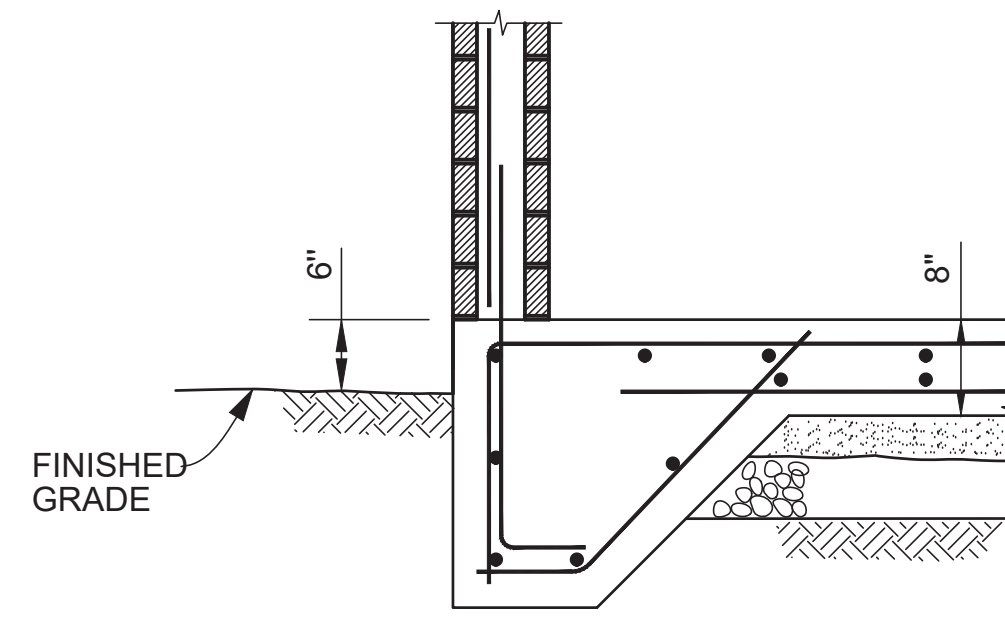
SHEET
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30 of 54
SHEETS

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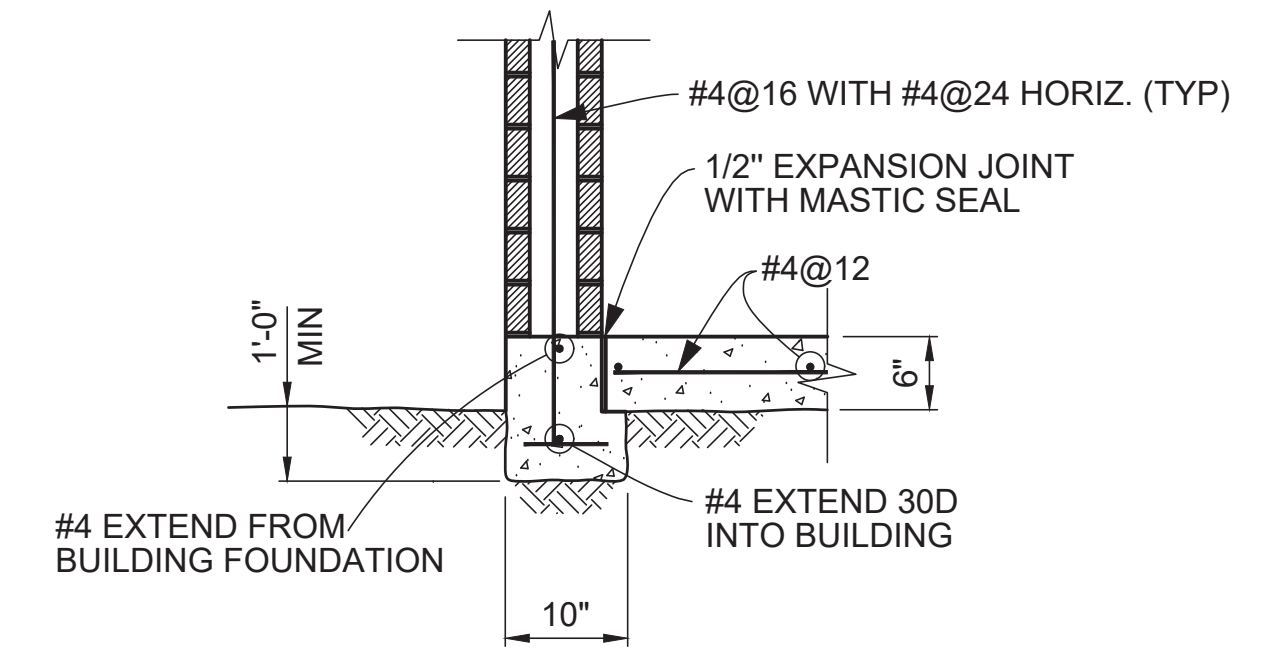
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



FLOOR PLAN
SCALE: NTS

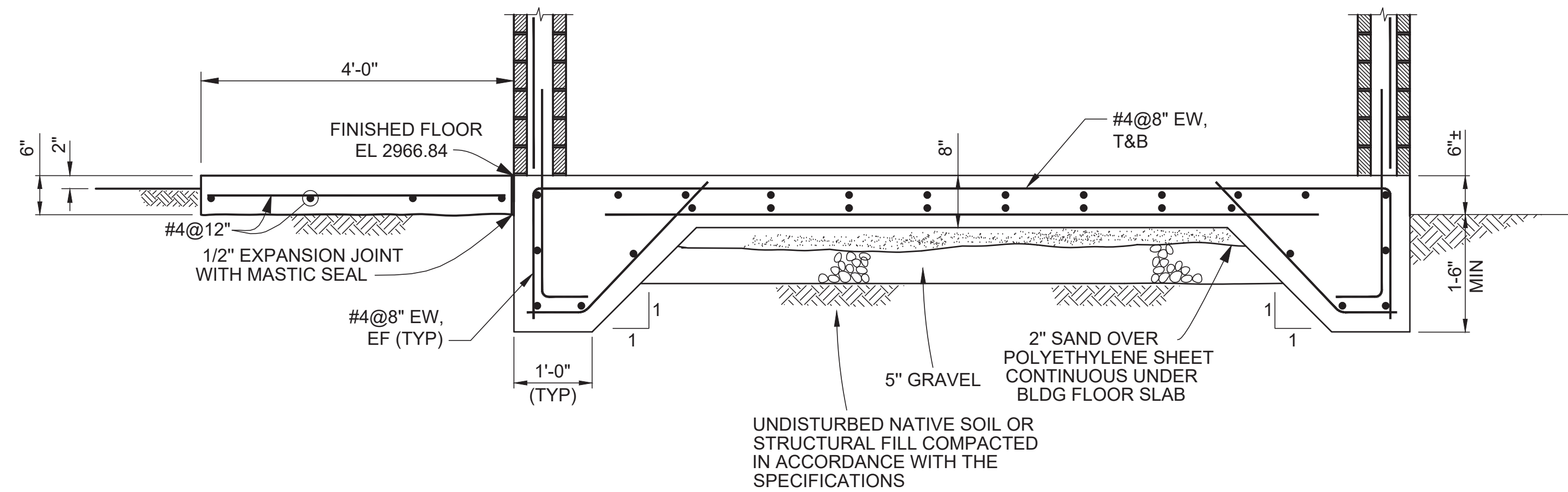


B SECTION
SCALE: NTS

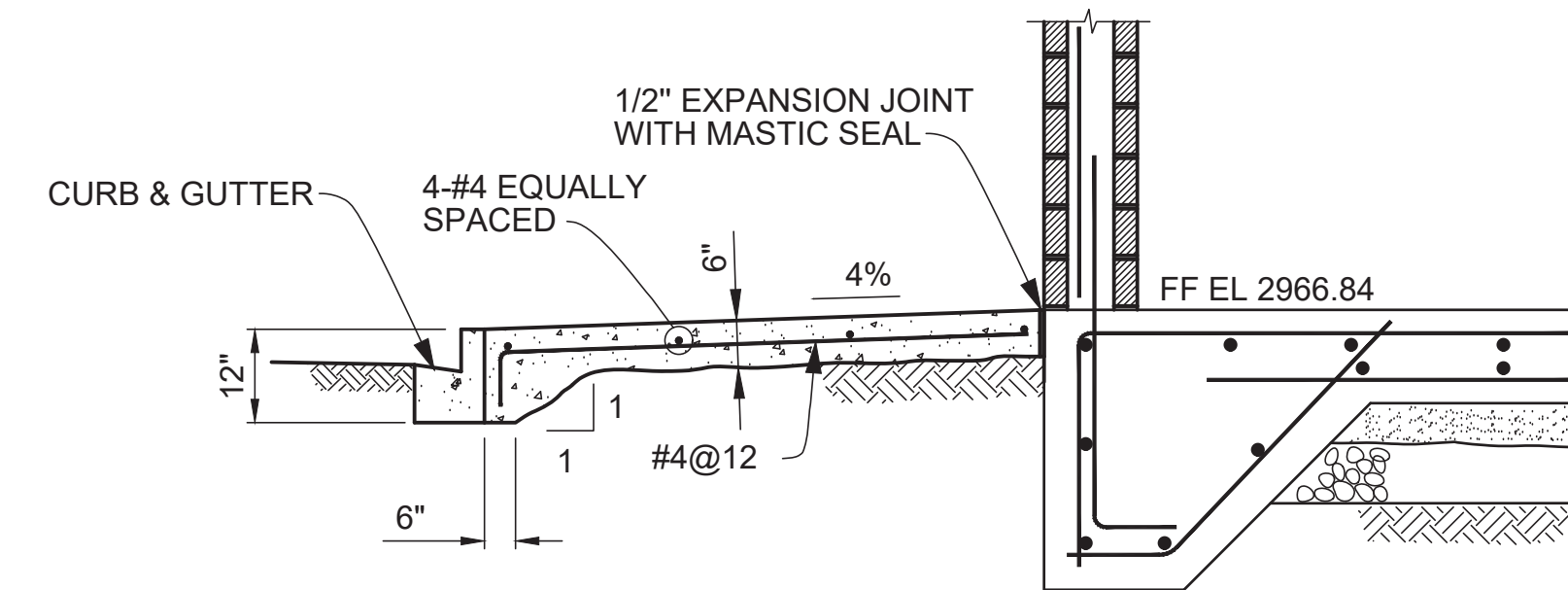


C SECTION
SCALE: NTS

- NOTES:**
- FOR GENERAL NOTES SEE DWG SG-01.



A SECTION
SCALE: NTS



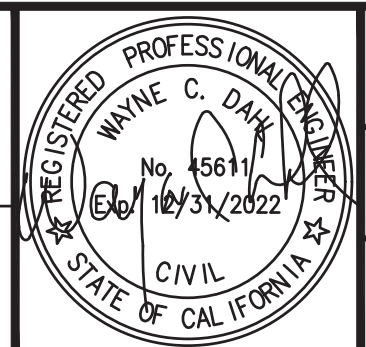
D SECTION
SCALE: NTS

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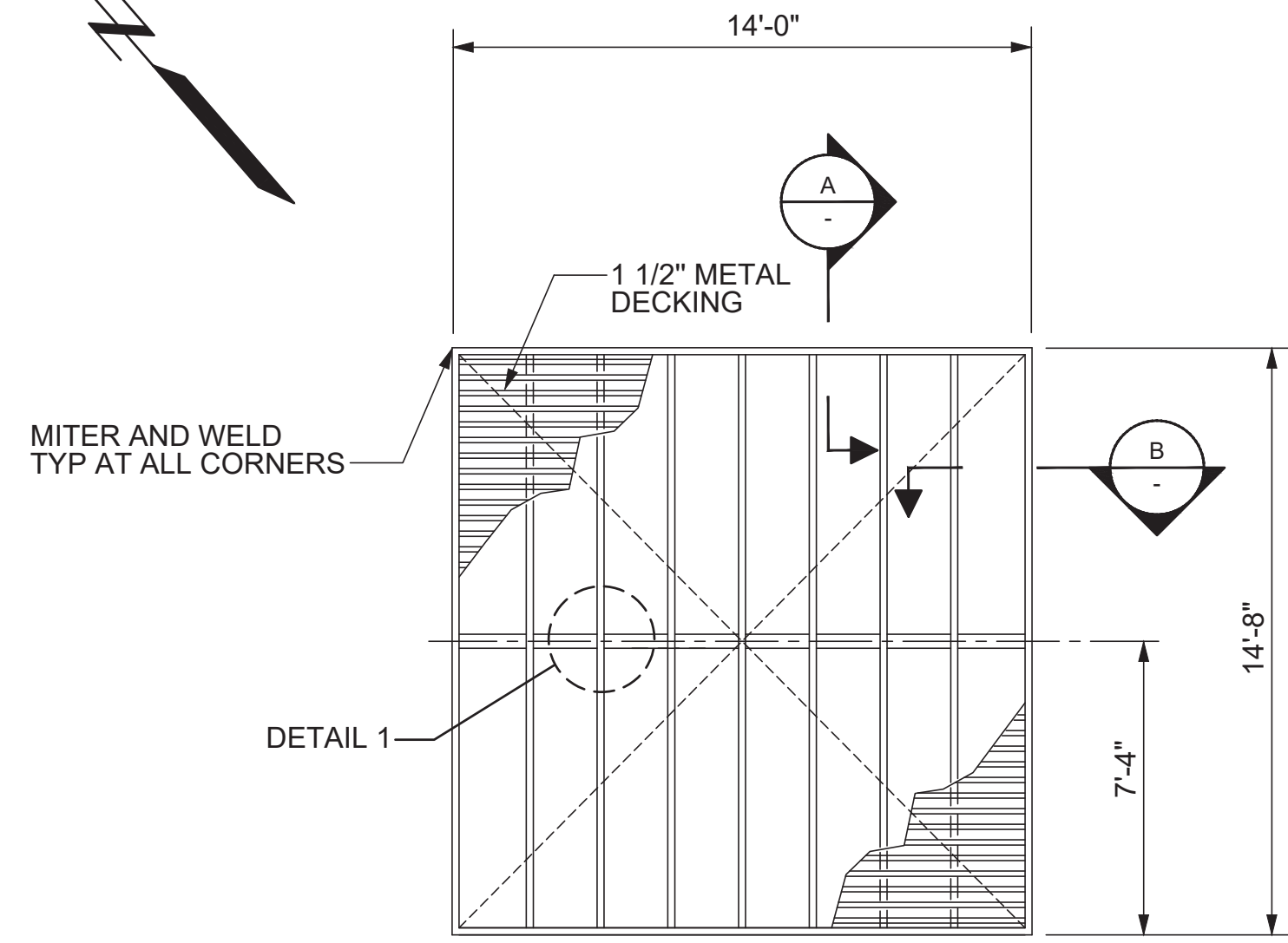
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
CONTROL BUILDING
FLOOR PLAN AND SECTIONS

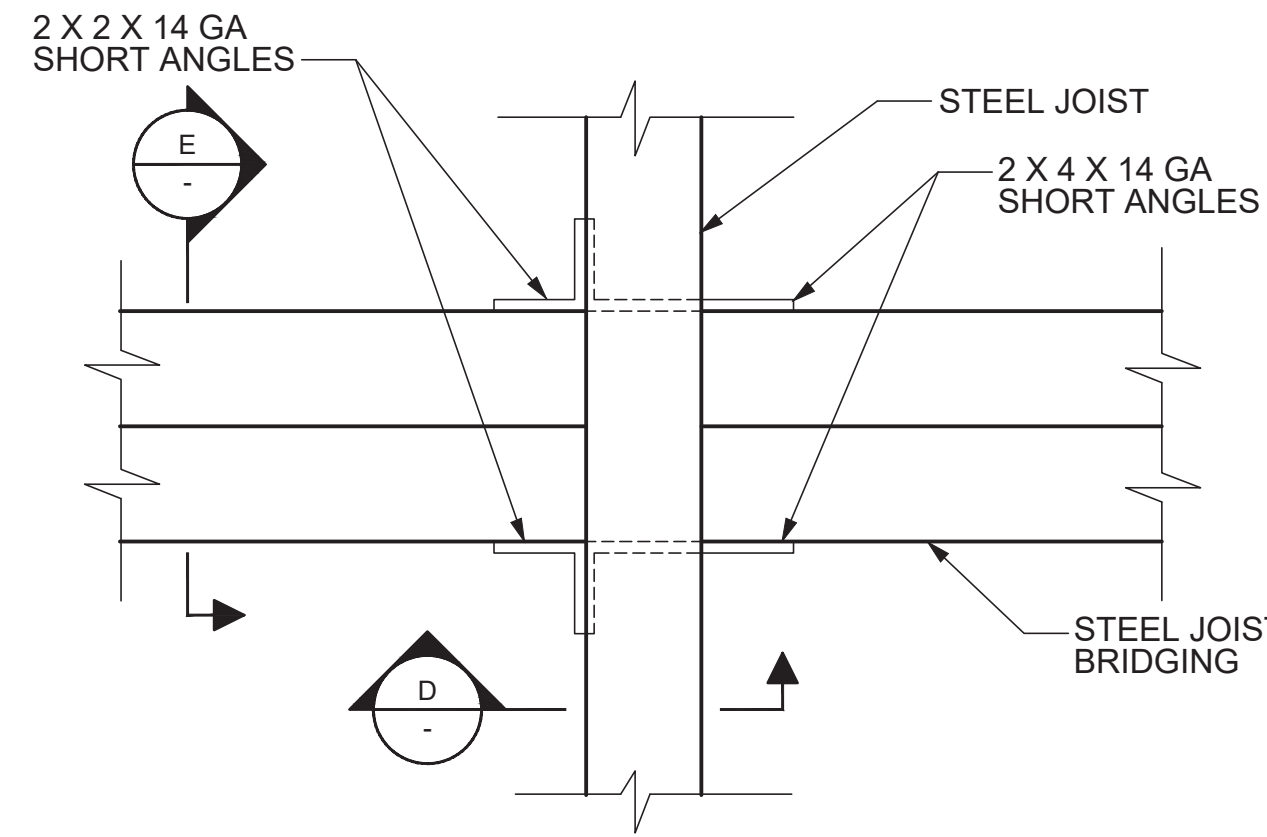
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SHEETS

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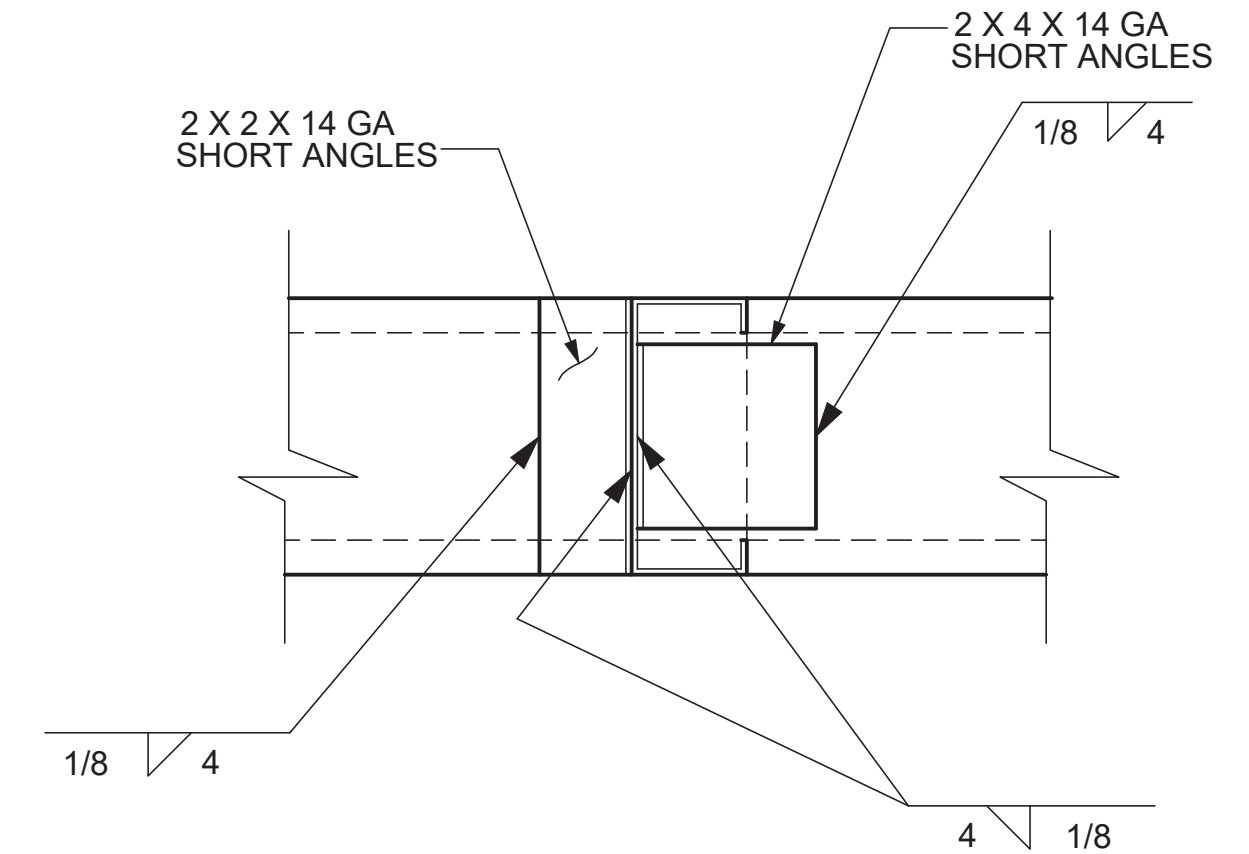
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



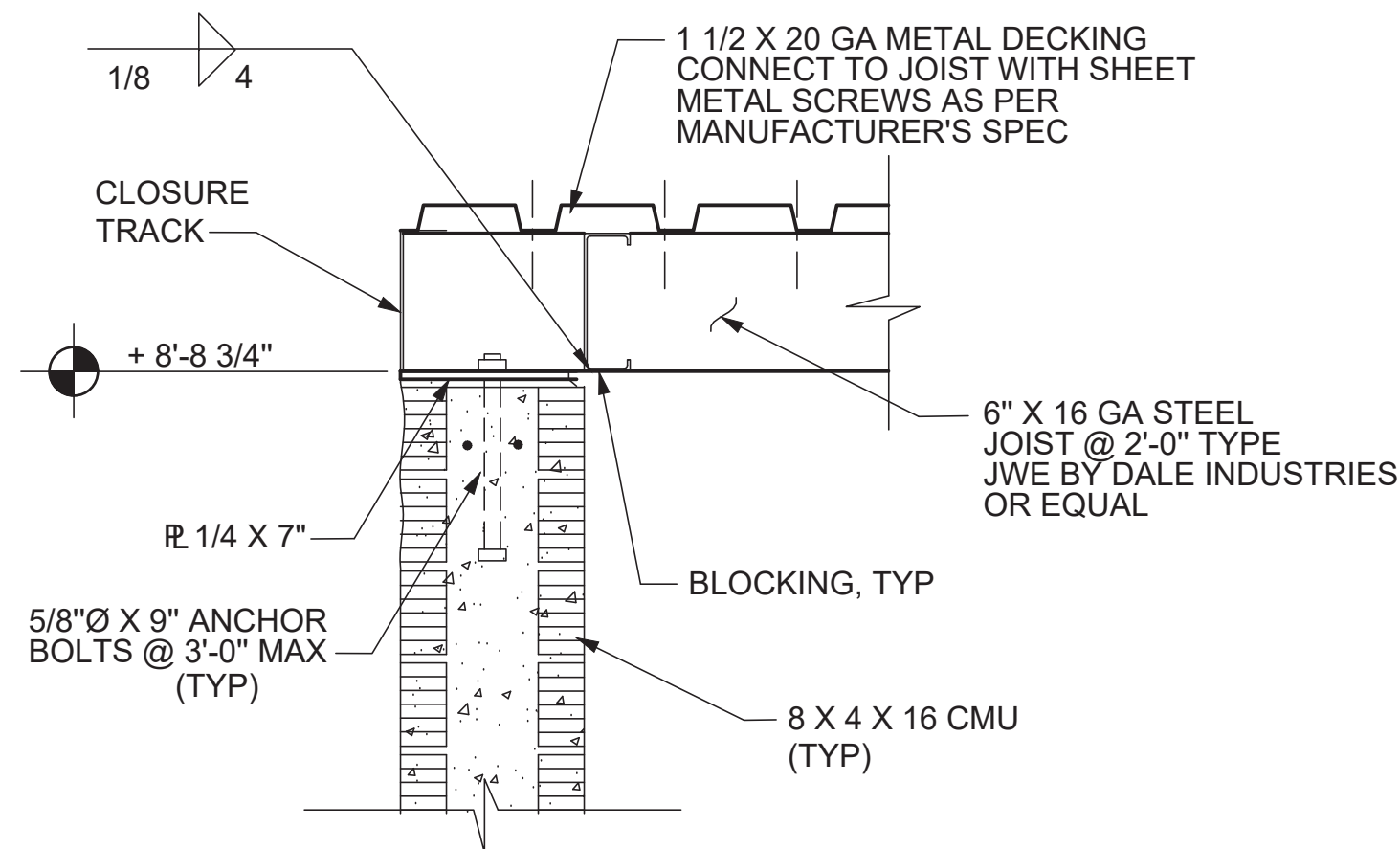
ROOF FRAMING PLAN
SCALE: NTS



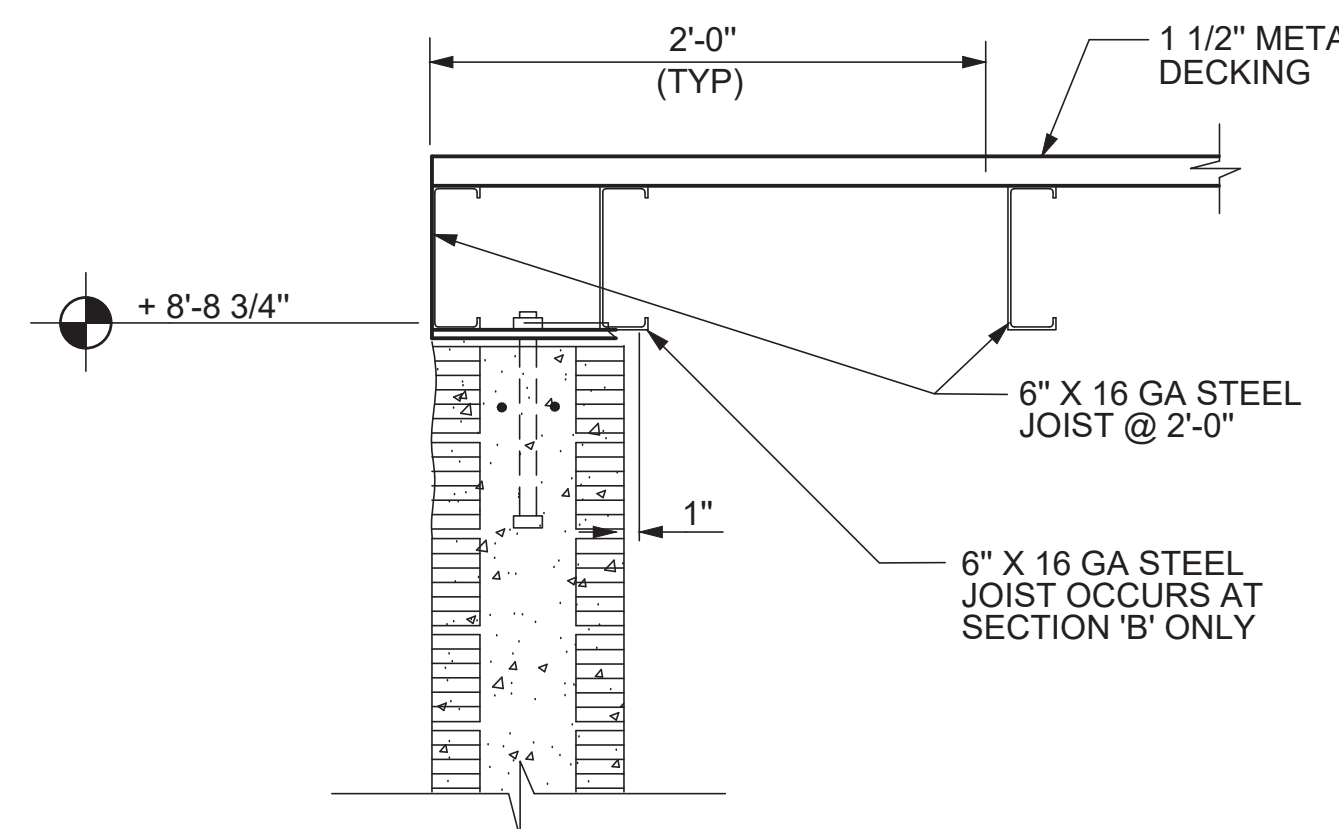
1 DETAIL
SCALE: NTS



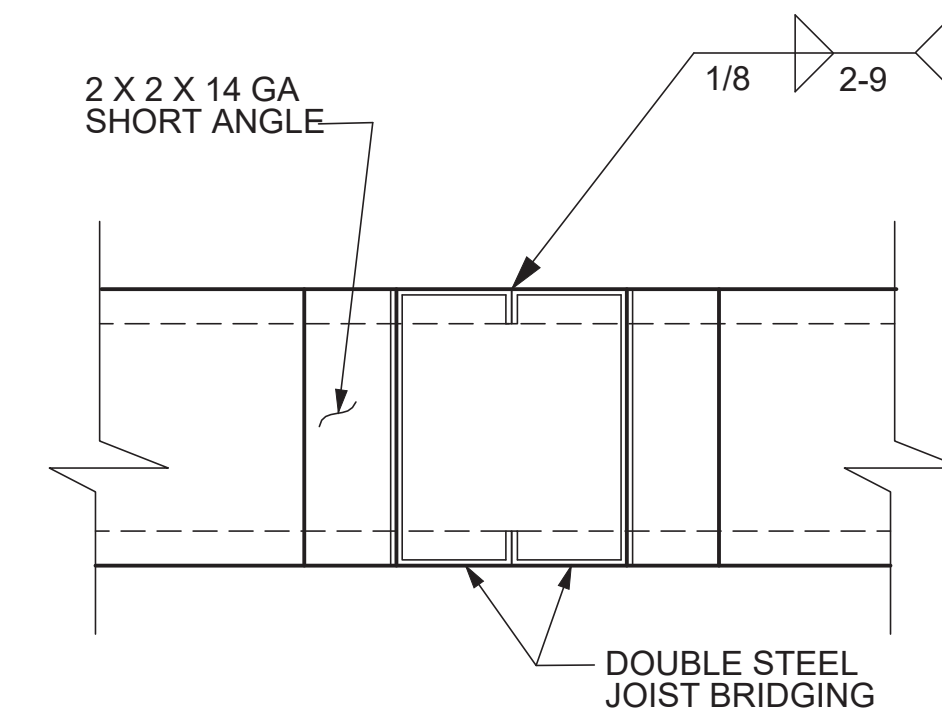
D SECTION
SCALE: NTS



A SECTION
SCALE: NTS



B SECTION
SCALE: NTS



E SECTION
SCALE: NTS

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ANTELOPE VALLEY - EAST KERN WATER AGENCY

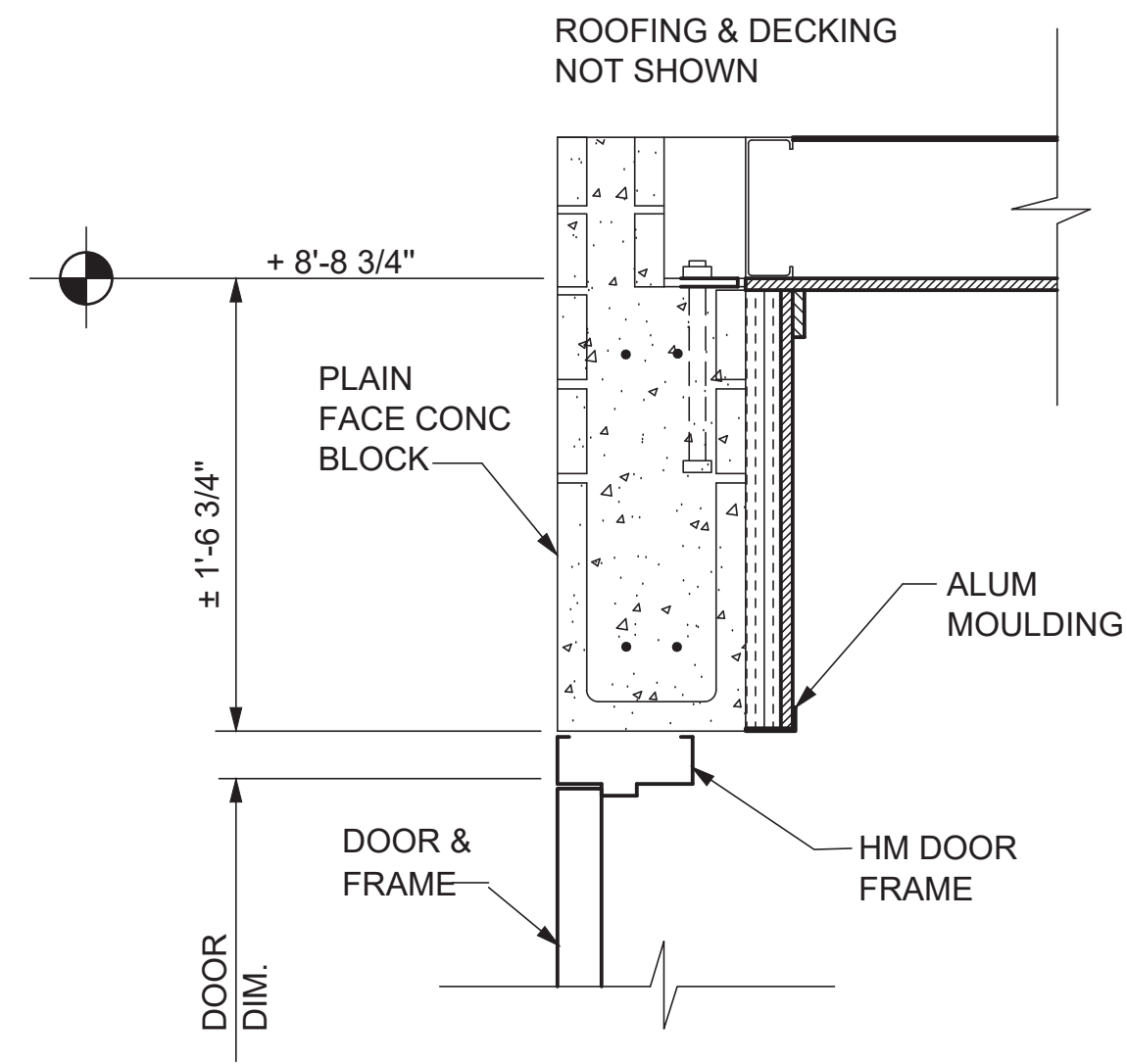
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
CONTROL BUILDING
ROOF FRAMING PLAN, SECTIONS,
AND DETAILS

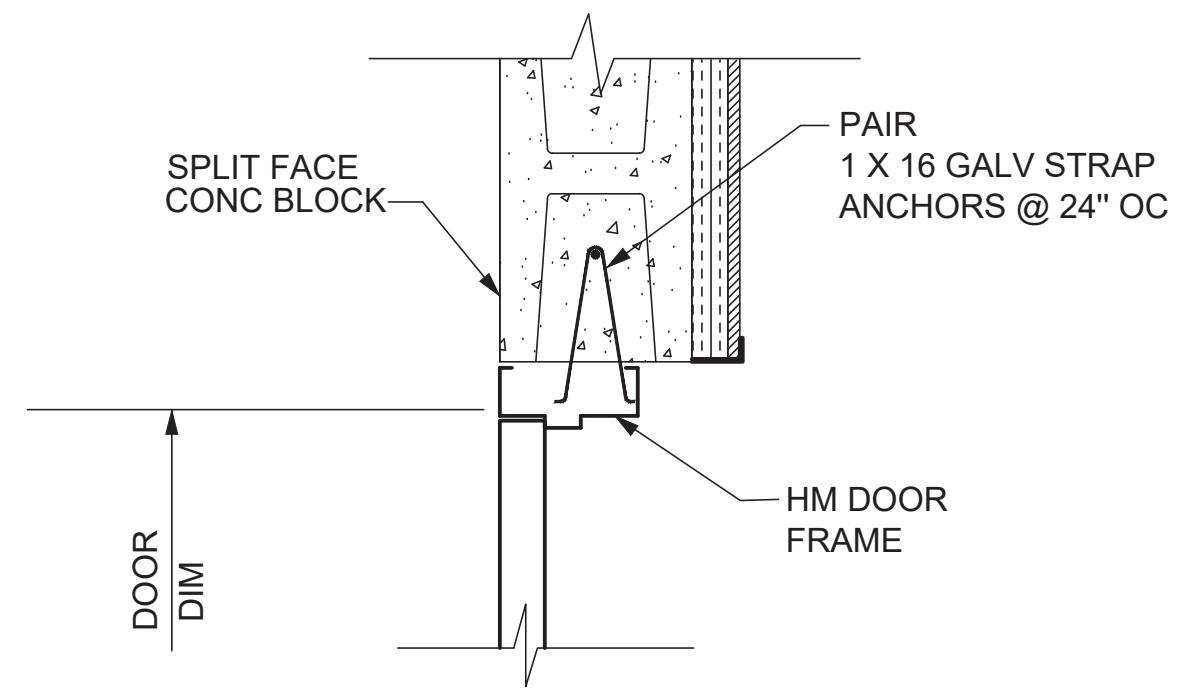
SHEET
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SHEETS

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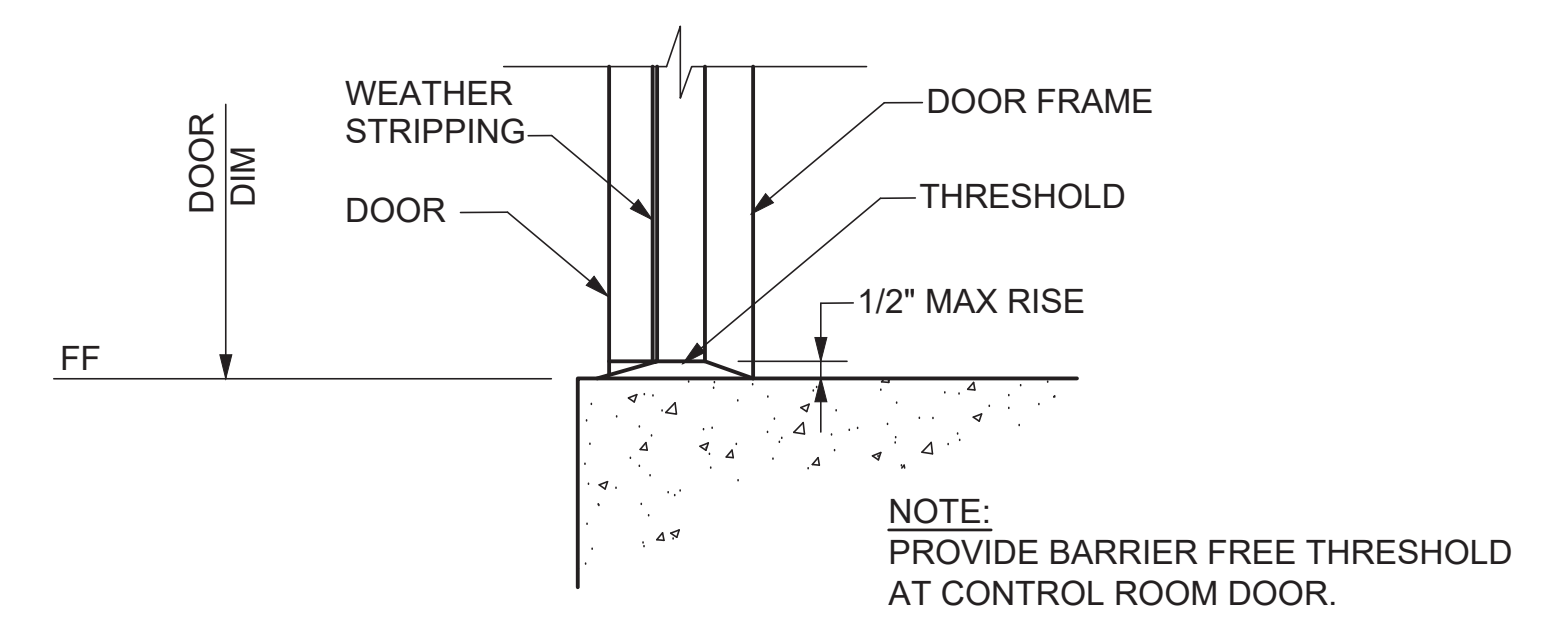
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



1 HEAD @ DOOR
SCALE: 1 1/2" = 1'-0"



2 JAMB @ DOOR
SCALE: 1 1/2" = 1'-0"



3 SILL @ DOOR
SCALE: 1 1/2" = 1'-0"

NOTE: PROVIDE BARRIER FREE THRESHOLD AT CONTROL ROOM DOOR.

