THE CITY OF SAN FERNANDO

PROJECT MANUAL
INCLUDING SPECIFICATIONS
FOR
UPPER RESERVOIR REPLACEMENT

CITY OF SAN FERNANDO
PROJECT NO. 7613, PLAN NO. P-733

JULY 2021



KENNEDY/JENKS CONSULTANTS
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JOB NO. 1944519.00

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PROJECT MANUAL

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DOCUMENT NUMBER 00010

INVITATION TO BID

1. Notice is hereby given that the Owner

   The City of San Fernando
   117 Macneil Street
   San Fernando, CA 91340

   will receive sealed bids for performing the construction of

   Upper Reservoir Replacement Project

   according to the Drawings and Project Manual including Specifications prepared by Kennedy/Jenks Consultants accepted by the Owner and described in general as:

2. Questions regarding the type of work required may be addressed to John Robinson at jrobinson@jrobinsonconsulting.com.

3. A pre-bid conference will be held on Tuesday, August 24, 2021, at 10:00 am. A pre-bid site visit will be held immediately following the pre-bid conference.

4. Sealed bids will be received at:

City of San Fernando, City Clerk's Office , 117 Macneil Street, San Fernando, CA 91340
Place

   until:

Friday	September 3, 2021	2:00 PM local time.
Day of Week	Date	Time

   Bids received after that time will not be accepted. Bids will be opened in public and read aloud shortly after the specified closing time. Interested parties are invited to attend.

5. Bid Security: Each Bid Proposal must be accompanied by a Bid Security in the form of a cashier's check, certified check, or bid bond executed on the prescribed form, in an amount not less than ten percent (10%) of the total bid price payable to the City of San Fernando. Bidders are hereby notified that in accordance with the provisions of Public Contract Code section 22300, securities may be substituted for any monies which the Owner may withhold pursuant to the terms of this Contract to ensure performance.

6. Requirements for California Public Works Contracts.

6.1 Wage Rates

The State Director of the Department of Industrial Relations has established the general prevailing rates of per diem wages and rates for overtime and legal holidays in the locality in which the work is to be performed. Not less than said prevailing wages shall be paid for work on this project.

No contractor or subcontractor may be listed on a bid proposal for a public works project (submitted on or after March 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

No contractor or subcontractor may be awarded a contract for public work on a public works project (awarded on or after April 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.

This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

6.2 License Requirements

The Contractor shall possess a valid State of California Class A General Engineering Contractor's License at the time of submitting a bid. The Contractor shall provide its license number classification and expiration date on the Bid Proposal.

6.3 Security in Lieu of Retainage

Provisions concerning the Contractors' rights to deposit security in lieu of retainage in accordance with California Public Contract Code Sections 10263 and 22300 are covered in the Agreement.

7. No bidder may withdraw its Bid for a period of sixty (60) days after the time fixed for the opening of the bids, within which time an award will be made.

   The Owner reserves the right to reject any and all bids or to waive any irregularities or informalities in any bid or in the bidding.

8. The Drawings and Project Manual including Specifications may be examined at

   City of San Fernando, Public Works Department , 117 Macneil Street, San Fernando, CA 91340

9. The Drawings and Project Manual including Specifications may be obtained at

   https://ci.san-fernando.ca.us/rfps-rfqs-nibs-nois/

   To be placed on the Plan Holder's list and receive the latest updates, including addenda, send an email to PublicWorks@sfcity.org, with the Subject Line: UPPER RESERVOIR REPLACEMENT PROJECT

By order of _____
(Owner)

_____ _____
(Date) (Clerk or Secretary)

END OF INVITATION TO BID

DOCUMENT NUMBER 00100

INSTRUCTIONS TO BIDDERS

Article 1. General

Bidding Documents containing the Bidding Requirements are provided to prospective bidders to enable them to prepare a bid. Documents that must be submitted with the Bid are listed at the end of the Instructions to Bidders.

Article 2. Defined Terms

2.1 Terms used in these Instructions to Bidders which are defined in the GENERAL CONDITIONS of the Construction Contract have the meanings assigned to them in the General Conditions.

2.2 The term "Addenda" (Addendum) means the written or graphic instruments issued prior to execution of the Agreement which modifies or interprets the Bidding Documents and Contract Documents.

2.3 The term "Bidder" means any person, firm or corporation submitting a Bid directly to Owner, as distinct from a sub-bidder, who submits a bid to a Bidder.

2.4 The term "Successful Bidder" means the lowest, qualified, responsible and responsive Bidder to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.

2.5 The term "Bid" means the offer or proposal of the Bidder submitted on the prescribed forms setting forth the prices for the work to be performed and furnishing other required information.

2.6 The term "Base Bid" means the amount bid on all of the work required to complete a single Contract as described in the Contract Documents. The Base Bid submitted by the successful bidder combined with any additive or deductive amounts bid on alternates accepted by the Owner and any other modifications becomes the Contract Price.

2.7 The term "Bidding Documents" includes the Invitation to Bid, Instructions to Bidders, Information Available to Bidders, the Bid Proposal with related documents, the Contract Conditions, Specifications and Drawings (and includes all Addenda issued prior to receipt of Bids.)

2.8 The terms "Contract" and "Project" are defined in the General Conditions paragraph 1.1.

2.9 The term "Notice of Award" is a written notice by the Owner to the Bidder that it is the successful Bidder and upon the Bidders compliance with the Owner's requirements the Owner will execute the Agreement.

Article 3. Copies of Bidding Documents

3.1 Complete sets of Bidding Documents (the Drawings and Project Manual including Specifications) may be obtained at the location and time designated in the Invitation to Bid for the non-refundable purchase price stated therein. Make all checks payable to the Owner.

3.2 Complete sets of Bidding Documents must be used in preparing Bids; neither the Owner nor the Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.3 The Owner and the Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer or grant a license for any other use.

Article 4. Examination of Contract Documents and Site

4.1 It is the responsibility of each Bidder before submitting a Bid to (a) examine the Bidding Documents thoroughly; (b) visit the site to become familiar with local conditions that may affect cost, progress, performance or furnishing of the Work; (c) dig test pits or drill test holes to further evaluate subsurface soil conditions to the extent the Bidder considers necessary; (d) consider federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work; (e) study and carefully correlate Bidder's observations with the Contract Documents; and (f) notify the Engineer of all conflicts, errors or discrepancies in the Contract Documents.