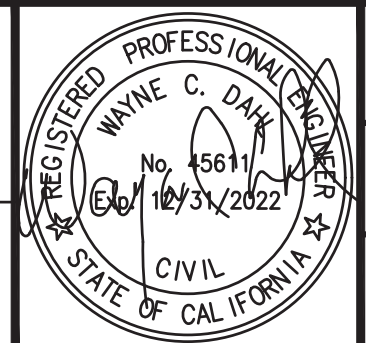
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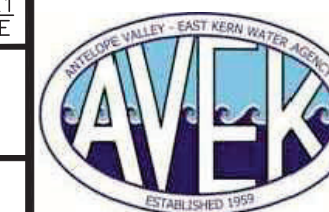
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NAME R.C.E. 45611 DATE

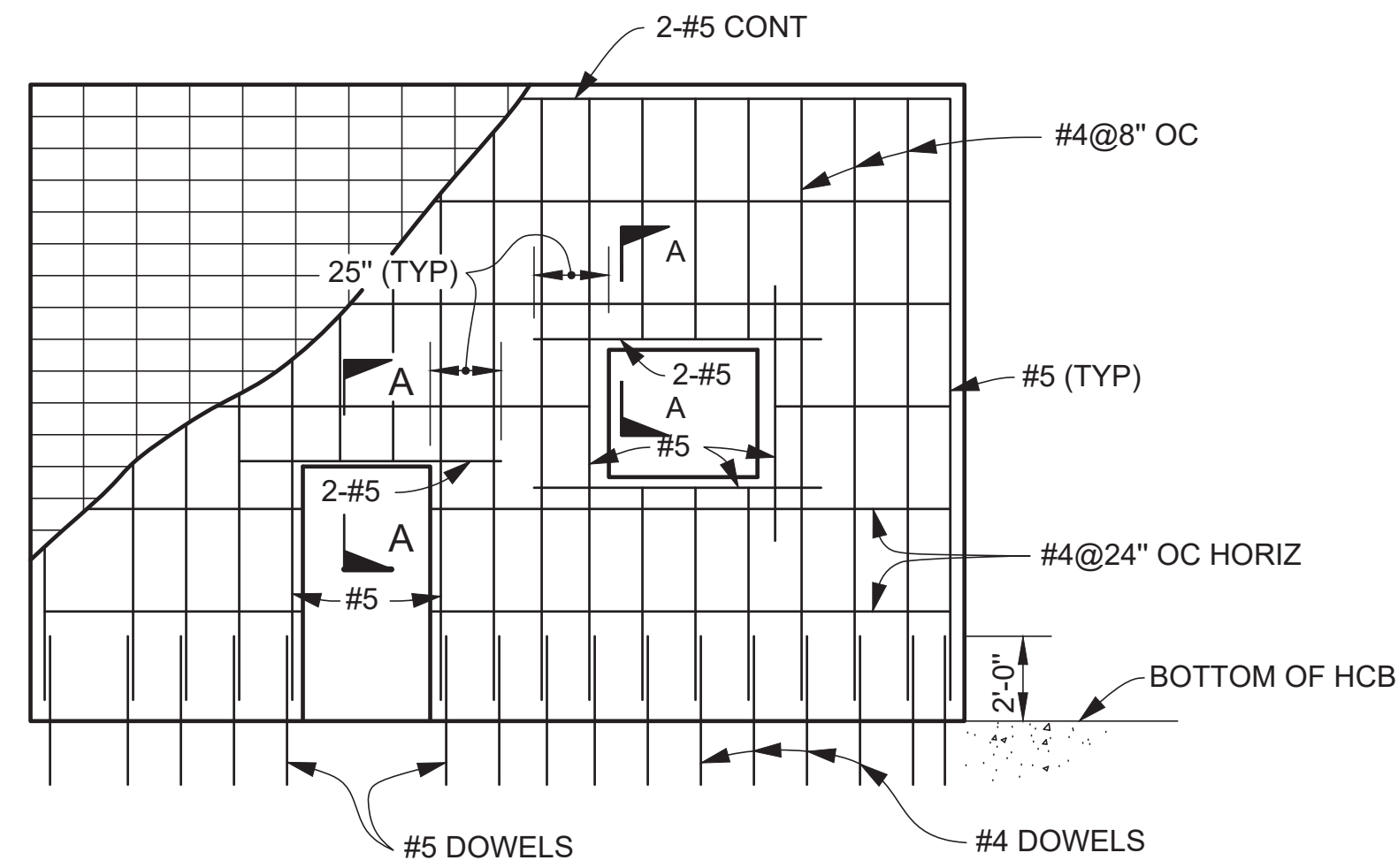
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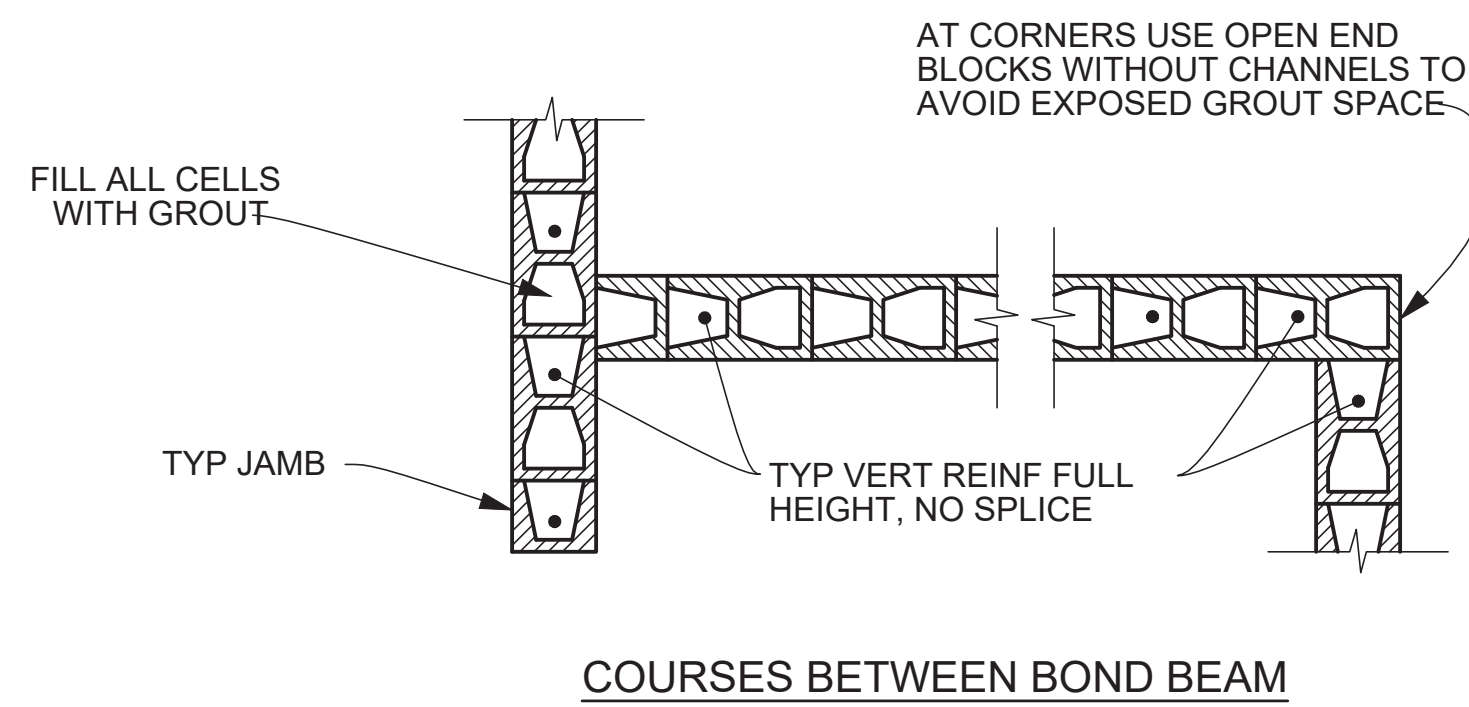
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL
CONTROL BUILDING DOOR AND
MISCELLANEOUS DETAILS

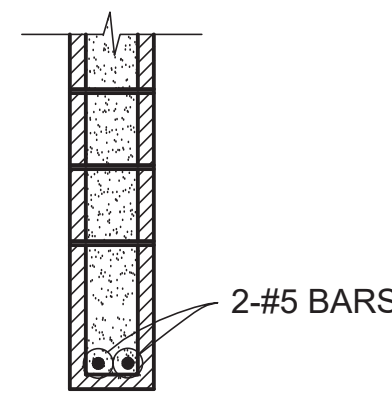
SHEET
S-16
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SHEETS



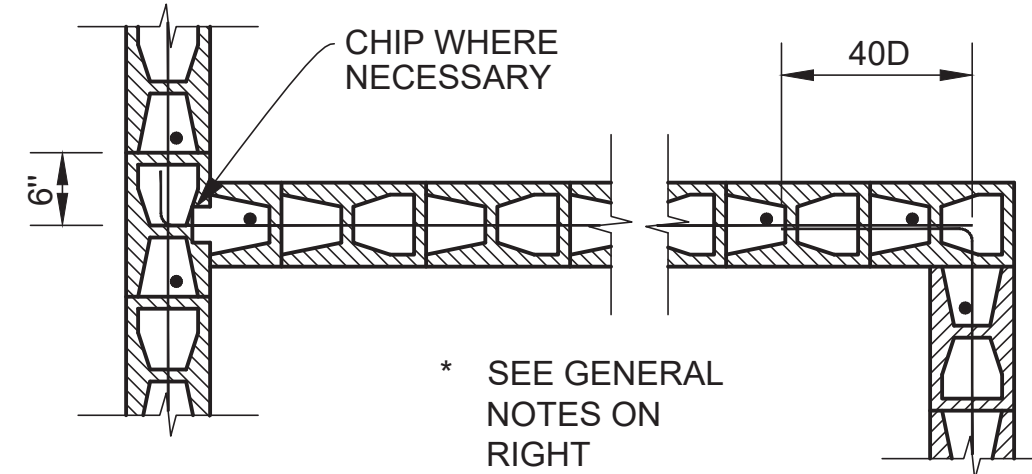
TYPICAL ELEVATION



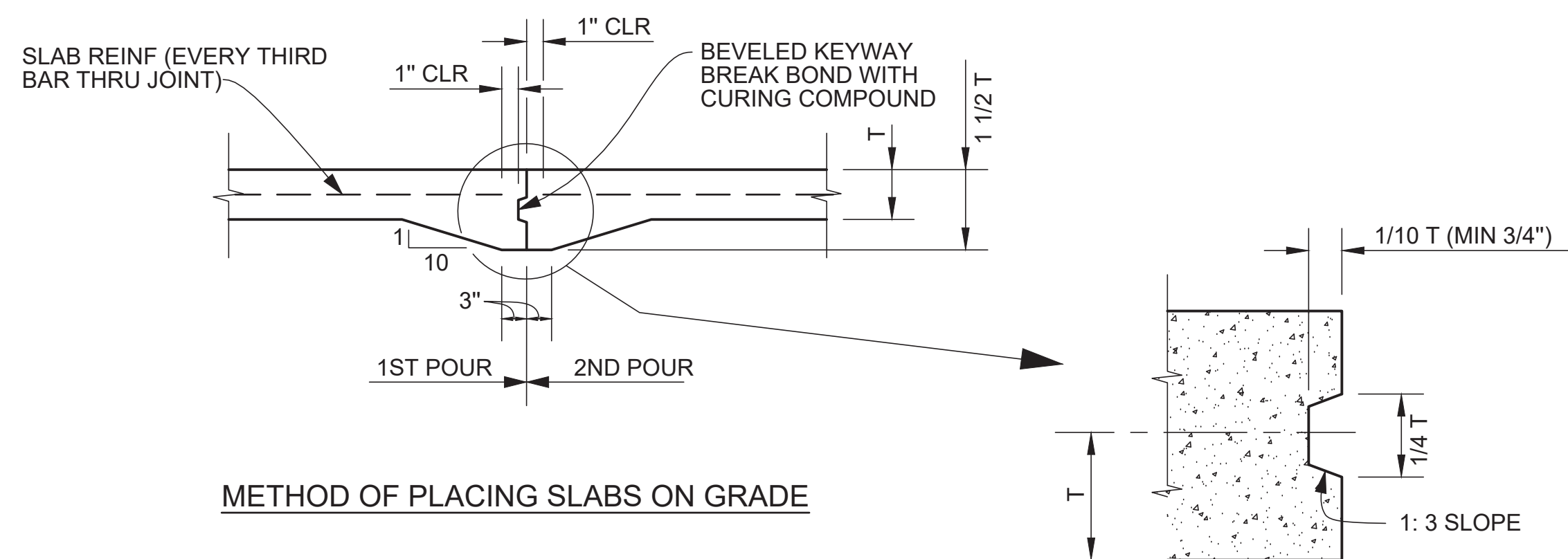
COURSES BETWEEN BOND BEAM



SECTION A-A
TYPICAL LINTEL



BOND BEAM COURSES



METHOD OF PLACING SLABS ON GRADE

GENERAL NOTES FOR CMU WALLS

1. TYPICAL DETAILS AND NOTES ON THIS SHEET SHALL APPLY UNLESS OTHERWISE SHOWN OR NOTED
2. USE OPEN END BLOCKS WHERE VERTICAL REINFORCEMENT OCCURS.
3. OPEN AND CHANNEL BLOCKS SHALL BE USED IN ALL COURSES, CONTAINING HORIZONTAL REINFORCEMENT. ALL OTHER COURSES SHALL BE OPEN END CHANNEL BLOCKS OR STANDARD BLOCKS.
4. ALL CELLS AND VOIDS SHALL BE FILLED WITH GROUT.
5. HORIZONTAL REINFORCEMENT SHALL NOT BE PLACED IN MORTAR JOINTS.
6. VERTICAL REINFORCEMENT SHALL EXTEND FULL HEIGHT OF WALL WITHOUT A SPLICE AND SHALL BE ACCURATELY PLACED AND HELD IN POSITION IN CENTER OF WALL.
7. ALL WALLS SHALL BE DOWELED TO FOOTINGS, WITH BARS SAME SIZE AND SPACING OF WALL BARS EXTENDED 2'-0" MINIMUM INTO BLOCK WALL.
8. THERE SHALL BE A MINIMUM LENGTH OF 8" RETURN OF C.M.U. AT ANY JAMB ADJACENT TO A CORNER OR INTERSECTION.
9. SHORING FOR BLOCKS LINTELS SHALL REMAIN IN PLACE A MINIMUM OF 15 DAYS AFTER THE WALL HAS BEEN COMPLETED.
10. SEE ARCHITECTURAL AND MECHANICAL DRAWINGS FOR WALL OPENINGS, WALL OFFSETS, SIZE AND LOCATION OF DUCTS, VENTS AND OTHER DETAILS NOT SHOWN IN STRUCTURAL DRAWINGS.
11. PIPES SHALL NOT BE EMBEDDED IN ANY MASONRY WALL.
12. LINTELS OVER OPENINGS SHALL NOT BE LESS THAN 15 5/8 INCHES DEEP.
13. ALL ANCHORS, BOLTS, REGLETS, DOWELS, AND OTHER MISCELLANEOUS ITEMS TO BE CAST IN THE WALL SHALL BE FIRMLY SECURED IN PLACED BEFORE GROUT IS POURED.

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

STRUCTURAL

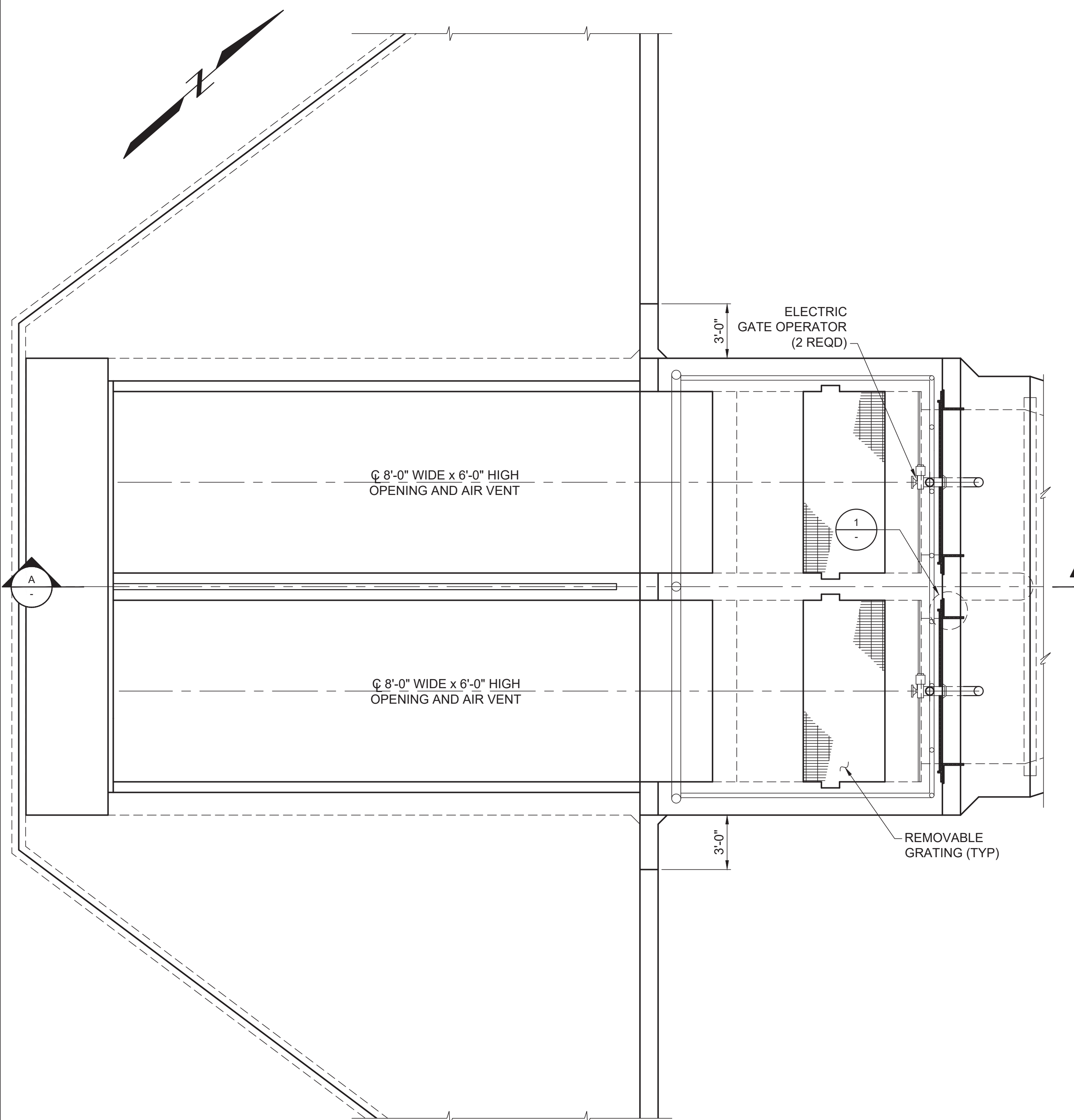
CONTROL BUILDING DOOR
STANDARD DETAILS AND NOTES

SHEET
S-17

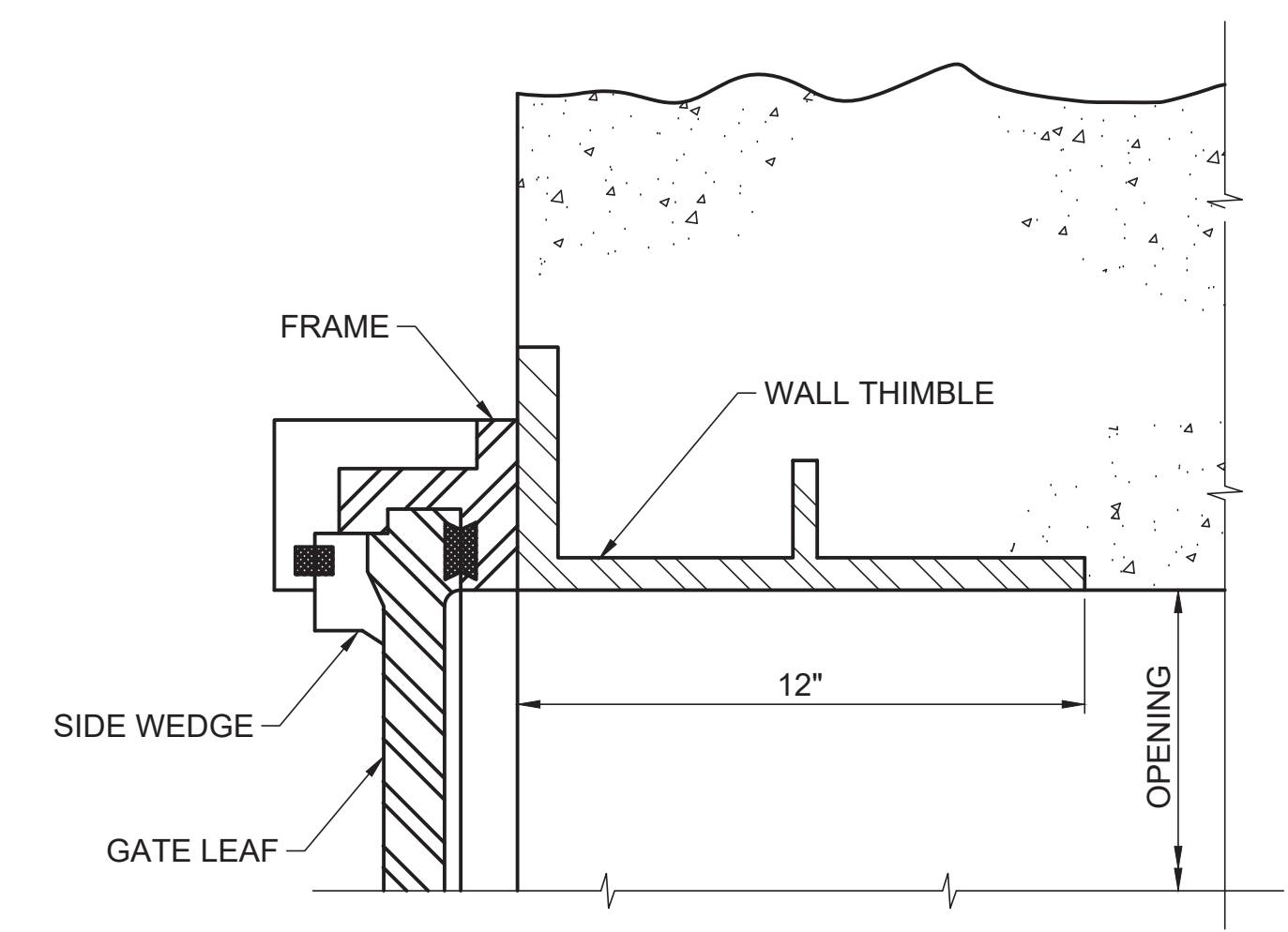
34 of 54
SHEETS

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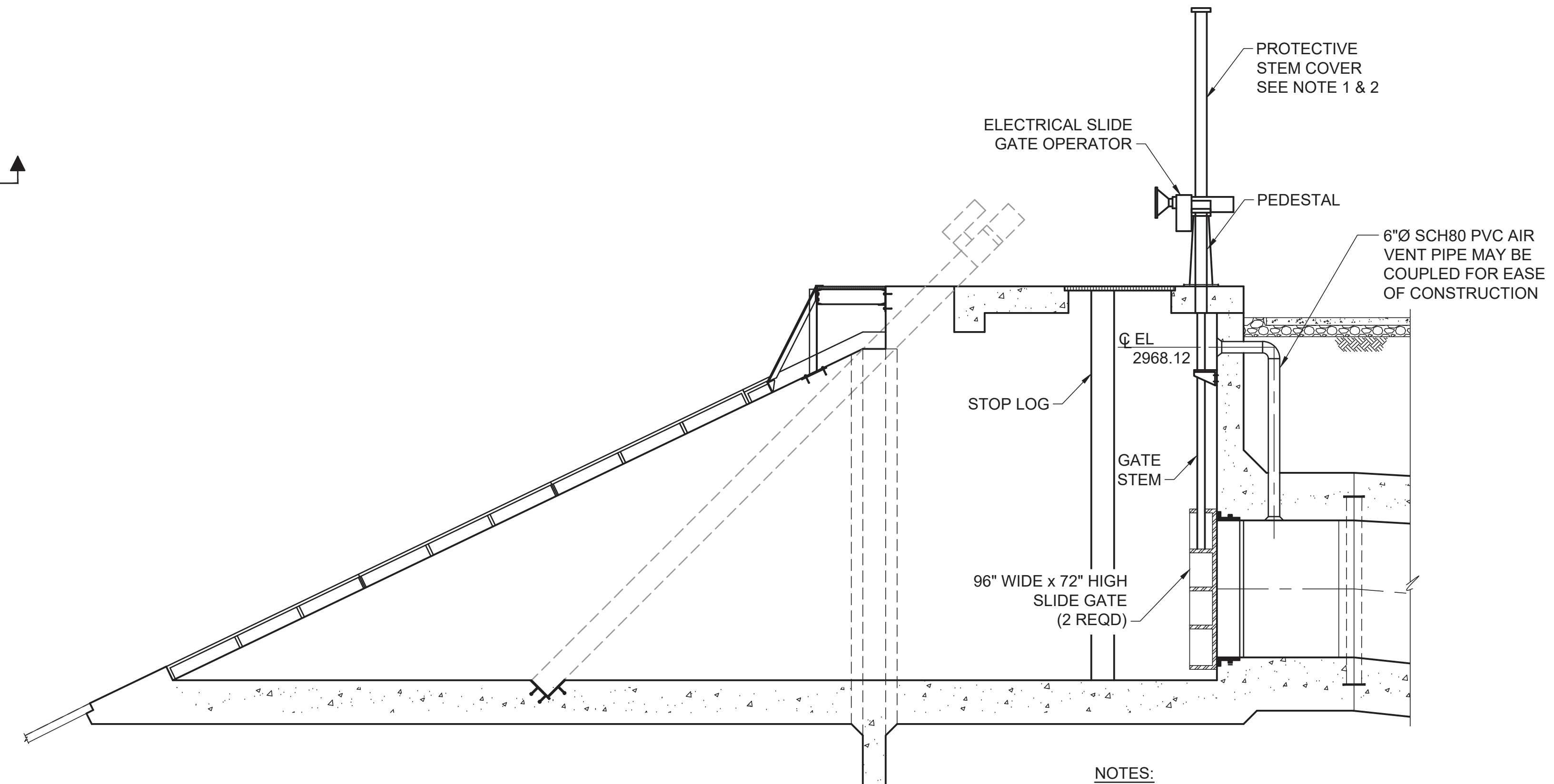
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PLAN
SCALE: 1/4"=1'-0"



1 DETAIL
SCALE: NTS



A SECTION
SCALE: 1/4"=1'-0"

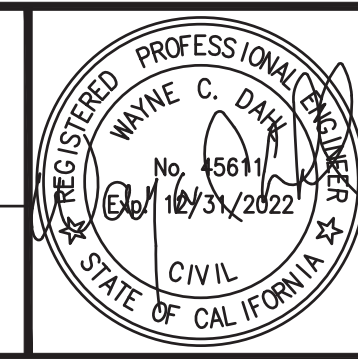
- NOTES:
- PROTECTIVE STEM COVER SHALL BE MADE OF 4" SCHEDULE 80 CLEAR PVC AND SHALL BE MARKED WITH GRADUATIONS IN FEET AND TENTHS OF FEET.
 - A REMOVABLE STEEL MESH CAGE WITH A HINGED DOOR AND LOCKING DEVICE SHALL BE PROVIDED.