4.2 Additional information available to Bidders, if any, is described in Document Number 00200, Information Available to Bidders.

4.3 Differing Conditions:

1. General Conditions paragraphs 3.3 through 3.5 limit the extent to which the Contractor may rely on information provided by the Owner or the Design Engineer with regard to: a) subsurface soil conditions, b) existing concealed or underground utilities and underground facilities, and c) existing structures and facilities.
2. General Conditions paragraphs 3.6 and 3.8 identify the Contractor's responsibility: a) for using care in making excavations and in doing demolition, b) for damage to existing utilities and underground facilities and for loss of use thereof, and c) for the protection of workers and others from known and unknown or concealed hazards.
3. General Conditions paragraph 3.7 identifies conditions under which the Contractor may be entitled to a change in Contract Time or Price due to differing or unknown conditions.

4.4 The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by Contractor. Easements for permanent facilities or utilities or easements for permanent changes in existing facilities or utilities have been obtained or will be obtained and paid for by Owner unless otherwise provided in the Contract Documents.

4.5 Bidder's Representations. By submitting a bid each bidder represents and warrants:

1. It has visited the site and has reviewed the Bidding Documents and the Information Available to Bidders; it has made any other investigations, explorations or tests and has obtained any other data it considers necessary for preparation of its Bid; and it has read and understands provisions in the General Conditions relevant to differing and unknown conditions.
2. It has read, studied and understands the entire set of Bidding Documents including the Construction Drawings, Specifications and General Conditions and finds them fit and sufficient for the purpose of preparing its Bid and constructing the Work required.
3. Its Bid is based on providing all of the material, labor, equipment, and services necessary to complete the Work in full compliance with the Contract Documents without exception.

Article 5. Interpretations and Addenda (Before Contract Award)

5.1 All questions about the meaning or intent of the Contract Documents are to be directed to the Engineer. Interpretations or responses considered necessary by the Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the Engineer as having received the Bidding Documents. Questions received less than five days prior to the date for opening of bids may not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or responses will be without legal effect and are not to be relied upon by the Bidders unless they are integrated into the written Contract Documents.

5.2 Addenda may also be issued to modify the Bidding Documents as deemed advisable by the Engineer.

Article 6. Bid Security

Each Bid must be accompanied by Bid Security conforming to the requirements of Document Number 00410, Bid Security.

Article 7. Contract Time

The numbers of days (Contract Time) within which the Work is to be Substantially Completed and Finally Completed and ready for acceptance and final payment are set forth in the Bid Proposal and the Agreement.

Article 8. Liquidated Damages

Provisions for liquidated damages, if any, are set forth in the Agreement.

Article 9. Substitute or Proposed Equivalent ("Or Equal") Items

The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or Proposed Equivalent ("Or Equal") items. Whenever it is indicated in the Drawings or specified in the Specifications that a Proposed Equivalent ("Or Equal") item of material or equipment may be furnished or used by the Contractor if acceptable to the Engineer, such acceptance will not be considered by the Engineer until after the Effective Date of the Agreement. The procedure for submission of any such Proposed Equivalent ("Or Equal") item by the Contractor for the

Engineer's review and consideration is set forth in Article 8 of the GENERAL CONDITIONS under Specified Items/Proposed Equivalents and may be supplemented in Division One.

Article 10. Listing of Subcontractors

The Contractor's Bid must include a listing of subcontractors conforming to the requirements and format of Document Number 00430.

Article 11. Bid Proposal

11.1 The Bid Proposal is included with the Bidding Documents; additional copies may be reproduced by the Bidder.

11.2 All blanks on the Bid Proposal must be completed legibly in ink or by typewriter. Bid amounts must be stated in words and in figures.

11.3 Bids by corporations must be executed in the corporate name by the president or a vice president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

11.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

11.5 All names must be legibly printed in ink or typed below the signature.

11.6 The Bid shall contain an acknowledgement of receipt of all ADDENDA (the numbers of which must be filled in on the Bid Proposal. ADDENDA are designated as Document Number 00900.

11.7 The address and telephone number for communications regarding the Bid must be shown.

Article 12. Submission of Bids

Bids shall be submitted at the time and place indicated in the Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked with the Project title and, when the Project includes more than one Contract, with the designated Contract or portion of the project for which the Bid is submitted. The envelope shall bear the name and address of the Bidder and the Bid shall be accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it.

Article 13. Modification, Withdrawal and Disqualification of Bidders

13.1 Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

13.2 If, within five days after Bids are opened, any Bidder files a duly signed, written notice with the Owner and promptly thereafter demonstrates in detail to the reasonable satisfaction of

Owner that there was a material and substantial mistake in the preparation of its Bid, how the mistake occurred, that the mistake was not due to an error in judgment or to carelessness in inspecting the site or reading the plans or specifications, that Bidder may withdraw its Bid and the Bid Security will be returned. A Bidder who withdraws its Bid will be disqualified from further bidding on the Work to be provided under the Contract Documents. See California Public Contract Code 5103.

13.3 More than one Bid from an individual, firm, partnership or corporation under the same or different names will not be considered. Reasonable grounds for believing that any individual, firm, partnership or corporation is interested in more than one Bid for the work contemplated may cause the rejection of all Bids in which the individual, firm, partnership or corporation is interested. If there is reason for believing that collusion exists among the Bidders, any or all Bids may be rejected. Bids in which the price is obviously unbalanced may be rejected.

13.4 All Bidders are put on notice that any collusive agreement fixing the prices to be bid so as to control or affect the awarding of this Contract is in violation of the competitive bidding requirements of the Public Contract Code and may render void any Contract let under such circumstances.

Article 14. Opening of Bids

Bids will be opened and (unless obviously non-responsive) read aloud publicly. An abstract of the amounts of the Base Bids and major Alternates (if any) will be made available to Bidders after the opening of Bids.

Article 15. Bids to Remain Subject to Acceptance

All Bids will remain subject to acceptance for ninety (90) days after the day of the Bid opening, but the Owner may, in its sole discretion, release any Bid and return the Bid Security prior to that date. Bids on Alternates shall remain valid for 60 days after execution of the Agreement.

Article 16. Award of Contract and Bid Protest

16.1 The Owner reserves the right to reject any and all Bids and to waive any and all irregularities in Bids not involving price, time or changes in the Work. The Owner reserves the right to reject any nonconforming, nonresponsive, incomplete, unbalanced or conditional Bids. The Owner also reserves the right to reject the Bid of any Bidder that in the Owner's judgment would not be financially or otherwise responsible or that does not meet pertinent minimum experience criteria established by the Owner and stated in the Instructions to Bidders.

16.2 In evaluating Bids, the Owner will consider whether or not the Bids comply with the prescribed requirements, and include such Alternates, unit prices and other data, as may be required in the Bid Proposal and supplements thereto.

16.3 Discrepancies in the multiplication of units of Work and unit prices, if any, will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between bid amounts stated in words and in figures will be resolved in favor of the amount stated in words.

16.4 The Owner may accept any Alternate without regard to the order in which they are listed and will determine the lowest Bidder on the basis of the Base Bid and the Alternates accepted.

16.5 If the Contract is to be awarded, it will be awarded to the lowest qualified, responsible and responsive Bidder that in the Owner's judgment will be in the best interests of the Project.

16.6 If the Contract is to be awarded, Owner will give the Successful Bidder a Notice of Award within the number of days that Bids are subject to acceptance as stated in Article 15.

16.7 The lack of prompt procedures to resolve disputes regarding the bidding process would impair the Owner's ability to carry out its purpose of constructing this project in a timely manner. Therefore, to the maximum extent authorized by law and notwithstanding any other procedures specified in documents referenced herein, all disputes and/or protests regarding the bidding process shall be subject to the following procedure. In submitting a Bid to the Owner for this project, the Bidder agrees to comply with and to be bound by this procedure. Any Bid protest must be submitted in writing to the Office of the City Clerk located at the San Fernando City Hall – 117 Macneil Street, San Fernando, CA 91340 by or before 5:00 p.m. on the fourth (4th) working day following the Bid opening.

(a) Required contents of Bid protest:

(1) Name, address, fax and telephone number of the protester and the name, address and telephone number of the person representing the protesting party.

(2) Solicitation of contract number.

(3) Detailed statement of the legal and factual grounds for the protest, to include a description of resulting prejudice to the protester.

(4) Reference to the specific portion of the Contract Documents which forms the basis for the protest.

(5) Copies of relevant documents.

(6) Request for a ruling by the Owner.

(7) Statement as to the form of relief requested.

(8) All information establishing that the protester is an interested party for the purpose of filing a protest.

(9) All information establishing the timeliness of the protest.

Written protests submitted via e-mail must be e-mailed to the City Clerk at JFritz@sfcity.org. Written protests must be in the physical possession of the City Clerk by or before the deadline for submitting protests. Protests mailed with a postmark that precedes the deadline but which is not received until after the deadline shall be deemed untimely and will not be considered. The delivery of written protests to any person (including any other official, officer or employee of the Owner) other than the City Clerk shall be deemed defective and such protest shall be deemed to have not been delivered

to the Owner. For purposes of this Instructions to Bidders, the term “working day” means any day of the week excluding Saturday, Sunday or any federal holiday. The term “City business day” is defined to mean those days of the week in which the City of San Fernando is open for business and excludes Saturday, Sunday and any City-observed holiday.

(b) Protests based on alleged apparent improprieties in a solicitation shall be filed before Bid opening or the closing date for receipt of proposals. In all other cases, protests shall be filed no later than ten (10) days after the basis of protest is known or should have been known, whichever is earlier. The City, for good cause shown, or where it determines that a protest raises issues significant to the City’s acquisition system, may consider the merits of any protest which is not timely filed.

(c) The party filing the protest must have actually submitted a Bid for the Work. A subcontractor of a party submitting a Bid for the Work may not submit a Bid protest. A party may not rely on the Bid protest submitted by another Bidder but must timely pursue its own protest.

(d) The party filing the protest must concurrently transmit a copy of the initial protest document and any attached documentation to all other parties with a direct financial interest which may be adversely affected by the outcome of the protest. Such parties shall include all other Bidders who appear to have a reasonable prospect of receiving an award depending upon the outcome of the protest. The Bid protest must be accompanied by a proof of service declaring under penalty of perjury that a copy of the written protest was concurrently delivered to all such affected parties, including any Bidder(s) against whom the protest is made.

(e) The protested Bidder will have until 5:00PM on the fourth (4th) working day after the deadline for submitting initial protests to submit a written response. The responding Bidder shall transmit the response to the protesting Bidder concurrent with delivery to the Owner in the manner prescribed for submitting initial protests, above.

(f) The procedure and time limits set forth in this paragraph are mandatory and are the Bidder's sole and exclusive remedy in the event of Bid protest. The Bidder's failure to comply with these procedures shall constitute a waiver of any right to further pursue the Bid protest, including filing a Government Code Claims Act claim or legal proceedings. A Bidder may not rely on a protest submitted by another Bidder, but must timely pursue its own protest.

(g) If the Owner determines that a protest is frivolous, the protesting Bidder may be determined to be non-responsible and that Bidder may be determined to be ineligible for future contract awards.

(h) Action upon receipt of protest by Owner.

(1) Upon receipt of a protest before a Notice of Award is issued, a Contract may not be rewarded, pending Owner resolution of the protest, unless Contract award is justified, in writing, for urgent and compelling reasons or is determined, in writing, to be in the best interest of the Owner. Such justification or determination shall be approved at a level above the contracting officer, or by another official pursuant to Owner procedures.

(2) If a Notice of Award is withheld pending resolution of the protest, the contracting officer will inform the other Bidders who Bids might become eligible for award of the Contract. If appropriate, the Bidders should be requested, before expiration of the time for acceptance of their Bids, to extend the time for acceptance to avoid the need for resolicitation. In the event of failure to obtain such extension of Bids, consideration should be given to proceeding with a Notice of Award pursuant to paragraph (h)(1) of this section.

(i) Owner shall make its best effort to resolve protests within thirty-five (35) days after the Bid protest is filed.

(j) Owner Bid protest decisions shall be well-reasoned and shall explain the Owner position. The Bid protest decision shall be provided to the protester in writing using a method that provides evidence of the protester's receipt.