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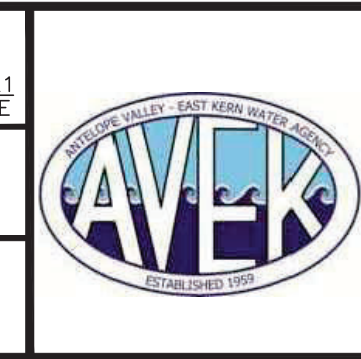
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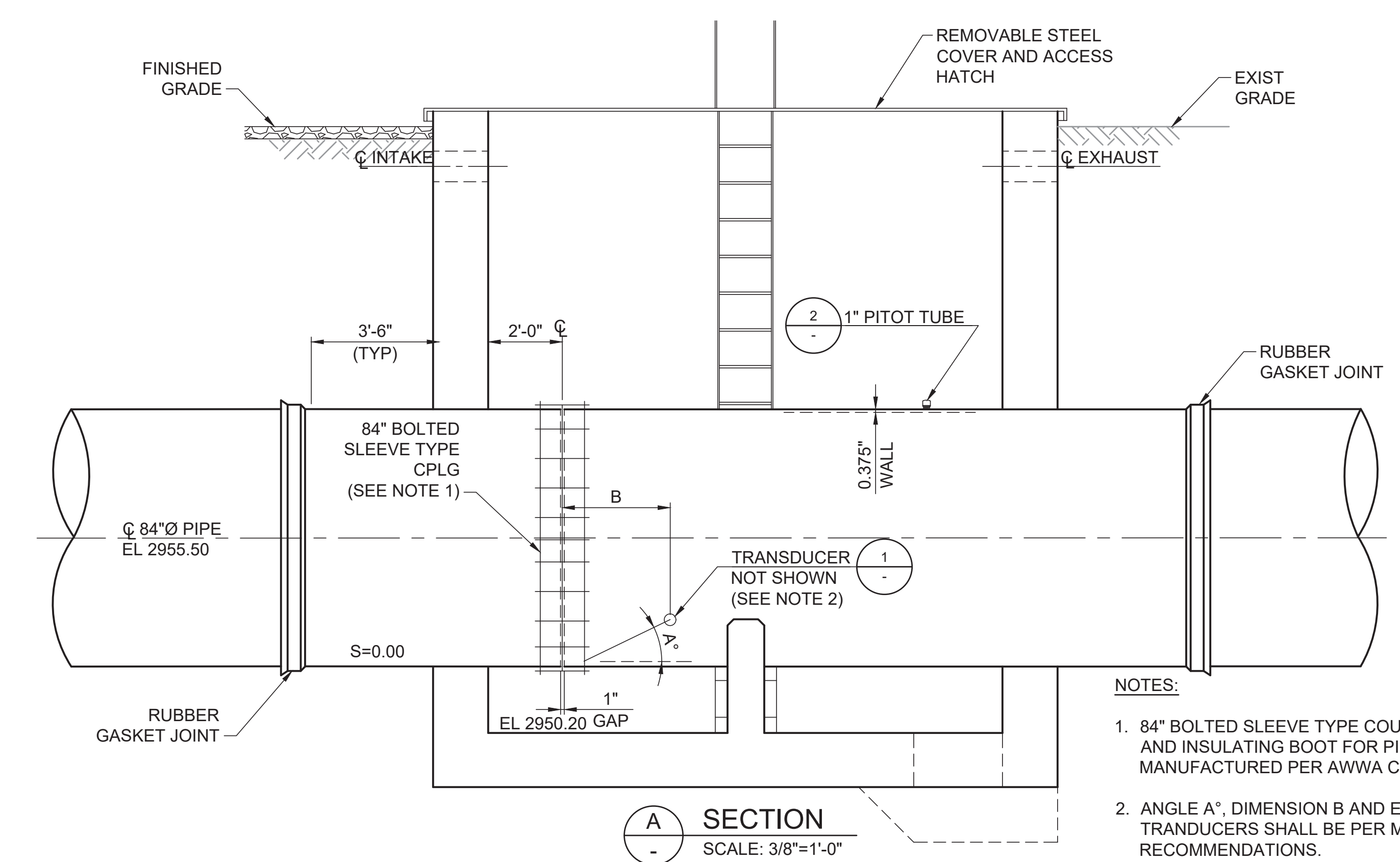
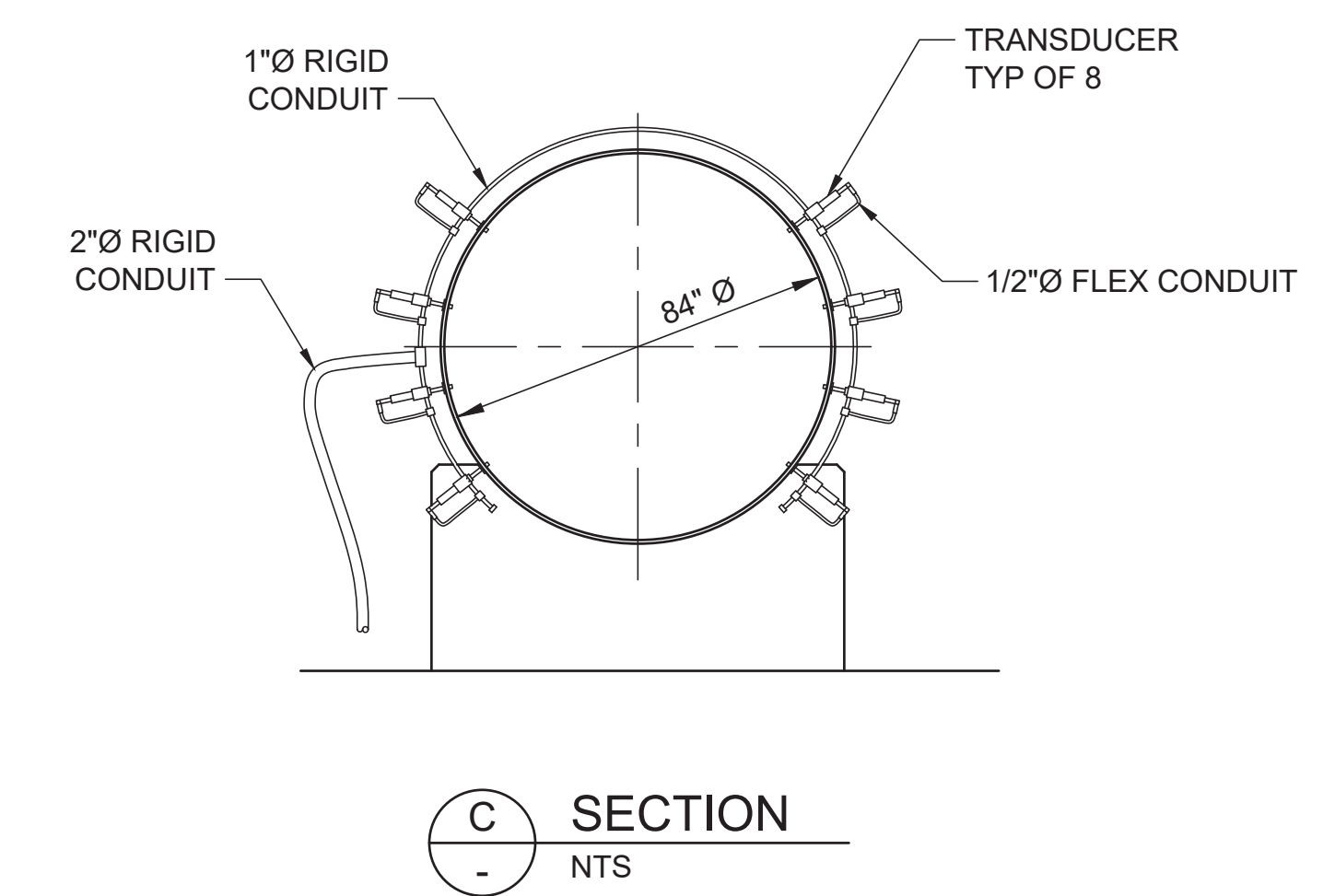
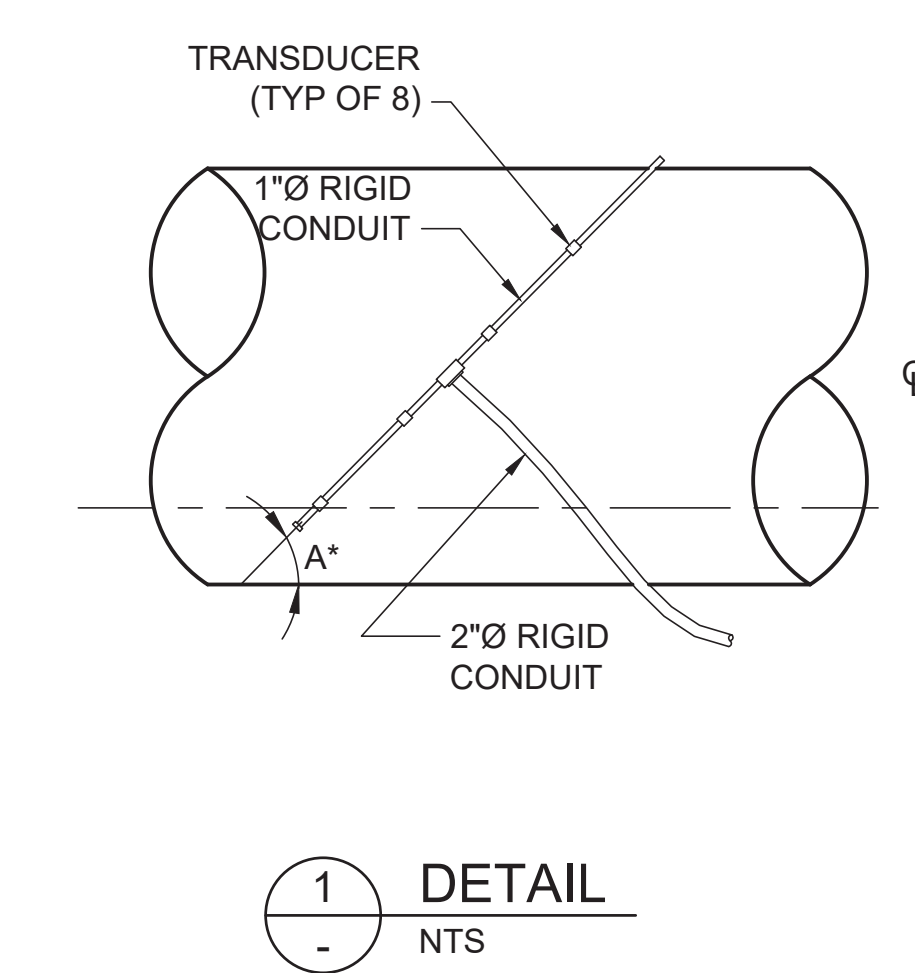
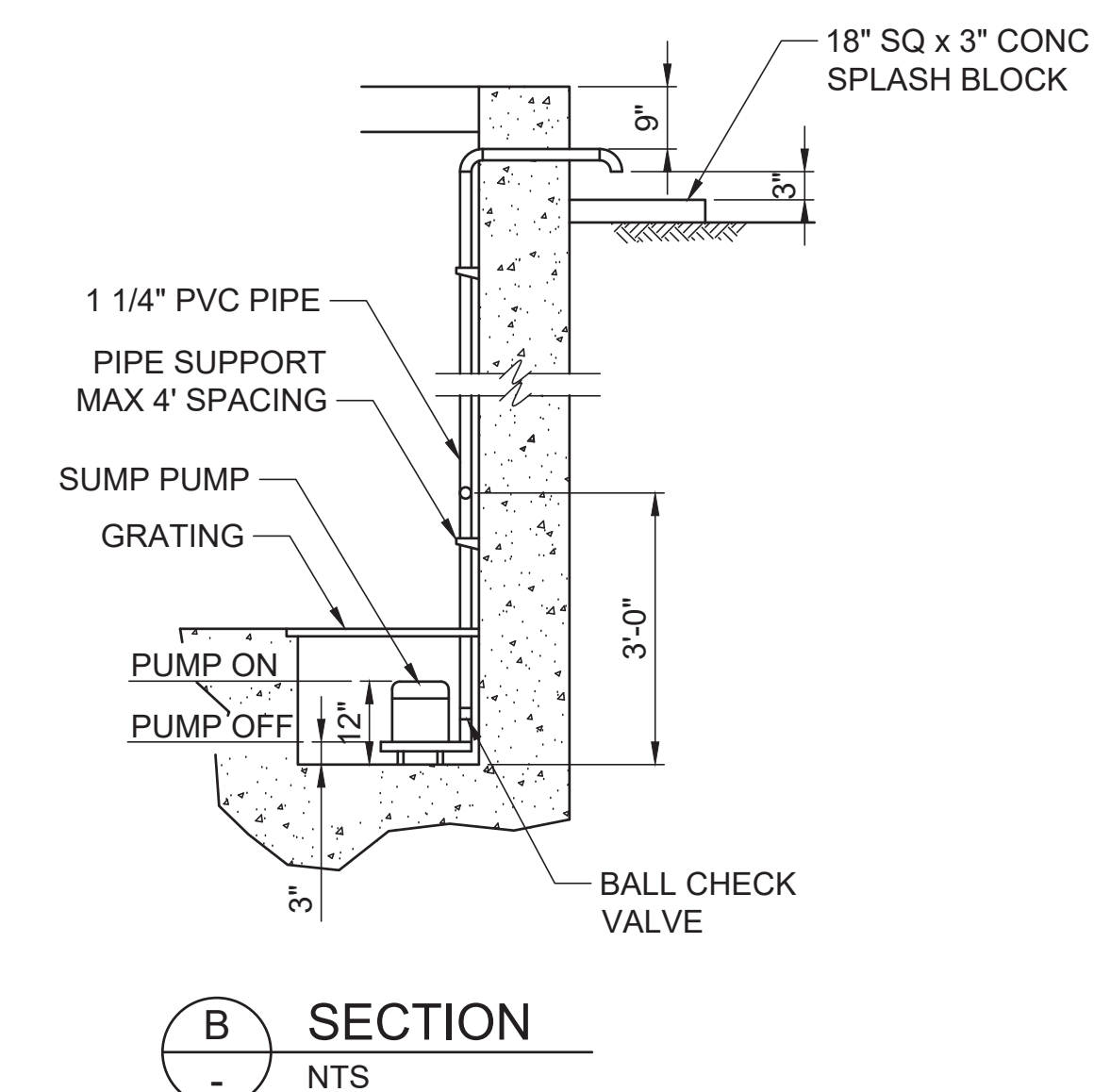
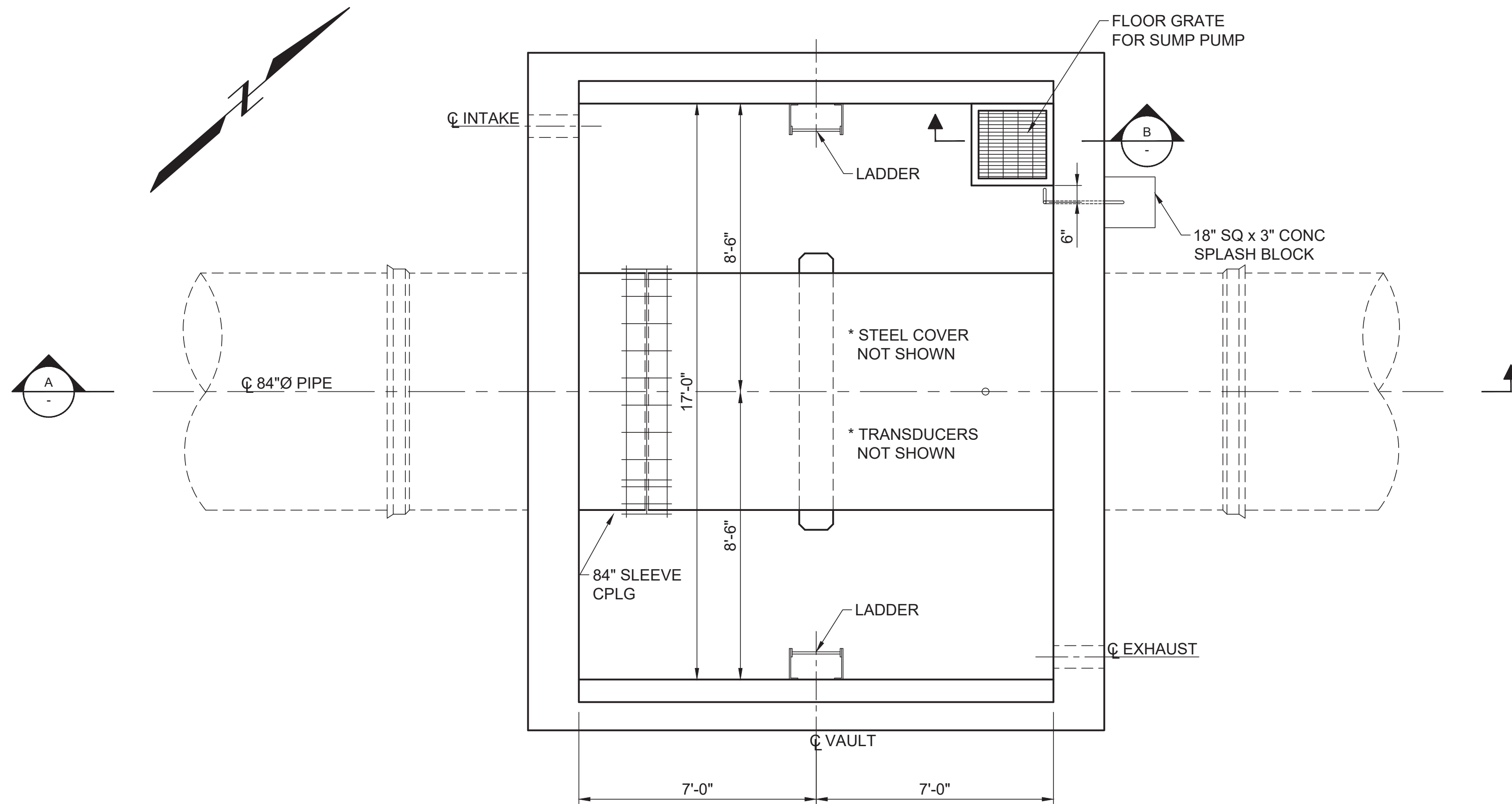


ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

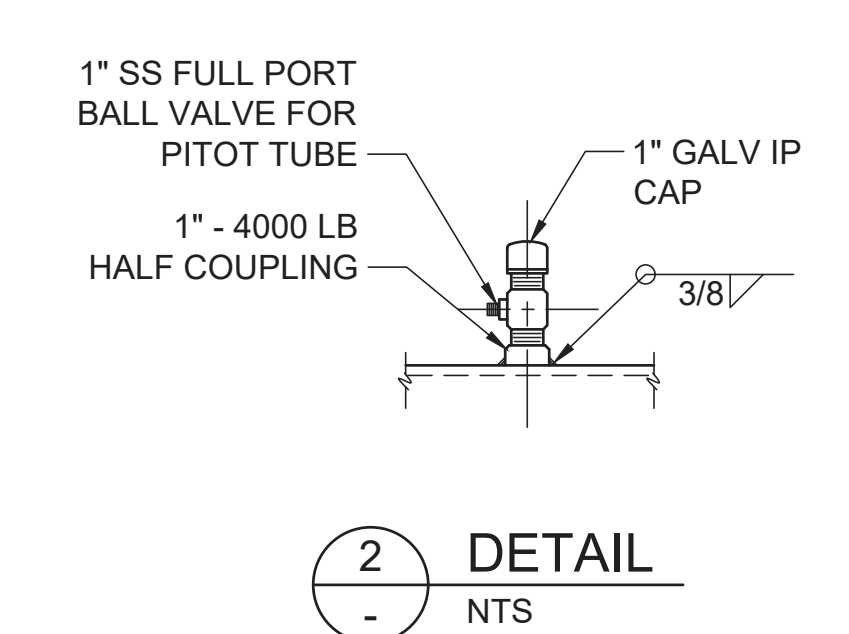
MECHANICAL
SLIDE GATE INSTALLATION DETAILS

SHEET
M-01
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SHEETS

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN
NOVEMBER 2021



- NOTES:
- 84" BOLTED SLEEVE TYPE COUPLING WITH 10" x 3/8" MIDDLE RING AND INSULATING BOOT FOR PIPE ENDS. COUPLING SHALL BE MANUFACTURED PER AWWA C219.
 - ANGLE A°, DIMENSION B AND EXACT LOCATION OF SONIC METER TRANSDUCERS SHALL BE PER METER MANUFACTURERS RECOMMENDATIONS.



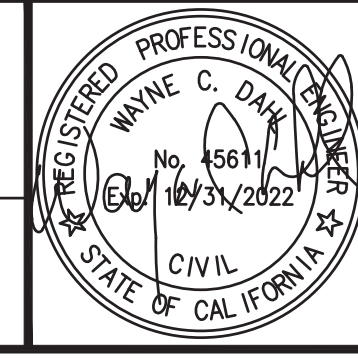
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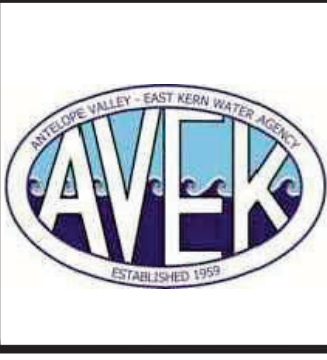
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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

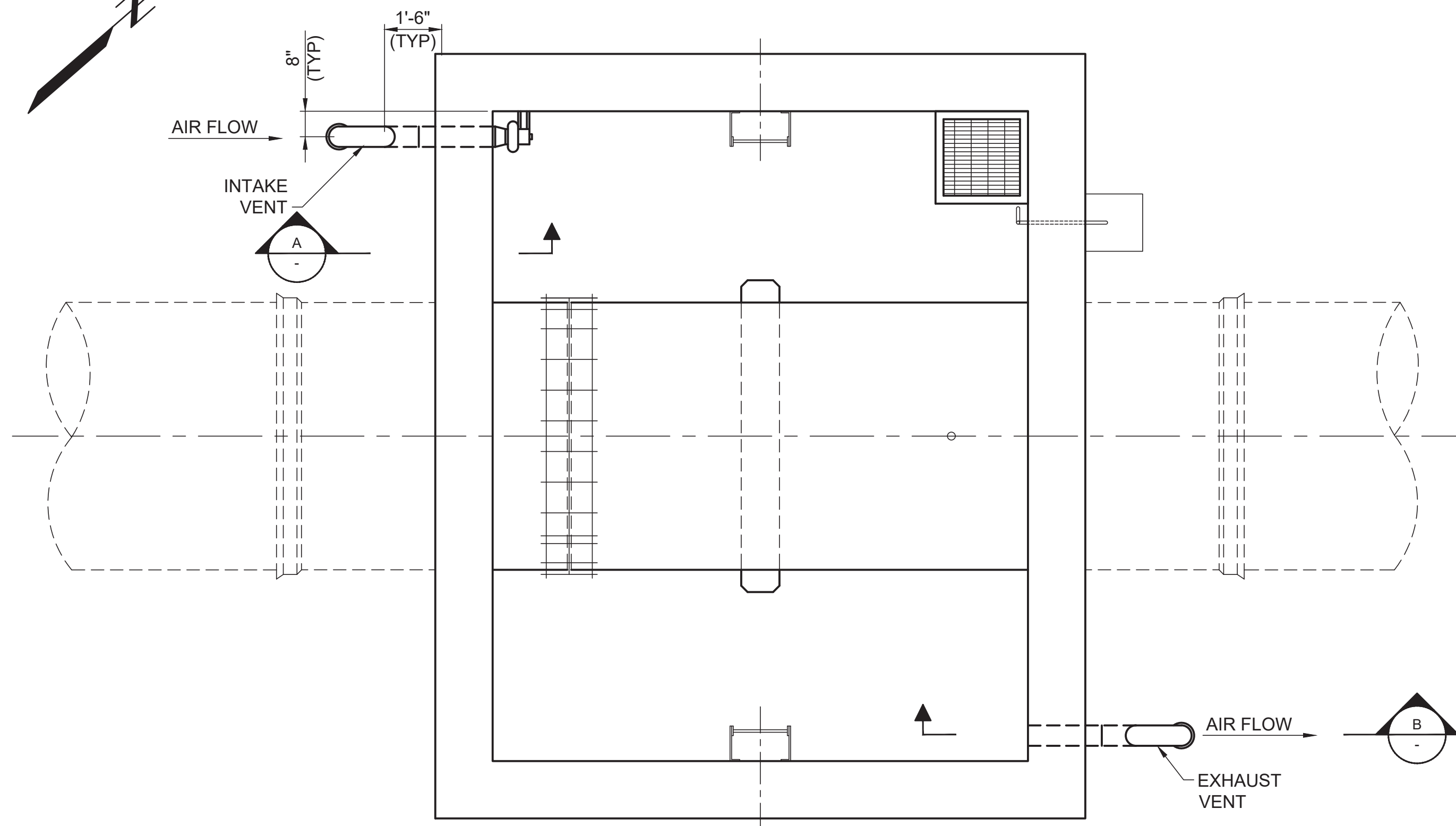
MECHANICAL

METER VAULT PLAN AND DETAILS

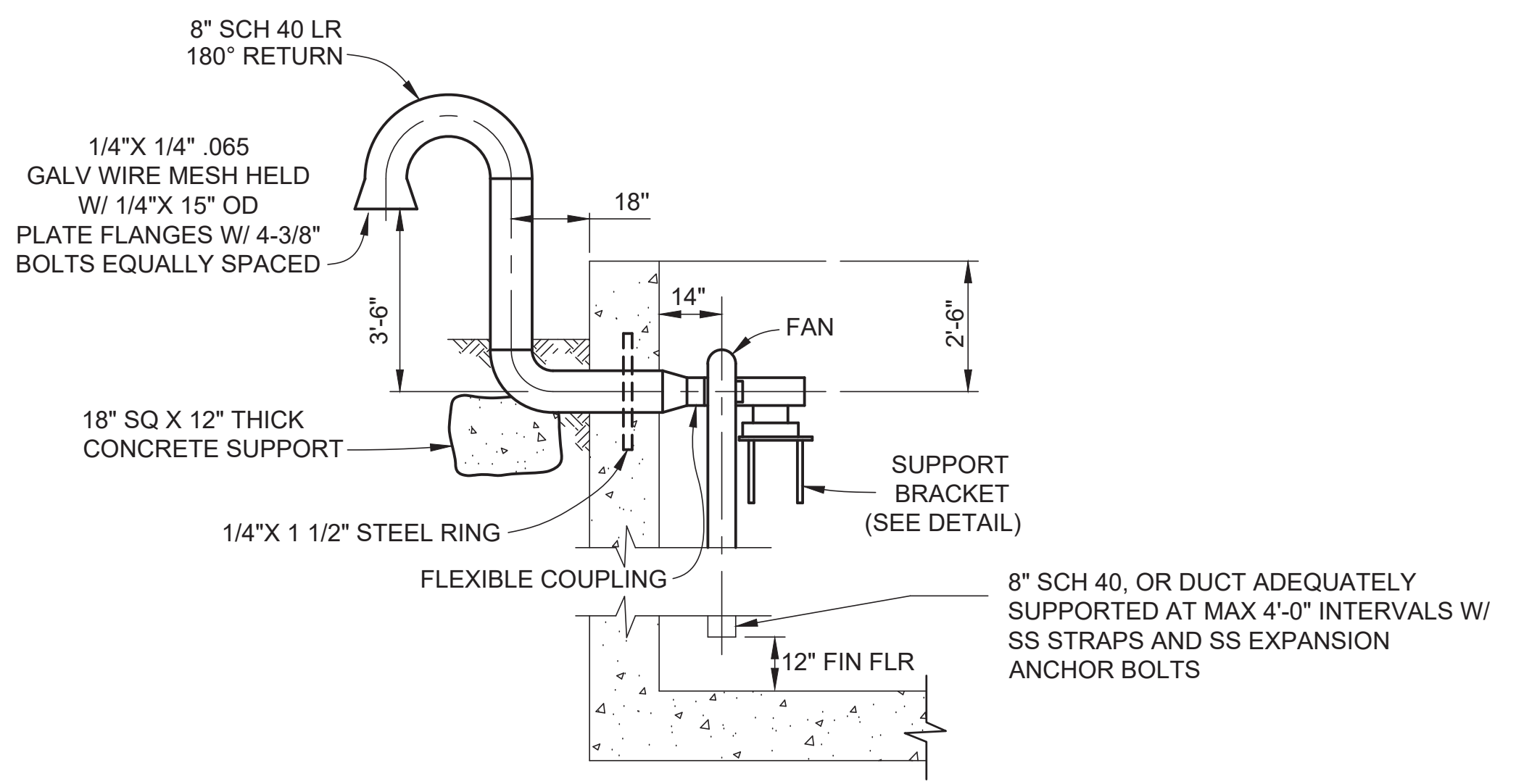
SHEET
M-02

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SHEETS

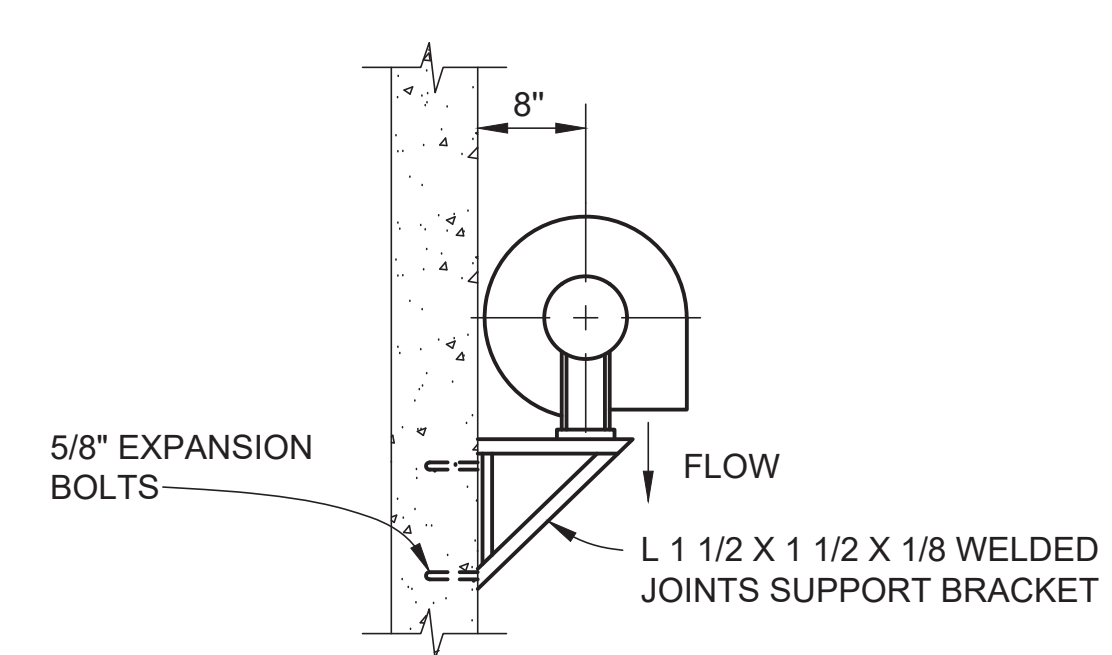
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



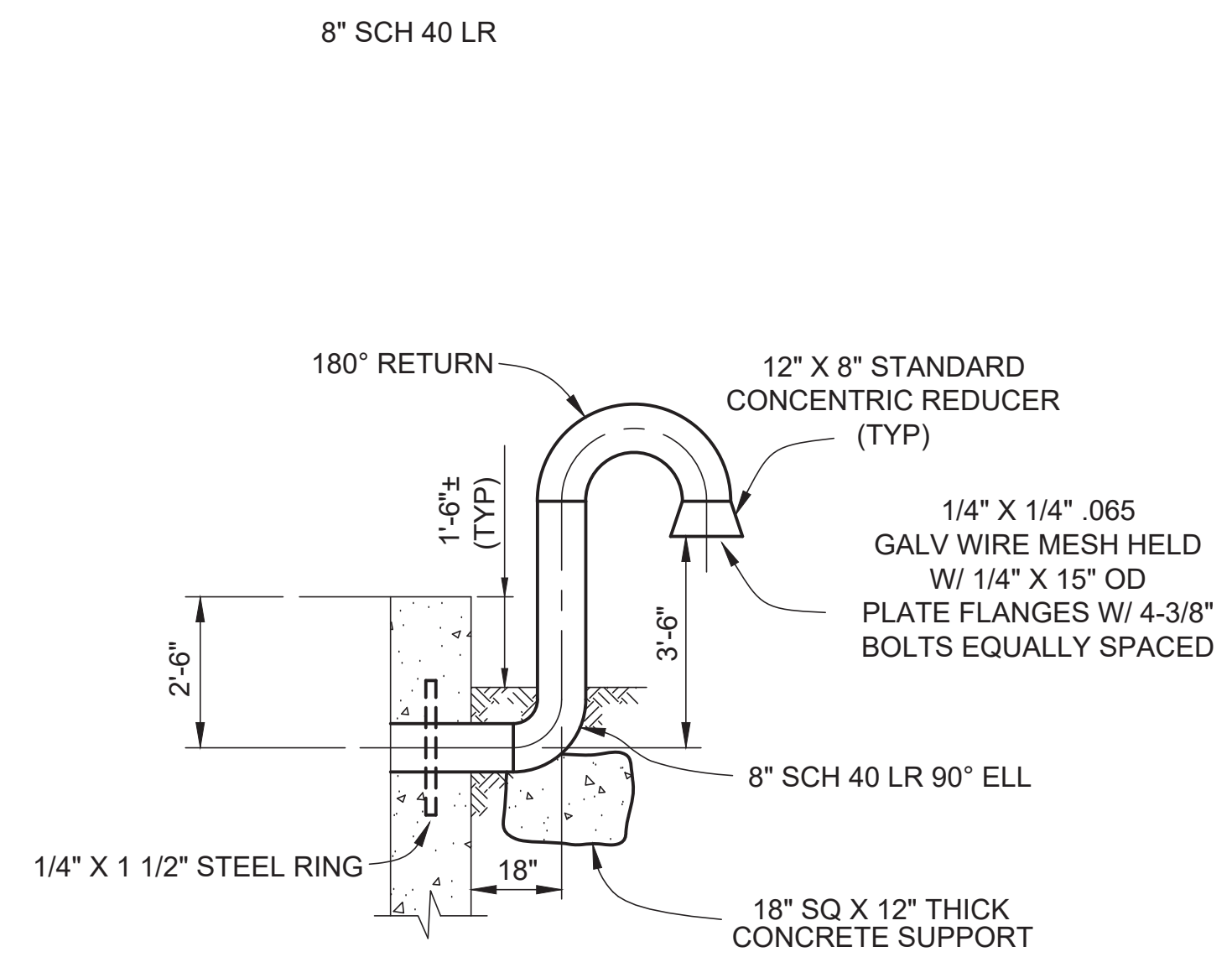
PLAN
SCALE: 3/8"=1'-0"



A SECTION
SCALE: NTS



FAN SUPPORT BRACKET
SCALE: NTS



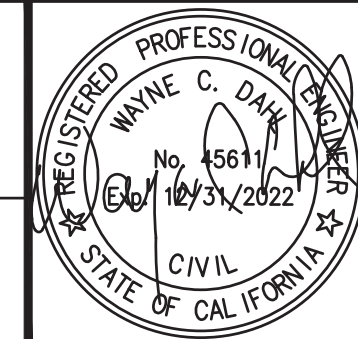
B SECTION
SCALE: NTS

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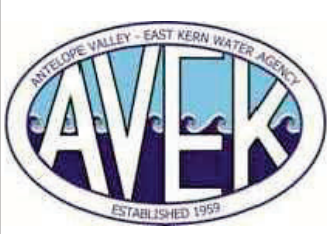
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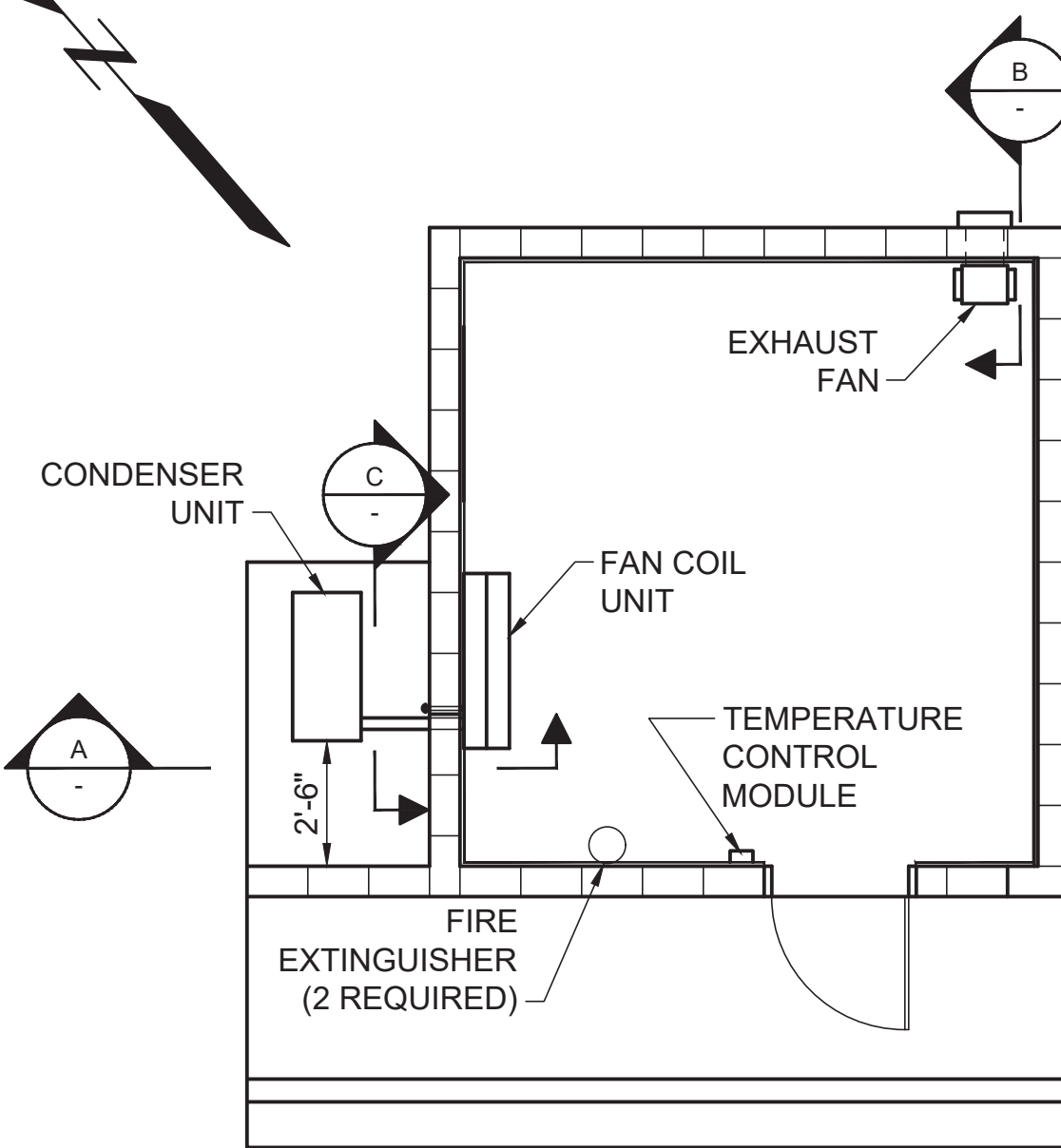
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

MECHANICAL
METER VAULT VENTILATION DETAILS

SHEET
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SHEETS

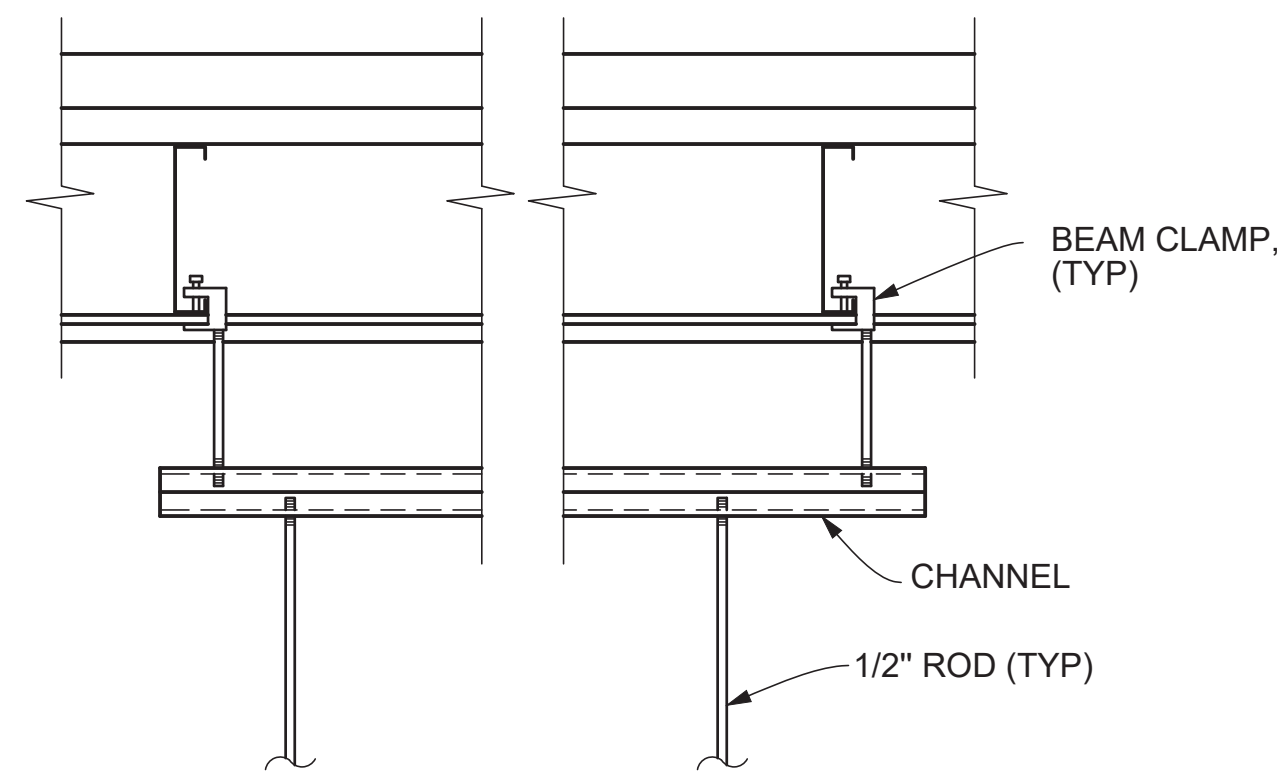
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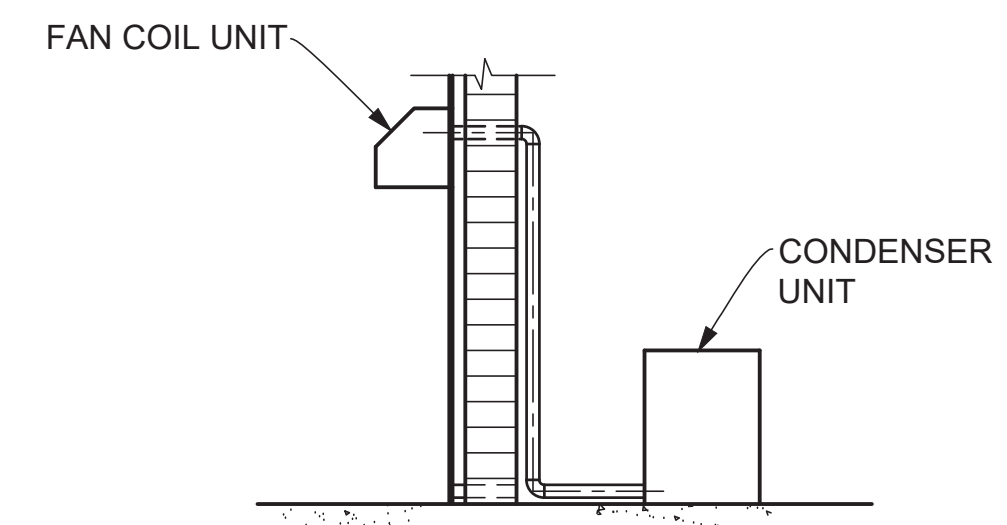


FLOOR PLAN
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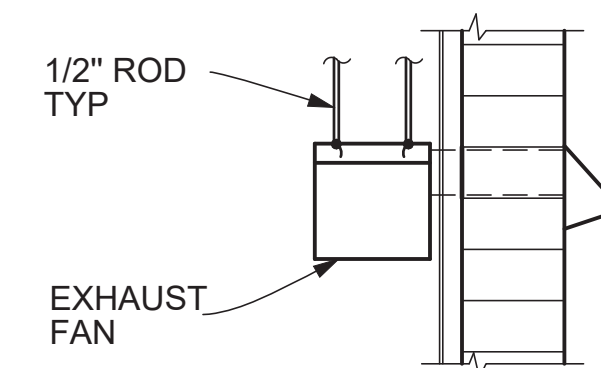
NOTE:
FIRE EXTINGUISHERS SHALL BE 10 LBS SIZE DRY CHEMICAL TYPE FOR CLASS A,B,C FIRES WITH HEAVY DUTY BRACKETS FOR WALL MOUNTING.