Article 17. Contract Security

17.1 The Owner's requirements for performance and payment bonds are set forth in Article 4 of the General Conditions.

17.2 The Successful Bidder shall engage a surety who through binding agreement will assume liability for all debts and responsibility for the acceptable performance of the Work under this Contract if the Contractor defaults.

17.3 When the Successful Bidder delivers the executed Agreement to the Owner, it must be accompanied by the required bonds in the forms contained in the section of the Project Manual titled Contract Forms.

Article 18. Insurance

18.1 The Owner's requirements for insurance are set forth in Article 4 of the General Conditions.

18.2 The Successful Bidder shall purchase insurance from an insurance company or companies who meet the requirements of General Conditions paragraphs 4.3 through 4.5, will provide the required insurance and will furnish insurance certificates.

18.3 The Successful Bidder shall deliver the required insurance certificates to the Owner and Engineer prior to beginning work. In no case will the Notice to Proceed be considered as allowing the Work to begin until the insurance certificates are received by the Owner, even though the Contract Time as stated in the Notice to Proceed will commence to run.

18.4 If Acts of God insurance is required, it will be quoted as a separate bid item.

Article 19. Signing of Agreement

When Owner gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within fifteen days thereafter the Contractor shall sign and deliver the required number of counterparts of the Agreement together with the required Bonds to the Owner. Within ten days thereafter the Owner will deliver one fully signed counterpart to the

Contractor. Each counterpart is to be accompanied by a complete set of the Drawings with appropriate identification which shall be signed by the parties to the Agreement.

Article 20. Retainage

The percentage of retainage that will be withheld from each Progress Payment is set forth in the Agreement.

Provisions concerning the Contractor's rights to deposit securities in lieu of retainage in accordance with California Public Contract Code Sections 10263 and 22300 are set forth in the Agreement.

Article 21: Sales and Use Taxes

Owner is exempt from California State Sales and Use Taxes on materials and equipment to be incorporated in the Work (Exemption No. ____). Said taxes shall not be included in the Contract Price. Refer to Supplementary Conditions for additional information.

Article 22. Pre-bid Conference

A pre-bid conference will be held at 10:00 a.m. on the 24th day of August 2021 at City of San Fernando, City Hal, 117 Macneil Street, San Fernando, CA 91340. Representatives of the Owner and the Engineer will be present to discuss the Project. Bidders are required to attend and participate in the conference. The Engineer will transmit to all prospective Bidders of record such Addenda as the Engineer considers necessary in response to questions arising at the conference.

Article 23. Pre-Bid Site Visit; Access to Site

A pre-bid site visit will be held immediately after the pre-bid conference on the 24th day of August 2021 at 13655 Foothill Boulevard, Sylmar, CA 91340. Representatives of the Owner and the Engineer will be present to show Bidders the general location of the Work. Bidders are encouraged to visit the site at the time prescribed.

The Contractor may arrange with the Owner for access to the site at the Owner's convenience for the purpose of digging test pits or drilling test holes to evaluate subsurface soil conditions. The Contractor shall fill all holes and leave site in "as found condition."

Article 24. Minimum Experience Requirement

Bidder shall submit Document Number 00420 - Bidder's Qualifications, with its Bid to verify it has the minimum experience qualifications required for bidding.

In the Owner's judgment, the minimum experience requirement for Bidders to Bid on this Contract is the successful completion of at least five (5) projects similar in size complexity and construction cost to the project being bid at this time.

Article 25. Documents that Must be Submitted with Bids

Bidders must submit the following signed Documents with their Bids:

Document Number	Title
00300	Bid Proposal
00410	Bid Security
00411	Designation of Equipment or Material Manufacturers
00414	Security for Compensation Certificate
00416	Bidder's References
00420	Bidder's Qualifications
00430	Designation of Subcontractors
00480	Non-Collusion Declaration

END OF INSTRUCTIONS TO BIDDERS

DOCUMENT NUMBER 00200

INFORMATION AVAILABLE TO BIDDERS

Article 1

For the convenience of Bidders, the Owner is providing the items and information listed below which the Owner has in its possession and which may relate to the Work, the Project, or the site. The Owner has not made any independent investigation to determine the accuracy or completeness of any such items and information; and all such items and information are provided or made available to Bidders without any representation or warranty by the Owner whatsoever as to their accuracy, completeness, or relevancy. Bidders are solely responsible for independently evaluating any such items and information; and such items and information shall not be relied upon by the Bidders without careful independent verification.

1.1 Preliminary Construction Schedule: try to find project version of schedule. *[Provide any preliminary construction schedules developed by the Design Engineer or Owner as advisory information for use by bidders in preparing their bids. Label all such schedules "Information Only" in a prominent location. All such schedules are not to be relied upon for bid purposes and are not a part of the Bidding Documents].*

1.2 Geotechnical Data: Preliminary Geotechnical Investigation Report Upper Reservoir Replacement Project by Converse Consultants (September 29, 2020). Provided for information only.

1.3 Existing Underground Facilities and Utilities Data: Foothill Boulevard SW/S 130’ to 370’ NW/O Hubbard Street by Gilbert Engineering Company, Inc. (June 8, 2012). Provided for information only.

1.4 Existing Site and Building Data: City of San Fernando Water Department Improvements to Water Works System by Koebig & Koebig Inc. (August 31, 1962). Provided for information only.

1.7 Easements: Currently no off-property easements available. Temporary access to roadways in front to be coordinated with traffic plan and City of Los Angeles transportation.

1.9 Others: Temporary Traffic Control Plans by JMD (April 2021). Provided for information only.

END OF INFORMATION AVAILABLE TO BIDDERS

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DOCUMENT NUMBER 00300

BID PROPOSAL

Proposal to: City of San Fernando
Public Works Department
San Fernando City Hall
117 Macneil Street, San Fernando, CA 91340

The undersigned Bidder hereby proposes to furnish and deliver all necessary labor, tools, equipment, and other means of construction to perform the work required for the completion of the project entitled **UPPER RESERVOIR REPLACEMENT PROJECT** in accordance with the intent of all plans, specifications, and addenda issued by the City of San Fernando, Public Works Department prior to the opening of the bid proposals.

Bidder has read the accompanying instructions to Bidders, has carefully examined the location(s) of the proposed work, and has examined all Contract Documents, drawings and addenda issued by the City and will contract with the City to construct the project, complete and in satisfactory condition.