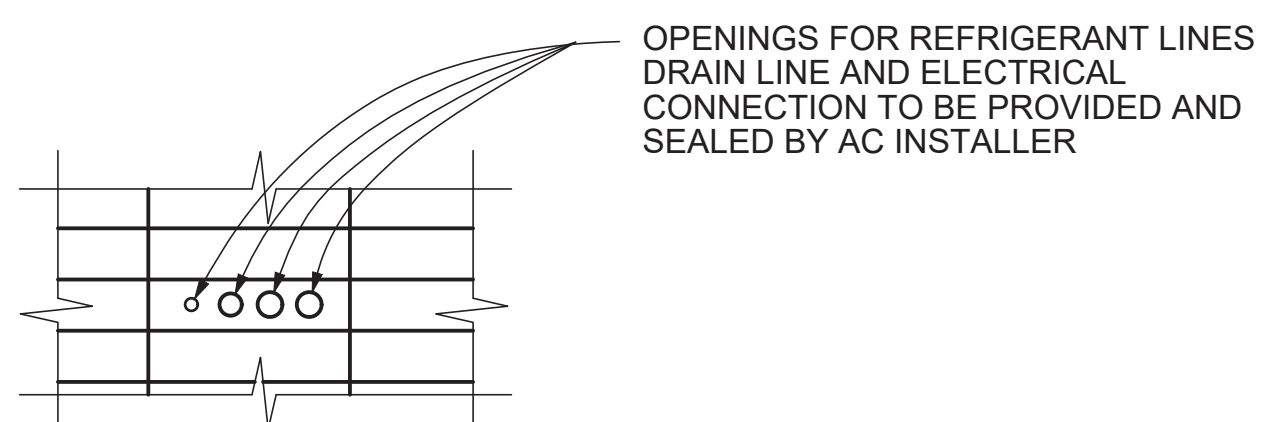
HANGER SUPPORT DETAIL (TYP)
SCALE: NTS



A SECTION
SCALE: NTS



B SECTION
SCALE: NTS



OPENINGS FOR REFRIGERANT LINES DRAIN LINE AND ELECTRICAL CONNECTION TO BE PROVIDED AND SEALED BY AC INSTALLER

C SECTION
SCALE: NTS

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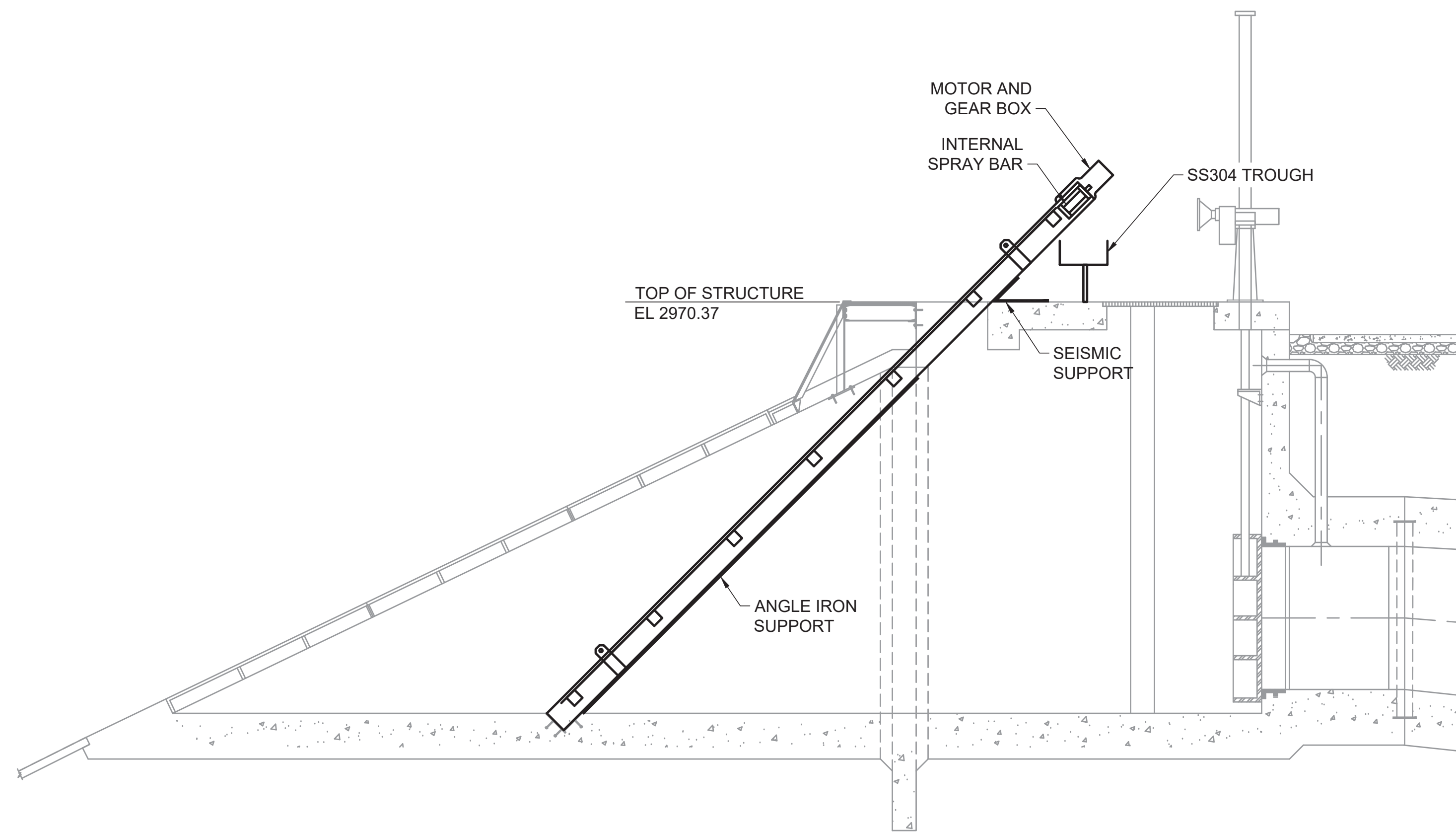
MECHANICAL
CONTROL BUILDING
MECHANICAL EQUIPMENT

SHEET
M-04
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SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

NOVEMBER 2021



TRAVELING WATER SCREEN
SCALE: 1/4" = 1'-0"

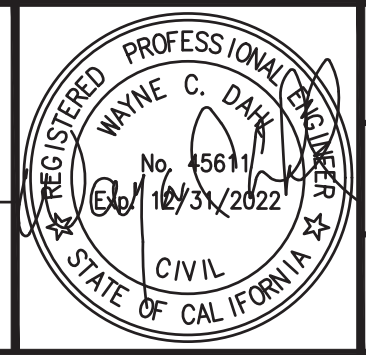
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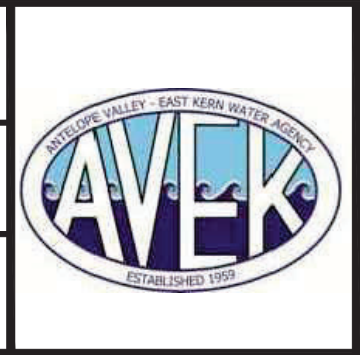


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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

MECHANICAL

TRAVELING WATER SCREEN

SHEET
M-05

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SHEETS

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

APPENDIX G

ABBREVIATIONS

3W	3-WIRE
4W	4-WIRE
A	AMPERE
AC	ALTERNATING CURRENT
AUX	AUXILIARY
CPT	CONTROL POWER TRANSFORMER (IN INDIVIDUAL STARTER CUBICLE)
DC	DIRECT CURRENT
DIA	DIAMETER
DPDT	DOUBLE PULL DOUBLE THROW
FIT	FLOW INDICATOR/TRANSMITTER
FM	FLOW METER
FMC	FLOW METER CONSOLE
FS	FLOW SWITCH
G, EG	EQUIPMENT GROUND
GFCT	GROUND FAULT CURRENT TRANSFORMER
GFI	GROUND FAULT INTERRUPTING
HP	HORSEPOWER
HZ	HERTZ
INST	INSTANTANEOUS
JB	JUNCTION BOX
KV	KILO (1000) VOLT
KVA	KILO (1000) VOLT AMPERES
LS	LIMIT SWITCH
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
NO	NUMBER, NORMALLY OPEN
OCB	OIL CIRCUIT BREAKER
OL	OVERLOAD RELAY
P	POLE
PH, Ø	PHASE
PL	PILOT LIGHT
PRESS	PRESSURE
PRI	PRIMARY
PS	PRESSURE SWITCH
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
RECT	RECTIFIER
RCPT	RECEPTACLE
RTD	RESISTANCE TEMPERATURE DETECTOR
RTU	REMOTE TELEMETRY UNIT
RVAT	REDUCED VOLTAGE AUTO TRANSFORMER
SEC	SECONDARY
SP	SPARE
SQ	SQUARE
SS	SELECTOR SWITCH, STAINLESS STEEL
SW	SWITCH
SWBD	SWITCHBOARD
TSP	TWISTED SHIELDED PAIR
TST	TWISTED SHIELDED TRIAD
T-STAT	THERMOSTAT
TYP	TYPICAL
UG	UNDERGROUND
UPT	UNSHIELDED TWISTED PAIR
V	VOLTAGE, VOLTS
VS	VIBRATION SWITCH
WP	WEATHERPROOF
W	WATTS
XFMR	TRANSFORMER
XMTR	TRANSMITTER

SYMBOLS LEGEND:

	CONDUIT RUN UNDERGROUND OR IN CONCRETE		JUNCTION BOX
	CONDUIT HOME RUN TO PANEL DP1, CIRCUIT NO. 1 SHORT MARKS INDICATE NO. OF POWER CONDUCTORS, LONG DASH DENOTES NEUTRAL, SHORT DASH DENOTES LINE, CURVED LINE DENOTES GROUND		ELAPSED TIME METER
	EXPOSED CONDUIT		CURRENT TRANSFORMER, RATIO AND NUMBER OF CT'S AS NOTED
	CONDUIT BENDS TOWARD OBSERVER		FUSED DISCONNECT SWITCH 3 POLE UNLESS OTHERWISE NOTED
	CONDUIT BENDS AWAY FROM OBSERVER		HEATER
	GROUND GRID WIRE		CONTROL RELAY
	FLEXIBLE LIQUID - TIGHT CONDUIT CONNECTION		MOTOR STARTER CONTACTOR
	INDICATES CONDUIT NUMBER SEE CABLE AND CONDUIT SCHEDULE		INSTANTANEOUS AND TIME OVERCURRENT RELAY
	POLE MOUNTED LIGHT FIXTURE X - LIGHTING SCHEDULE DESIGNATION		TIME OVERCURRENT RELAY
	120V DUPLEX RECEPTACLE, NEMA CONFIGURATION 5-20.		LOCKOUT RELAY (HAND RESET)
	MOLDED CASE CIRCUIT BREAKER, 3 POLE UNLESS OTHERWISE NOTED: 100A - TRIP RATING IN AMPERES AT - AMPERES TRIP AF - AMPERES FRAME MCP - MOTOR CIRCUIT PROTECTOR		GROUND FAULT OVERVOLTAGE RELAY
	MEDIUM VOLTAGE STARTER		EMERGENCY LIGHTING PACK
	N.O. CONTACT		GROUND ROD
	N.C. CONTACT		PUSHBUTTON STATION
	NORMALLY OPEN - TIME DELAY		DISCONNECT SWITCH
	NORMALLY CLOSED - TIME DELAY		THERMOSTAT OR MOTOR TEMP. SWITCH
	OVERLOAD RELAY CONTACTS		INDUCTION MOTOR, (NUMBER INDICATES HORSEPOWER)
	FUSE		OVERLOAD RELAY
	INDICATING LIGHT: G-GREEN R-RED		
	FIELD TERMINATION (DEVICES)		
	MEDIUM OR HIGH VOLTAGE DRAWOUT BREAKER		
	FULL VOLTAGE NON-REVERSING STARTER, NEMA SIZE AS INDICATED BY *		
	LED LIGHT FIXTURE		
	X - LIGHTING SCHEDULE DESIGNATION		

GENERAL NOTES:

- INSTALLATION SHALL MEET ALL REQUIREMENTS OF THE 2017 EDITION OF THE NATIONAL ELECTRICAL CODE (NEC) AND ALL LOCAL CODES HAVING JURISDICTION.
- AN EQUIPMENT GROUNDING CONDUCTOR, SIZED PER THE NEC, SHALL BE PULLED IN ALL ELECTRICAL CONDUITS (POWER AND CONTROL) WHETHER OR NOT SHOWN ON THE PLANS.
- ALL EQUIPMENT SHALL BE NEW, UNUSED, AND U.L. LISTED (WHERE A U.L. LISTING IS AVAILABLE FOR THAT CLASS OF EQUIPMENT).
- ALL EQUIPMENT FURNISHED AND INSTALLED BY THE CONTRACTOR SHALL BE GUARANTEED AGAINST DEFECTS IN MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM THE DATE OF ACCEPTANCE.
- THE DRAWINGS ARE NOT INTENDED TO SHOW THE EXACT LOCATION OF CONDUIT RUNS AND STUB-UPS. THESE ARE TO BE COORDINATED WITH OTHER TRADES TO AVOID CONFLICTS AND MAINTAIN REQUIRED CLEARANCES. THE CONTRACTOR SHALL COORDINATE CONDUIT STUB-UP LOCATIONS BASED UPON APPROVED EQUIPMENT SHOP DRAWINGS.
- UNLESS SHOWN OTHERWISE, ALL LIGHTING & RECEPTACLE HOMERUNS SHALL BE 3/4" CONDUIT CONTAINING (AS A MINIMUM) 2#12 AND 1#12 GND.
- ELECTRICAL DETAILS APPLY TO ALL WORK, EVEN IF NOT CALLED OUT ON DRAWINGS.
- REFER TO SPECIFICATIONS FOR UTILITY WORK PER SCE REQUIREMENTS.
- WHEN DIGGING IN ANY AREA THAT CONTAINS COBBLES OR BACKFILL MATERIAL LARGER THAN 3", APPROVED BACKFILL MATERIAL WILL BE REQUIRED 12" OVER TOP MOST UTILITY. TRENCHING AGENTS ARE RESPONSIBLE TO CHECK EACH UTILITIES REQUIREMENTS.
- ALL TRENCHES REQUIRE 95% RELATIVE DENSITY COMPACTION.
- CALL USA AT 1-800-422-4133 48 HOURS PRIOR TO DIGGING.
- THE CONTRACTOR SHALL RELOCATE OR PROTECT IN PLACE ALL IMPACTED DWR COMMUNICATION CABLES WITHIN THE CONSTRUCTION ZONE AS MUCH AS POSSIBLE TO MINIMIZE DAMAGE AND DISRUPTION TO DWR OPERATIONS.
- ALL TRENCH EXCAVATION SHALL COMPLY WITH THE MOST CURRENT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION STANDARDS. TRENCH BACKFILL SHALL BE PLACED IN NO GREATER THAN 4-INCH LIFTS IF HAND COMPACTED OR NO GREATER THAN 8-INCH LIFTS IF POWER COMPACTED. TRENCH BACKFILL WITHIN THE DWR RIGHT-OF-WAY SHALL BE COMPACTED TO 95 PERCENT RELATIVE COMPACTION (ASTM D1557).
- A SEVEN (7) DAY ADVANCE NOTIFICATION IS REQUIRED PRIOR TO STARTING WORK WITHIN DEPARTMENT OF WATER RESOURCES RIGHT-OF-WAY. CONTACT THE DEPARTMENT OF WATER RESOURCES, DIVISION OF ENGINEERING, ENCROACHMENT PERMIT SECTION, SACRAMENTO, CALIFORNIA AT (800) 600-4397. THE SOUTHERN FIELD DIVISION SHALL BE SIMULTANEOUSLY NOTIFIED AT (661) 944-8500.

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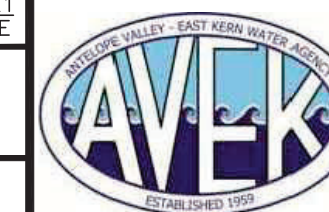
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NO.	DATE	REVISIONS	APPROVED

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IRVINE, CA 92618
949-923-6000
stantec.com

WAYNE C. DAHL DESIGN TEAM LEAD 11/10/21
NAME R.C.E. 45611 DATE

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ANTELOPE VALLEY - EAST KERN WATER AGENCY

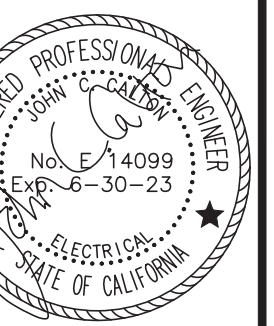
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL

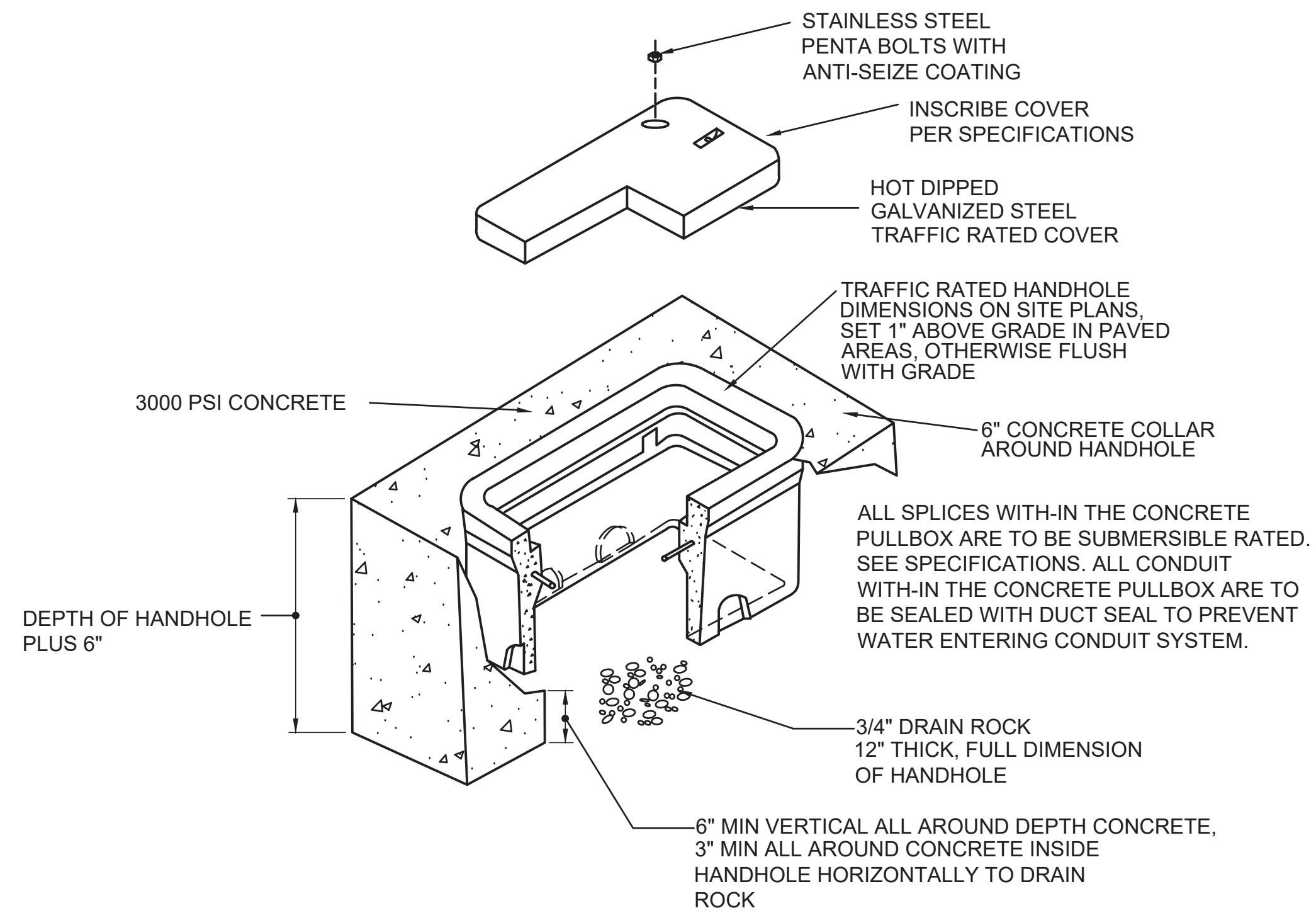
GENERAL NOTES, SYMBOLS,
AND ABBREVIATIONS

SHEET
EG-01

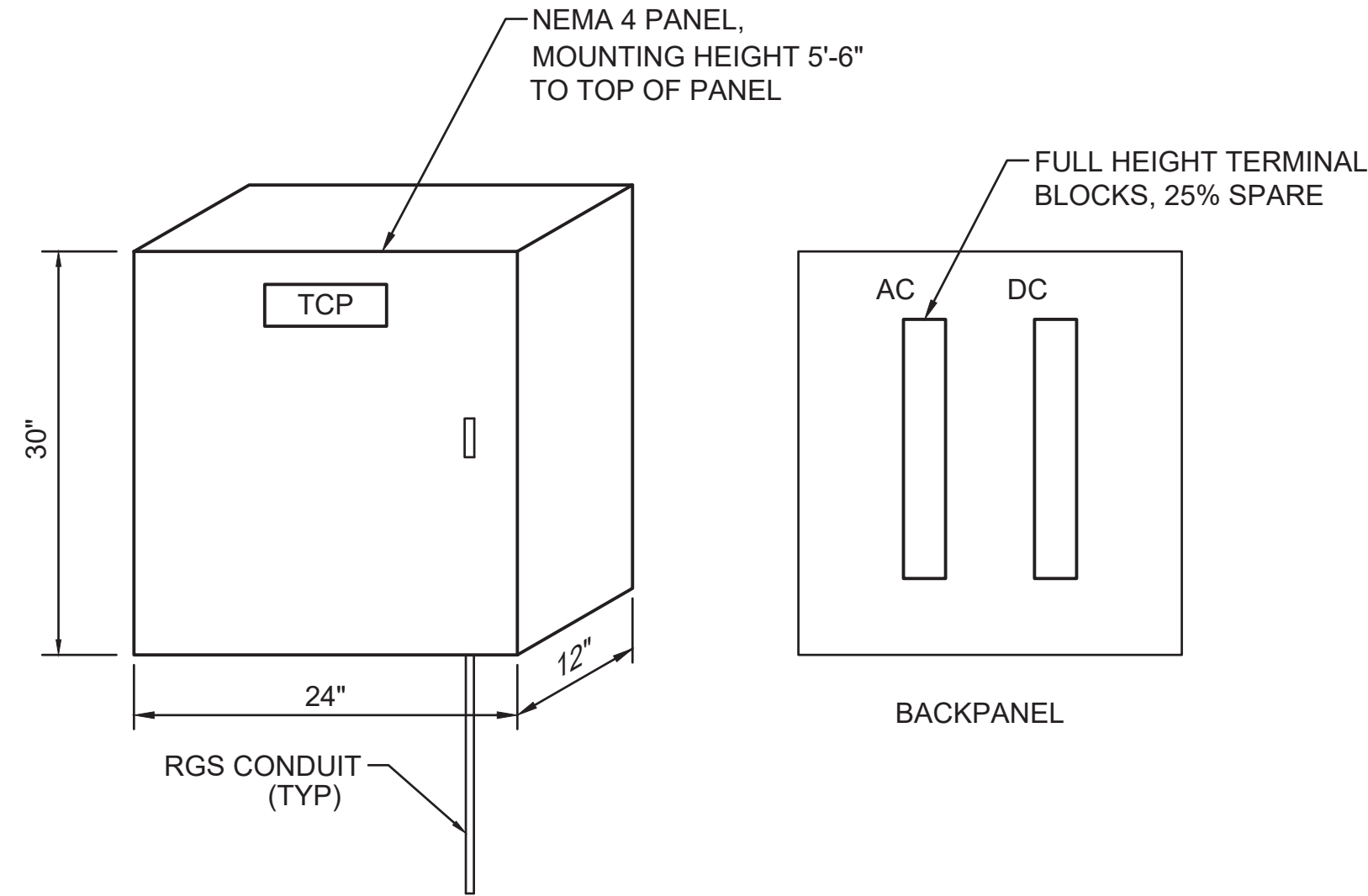
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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



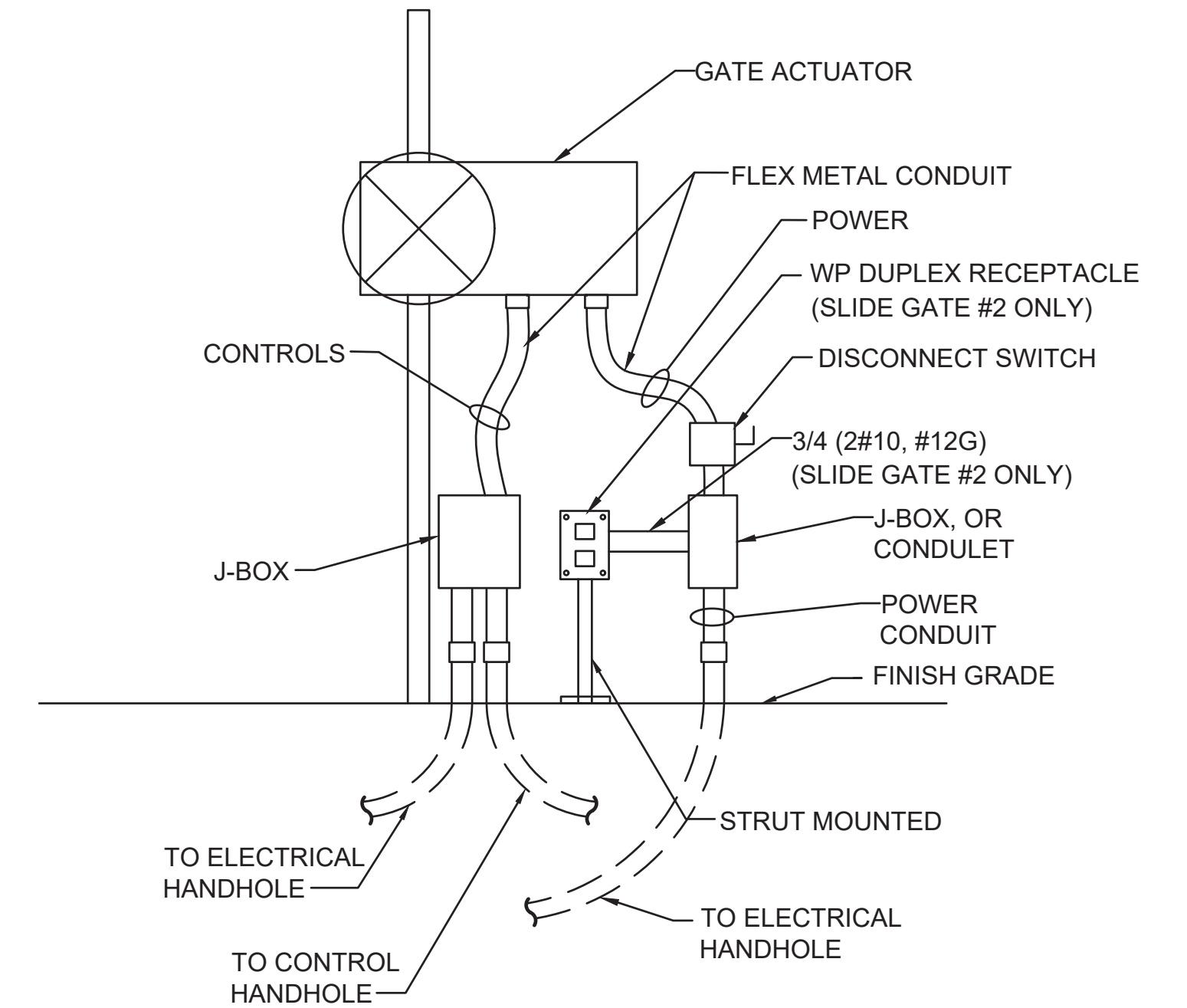
1 HANDHOLE DETAIL
- NTS



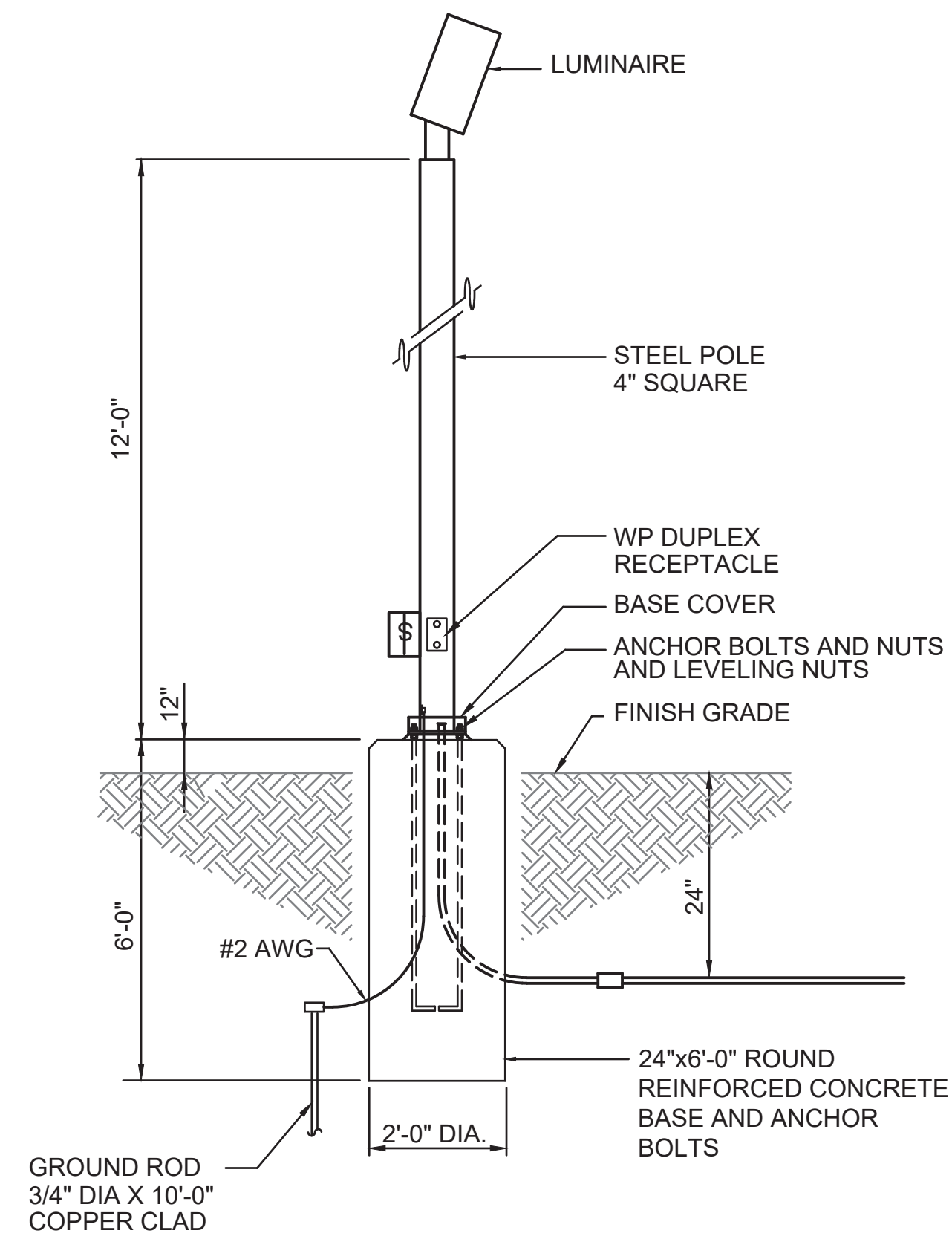
NOTES:

1. SEAL CONDUITS ENTERING PANEL WITH ELECTRICAL DUCT SEAL.
2. PROVIDE TYPE WRITTEN TERMINAL BLOCK SCHEDULE IN DOOR POCKET.
3. REFER TO DWGS E-08 TO E-10.

2 TERMINAL CABINET "TCP" DETAIL
- NTS



3 SLIDE GATE OPERATION DETAIL
- NTS



4 LIGHT POLE DETAIL
- NTS

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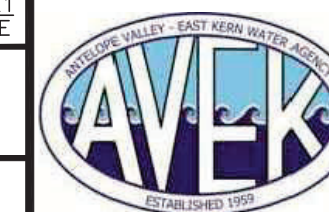
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stantec.com

DAHL
consultants

REGISTERED PROFESSIONAL ENGINEER
WAYNE C. DAHL
No. 45611
Exp. 12/31/2022
CIVIL
STATE OF CALIFORNIA

WAYNE C. DAHL DESIGN TEAM LEAD 11/10/21
NAME R.C.E. 45611 DATE

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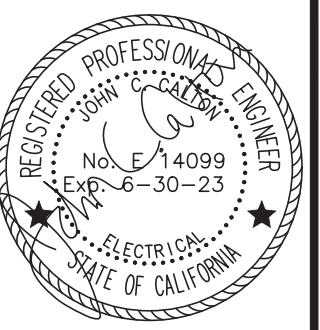
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL

DETAILS
SHEET 1 OF 2

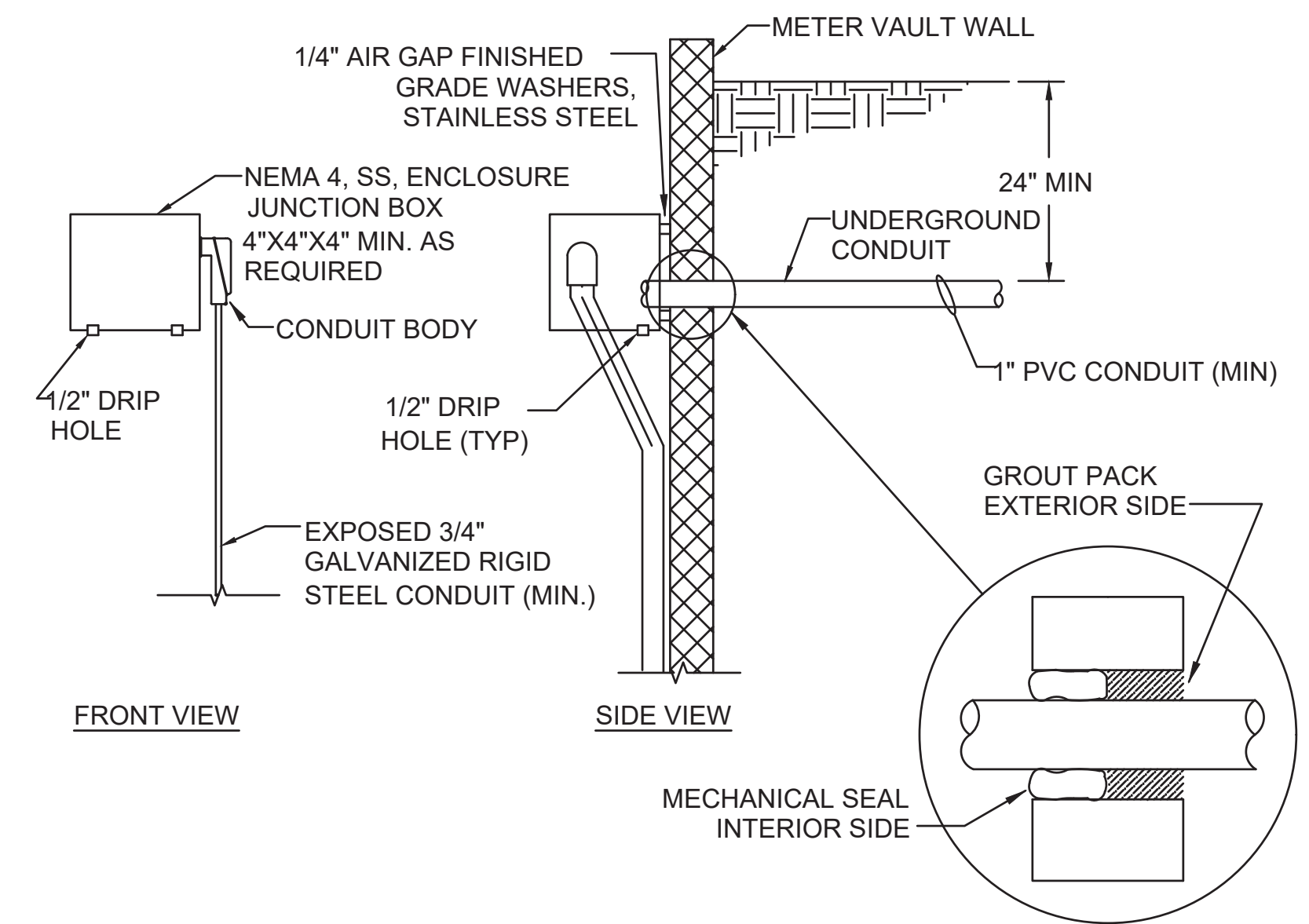
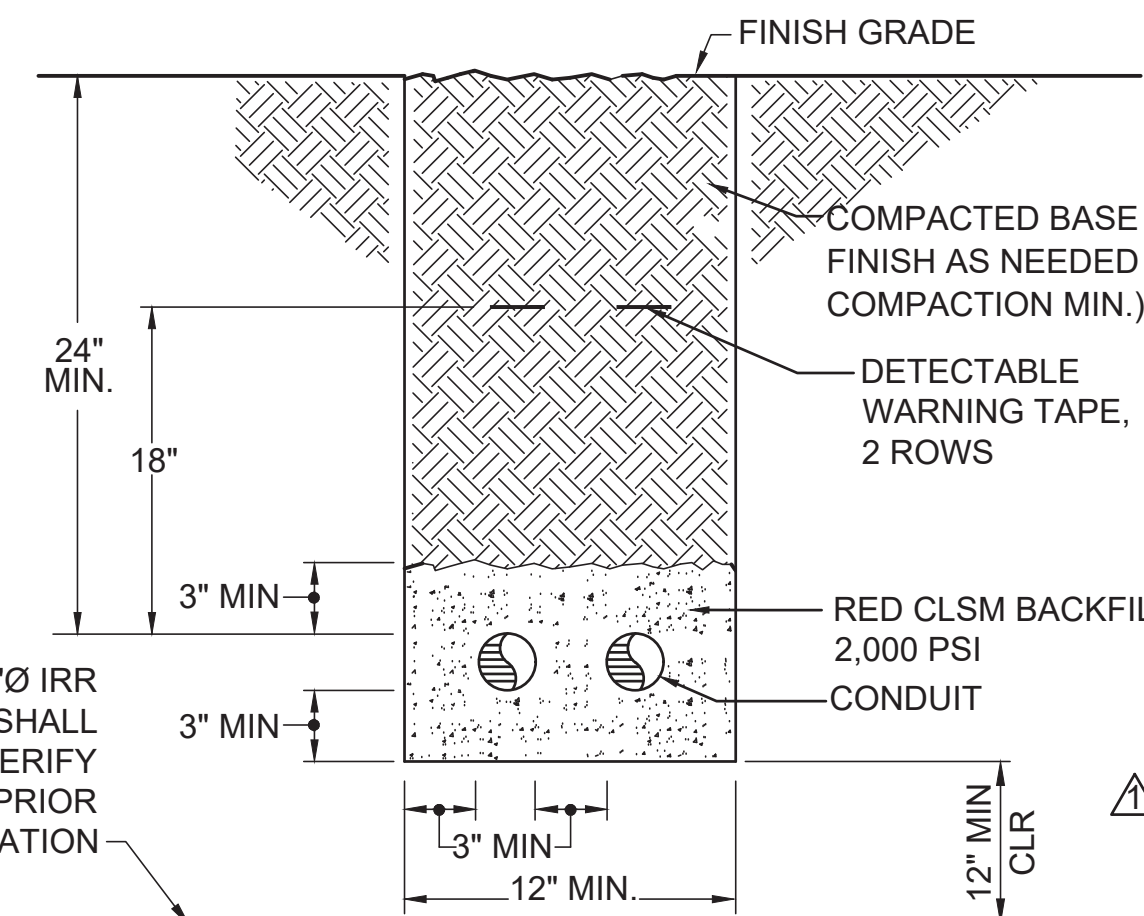
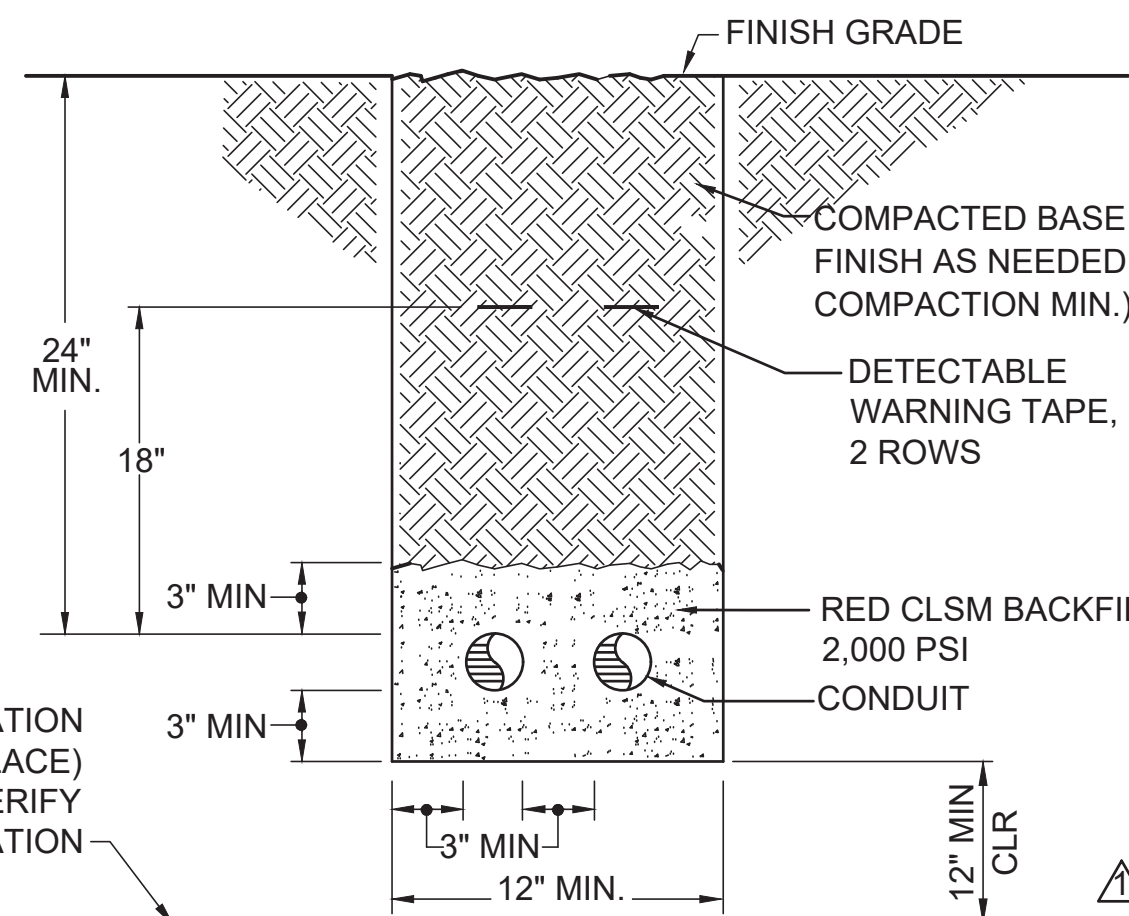
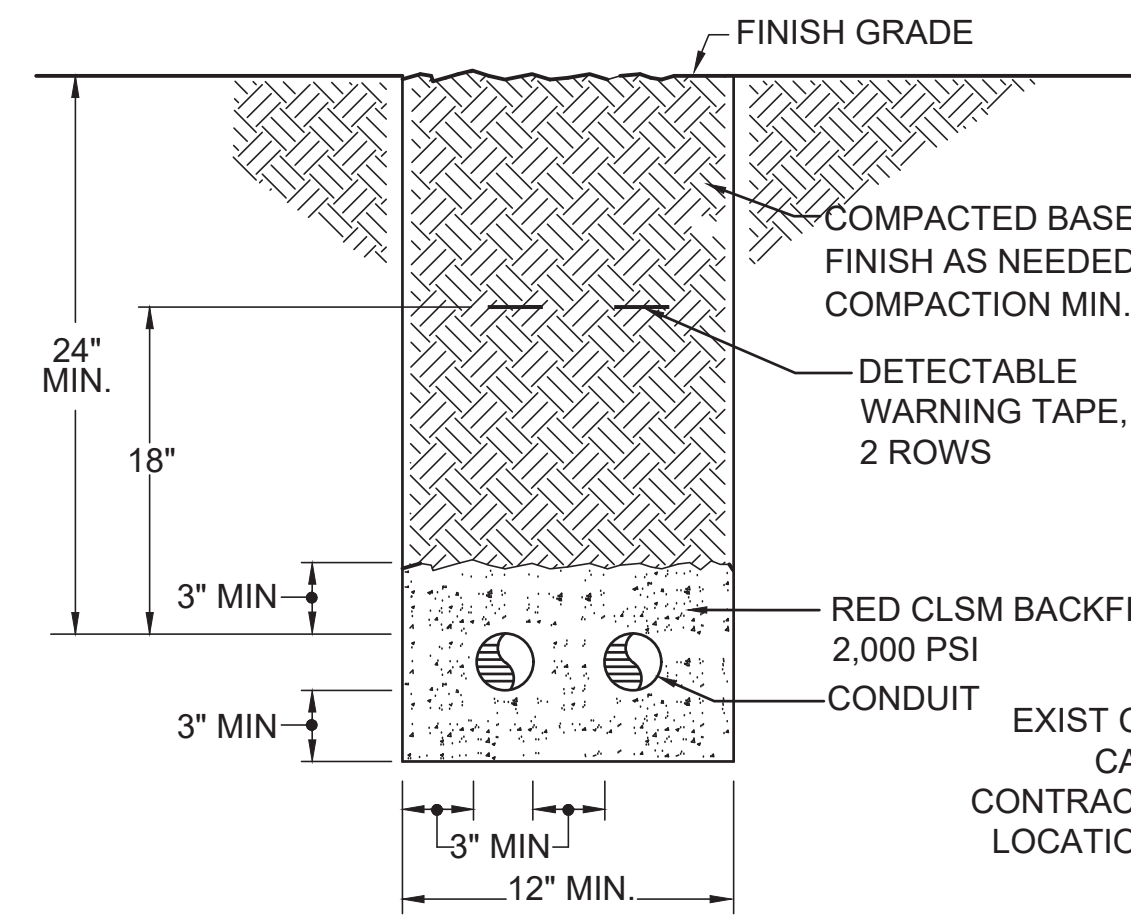
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SHEETS



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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

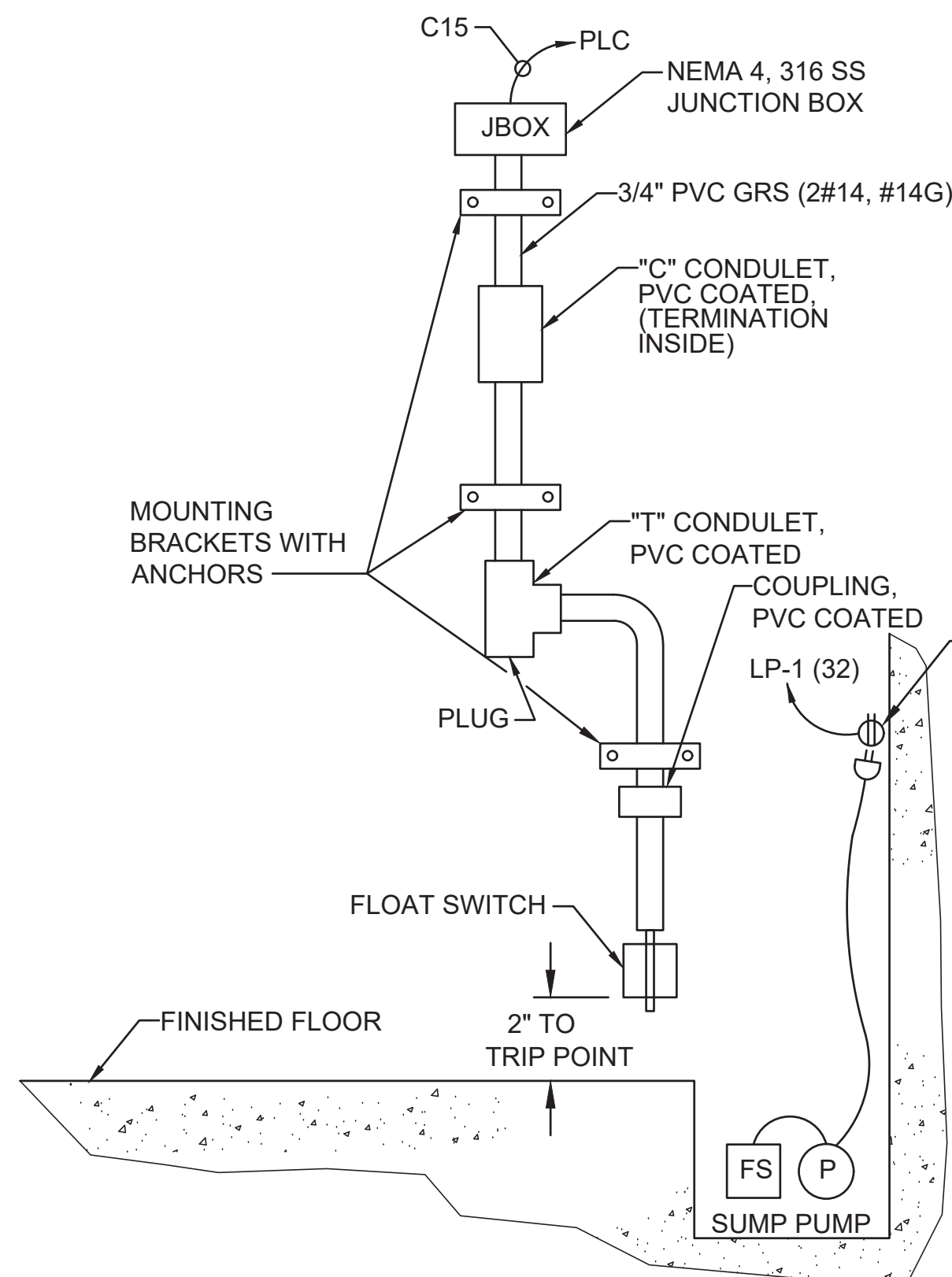


11 TYPICAL TRENCH CROSS SECTION
- NTS

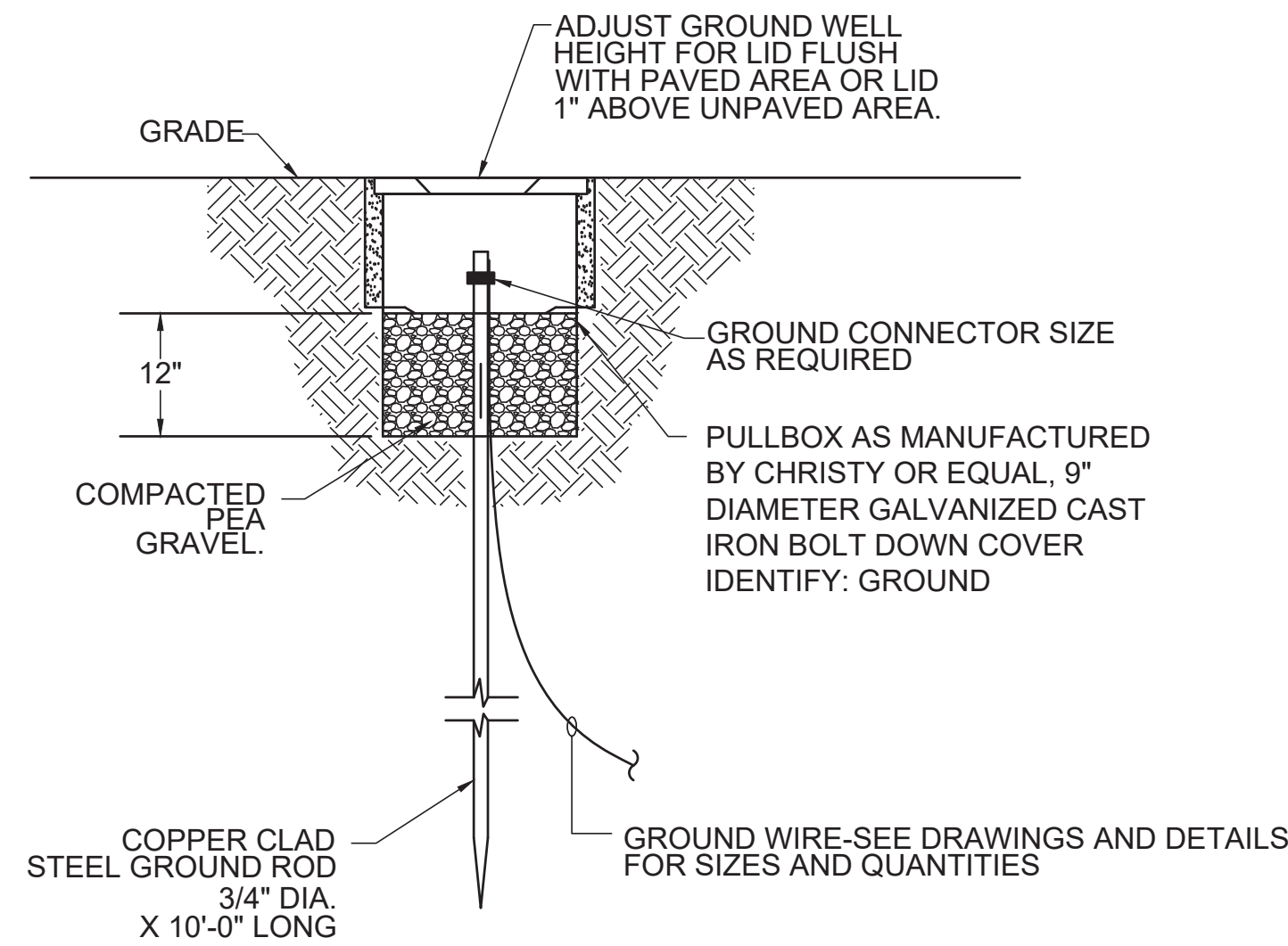
11A TRENCH CROSS SECTION
- NTS

11B TRENCH CROSS SECTION
- NTS

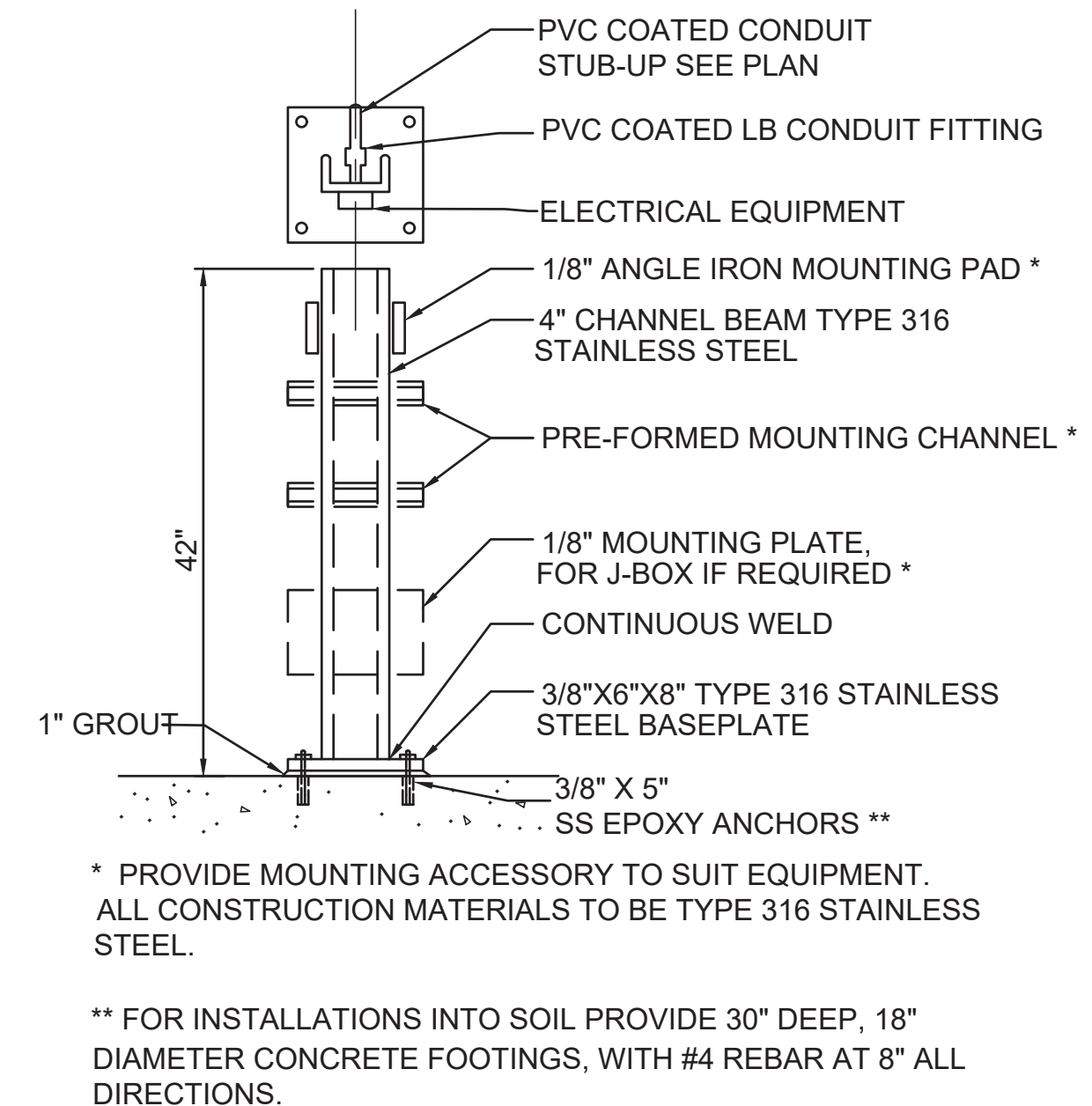
12 BELOW GRADE CONDUIT ENTRANCE DETAIL
- NTS



13 METER VAULT FLOOD SWITCH DETAIL
- NTS



14 GROUND ROD/GROUND WELL DETAIL
- NTS



15 EQUIPMENT MOUNTING STAND
- NTS

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NO.	DATE	REVISIONS	APPROVED
1	12/14/21	ADDENDUM NO. 1	

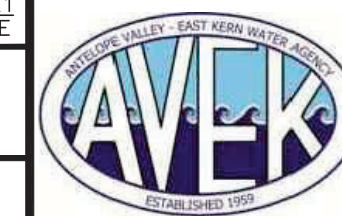
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DAHL
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REGISTERED PROFESSIONAL ENGINEER
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No. 45611
Exp. 12/31/2022
CIVIL
STATE OF CALIFORNIA

WAYNE C. DAHL
NAME
DESIGN TEAM LEAD
R.C.E. 45611
11/10/21
DATE

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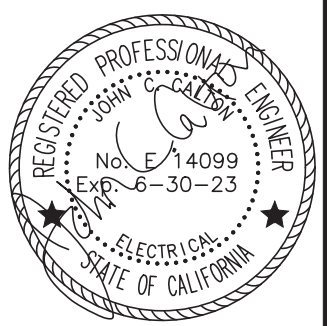
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL
DETAILS
SHEET 2 OF 2

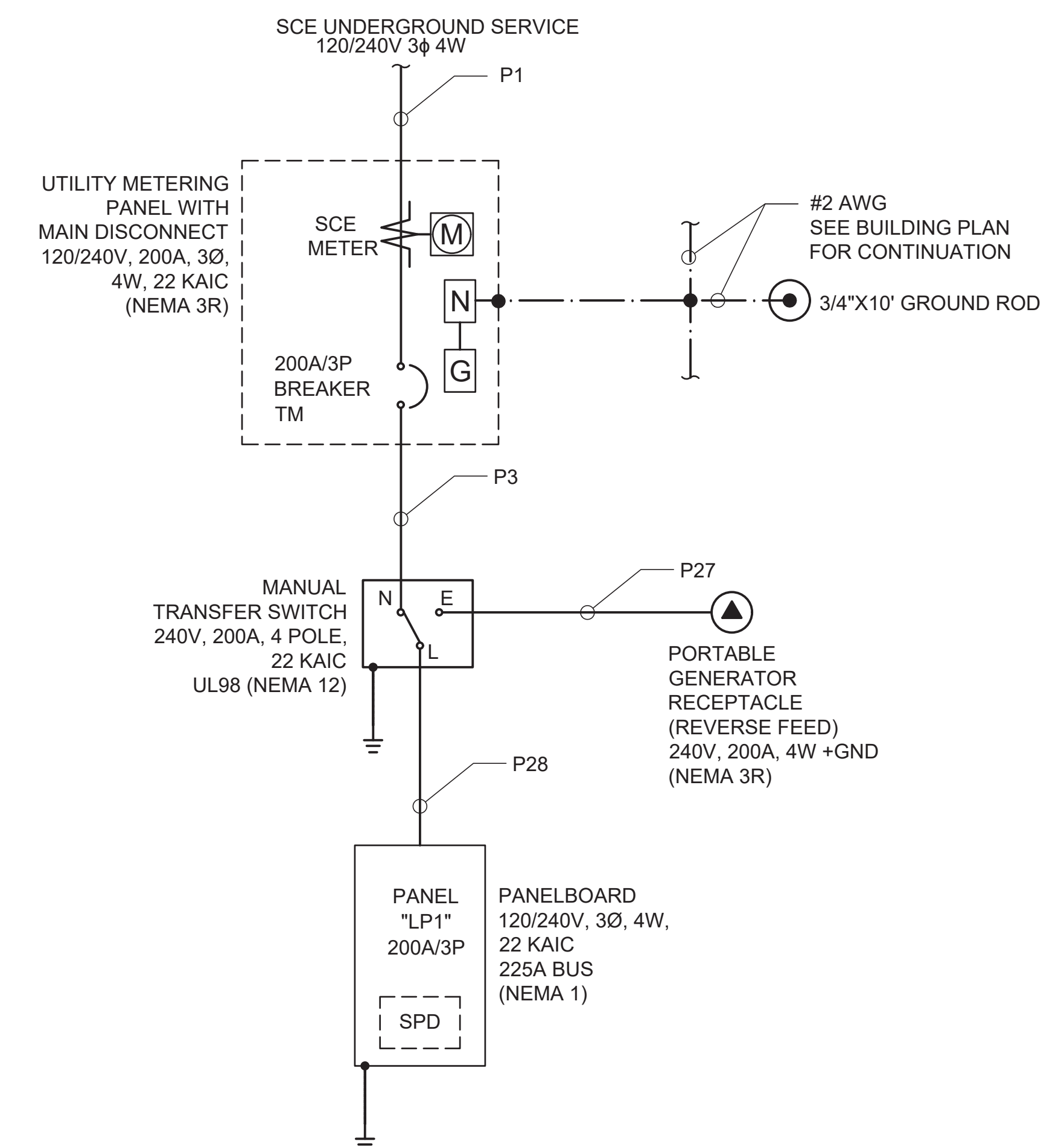
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SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



CONDUIT AND CABLE SCHEDULE					
CONDUIT		CABLE QTY AND SIZE	FROM	TO	REMARKS
NO.	SIZE				
P1	3"	PULLTAPE	SCE POWER POLE	METERING PANEL	PER SCE REQUIREMENTS
P2	1"	#12, #12N, #12G	PANELBOARD "LP1"	SLIDE GATE CONTROL PANEL "SGCP"	120V POWER
P3	2"	3-#3/0, #2N, #4G	METERING PANEL	MANUAL TRANSFER SWITCH	120/240V, 3 PHASE
P4	1"	5-#10, 5-#10N, #12G	PANELBOARD "LP1"	HANDHOLE "HH-E3"	120V, METER VAULT, SITE LIGHT 1
P5	1"	3-#8, #10G	HANDHOLE "HH-E2"	SLIDE GATE 1 VIA DISCONNECT SWITCH	240V, 3 PHASE POWER GATE 1
P6	1"	3-#8, #10, #10N, #10G	HANDHOLE "HH-E2"	SLIDE GATE 2 AND RECEPTACLE, VIA J-BOX, DISC SW	240V, 3 PHASE POWER GATE 2, 120V POWER RECEPT
P7	1"	#10, #10N, #12G	HANDHOLE "HH-E2"	SITE LIGHT 2	120V, SITE LIGHT 2 POWER
P8	1"	16-#14, #14G	HANDHOLE "HH-E2"	SLIDE GATE 1	AC STATUS AND CONTROL GATE 1
P9	1"	16-#14, #14G	HANDHOLE "HH-E2"	SLIDE GATE 2	AC STATUS AND CONTROL GATE 2
P10	1 1/2"	32-#14, #14G	TERMINAL CABINET "TCP"	SLIDE GATE CONTROL PANEL "SGCP"	AC CONTROL FOR GATES, 4 SPARES
P11	1"	8-#14, #14G	SLIDE GATE CONTROL PANEL "SGCP"	PLC PANEL	AC CONTROL FOR GATES
P12	1"	4-#14, #14G	TERMINAL CABINET "TCP"	PLC PANEL	AC CONTROL TRAVELING SCREEN
P13	2"	34-#14, #14G	TERMINAL CABINET "TCP"	HANDHOLE "HH-E1"	AC STATUS AND CONTROL, 8 SPARES
P14	2"	34-#14, #14G	HANDHOLE "HH-E1"	HANDHOLE "HH-E2"	AC STATUS AND CONTROL, 8 SPARES
P15	1"	#10, #10N, #12G	HANDHOLE "HH-E3"	SITE LIGHT 1	120V, SITE LIGHT POWER
P16	3/4"	#10, #10N, #12G	J-BOX AT SLIDE GATE 2	RECEPTACLE AT SLIDE GATE 2	120V POWER
P17	1 1/2"	6-#8, #10, #10N, #10G	HANDHOLE "HH-E1"	HANDHOLE "HH-E2"	240V, 3 PHASE POWER GATES, 120V POWER RECEPT
P18	1 1/2"	6-#8, #10, #10N, #10G	PANELBOARD "LP1"	HANDHOLE "HH-E1"	240V, 3 PHASE POWER GATES, 120V POWER RECEPT
P19	1"	4-#10, 4-#10N, #12G	HANDHOLE "HH-E3"	METER VAULT VIA J-BOX	120V POWER METER VAULT LIGHTS, FAN, RECEPTS
P20	1 1/2"	3-#4, #8G	PANELBOARD "LP1"	HANDHOLE "HH-E1"	240V, 3 PHASE POWER TRAVELING SCREEN
P21	1 1/2"	3-#4, #8G	HANDHOLE "HH-E1"	HANDHOLE "HH-E2"	240V, 3 PHASE POWER TRAVELING SCREEN
P22	1 1/2"	3-#4, #8G	HANDHOLE "HH-E2"	TRAVELING SCREEN CONTROL PANEL	240V, 3 PHASE POWER TRAVELING SCREEN
P23	1"	2-#10, #10G	PANELBOARD "LP1"	CONDENSING UNIT VIA DISCONNECT SWITCH	240V, 1 PHASE POWER TO CU-1
P24	1"	2-#10, #10G	PANELBOARD "LP1"	FAN COIL VIA DISCONNECT SWITCH	240V, 1 PHASE POWER TO FC-1
P25	3/4"	#12, #12N, #12G	PANELBOARD "LP1"	PLC PANEL	120V POWER
P26	3/4"	#12, #12N, #12G	PANELBOARD "LP1"	FLOW TRANSMITTER	120V POWER
P27	2"	3-#3/0, #2N, #4G	MANUAL TRANSFER SWITCH	PORTABLE GENERATOR RECEPTACLE	120/240V, 3 PHASE
P28	2"	3-#3/0, #2N, #4G	MANUAL TRANSFER SWITCH	PANELBOARD "LP1"	120/240V, 3 PHASE
P31	2"	PULLTAPE	TERMINAL CABINET "TCP"	HANDHOLE "HH-E1"	SPARE
P32	2"	PULLTAPE	HANDHOLE "HH-E1"	HANDHOLE "HH-E2"	SPARE
P33	2"	PULLTAPE	HANDHOLE "HH-E2"	TRAVELING SCREEN CONTROL PANEL	SPARE
P34	1"	PULLTAPE	HANDHOLE "HH-E2"	STUB OUT NEAR SLIDE GATE 1	SPARE, STUB UP AND CAP
P35	1"	PULLTAPE	TERMINAL CABINET "TCP"	HANDHOLE "HH-E3"	SPARE
C1	1 1/2"	22-#14, #14G	TERMINAL CABINET "TCP"	PLC PANEL	DC STATUS TO PLC, 10 SPARES
C2	1"	2-#16 TWSP, #14G	TERMINAL CABINET "TCP"	SLIDE GATE CONTROL PANEL "SGCP"	GATE POSITIONS
C3	1 1/2"	2-#16 TWSP, CAT6, 6-#14, #14G	FLOW TRANSMITTER	PLC PANEL	FLOW SIGNALS, ALARM, FLOW DIRECTION, FLOW COMMS, 2 SPARES
C4	2"	8-MANU COAX CABLES, #12G	FLOW TRANSMITTER	FLOW TRANSDUCERS AT METER VAULT	MANU CABLES BY METER SUPPLIER, INSTALLED BY CONTRACTOR
C5	1 1/2"	20-#14, #14G, PULLTAPE	TERMINAL CABINET "TCP"	HANDHOLE "HH-C1"	DC STATUS AND CONTROL FOR GATES, TRAVELING, SPARES
C6	1"	6-#14, #16 TWSP, #14G	HANDHOLE "HH-C2"	SLIDE GATE 1	DC CONTROL, GATE 1 POSITION
C7	1"	6-#14, #16 TWSP, #14G	HANDHOLE "HH-C2"	SLIDE GATE 2	DC CONTROL, GATE 2 POSITION
C8	1"	2-#16 TWSP, #14G	TERMINAL CABINET "TCP"	HANDHOLE "HH-C1"	GATES POSITION
C9	3/4"	#16 TWSP, #14G	PLC PANEL	INTRUSION SWITCH	DC STATUS
C10	1 1/2"	#14G, CAT 6	PLC PANEL	COMMUNICATION BACKBOARD "CBB"	COMMUNICATIONS
C11	1"	8-#14, 2-#16 TWSP, #14G	SLIDE GATE CONTROL PANEL "SGCP"	PLC PANEL	DC STATUS, GATE POSITIONS, 4 SPARES
C12	1 1/2"	20-#14, #14G, PULLTAPE	HANDHOLE "HH-C1"	HANDHOLE "HH-C2"	DC STATUS AND CONTROL FOR GATES, TRAVELING, SPARES
C13	1"	2-#16 TWSP, #14G	HANDHOLE "HH-C1"	HANDHOLE "HH-C2"	GATES POSITION
C14	1"	PULLTAPE	PLC PANEL	COMMUNICATION BACKBOARD "CBB"	SPARE, STUB UP AND CAP
C15	1"	2-#14, #16 TWSP, #14G	PLC PANEL	METER VAULT INTRUSION, FLOOD SWITCHES	DC STATUS
C16	2"	50 PAIR TEL, #14G	COMMUNICATION BACKBOARD "CBB"	DWR NETWORK	DC COMMUNICATIONS
C17	1"	8-#14, #14G, PULLTAPE	HANDHOLE "HH-C2"	TRAVELING SCREEN CONTROL PANEL	DC STATUS TRAVELING SCREEN
C18	1"	CAT 6, #14G	PLC PANEL	WIRELESS RADIO/ANTENNA	DC COMMUNICATIONS
C31	1"	PULLTAPE	TERMINAL CABINET "TCP"	HANDHOLE "HH-C1"	SPARE
C32	1"	PULLTAPE	HANDHOLE "HH-C1"	HANDHOLE "HH-C2"	SPARE
C33	1"	PULLTAPE	HANDHOLE "HH-C2"	TRAVELING SCREEN CONTROL PANEL	SPARE
C34	1"	PULLTAPE	HANDHOLE "HH-C2"	STUB OUT NEAR SLIDE GATE 1	SPARE, STUB UP AND CAP