The Bidder further agrees to complete all work required under the Contract within _____ working days from the date designated in the Notice to Proceed, and to accept in full payment therefore the price indicated on the Bid Schedule. The terms “working days” or “work days” means any day of the week, excluding Saturday, Sunday and any federally observed holiday.

The Bidder acknowledges that it understands that a waiting period from time of bid opening until award may be sixty (60) calendar days during which time Bidder may not withdraw its bid. The Bidder further acknowledges that it has adjusted its bid price to include all possible items which may influence the proposal during the waiting period. Requests for bid price change due to the delay shall not be agreed to by the City.

Company Name:_____

Bidder’s Name (Printed):_____
Bidder’s Title:_____

Bidder’s Signature:_____
Date:_____

Address:_____
_____
Phone Number:_____

Contractor’s License Number:_____
Classification:_____
Expiration Date:_____

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DOCUMENT NUMBER 00410

BID SECURITY

1.1 Bid Security: Each proposal must be accompanied by a Bid Security in the form of a cashier's check, certified check, or bid bond executed on the prescribed form, in an amount not less than ten percent (10%) of the total bid price payable to the City of San Fernando. Bidders are hereby notified that in accordance with the provisions of Public Contract Code section 22300, securities may be substituted for any monies which the City may withhold pursuant to the terms of this Contract to ensure performance.

1.2 Bid Security

(a) All Bids shall be accompanied by a Bid Security. Such Bid Security shall include cash, cashier's or certified check made payable to the City or a Bid Bond executed by an admitted surety insurer. The Bid Security must be enclosed in the same envelope with the Bid. The amount of the Bid Security shall be not less than ten percent (10%) of the total amount of the Bid.

(b) The Attorney-in-Fact (resident agent) who executes the Bid Bond on behalf of the surety company must attach a copy of its Power of Attorney as evidence of its authority. A notary shall acknowledge the power as of the date of execution of the surety bond which it covers.

(c) Bid Bonds must be provided on the Bid Bond form furnished by the City. The Bid Bond must be furnished by a company, acceptable to the City, that is authorized and licensed by the Insurance Commissioner as an "admitted surety insurer" and that maintains at least one office in California for conducting business.

BID BOND

THAT WE, THE UNDERSIGNED, _____, as principal; and _____, as Surety, are hereby held and bound unto the CITY OF SAN FERNANDO, hereinafter "City" or "Owner", in the sum of _____dollars($_____), which sum is equal to at least ten percent (10%) of the total amount of the Bid for the Work, payment of which sum, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

The condition of the above obligation is such that whereas the Principal has submitted to the City a certain Bid, attached hereto and made a part hereof, to enter into a Contract, in writing, for the construction of: **Upper Reservoir Replacement Project**

NOW, THEREFORE,

a) If the Bid is rejected, or in the alternative,
b) If the Bid is accepted and the Principal shall sign and deliver a Contract, in the form of a Contract attached hereto (all completed in accordance with said Bid and Contract), and shall in all other respects perform the agreement created by the acceptance of said Bid;

Then, this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all default of the Principal hereunder shall be the amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the City may accept such bid, and said Surety does hereby waive notice of any such extension.

IN WITNESS THEREOF, the above-bounded parties have executed this instrument under their several seals this _____ day of _____, 20___, the name and corporate seal of each corporate party being hereto affixed and duly signed by its undersigned representative, pursuant to authority of its governing body.

IN PRESENCE OF:

_____	_____Affix
	(Individual Principal)
_____	_____
(Address)	(Business Address)
_____	_____
	(Individual Principal)
_____	_____
(Address)	(Business Address)

END OF BID SECURITY

DESIGNATION OF EQUIPMENT OR MATERIAL MANUFACTURERS
(To be submitted with Bid)

The Bidder states that the manufacturer of each listed item of equipment or material proposed by the Contractor for use on this project will be as listed below:

Material Item	Description	Equipment or Material Manufacturer (Do not show Dealer or Supplier)
1.	Pipe	
	a. Welded Steel, Mortar Lined and Coated	_____
	b. Epoxy Lined Steel Pipe	_____
	c. Ductile Iron Pipe	_____
	d. PVC Pipe	_____
2.	Valves	
	a. Gate Valve	_____
	b. Butterfly Valve	_____
3.	Reinforcing Steel	_____
4.	Concrete Cement	_____
5.	Structural Aluminum	_____
6.	High-Strength Low-Alloy Steel	_____
7.	Carbon Steel	_____
8.	Ladder	_____
9.	Guardrails	_____
10.	Handrails	_____
11.	Aggregate	_____
12.	Structural Backfill	_____
13.	Form Liner	_____
14.	Access Hatches	_____
15.	Roof Vent	_____
16.	Sump Pumps	_____

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Material Item	Description	Equipment or Material Manufacturer (Do not show Dealer or Supplier)
17.	Conduit	
18.	Fencing	
19.	Instrumentation (SCADA)	

The Bidder must include in the space provided, the name of the equipment or material manufacturer he has used in determining his Base Bid which will be used by the Successful Bidder in constructing the project. If the Bidder does not fill in any of the spaces, it will be considered that the Bidder has selected the first-named manufacturer as his selection for those spaces not filled in.

After the opening of Bids, no changes or substitutions from those listed manufacturers will be allowed without the express written approval of the Engineer. If such change is permitted by the Engineer, it will be evaluated in accordance with provisions of the Contract Documents pertaining to Specified Items/Proposed Equivalents.

Circumstances which will justify changes to the above listing are limited to the following:

1. Manufacturer is unable to meet specifications.

2. Manufacturer fails to honor original quotation upon which the Contractor's bid was based.

3. Manufacturer goes out of business or ceases to make the specified product.

It is the responsibility of the Contractor to furnish materials and equipment meeting the requirements of the Specifications, and acceptance of the bid does not constitute nor imply favorable review or approval of items proposed. The Owner reserves the right to deny approval or acceptance of any equipment or materials which do not comply with Specifications even though listed herein.