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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

CONFORMED

NO.	DATE	REVISIONS	APPROVED
1	12/29/21	ADDENDUM NO. 3	

WAYNE C. DAHL
NAME
DESIGN TEAM LEAD
R.C.E. 45611
11/10/21
DATE

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ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL
SINGLE LINE, CONDUIT AND
CABLE SCHEDULE

SHEET
E-01
43 of 54
SHEETS

NOVEMBER 2021

APPENDIX G

NOTES:

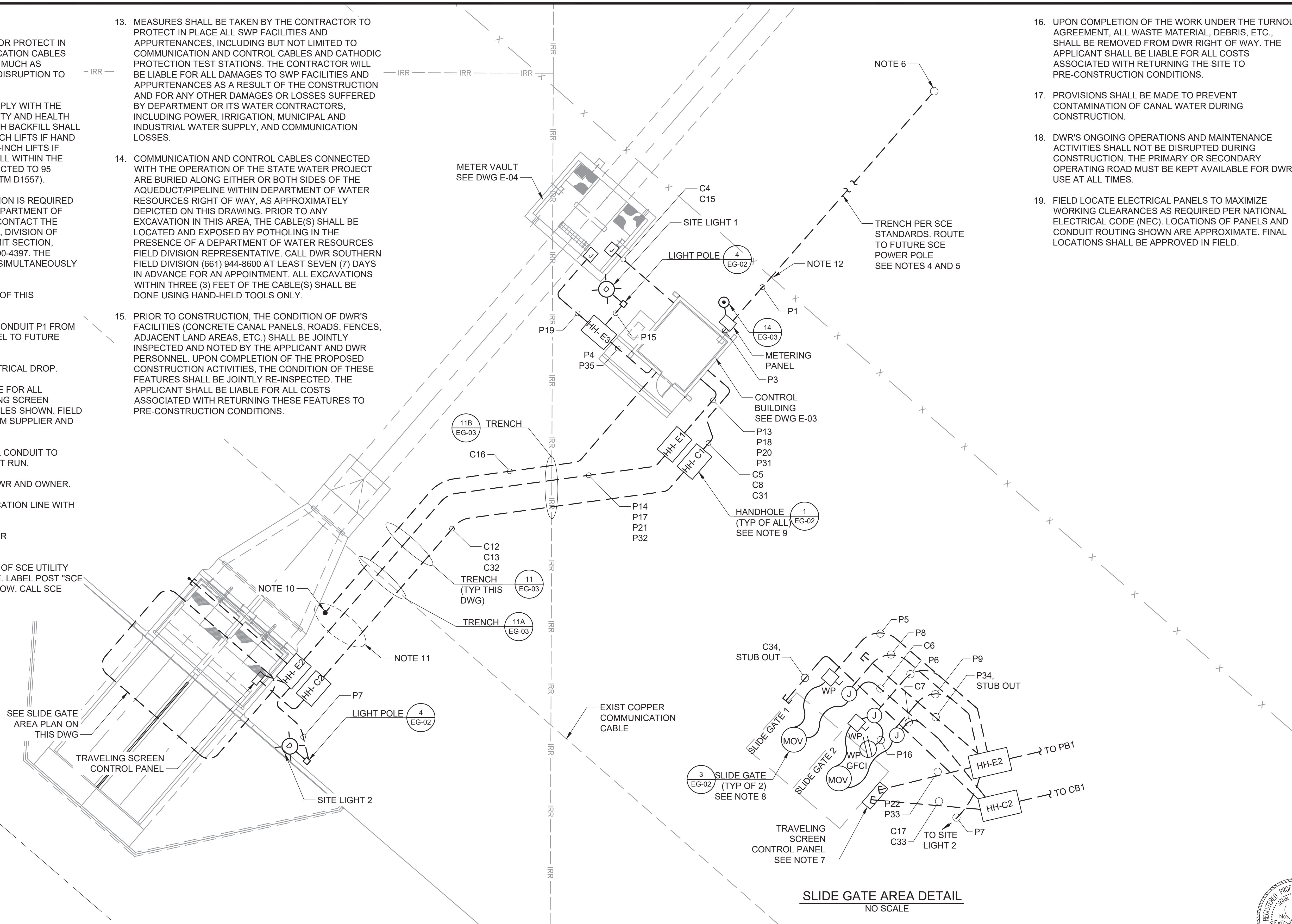
1. THE CONTRACTOR SHALL RELOCATE OR PROTECT IN PLACE ALL IMPACTED DWR COMMUNICATION CABLES WITHIN THE CONSTRUCTION ZONE AS MUCH AS POSSIBLE TO MINIMIZE DAMAGE AND DISRUPTION TO DWR OPERATIONS.
2. ALL TRENCH EXCAVATION SHALL COMPLY WITH THE MOST CURRENT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION STANDARDS. TRENCH BACKFILL SHALL BE PLACED IN NO GREATER THAN 4-INCH LIFTS IF HAND COMPACTED OR NO GREATER THAN 8-INCH LIFTS IF POWER COMPACTED. TRENCH BACKFILL WITHIN THE DWR RIGHT-OF-WAY SHALL BE COMPACTED TO 95 PERCENT RELATIVE COMPACTION (ASTM D1557).
3. A SEVEN (7) DAY ADVANCE NOTIFICATION IS REQUIRED PRIOR TO STARTING WORK WITHIN DEPARTMENT OF WATER RESOURCES RIGHT-OF-WAY. CONTACT THE DEPARTMENT OF WATER RESOURCES, DIVISION OF ENGINEERING, ENCROACHMENT PERMIT SECTION, SACRAMENTO, CALIFORNIA AT (800) 600-4397. THE SOUTHERN FIELD DIVISION SHALL BE SIMULTANEOUSLY NOTIFIED AT (661) 944-8500.
4. POWER LINE DROP BY SCE NOT PART OF THIS CONTRACT.
5. CONTRACTOR SHALL ROUTE 150' OF CONDUIT P1 FROM CONTROL BUILDING'S METERING PANEL TO FUTURE POWER POLE.
6. FUTURE SCE POWER POLE FOR ELECTRICAL DROP.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CONDUITS AND CABLES FOR TRAVELING SCREEN SYSTEM. NOT ALL CONDUITS AND CABLES SHOWN. FIELD VERIFY PANEL LOCATION WITH SYSTEM SUPPLIER AND OWNER.
8. PROVIDE SEAL TIGHT FLEXIBLE METAL CONDUIT TO ACTUATORS FOR LAST 12" OF CONDUIT RUN.
9. LOCATE HANDHOLES IN FIELD WITH DWR AND OWNER.
10. COORDINATE SPLICING OF COMMUNICATION LINE WITH DWR.
11. HAND DIG THIS AREA TO PROTECT DWR COMMUNICATION LINE.
12. PROVIDE SIGN POST ON CENTER LINE OF SCE UTILITY TRENCH, EXTENDING 5' ABOVE GRADE. LABEL POST "SCE ELECTRICAL 3" SERVICE CONDUIT BELOW. CALL SCE (661) 726-5658 FOR EMERGENCY".

13. MEASURES SHALL BE TAKEN BY THE CONTRACTOR TO PROTECT IN PLACE ALL SWP FACILITIES AND APPURTENANCES, INCLUDING BUT NOT LIMITED TO COMMUNICATION AND CONTROL CABLES AND CATHODIC PROTECTION TEST STATIONS. THE CONTRACTOR WILL BE LIABLE FOR ALL DAMAGES TO SWP FACILITIES AND APPURTENANCES AS A RESULT OF THE CONSTRUCTION AND FOR ANY OTHER DAMAGES OR LOSSES SUFFERED BY DEPARTMENT OR ITS WATER CONTRACTORS, INCLUDING POWER, IRRIGATION, MUNICIPAL AND INDUSTRIAL WATER SUPPLY, AND COMMUNICATION LOSSES.
14. COMMUNICATION AND CONTROL CABLES CONNECTED WITH THE OPERATION OF THE STATE WATER PROJECT ARE BURIED ALONG EITHER OR BOTH SIDES OF THE AQUEDUCT/PIPELINE WITHIN DEPARTMENT OF WATER RESOURCES RIGHT OF WAY, AS APPROXIMATELY DEPICTED ON THIS DRAWING. PRIOR TO ANY EXCAVATION IN THIS AREA, THE CABLE(S) SHALL BE LOCATED AND EXPOSED BY POTHOLING IN THE PRESENCE OF A DEPARTMENT OF WATER RESOURCES FIELD DIVISION REPRESENTATIVE. CALL DWR SOUTHERN FIELD DIVISION (661) 944-8600 AT LEAST SEVEN (7) DAYS IN ADVANCE FOR AN APPOINTMENT. ALL EXCAVATIONS WITHIN THREE (3) FEET OF THE CABLE(S) SHALL BE DONE USING HAND-HELD TOOLS ONLY.
15. PRIOR TO CONSTRUCTION, THE CONDITION OF DWR'S FACILITIES (CONCRETE CANAL PANELS, ROADS, FENCES, ADJACENT LAND AREAS, ETC.) SHALL BE JOINTLY INSPECTED AND NOTED BY THE APPLICANT AND DWR PERSONNEL. UPON COMPLETION OF THE PROPOSED CONSTRUCTION ACTIVITIES, THE CONDITION OF THESE FEATURES SHALL BE JOINTLY RE-INSPECTED. THE APPLICANT SHALL BE LIABLE FOR ALL COSTS ASSOCIATED WITH RETURNING THESE FEATURES TO PRE-CONSTRUCTION CONDITIONS.

16. UPON COMPLETION OF THE WORK UNDER THE TURNOUT AGREEMENT, ALL WASTE MATERIAL, DEBRIS, ETC., SHALL BE REMOVED FROM DWR RIGHT OF WAY. THE APPLICANT SHALL BE LIABLE FOR ALL COSTS ASSOCIATED WITH RETURNING THE SITE TO PRE-CONSTRUCTION CONDITIONS.
17. PROVISIONS SHALL BE MADE TO PREVENT CONTAMINATION OF CANAL WATER DURING CONSTRUCTION.
18. DWR'S ONGOING OPERATIONS AND MAINTENANCE ACTIVITIES SHALL NOT BE DISRUPTED DURING CONSTRUCTION. THE PRIMARY OR SECONDARY OPERATING ROAD MUST BE KEPT AVAILABLE FOR DWR USE AT ALL TIMES.
19. FIELD LOCATE ELECTRICAL PANELS TO MAXIMIZE WORKING CLEARANCES AS REQUIRED PER NATIONAL ELECTRICAL CODE (NEC). LOCATIONS OF PANELS AND CONDUIT ROUTING SHOWN ARE APPROXIMATE. FINAL LOCATIONS SHALL BE APPROVED IN FIELD.

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← CALIFORNIA AQUEDUCT (APPROXIMATE)



TURNOUT/TURN-IN GENERAL SITE PLAN
SCALE: 1"=10'

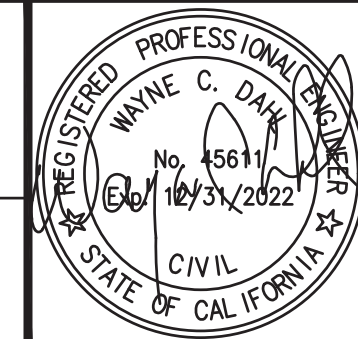
SLIDE GATE AREA DETAIL
NO SCALE

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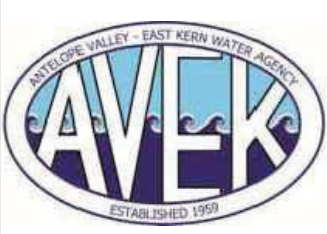


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NAME

DESIGN TEAM LEAD
R.C.E. 45611

11/10/21
DATE

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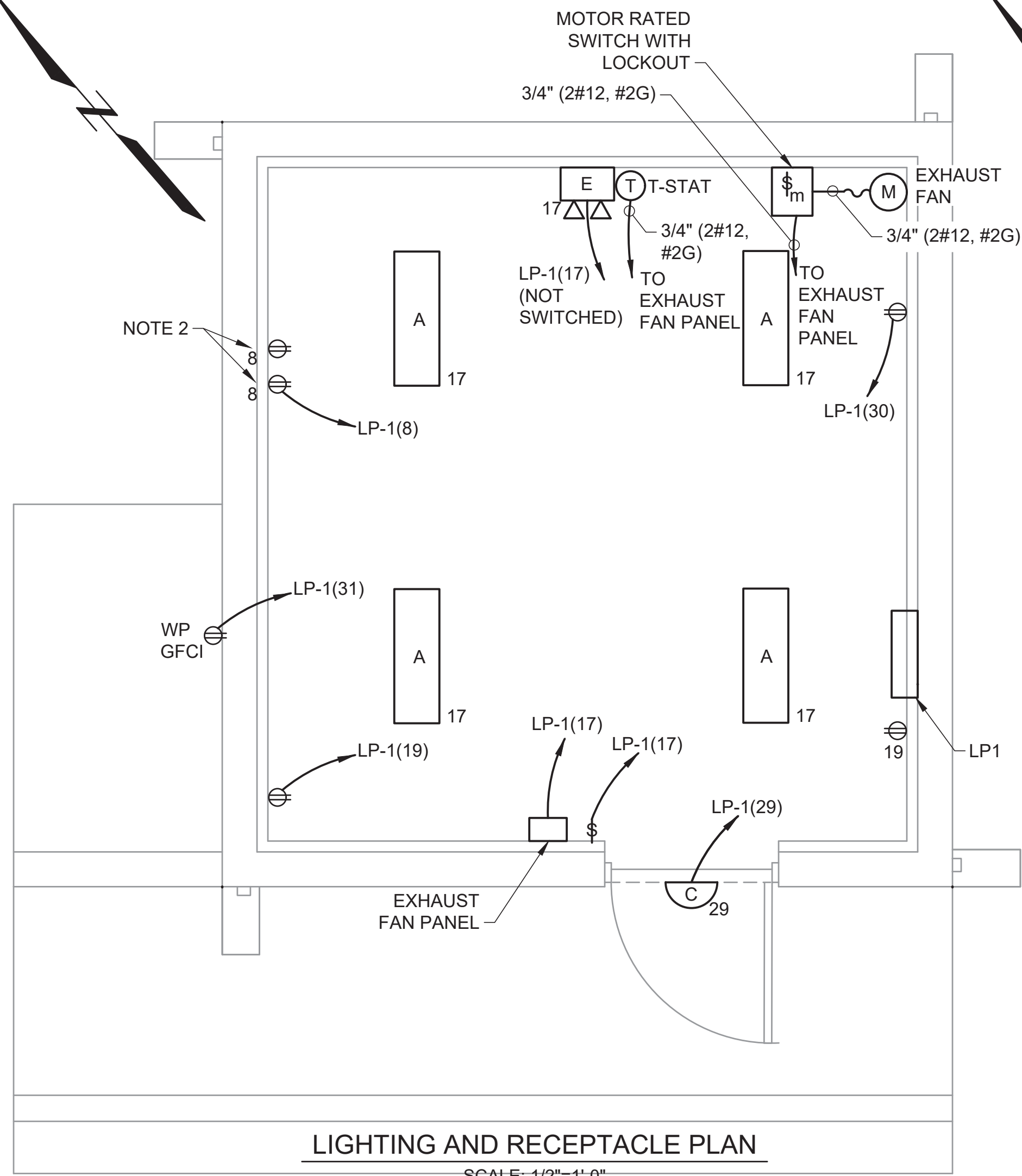
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL
AQUEDUCT TURNOUT/TURN-IN
SITE PLAN

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SHEETS

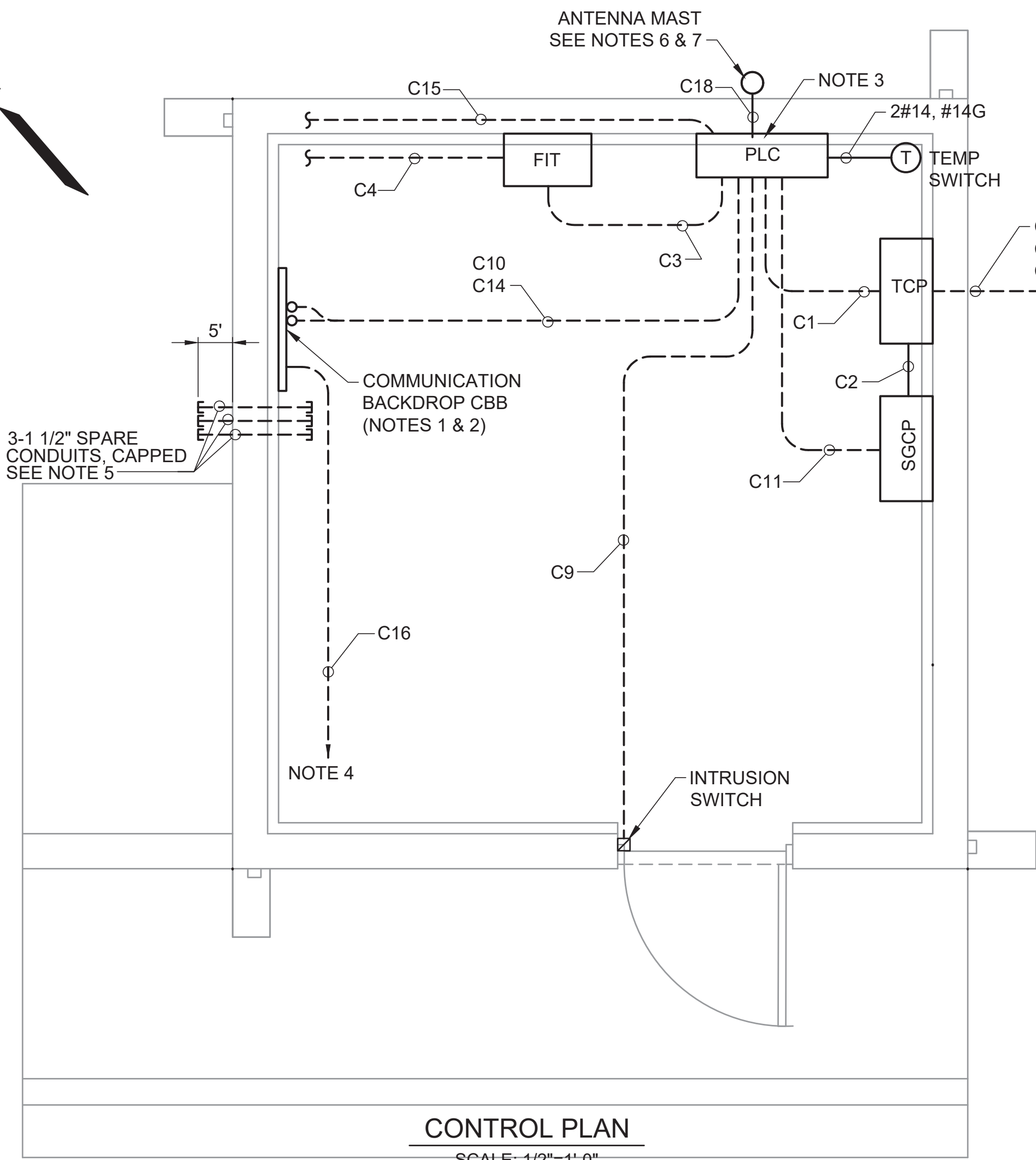


HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



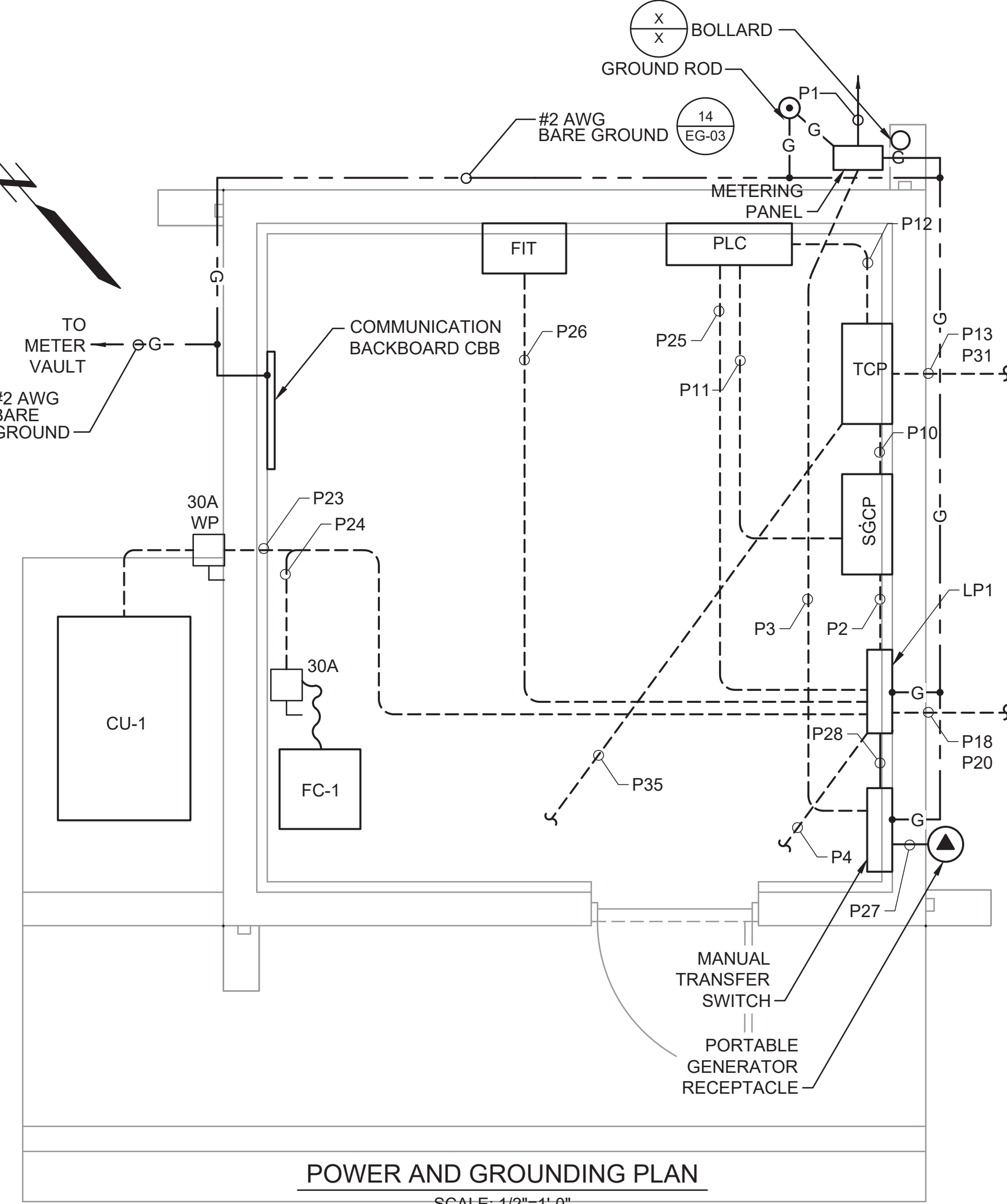
LIGHTING AND RECEPTACLE PLAN
SCALE: 1/2"=1'-0"

- NOTES
1. ALL HOME RUNS SHALL BE 3/4" GALVANIZED RIGID STEEL CONDUITS WITH 2#12, #12G.
 2. PROVIDE TWO DUPLEX RECEPTACLES ON COMMUNICATION BACKBOARD. RECEPTACLES ARE FOR DWR USE ONLY.
 3. PROVIDE HOA SWITCH AND MOTOR RATED, LOCKABLE, TOGGLE SWITCH FOR EXHAUST FAN. REFER TO DWG E-07 FOR SCHEMATIC.



CONTROL PLAN
SCALE: 1/2"=1'-0"

- NOTES
1. PROVIDE 4'X4'X3/4" PAINTED WHITE PLYWOOD BACKBOARD FOR COMMUNICATION BACKBOARD. PROVIDE BACKBOARD WITH PUNCHDOWN BLOCKS AND GROUND BUS FOR CONNECTION TO #2 AWG GROUND WIRE. COMMUNICATION BACKBOARD IS FOR DWR USE ONLY.
 2. PROVIDE AND INSTALL VOICE AND DATA COMMUNICATION EQUIPMENT PER SPECIFICATIONS.
 3. COMPLETE PLC SYSTEM AND RADIO MOUNTED ON BACKBOARD SHALL BE FURNISHED BY AVEK. CONTRACTOR SHALL PROVIDE AND INSTALL PLC CABINET (36"x30"x10", NEMA 12) AND CONNECT ALL WIRING AS DIRECTED BY AVEK/DWR.
 4. CONNECT/SPLICE 50 PAIR COPPER CABLE EXISTING DWR NETWORK CABLE PER SPECIFICATIONS. COORDINATE EXACT LOCATION OF SPLICE WITH DWR.
 5. CONSTRUCT THREE(3)-1 1/2" CONDUITS (SPARE) FOR FUTURE USE. CAP END OF CONDUITS INSIDE AND OUTSIDE OF BUILDING.
 6. PROVIDE AND INSTALL 10'-0" LONG OF 2" RIGID CONDUIT WITH A WEATHER HEAD ON TOP AND LB ON THE BOTTOM. CONDUIT SHALL BE MOUNTED ON THE BUILDING WALL SUPPORTED BY 316 SST UNISTRUT, CLAMPS AND HARDWARE.
 7. RADIO ANTENNA SHALL BE FURNISHED BY AVEK/DWR. CONTRACTOR SHALL INSTALL ANTENNA AS DIRECTED BY AVEK/DWR.
 8. ALL CONDUITS AND CABLE SHALL BE LABELED.
 9. FOR DETAILS ON TCP, SEE DETAIL 2/EG-02 AND DRAWINGS E-08 THROUGH E-10.



POWER AND GROUNDING PLAN
SCALE: 1/2"=1'-0"

- NOTES
1. ALL CONDUITS AND CABLE SHALL BE LABELED.
 2. FOR DETAILS ON TCP, SEE DETAIL 2/EG-02 AND DRAWINGS E-08 THROUGH E-10.
 3. CONTRACTOR SHALL SUPPLY PORTABLE GENERATOR AND CONNECT TO PORTABLE GENERATOR RECEPTACLE TO TEST, START UP, AND FUNCTIONAL OPERATE SYSTEM FOR UP TO 7 DAYS. MINIMUM SIZE FOR PORTABLE GENERATOR SHALL BE 10 KW.

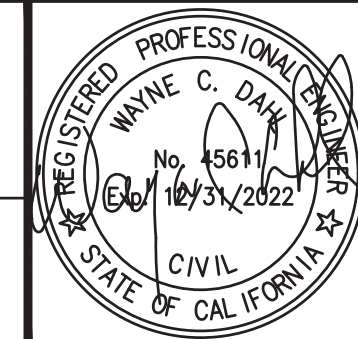
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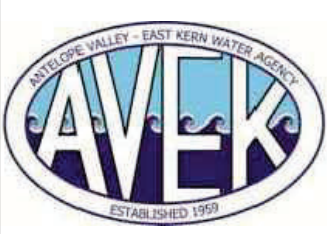
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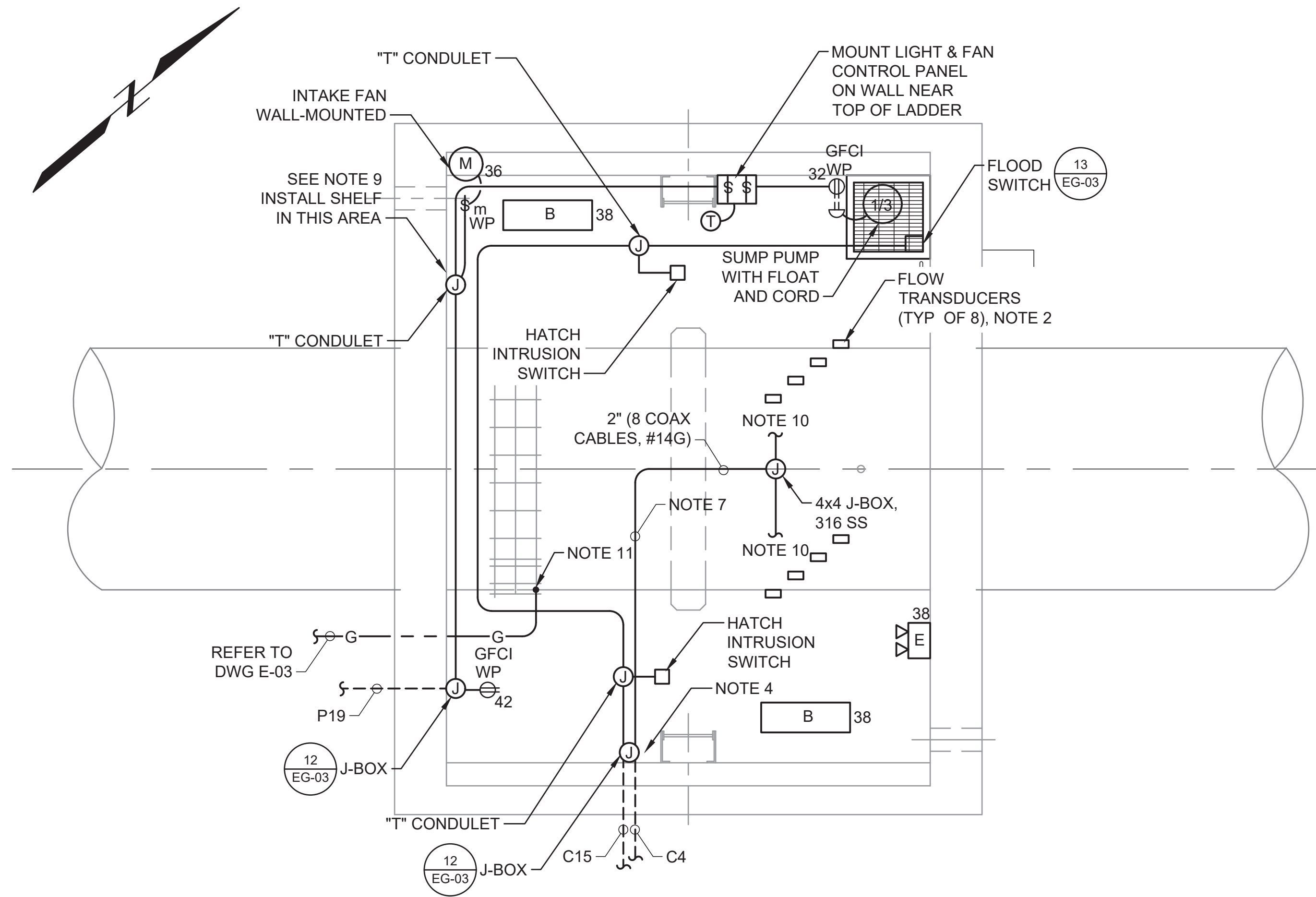
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL
AQUEDUCT TURNOUT/TURN-IN
CONTROL BUILDING PLANS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



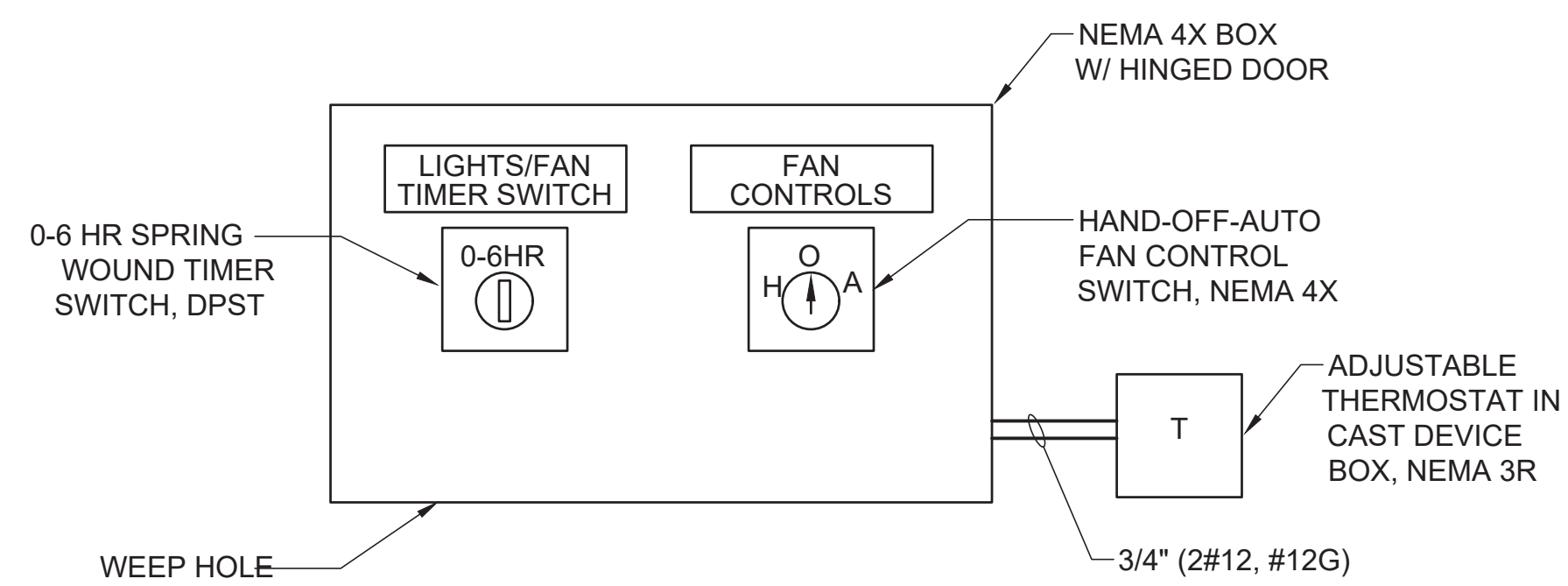


NOTES:

1. MOUNT METER VAULT LIGHTS AND FAN CONTROL PANEL NEAR ACCESS HATCH.
2. INSTALL FLOW METER TRANSDUCERS PER MANUFACTURER RECOMMENDATIONS.
3. ROUTE CONDUITS FOR LIGHTING, FAN, SUMP PUMP, AND RECEPTACLES TO MINIMIZE CROSSINGS AND INTERFERENCE.
4. WIRE HATCH INTRUSION SWITCHES IN SERIES SO IF EITHER HATCH OPENS, CIRCUIT IS OPEN.
5. LIGHTING AND RECEPTACLE CONDUITS SHALL BE 3/4" MINIMUM, OR AS REQUIRED TO FIT CABLES PER CONTRACTOR WIRING, PER NEC.
6. ALL CONDUITS WITHIN METER VAULT SHALL BE GALVANIZED RIGID STEEL.
7. ROUTE CONDUIT TO FLOW TRANSDUCERS DOWN WALL FROM J-BOX, ACROSS FLOOR AND UP J-BOX, THEN ROUTE TO FLOW TRANSDUCERS. PROVIDE 18" OF FLEXIBLE SEALTITE CONDUIT FOR FINAL CONNECTION TO EACH TRANSDUCER.
8. ALL CONDUITS TO BE ROUTED ON WALLS AND FLOOR. NO CONDUITS TO BE ROUTED ON REMOVABLE STEEL ROOF.
9. CONTRACTOR SHALL FURNISH AND INSTALL A WALL MOUNTED STAINLESS STEEL FOLDABLE SHELF, SUFFICIENT TO SUPPORT LAPTOP COMPUTER OR DATA EQUIPMENT, IN THE METER VAULT. LOCATE IN FIELD PER ENGINEER.
10. REFER TO DWG M-02 FOR ADDITIONAL FLOW TRANSDUCER INSTALLATION DETAILS.
11. MECHANICALLY CONNECT #2 AWG GROUNDING ELECTRODE CONDUCTOR TO PIPELINE.