_____
(Signature)

_____
(Type or Print Name)

_____
(Title)

_____
(Company)

END OF DESIGNATION OF EQUIPMENT OR
MATERIAL MANUFACTURERS DOCUMENT

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DOCUMENT NUMBER 00414

SECURITY FOR COMPENSATION CERTIFICATE
(To be submitted with Bid)
(Required by Section 1861, California Labor Code)

TO: City of San Fernando
117 Macneil Street
San Fernando, CA 91340

I am aware of the provisions of Section 3700 of the Labor Code of the State of California which require every employer to be insured against liability for workers' compensation claims 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 the Work of this Contract.

_____
(Signature of Bidder)

_____
(Type or Print Name)

_____
(Title)

_____
(Company)

_____
(Business Address)

_____

_____
(Place of Residence)

END OF SECURITY FOR COMPENSATION CERTIFICATE

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DOCUMENT NUMBER 00416

BIDDER'S REFERENCES
(To be submitted with Bid)

Reference is hereby made to the following bank or banks about the financial responsibility of the Bidder:

Name of Bank	Address
_____	_____
	_____
_____	_____
	_____

Reference is hereby made to the following surety company or companies about the financial responsibility and general reliability of the Bidder:

Name of Surety Company _____

_____

_____

Name of Surety Company _____

_____

_____

Signature of Bidder _____

Title _____

Company _____

Address _____

_____

END OF BIDDER'S REFERENCES

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DOCUMENT NUMBER 00420

BIDDER'S QUALIFICATIONS
(To be submitted with Bid)

The Bidder has been engaged in the contracting business, under the present business name for ten (10) years. Experience in work of a nature similar to that covered in the proposal extends over a period of ten (10) years in the State of California.

The Bidder, as a contractor, has never failed to satisfactorily complete a contract awarded to him, except as follows:

_____

The following contracts have been satisfactorily completed in the last three years for the persons, firm or authority indicated, and to whom reference is made:

Year	Type of Work	Contract Amount	For Whom

Signed _____
(Same signature as on bid form)

END OF BIDDER'S QUALIFICATIONS

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DOCUMENT NUMBER 00430

DESIGNATION OF SUBCONTRACTORS

DESIGNATION OF SUBCONTRACTORS

In compliance with Sections 4100-4114 of the California Public Contract Code each Bidder shall submit the name, contractor license number, and business location of each subcontractor who will perform work or labor or render service to the Contractor for the construction of the work performed under these specifications in excess of one-half (1/2) of one percent (1%) of the prime Contractor's total bid. If the Contractor fails to specify a subcontractor for any portion of the work to be performed under the Contract, it shall be deemed to have agreed to perform such portion itself, and it shall not be permitted to subcontract that portion of the work except under the conditions hereinafter set forth. (Attach additional forms as necessary)

Name Subcontractor	Street Address of Shop, Mill or Office	Types of Work/Category of Contract	$ Value of Work to be Performed	DIR Registration Number	Subcontractor's License Number/ Type/Exp. Date

If no subcontractors will be used, write "None" here:_____

I declare under penalty of perjury that the foregoing is true and correct and this Declaration is executed this _____ day of _____, 20___, in _____, California.

By: _____

Contractor Company Name: _____

SUBCONTRACTOR FORM MUST BE RETURNED WITH BID

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DOCUMENT 00480

NON-COLLUSION DECLARATION

STATE OF CALIFORNIA)
)
COUNTY OF LOS ANGELES)

The undersigned declares:

I am the _____ of _____ , the party making the foregoing bid.

The bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation. The bid is genuine and not collusive or sham. The Bidder has not directly or indirectly induced or solicited any other Bidder to put in a false or sham bid. The Bidder has not directly or indirectly colluded, conspired, connived, or agreed with any Bidder or anyone else to put in a sham bid, or to refrain from bidding. The Bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the Bidder or any other Bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other Bidder. All statements contained in the bid are true. The Bidder has not, directly or indirectly, submitted its bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, to any corporation, partnership, company, association, organization, bid depository, or to any member or agent thereof, to effectuate a collusive or sham bid, and has not paid, and will not pay, any person or entity for such purpose.

Any person executing this declaration on behalf of a Bidder that is a corporation, partnership, joint venture, limited liability company, limited liability partnership, or any other entity, hereby represents that it has full power to execute, and does execute, this declaration on behalf of the Bidder.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct and that this declaration is executed on _____[date], at _____[City], _____[state].

Bidder's Name (Printed):_____

Bidder's Signature:_____
(Same Signature as on Proposal)

Bidder's Title:_____

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CONSTRUCTION CONTRACT

(Name of Construction Contractor: [INSERT CONTRACTOR NAME])
(Name of Project: UPPER RESERVOIR REPLACEMENT PROJECT, CIP NO. ___])

THIS CONSTRUCTION CONTRACT (hereinafter, "Contract" or "Agreement") is made and entered into this _____ day of _____ 2021 (hereinafter, the "Effective Date") by and between the CITY OF SAN FERNANDO, a municipal corporation (hereinafter, "CITY" or "Owner") and [INSERT CONTRACTOR NAME] (hereinafter, "CONTRACTOR" or "Contractor"). For the purposes of this Agreement, CITY and CONTRACTOR may be referred to collectively by the capitalized term "Parties." The capitalized term "Party" may refer to CITY or CONTRACTOR interchangeably as appropriate.

RECITALS

WHEREAS, CITY requires construction services for UPPER RESERVOIR REPLACEMENT PROJECT, CIP NO. __] (hereinafter, the "Project"); and

WHEREAS, CITY issued notice inviting competitive bids for the Project on [INSERT DATE OF BID]; and

WHEREAS, following the opening of bids on [INSERT DATE OF OPENING BIDS], CONTRACTOR was determined to be the lowest responsive and responsible bidder for the Project; and

NOW, THEREFORE, for and in consideration of the mutual covenants and conditions herein contained, CITY and CONTRACTOR agree as follows:

I.
THE CONTRACT DOCUMENTS

1.1 The complete Contract consists of the following documents ("Contract Documents") which are incorporated in this Contract by their reference:

a) Invitation to Bid entitled "00010 Invitation to Bid" dated, [INSERT DATE OF BID], (hereinafter, the "Bid Solicitation Packet");
b) CONTRACTOR's submitted Bid Proposal, dated [INSERT DATE OF BID PROPOSAL], which is attached hereto as **Exhibit "A"**;
c) CONTRACTOR's submitted Bid Schedule which is attached and incorporated hereto as **Exhibit "B"**; **NOT USED**
d) CONTRACTOR's submitted Designation of Subcontractors, dated [INSERT DATE OF DESIGNATION OF SUBCONTRACTORS], which is attached and incorporated

hereto as **Exhibit "C"**;

e) This Contract (Contract No. [INSERT CONTRACT NO.]);
f) CONTRACTOR's Bid Security dated [INSERT DATE OF BID SECURITY], which is attached hereto as **Exhibit "D"**;
g) CONTRACTOR's Payment Bond No. [INSERT BOND NO.], dated [INSERT DATE OF PAYMENT BOND], a true and correct copy of which is attached hereto as **Exhibit "E"**;
h) CONTRACTOR's Performance Bond No. [INSERT BOND NO.], dated [INSERT DATE OF PERFORMANCE BOND], a true and correct copy of which is attached hereto as **Exhibit "F"**;
i) CONTRACTOR's submitted Non-Collusion Declaration, dated [INSERT DATE OF NON-COLLUSION DECLARATION], which is attached and incorporated hereto as **Exhibit "G"**;
j) CONTRACTOR's Certification Regarding Worker's Compensation, which is attached and incorporated hereto as **Exhibit "H"**;
k) Drawings;
l) Specifications of the Bid Solicitation Packet;
m) Supplementary and Special Conditions to the Bid Solicitation Packet, if any;
n) All documents made a part of this Contract under the terms of the Bid Solicitation Packet; and
o) All Change Orders approved by CITY.

II.
WORK TO BE PERFORMED

2.1 The CONTRACTOR agrees to furnish all tools, equipment, apparatus, facilities, labor, transportation, and material necessary to perform and complete in a good and workmanlike manner, UPPER RESERVOIR REPLACEMENT PROJECT, CIP NO. ___], as called for, and in the manner designated in, and in strict conformity with the Contract Documents. It is understood and agreed that the tools, equipment, apparatus, facilities, labor, transportation, and material shall be furnished and the Work performed and completed as required in the Contract Documents under the sole direction and control of the CONTRACTOR, and subject to inspection and approval of the CITY, or its representatives. The CITY hereby designates as its representative for the purpose of this Contract the following named person: The Director of Public Works and Utilities.

The Work is generally described as follows:

The replacement of an existing 1.0 MG circular concrete reservoir as shown in the Drawings and more fully described in Section 01010 Summary of Work Article 1.01 Work Covered by Contract Documents.

The Contract Documents which define the Work covered by this Agreement are those prepared by the Design Engineer Kennedy/Jenks Consultants and filed in the office of the City Clerk and identified by the signatures of the parties to this Agreement.

The Work was designed by and the Contract Documents were prepared by Kennedy/Jenks Consultants herein referred to as the Design Engineer.

The Owner's representative during the construction phase will be _____ herein referred to as the Engineer who will assume the duties and responsibilities and will have the rights and authority assigned to the Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

III.

CONTRACT PRICE

3.1 The CITY agrees to pay, and the CONTRACTOR agrees to accept, in full payment for the work, above agreed to be done, the sum of **[INSERT BID PRICE SPELLED OUT] ($[INSERT BID PRICE NUMERICAL])** for the Project (hereinafter, the "Bid Price" or "Contract Price").

Acts of God Insurance

Add an endorsement to the Contractor's Property Insurance to provide full replacement cost coverage in the amount of the Contract Price plus modifications thereto for physical loss or damage due to "Acts of God" including earthquakes of a magnitude of Richter 3.5 and above and tidal waves.

Add: _____ ($_____)
words figures

Sheeting, Shoring and Bracing for Trenches

Cost of sheeting, shoring and bracing for all trenching and excavation work 5 feet and deeper in accordance with California Labor Code Section 6707.

Add: _____ ($_____)
words figures

The total Contract Price for all work awarded is:

_____ ($_____)
words figures

IV.

COMPLETION DATE

4.1 The Project shall be commenced on the date specified in the Notice to Proceed. The total project shall be completed [INSERT NUMBER SPELLED OUT] ([INSERT NUMBER]) working days after the date of the Notice to Proceed. The terms "workday" or "working day" mean any day of the week excluding Saturday, Sunday or any federal holiday.

V.
NOTICE AND SERVICE THEREOF

5.1 Any notice from one party to the other under the Contract shall be in writing and shall be dated and signed by the Party giving such notice or by a duly authorized representative of such Party. Any such notice shall not be effective for any purpose whatsoever unless served in the following manner, namely:

(a) If the notice is given to the CITY, by personal delivery thereof, or by depositing the same in the United States mail, enclosed in a sealed envelope, postage prepaid, and certified; addressed to the CITY at:

City of San Fernando
Public Works Department
Attn: Director of Public Works
City of San Fernando City Hall
117 Macneil Street
San Fernando, CA 91340

(b) If the notice is given to the CONTRACTOR, by personal delivery thereof to said CONTRACTOR or to its duly authorized representative at the site of the project, or by depositing the same in the United States mail, enclosed in a sealed envelope, postage prepaid, and certified; addressed to the CONTRACTOR at:

[INSERT CONTRACTOR NAME]
[Attn: _____]
[ADDRESS _____]
[ADDRESS _____]
[PHONE NO. _____]

(c) If the notice is given to the surety or any other person, by personal delivery to such surety or other person, or by depositing the same in the United States mail, enclosed in a sealed envelope, addressed to such surety or other person, as the case may be, at the address of such

surety or person last communicated by it to the party giving the notice, postage prepaid and certified.

VI.
LIQUIDATED DAMAGES

6.1 Liquidated damages as provided for in the General Conditions of the Contract shall be in the sum of Ten Thousand Dollars ($10,000) for each and every day as defined therein for each different scope of work as defined by the Base Bid and each change order except as otherwise specified in the General Conditions.

6.2 It is agreed by the parties to this Contract that time is of the essence. In the event all the Work is not completed before or upon the expiration of the time limit as set in the Contract Documents, or within any time extensions that may have been granted, damage will be sustained by the City; and that it may be impracticable to determine the actual amount of damage by reason of such delay. Accordingly, it is agreed that the Contractor shall pay to the City as damages the amount set forth for each and every day's delay in finishing the Work in excess of the number of days specified. Liquidated damages shall be paid at a rate of ten thousand dollars ($10,000) per day unless otherwise stated in the Contract Documents. The parties expressly agree that the liquidated damage clause found in the Contract Documents is reasonable under the circumstances existing at the time the Contract was made. The City shall have the right to deduct the amount of liquidated damages from any money due or to become due the Contractor.