POWER, LIGHTING, RECEPTACLE, AND CONTROL PLAN

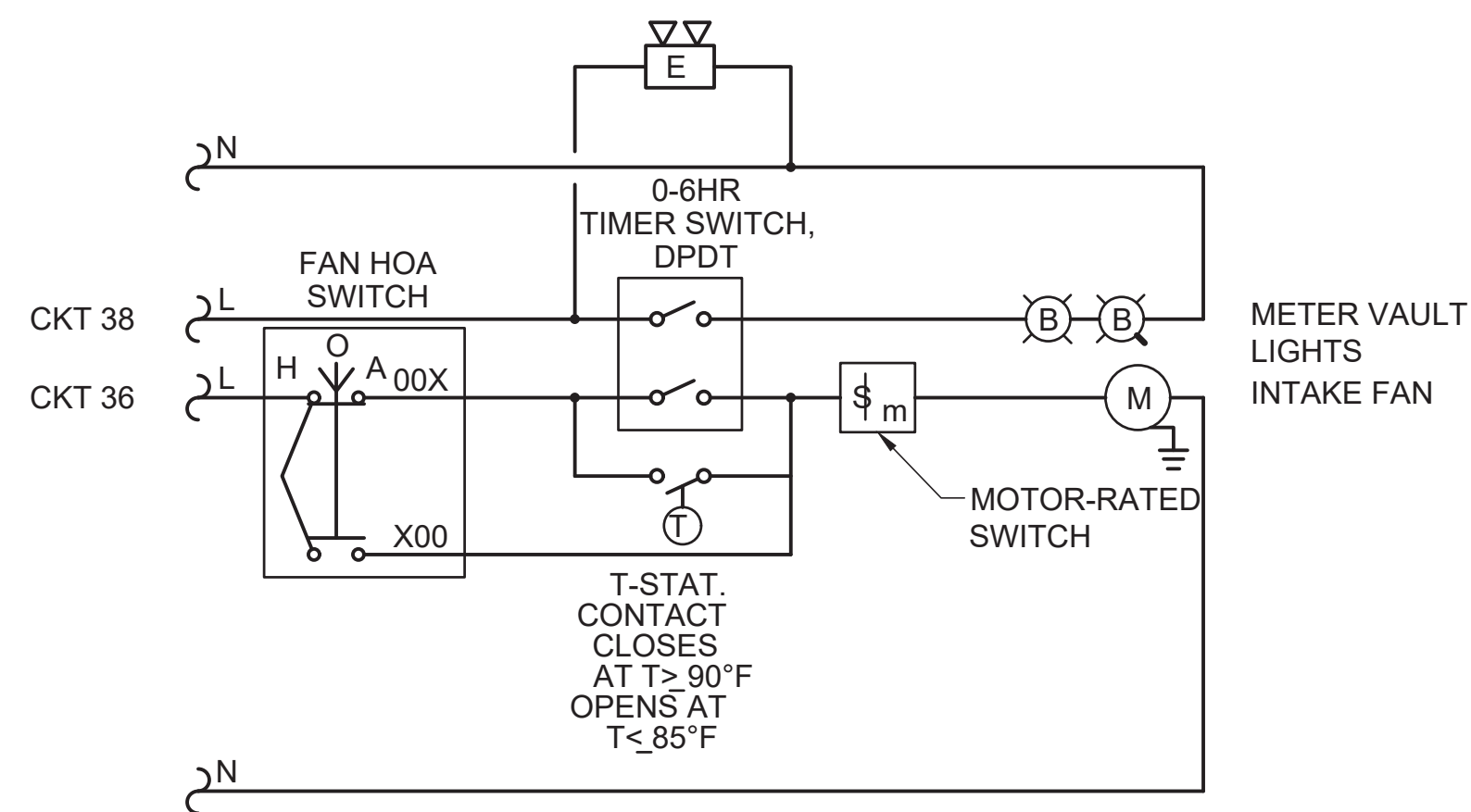
SCALE: 3/8"=1'-0"



NOTES:

1. REFER TO METER VAULT LIGHTS AND FAN SCHEMATIC FOR CONTROLS.

1 METER VAULT LIGHTS AND FAN CONTROL PANEL DETAIL
NO SCALE



2 METER VAULT LIGHTS AND FAN SCHEMATIC
NO SCALE

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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

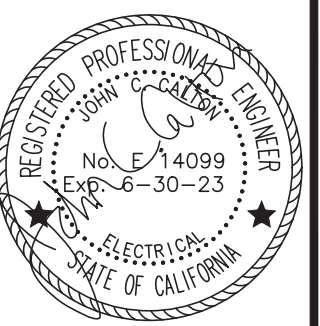
ELECTRICAL
AQUEDUCT TURNOUT/TURN-IN
METER VAULT PLAN
AND DETAILS

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SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

NOVEMBER 2021



APPENDIX G

LIGHTING PANELBOARD "LP-1"										7/7/2021
LOCATION:	CA TURNOUT	NEMA: 1	PH A VA	21680						
VOLTS:	120/240	FEED: BOTTOM	PH B VA	23000						
PHASE & WIRE:	3PH 4W	MTG. MCC	PH C VA	19540						
INTERRUPT:	22 KAIC	BUS RATING: 225 A								
OPTIONS:	INTERNAL SPD, 120KA PER PHASE	MAIN: 200 A	TOTAL VA	64220						
		MAIN INTERRUPT: 22 KAIC	PANEL AMPS / PHASE	89.2						
I/C/F	DESCRIPTION	LOAD (VA)	BKR	CIR	PH	CIR	BKR	LOAD (VA)	DESCRIPTION	I/C/F
	SLIDE GATE 1	2200		1	A	2		2200		
		2200	30A-3P	3	B	4	30A-3P	2200	SLIDE GATE 2	
		2200		5	C	6		2200		
	SLIDE GATE CONTROL PANEL "SGCP" (NOT USED)	200	20A-1P	7	A	8	20A-1P	360	COMM BACK BOARD RECEPTACLES	
				9	B	10		3700	CONDENSING UNIT	
	FLOW TRANSMITTER	300	20A-1P	11	C	12	30A-2P	3700		
	PLC PANEL	300	20A-1P	13	A	14	30A-2P	5400	FAN COIL	
	(NOT USED)			15	B	16		5400		
	CONTROL BUILDING LIGHTS	250	15A-1P	17	C	18	20A-1P	180	GFCI RECEPTACLE NEAR SLIDE GATE 2	
	CONTROL BUILDING RECEPTACLES (NOT USED)	540	20A-1P	19	A	20				
				21	B	22	20A-3P		SPARE	
	CONTROL BUILDING EXHAUST FAN	600	20A-1P	23	C	24				
	SITE LIGHT 1	50	15A-1P	25	A	26	15A-1P	50	SITE LIGHT 2	
	(NOT USED)			27	B	28			(NOT USED)	
	CONTROL BUILDING EXTERIOR LIGHT	50	20A-1P	29	C	30	20A-1P	180	TERMINAL CABINET "TCP" RECEPTACLE	
	EXTERIOR RECEPTACLE AT HVAC	180	20A-1P	31	A	32	20A-1P	600	METER VAULT SUMP PUMP RECEPTACLE	
	(NOT USED)			33	B	34			(NOT USED)	
	SPARE		20A-1P	35	C	36	15A-1P	200	METER VAULT FAN	
		9500		37	A	38	15A-1P	100	METER VAULT LIGHTS	
	TRAVELING SCREEN PANEL	9500	60A-3P	39	B	40			(NOT USED)	
		9500		41	C	42	20A-1P	180	METER VAULT RECEPTACLE	

IDENTIFIER NUMBER	INTERIOR DIMENSIONS			HANDHOLE SCHEDULE			REMARKS
	LENGTH	WIDTH	DEPTH	LOADING AND COVER MATERIAL			
HH-E1	17"	30"	36"	H-20	GALV STEEL	CONCRETE	SOLID BOTTOM
HH-E2	17"	30"	36"	X	X		SOLID BOTTOM
HH-E3	10"	17"	36"	X	X		SOLID BOTTOM
HH-C1	17"	30"	36"	X	X		SOLID BOTTOM
HH-C2	17"	30"	36"	X	X		SOLID BOTTOM

NOTES:
 1. ALL COVERS SHALL INCLUDE DESCRIPTION AND IDENTIFIER NUMBER INSCRIBED ON COVER.
 2. DIMENSIONS PROVIDED ARE MINIMUM. CONTRACTOR TO VERIFY AND SUPPLY BASED ON INSTALLED CONDUITS, PER NEC.

LIGHTING FIXTURE SCHEDULE					
TYPE	VAC	DESCRIPTION	LAMPS	MOUNTING	MANUFACTURER / MODEL NO.
A	120	LED FIXTURE, 48" LONG, ROLL FORMED STEEL WITH DIE CAST END CAPS. IMPACT MODIFIED LINEAR FACETED REFRACTOR. 4000 KELVIN TEMPERATURE. 5 YEAR WARRANTY. MULTIVOLT. NATURAL ALUMINUM FINISH.	LED 45 WATT	CEILING	LITHONIA STL4-48L-LP840-DNA
B	120	LED FIXTURE, 48" LONG, FIBERGLASS HOUSING, SUITABLE FOR WET LOCATIONS. 100% IMPACT MODIFIED FROSTED ACRYLIC LENS. 5YEAR WARRANTY. MULTIVOLT.	LED 24 WATT	WALL MOUNTED	LITHONIA FEM-L48-4000LM-IMAFL-MVOLT-GZ10-40KL-80CRI
C	120	LED WALL SCONCE FIXTURE. ENCLOSED AND GASKETED FOR WET LOCATIONS. UL LISTED. 120 VAC. PROVIDE WITH PHOTOCELL. DARK BRONZE FINISH.	LED 20 WATT	WALL	LITHONIA WSQLED-P1-30K-SR3-MVOLT-PE-DBXD
D	120	HEAVY DUTY LED FLOODLIGHT WITH DIE-CAST ALUMINUM HOUSING. CORROSION RESISTANT HARDWARE. TYPE FL DISTRIBUTION. DARK BRONZE FIXTURE AND POLE. SUPER DURABLE FINISH. UL LISTED FOR WET LOCATIONS. FIXTURE TO BE SWITCHED WITH POLE MOUNTED WEATHERPROOF SWITCH LOCATED APPROXIMATELY 48" ABOVE GRADE. AS WELL AS PHOTOCELL CONTROL.	LED 148 WATT	12' SQUARE STRAIGHT STEEL POLE. HOT DIPPED GALVANIZED ANCHOR BOLTS.	FIXTURE: LITHONIA DSXF3-LED-6-P2-40K-70CRI-FL-MVOLT-IS-PE-DBXD. POLE: LITHONIA SSS-12-4C-T20-FDL4A-DBB. PROVIDE ANCHOR BOLTS. PROVIDE WEATHERPROOF SWITCH TO OPERATE LIGHT.
E	120	INDUSTRIAL EMERGENCY LIGHTING UNIT WITH 90 MINUTES OF ILLUMINATION. THERMOPLASTIC HOUSING WITH TEST SWITCH, LITHIUM IRON PHOSPHATE BATTERY, TWO SEALED LAMPS. PROVIDE WITH SELF DIAGNOSTICS, FAILURE INDICATION, UL LISTED. GREY FINISH.	LED 2-6 WATT LAMPS	WALL	LITHONIA INDL-SP640L-UVOLT-LTP-SDRT

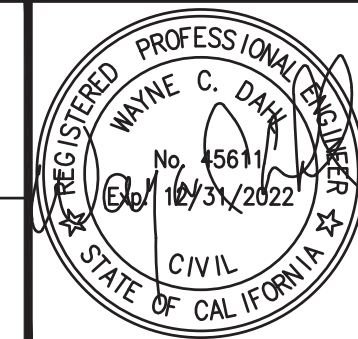
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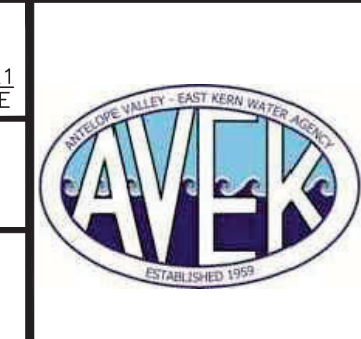



WAYNE C. DAHL
 NAME

DESIGN TEAM LEAD
 R.C.E. 45611

11/10/21
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HIGH DESERT WATER BANK
 AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL

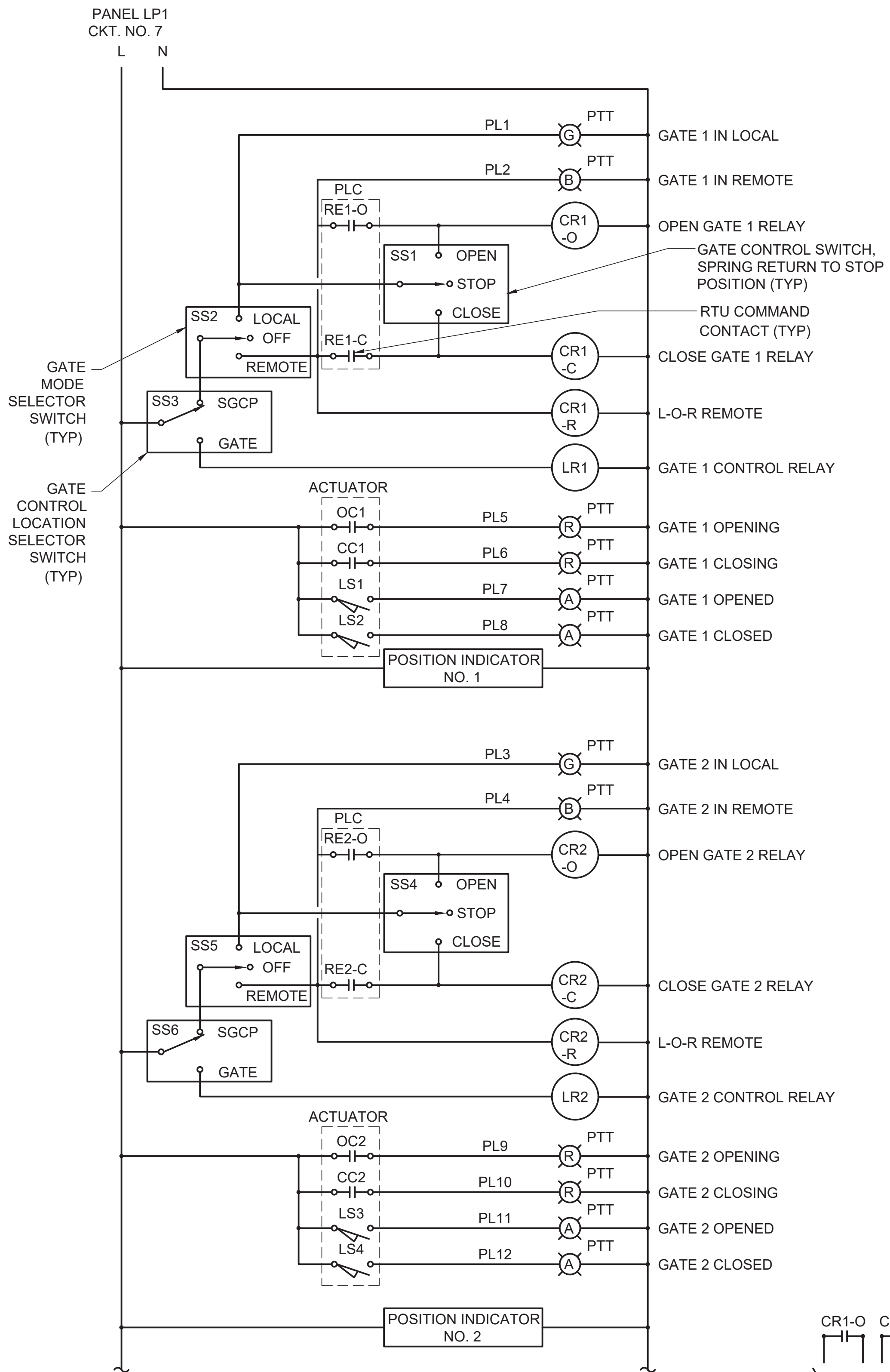
PANELBOARD, LIGHTING FIXTURE, AND
 HANDHOLE SCHEDULES

SHEET
 E-05

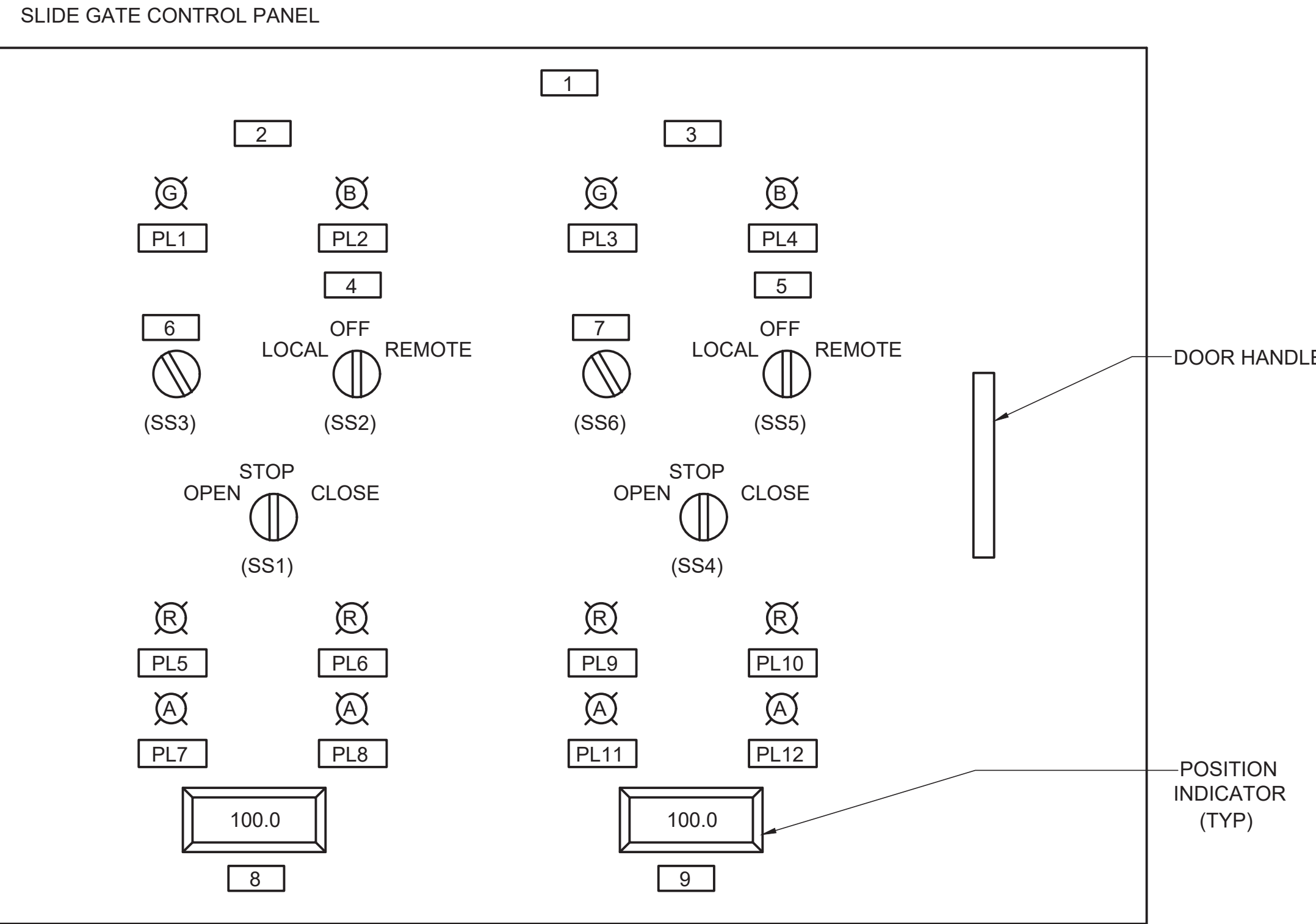
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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

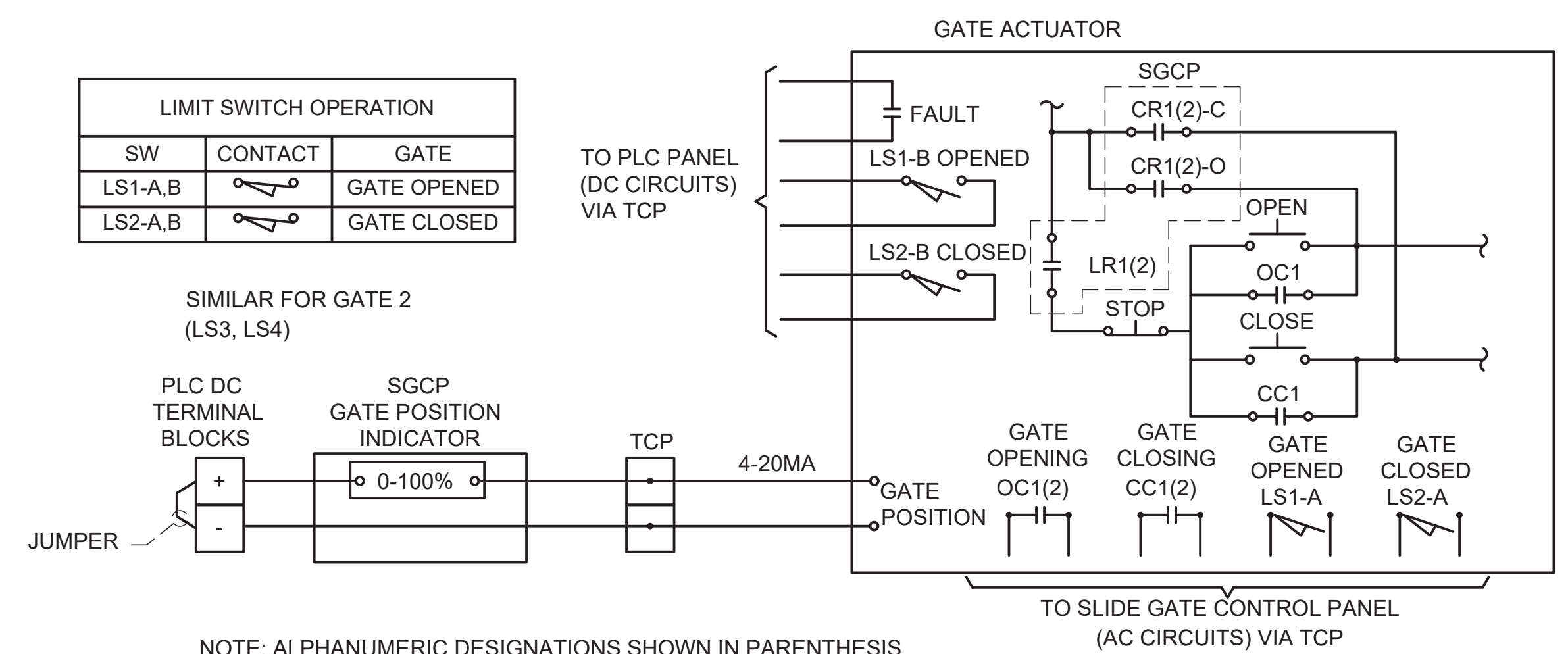


SLIDE GATE CONTROL PANEL (SGCP) SCHEMATIC
NO SCALE

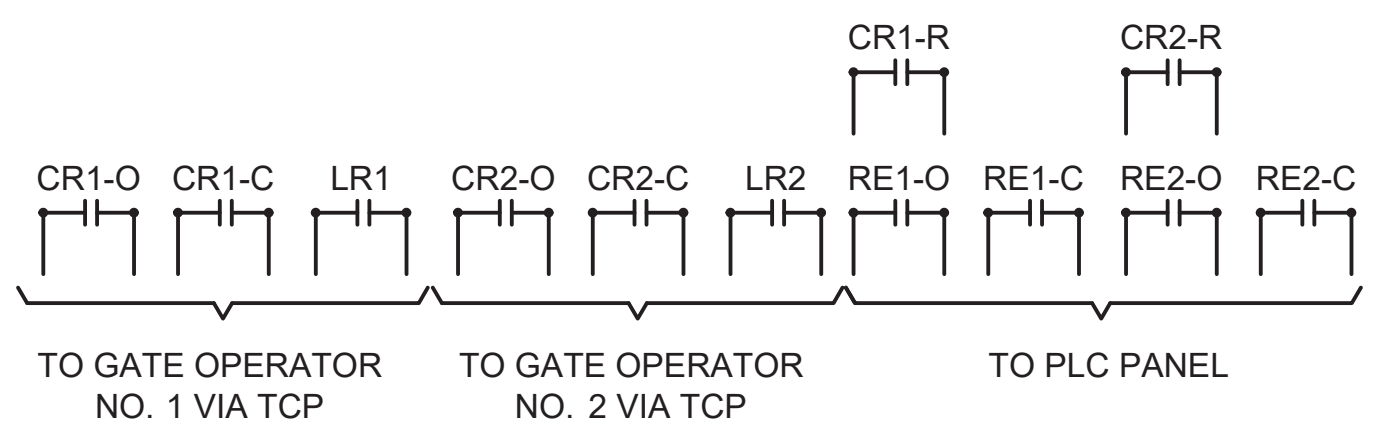


SLIDE GATE CONTROL PANEL (SGCP) ELEVATION
NO SCALE

ENGRAVED NAMEPLATE SCHEDULE		
TAG	TYPE	DESCRIPTION
1	1" WIDE	SGCP
2	3/4" WIDE	GATE NO. 1
3	3/4" WIDE	GATE NO. 2
PL1	1/2" WIDE	LOCAL
PL2	1/2" WIDE	REMOTE
PL3	1/2" WIDE	LOCAL
PL4	1/2" WIDE	REMOTE
4	1/2" WIDE	CONTROL MODE
5	1/2" WIDE	CONTROL MODE
6	1/2" WIDE	SGCP/GATE ACTUATOR
SS2	RING	LOCAL-OFF-REMOTE
7	1/2" WIDE	SGCP/GATE ACTUATOR
SS5	RING	LOCAL-OFF-REMOTE
SS1	RING	OPEN-STOP-CLOSE
SS4	RING	OPEN-STOP-CLOSE
PL5	1/2" WIDE	GATE OPENING
PL6	1/2" WIDE	GATE CLOSING
PL9	1/2" WIDE	GATE OPENING
PL10	1/2" WIDE	GATE CLOSING
PL7	1/2" WIDE	GATE FULLY OPENED
PL8	1/2" WIDE	GATE FULLY CLOSED
PL11	1/2" WIDE	GATE FULLY OPENED
PL12	1/2" WIDE	GATE FULLY CLOSED
8	1/2" WIDE	PERCENT OPEN
9	1/2" WIDE	PERCENT OPEN



TYPICAL INTERFACE TO GATE ACTUATOR
NO SCALE



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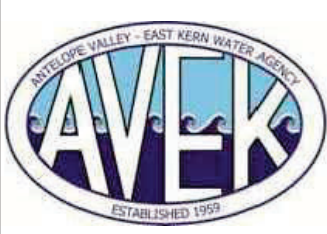
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REGISTERED PROFESSIONAL ENGINEER
WAYNE C. DAHL
No. 45611
Exp. 12/31/2022
CIVIL
STATE OF CALIFORNIA

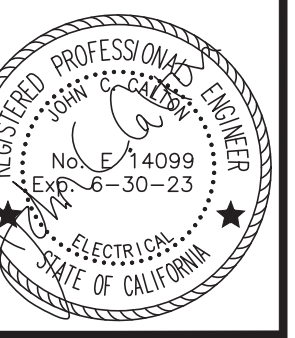
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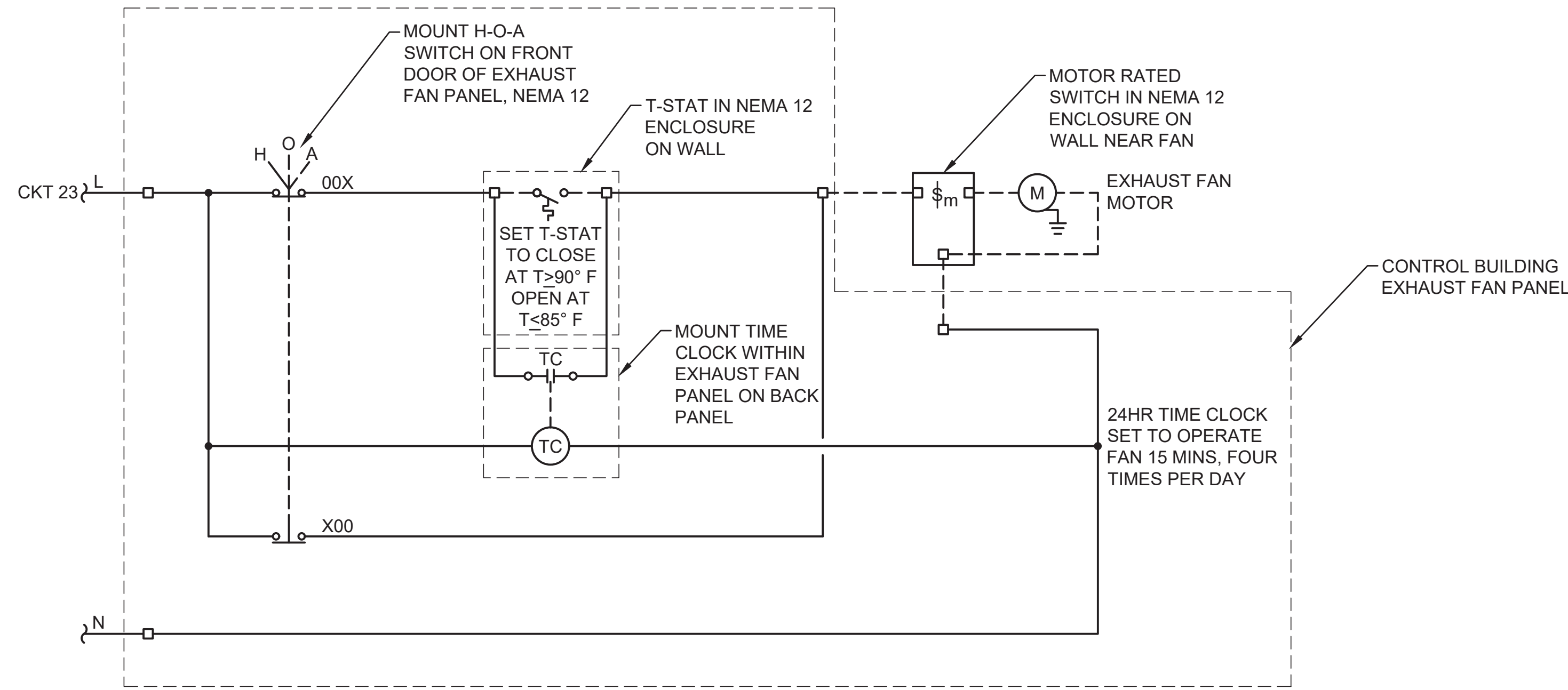
ANTELOPE VALLEY - EAST KERN WATER AGENCY
HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL
SCHEMATICS
SHEET 1 OF 2

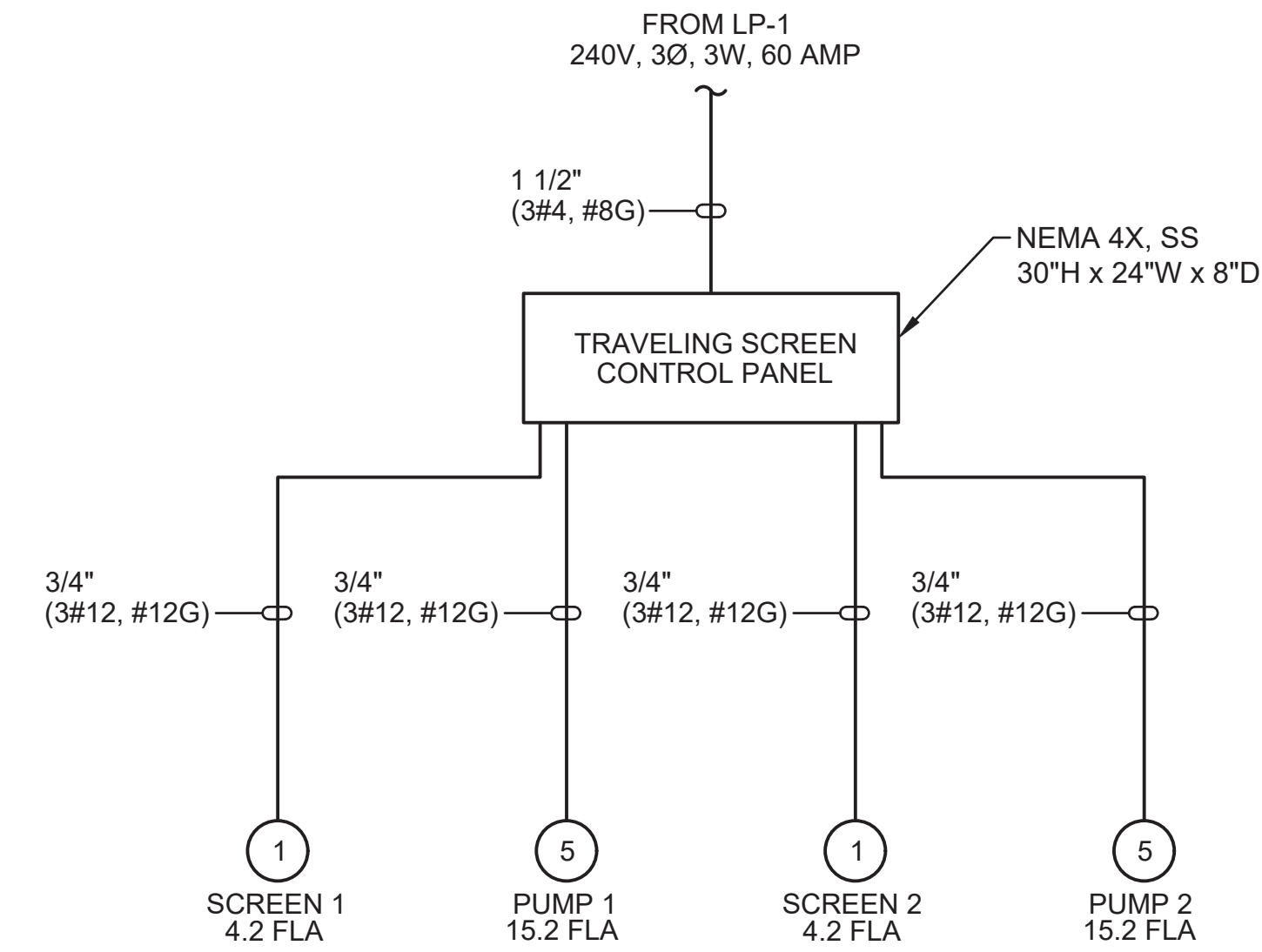


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SHEETS

HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021



CONTROL BUILDING EXHAUST FAN SCHEMATIC
NO SCALE



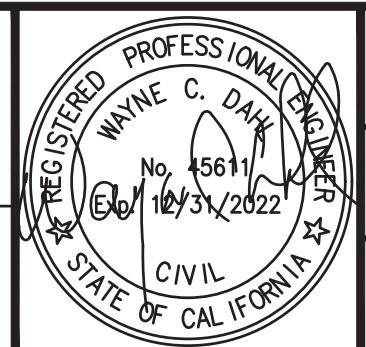
TRAVELING SCREEN - CONDUIT DEVELOPMENT
NO SCALE

NOTES:
CONDUITS AND CABLES SHALL BE BASED ON APPROVED TRAVELING SCREEN SYSTEM SUBMITTAL.

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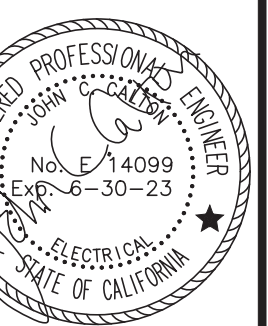
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AQUEDUCT TURNOUT/TURN-IN

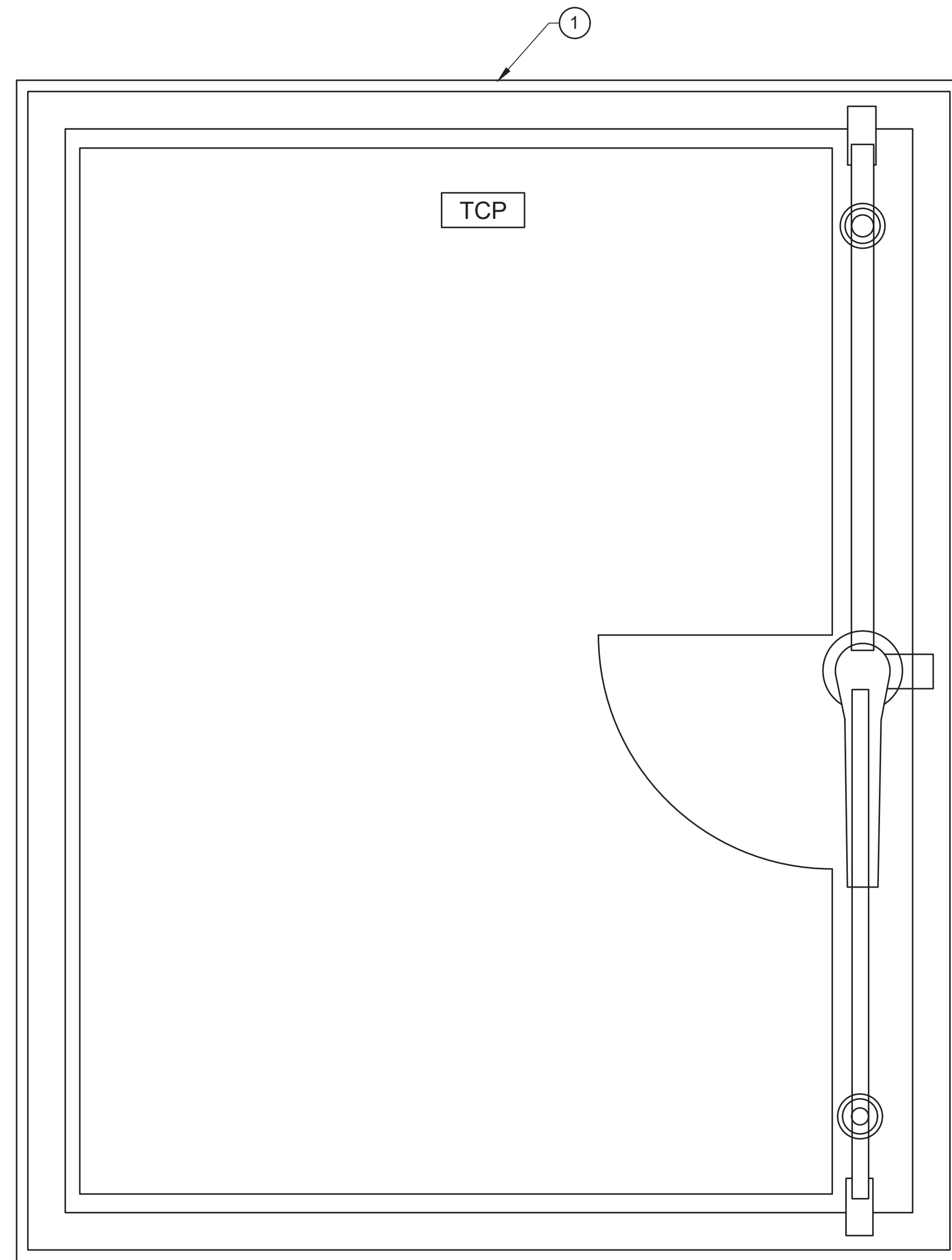
ELECTRICAL
SCHEMATICS
SHEET 2 OF 2



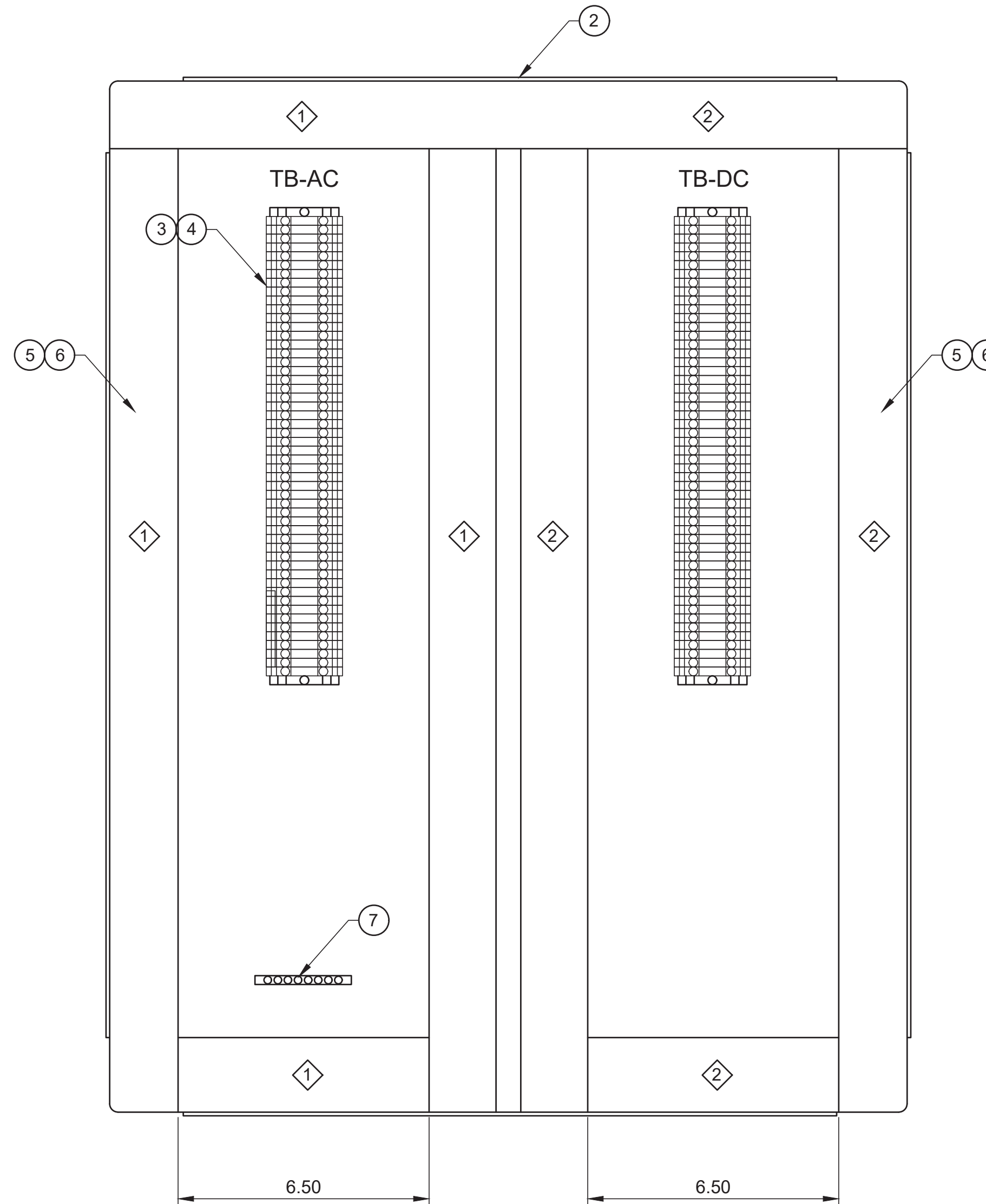
SHEET
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SHEETS

APPENDIX G

BILL OF MATERIAL					
NO	TAG	QTY	DESCRIPTION	MANUFACTURER	PART NUMBER
1	TCP	1	ENCLOSURE 30"Hx24"Wx12"D, NEMA 4, 3-PT LATCH	EATON	302412-43PT
2	-	1	SUB-PANEL	EATON	AW3024P
3	AC, DC	100	KNIFE DISCONNECT TERMINAL BLOCK, UK 5-MTK-P/P	PHOENIX CONTACT	3004032
4	-	4	END CLAMP	PHOENIX CONTACT	800886
5	-	12	WIRING DUCT 1.5"Wx3"H, WHITE	PANDUIT	F1.5X3WH6
6	-	12	WIRING DUCT COVER 1.5", WHITE	PANDUIT	C1.5WH6
7	GND	1	GROUND BUS	SQUARE D	PK7GTA



ENCLOSURE EXTERIOR (FRONT VIEW)
NO SCALE



INTERIOR BACK PANEL (FRONT VIEW)
NO SCALE

* TAGNAME SHALL BE WHITE LETTER ON BLACK BACKGROUND.

WIRE COLORS: 120VAC POWER: BLACK
 120VAC NEUTRAL: WHITE
 24VDC POSITIVE: BLUE
 24VDC NEGATIVE: BLUE/WHITE
 120VAC CONTROL CIRCUITS: RED
 FOREIGN SOURCE: YELLOW
 12VDC POSITIVE: PURPLE
 12VDC NEGATIVE: GRAY
 ANALOG SIGNAL CABLE: RED (+) AND BLACK (-)

CONTROL WIRING ON DISTRIBUTION SHALL BE #14.

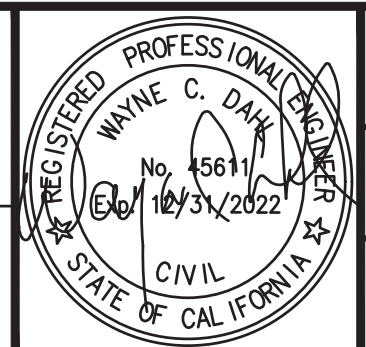
- 1 120V WIRE DUCT.
- 2 24VDC WIRE DUCT.
- 3 NETWORK CABLE WIRE DUCT.

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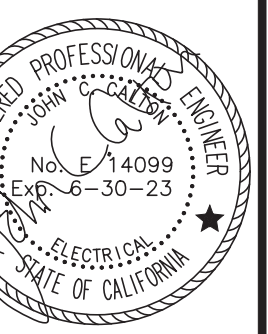
WAYNE C. DAHL DESIGN TEAM LEAD 11/10/21
 NAME R.C.E. 45611 DATE

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ANTELOPE VALLEY - EAST KERN WATER AGENCY
 HIGH DESERT WATER BANK
 AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL
 TCP ELEVATION AND
 BILL OF MATERIALS

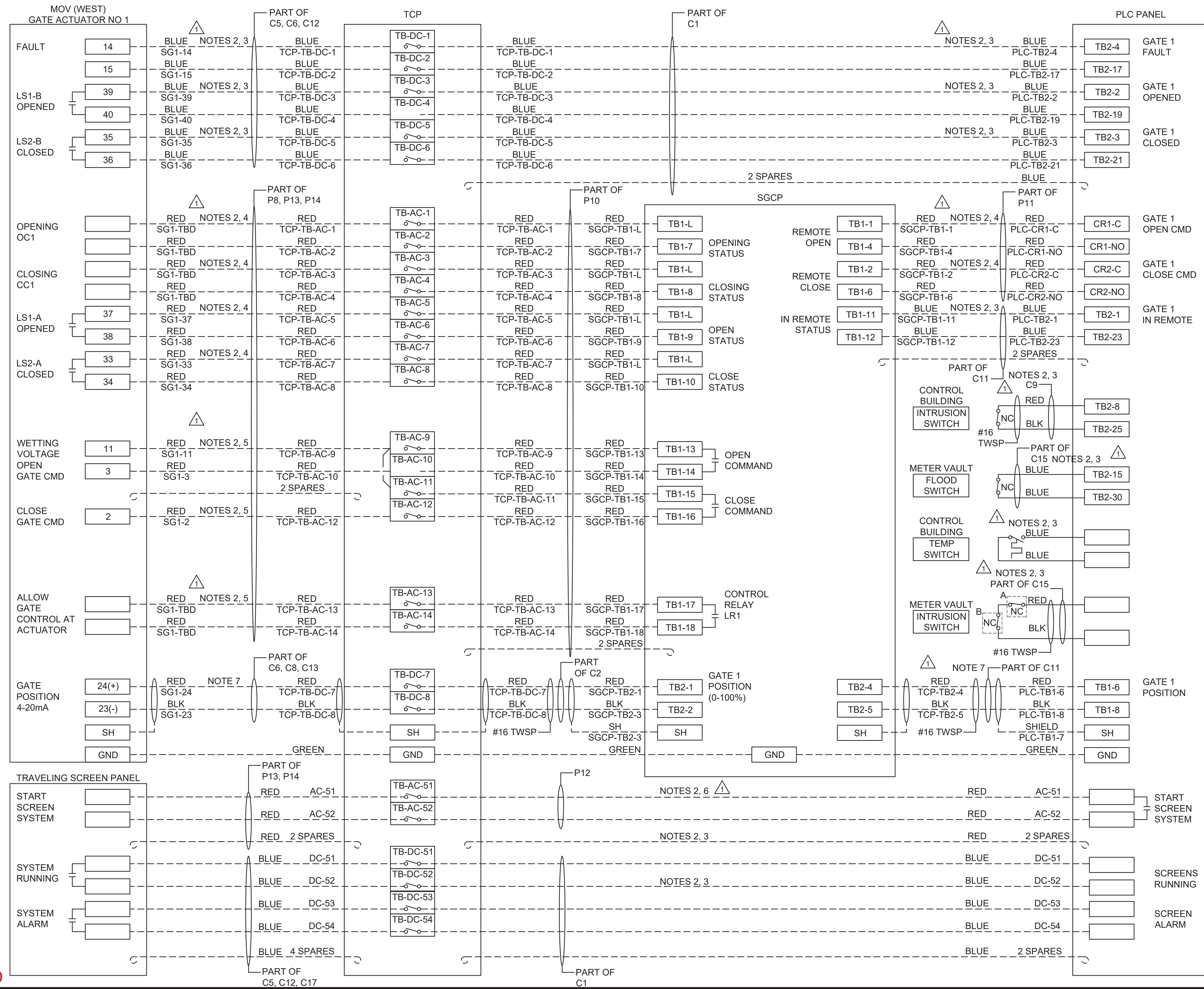


SHEET
 E-08
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 SHEETS

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN

NOVEMBER 2021



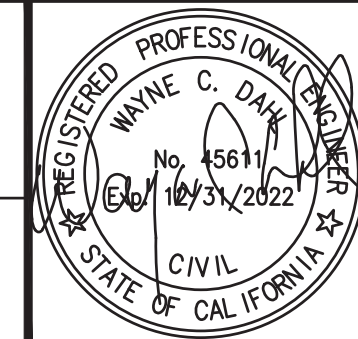
- NOTES:**
1. TERMINAL BLOCK LABELS AND WIRE LABELS SHALL BE REVISED AND PROVIDED BY CONTRACTOR, AS PART OF INTERCONNECT SUBMITTAL.
 2. AC VOLTAGES TO BE 120 VAC. DC VOLTAGES TO BE 24 VDC.
 3. POWER SOURCE OR WHETTING VOLTAGE FROM PLC PANEL.
 4. POWER SOURCE OR WHETTING VOLTAGE FROM PANELBOARD LP-1, CIRCUIT 7.
 5. POWER SOURCE OR WHETTING VOLTAGE FROM GATE ACTUATOR.
 6. POWER SOURCE OR WHETTING VOLTAGE FROM TRAVELING SCREEN.
 7. 4-20 MA ANALOG LOOP POWERED FROM GATE ACTUATOR.

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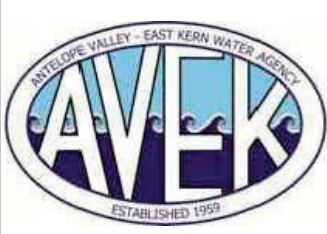


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11/10/21
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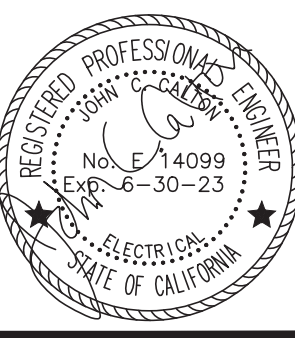


ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
 AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL

TCP, SGCP, AND PLC PANEL
 INTERCONNECTION DIAGRAMS
 SHEET 1 OF 2



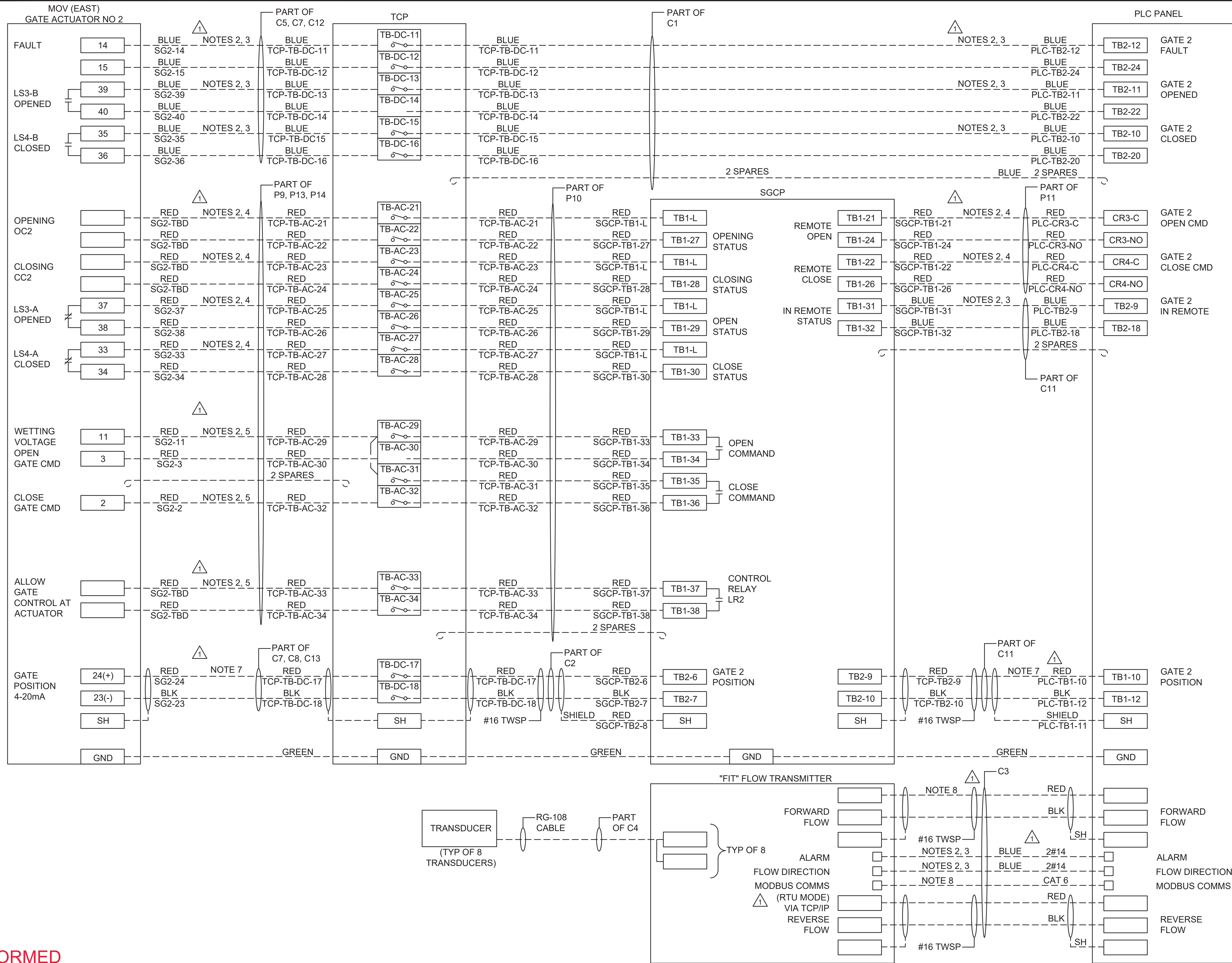
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E-09

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HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

APPENDIX G



- NOTES:**
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 3. POWER SOURCE OR WHETTING VOLTAGE FROM PLC PANEL.
 4. POWER SOURCE OR WHETTING VOLTAGE FROM PANELBOARD LP-1, CIRCUIT
 5. POWER SOURCE OR WHETTING VOLTAGE FROM GATE ACTUATOR.
 6. POWER SOURCE OR WHETTING VOLTAGE FROM TRAVELING SCREEN.
 7. 4-20 MA ANALOG LOOP POWERED FROM GATE ACTUATOR.
 8. 4-20 MA ANALOG LOOP POWERED FROM FLOW TRANSMITTER.

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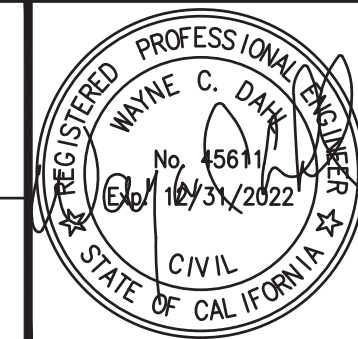
HIGH DESERT WATER BANK AQUEDUCT TURNOUT/TURN-IN NOVEMBER 2021

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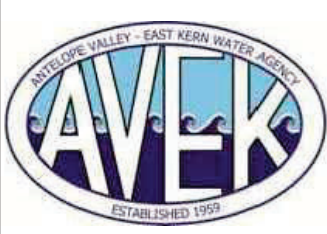


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NAME

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R.C.E. 45611

11/10/21
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ANTELOPE VALLEY - EAST KERN WATER AGENCY

HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

ELECTRICAL

TCP, SSCP, AND PLC PANEL
INTERCONNECTION DIAGRAMS
SHEET 2 OF 2



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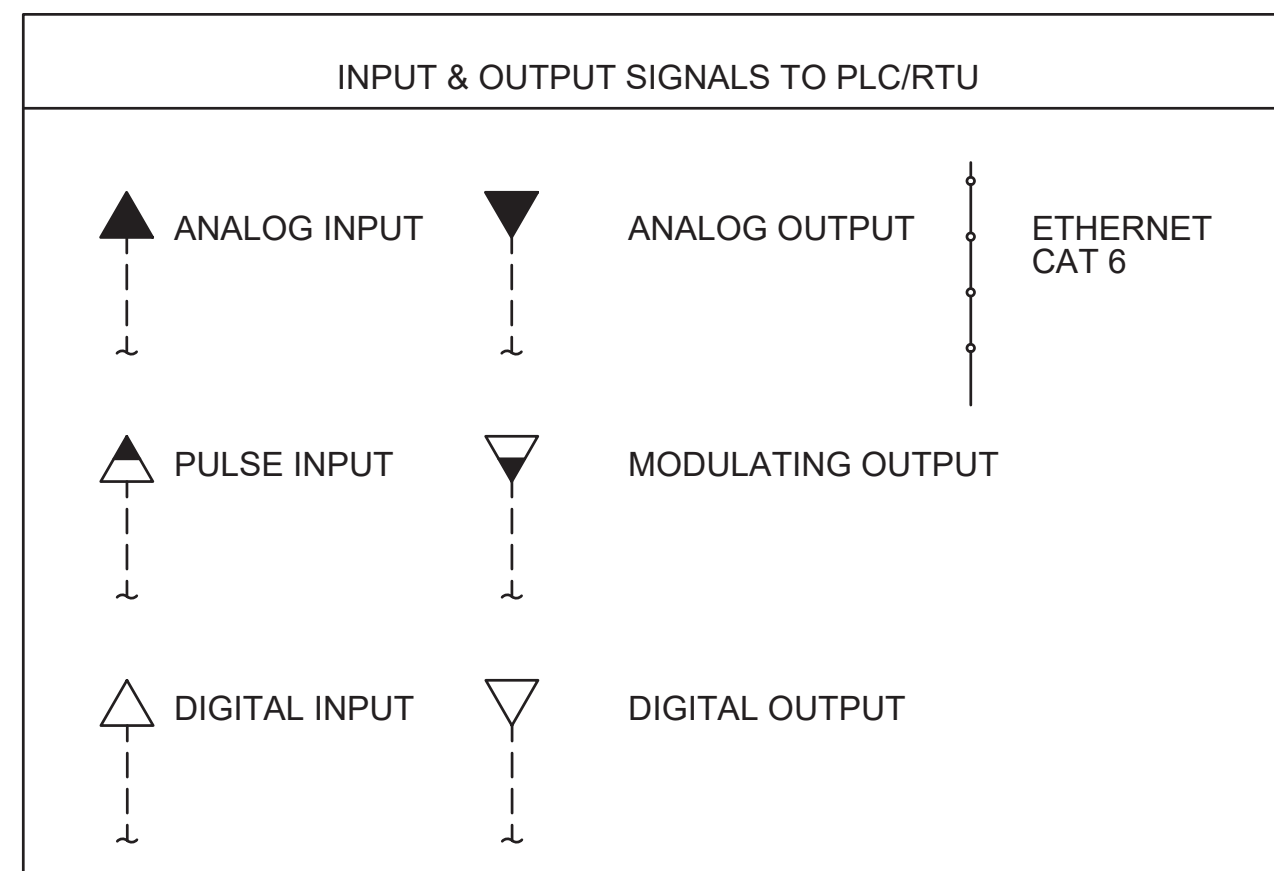
APPENDIX G

SYMBOLS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	MAGNETIC FLOW METER		ELECTRIC SUPPLY OR AIR SUPPLY
	MOTOR		MOTOR
	PROPELLER FLOW METER		PUMP
	ROTAMETER		RESISTOR, RTD
	ELECTRICAL SIGNAL		SOLENOID VALVE
	ELECTRIC POWER/CONTROL		SLIDE GATE WITH ACTUATOR
	PNEUMATIC SIGNAL		
	CAPILARY TUBING (FILLED SYSTEM)		
	HYDRAULIC SIGNAL		
	SONIC OR ELECTROMAGNETIC SIGNAL		
	DRAIN		
	SIGNAL CONVERTER		
	REDUCER		
	BUTTERFLY VALVE		
	GLOBE VALVE		
	GATE VALVE		
	FLOW/PRESSURE CONTROL VALVE		
	EDUCTOR		
	THREE WAY SOLENOID VALVE		
	DIAPHRAGM SEAL		
	AIR VALVE		
	BALL VALVE		
	DIAPHRAGM VALVE		
	CHECK VALVE		
	INTERLOCK		
	PNEUMATIC OPERATED VALVE		
	PLUG VALVE		

ABBREVIATIONS

A	AMPS	LO	LOW
AC	ALTERNATING CURRENT	LOR	LOCAL OFF REMOTE
AI	ANALOG INPUT	LOS	LOCK OUT STOP
AO	ANALOG OUTPUT	LPU	LINE PROTECTION UNIT
AS	AIR SUPPLY		
AV	AIR VALVE	mA	MILLIAMPERES
BL	BLEND	MAG	MAGNETIC
BLDG	BUILDING	MCP	MAIN CONTROL PANEL
BP	BOOSTER PUMP	MFG	MANUFACTURER
BS	BISULFATE	MOV	MOTOR OPERATED VALVE
BW	BACKWASH	MUX	MULTIPLEXER
BWR	BACKWASH WATER RECLAIM		
BFV	BUTTERFLY VALVE	N	NEUTRAL
		O	OPEN
		O/S/C	OPEN/STOP/CLOSE
C	CLOSE	PI	PRESSURE GAGE
CA	CATHODIC	PID	PROPORTIONAL, INTEGRATION, DERIVATIVE
CL	CHLORINE	P/I	PRESSURE TO CURRENT DEVICE
CNTL	CONTROL	PLC	PROGRAMMABLE LOGIC CONTROLLER
COMP	COMPRESSOR	PNL	PANEL
CP	CONTROL PANEL	POS	POSITION
CR	CONTROL RELAY	POT	POTENTIOMETER
CV	CHECK VALVE	POV	PNEUMATIC OPERATED VALVE
		PR	SHIELDED, PAIR CABLE
D	DRAIN	PRESS	PRESSURE
DC	DIRECT CURRENT	PS	PRESSURE SWITCH
DI	DIGITAL INPUT	PSI	POUNDS PER SQUARE INCH
DO	DIGITAL OUTPUT	PSIG	POUNDS PER SQUARE INCH GAGE
D.O.	DISSOLVED OXYGEN	PTT	PUSH TO TEST
DP	DIFFERENTIAL PRESSURE	PV	PROCESS VARIABLE
DPDT	DOUBLE POLE DOUBLE THROW		
		R	RED
EJECT	EJECTOR	REC	RECLAIM
ES	ELECTRIC SUPPLY	REG	REGULATOR
ETM	ELAPSED TIME METER	RES	RESIDUAL
		RTU	REMOTE TELEMETRY UNIT
F	FLUORIDE	RW	RAW WATER
(F)	FUTURE	SD	STORM DRAIN
FC	FAIL CLOSED	SB	SODIUM BISULFITE
FLP	FAIL LAST POSITION	SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
FO	FAIL OPEN	STOR	STORAGE
FS	FLOAT SWITCH	SW	SURFACE WASH
FTW	FILTER TO WASTE		
		TDD, TDE	TIME DELAY RELAY
G	GALLONS, GREEN	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
GND	GROUND	TW	TREATED WATER
		TWSP	TWISTED SHIELDED AIR
HI	HIGH	TWP	TWISTED PAIR
HOA	HAND OFF AUTO	TYP	TYPICAL
HS	HAND SWITCH		
		V, VAC	VOLTS, VOLTAGE
I	INTERLOCK	VFD	VARIABLE FREQUENCY DRIVE
IND	INDICATOR	VLV	VALVE
ISR	INTRINSICALLY SAFE RELAY		
I/E	CURRENT TO VOLTAGE DEVICE		
I/I	CURRENT TO CURRENT DEVICE		
I/O	INPUT/OUTPUT		
I/P	CURRENT TO PRESSURE DEVICE	W	WHITE



P & I DIAGRAM INSTRUMENT IDENTIFICATION					
CODE LETTER	FIRST LETTER(S)		SUCCEEDING LETTER(S)		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BRUNER FLAME			CONTROL	CLOSE
C	CONDUCTIVITY				
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		ELEMENT		
F	FLOW	RATIO			
G	GAGING		GLASS		
H	HAND				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME			CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE	MOMENTARY			MIDDLE
N	STATUS				
O	OPERATOR		ORIFICE		OPEN
P	PRESSURE		POINT		
Q	EVENT	TOTALIZE			
R	RESET		RECORD		
S	SPEED	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMITTER	
U	MULTIVARIABLE		MULTIFUNCTION		
V	VIBRATION			VALVE	
W	WEIGHT		WELL		
X	SWITCH		TROUBLE/FAIL		
Y	EVENT/STATE			COMPUTE/RELAY	
Z	POSITION			ACTUATE	

GENERAL INSTRUMENT OR FUNCTION SYMBOLS				
	LOCATION NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	LOCATION NORMALLY NOT ACCESSIBLE TO OPERATOR	SECONDARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS				
SHARED DISPLAY, SHARED CONTROL				
COMPUTER FUNCTION				
PROGRAMMABLE LOGIC CONTROL				

NOTES

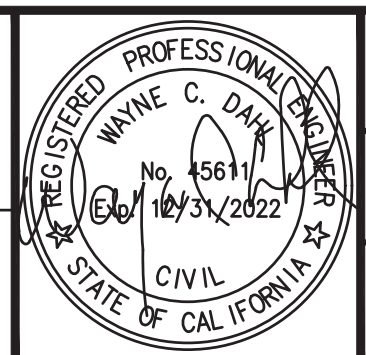
- ALL INSTRUMENTATION DETAILS SHALL BE FOLLOWED, EVEN IF NOT SPECIFICALLY CALLED OUT ON DRAWINGS.

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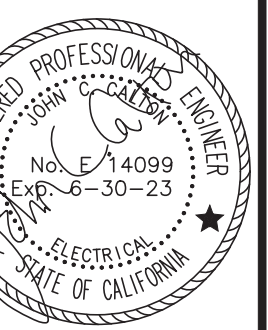
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HIGH DESERT WATER BANK
AQUEDUCT TURNOUT/TURN-IN

INSTRUMENTATION
ABBREVIATIONS AND SYMBOLS

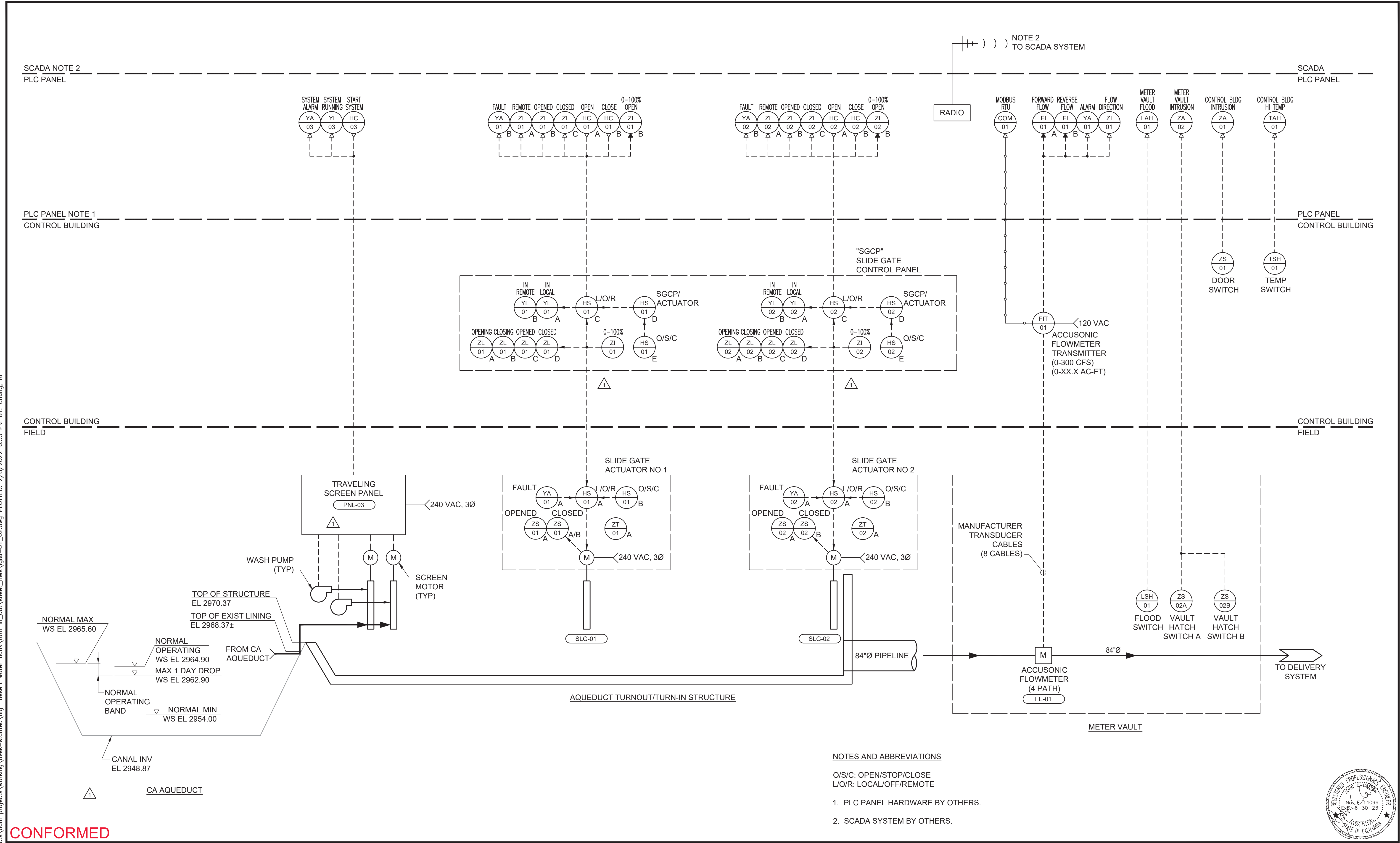


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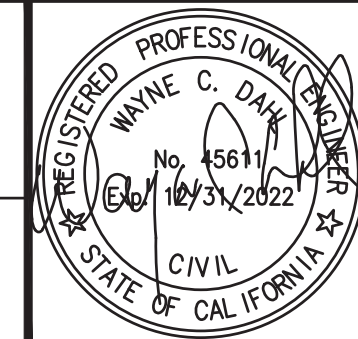


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 AQUEDUCT TURNOUT/TURN-IN

INSTRUMENTATION

P & ID

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