6.3 In addition, the City shall have the right to charge to the Contractor and to deduct from the final or progress payments for the Work the actual cost to the City of legal, engineering, inspection, superintendence, and other expenses, which are directly chargeable to the Contract and which accrue during the period of such delay, except that the cost of final inspection and preparation of the final estimate shall not be included in the charges.

6.4 Exclusions: The Contractor shall not be liable for liquidated damages or delays caused by the removal or relocation of utilities when such removal or relocation is the responsibility of the City or the owner of the utility under Government Code section 4215.

VII.
PREVAILING WAGE

7.1 Copies of the prevailing rate of per diem wages as determined by the Director of the Department of Industrial Relations in accordance with Labor Code Section 1773 are on

file at the CITY, and copies are available for inspection at that office to any interested party on request. Bidders shall be responsible for verifying with the Director of the Department of Industrial Relations that all such copies of the prevailing rate provided by the CITY are current and accurate. The requirement to pay the wage rate so specified is further detailed in the General Conditions. Copies of the prevailing rate of per diem wages may also be obtained from the Department of Industrial Relations, P.O. Box 420603, San Francisco, CA 94142-0603, Attn: Chief, Division of Labor Statistics and Research or online at: http://www.dir.ca.gov/oprl/DPreWageDetermination.htm.

7.2 Hours of Labor: Eight-hour labor constitutes a legal day's work. The Contractor shall forfeit, as penalty to the Owner, twenty-five dollars ($25.00) for each worker employed in the execution of the contract by him or by any subcontractor, for each calendar day during which any worker is required or permitted to labor more than eight (8) hours in any one calendar day and forty (40) hours in any one calendar week, except as permitted by the provisions of Article 3, Chapter 1, Part 7, Division 2 (commencing with Section 1810) of the Labor Code of the State of California.

7.3 Apprentices: In accordance with the provisions of Section 1777.5 of the Labor Code, and in accordance with the regulations of the California Apprenticeship Council, properly registered, apprentices may be employed in the prosecution of the work.

Information relative to number of apprentices, identifications, wages, hours of employment and standards of working conditions shall be obtained from the Director of the Department of Industrial Relations, who is the Administrative Officer of the California Apprenticeship Council.

7.4 Prohibited Employment Discrimination: Attention is directed to Section 1735 of the California Labor Code, which reads as follows:

> "A contractor shall not discriminate in the employment of persons upon public works on any basis listed in subdivision (a) of Section 12940 of the Government Code, as those bases are defined in Sections 12926 and 12926.1 of the Government Code, except as otherwise provided in Section 12940 of the Government Code. Every contractor for public works who violates this section is subject to all the penalties imposed for a violation of this chapter."

7.5 Workers' Compensation Insurance: In accordance with the provisions of Article 5, Chapter 1, Part 7, Division 2 (commencing with Section 1860) and Chapter 4, Part 1, Division 4 (commencing with Section 3700) of the California Labor Code, the Contractor is required to secure the payment of compensation to his employees and

shall for that purpose obtain and keep in effect adequate Workers' Compensation Insurance.

The undersigned Contractor is aware of the provisions of Section 3700 of the Labor Code, which requires every employer to be insured against liability for Workers' Compensation claims or to undertake self-insurance in accordance with the provisions of that Code, and will comply with such provisions before commencing the performance of the Work in this contract.

7.6 Security for Compensation: The Contractor hereby stipulates that the provisions of Section 1775 of the California Labor Code will be complied with. The Contractor further agrees to secure the payment of compensation to his employees in accordance with the provisions of Section 3700 of the California Labor Code.

7.7 Contractor Claims Against the City: Effective January 1, 1991, the California Legislature enacted a requirement that all contract claims of $375,000.00 or less on local government public works contracts must be submitted to mediation and judicial arbitration. Article 1.5 (Sections 20104 through 20104.6, inclusive) of Chapter 1 of Part 3 of the Public Contract Code concerning Resolution of Construction Claims, is hereby incorporated into this agreement. See Supplementary Conditions for a summary of the timing provisions in Section 20104 through 20104.6.

7.8 Contractor's License: The Contractor declares that it possesses a valid California Contractor's License of the required class at the time of signing this Agreement. The Contractor shall affirm its license number, classification and expiration date on this Agreement.

The following statement is included in accordance with Section 7030 of the California Business and Professions Code: "Contractors are required by law to be licensed and regulated by the Contractors State License Board. Any questions concerning a Contractor may be referred to the Registrar, Contractors State License Board, P.O. Box 26000, Sacramento, California 95826."

VIII.
CONTRACTOR REGISTRATION

8.1 By the execution of this Contract, CONTRACTOR hereby certifies that it is registered with the California Department of Industrial Relations as required pursuant to Labor Code section 1725.5 (contractor registration).

IX.
MISCELLANEOUS

9.1 Terms used in this Contract, which are defined in Article 1 of the General Conditions, will have the meanings indicated in the General Conditions.

9.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

9.3 The Owner and the CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect of all covenants, agreements and obligations contained in the Contract Documents

(SIGNATURES ON NEXT PAGE)

IN WITNESS WHEREOF, the Parties hereto have caused this Contract to be executed the day and year first appearing in this Contract, above.

CITY OF SAN FERNANDO

By:_____

Date:_____

[INSERT CONTRACTOR NAME]

By:_____

Name:_____

Title:_____

Date:_____

APPROVED AS TO FORM

By:_____
Richard Padilla
Assistant City Attorney

Date:_____

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PAYMENT BOND

The CITY OF SAN FERNANDO, hereinafter "City," has awarded to _____, hereinafter "Contractor," a Contract for the work described as follows:

[NAME OF PROJECT HERE]

WHEREAS, the Contractor is required by the Contract and by the provisions of Third Division, Part 4, Title 15, Chapter 7 of the Civil Code to furnish a bond in connection with the Contract, as hereinafter set forth.

NOW, THEREFORE, we, _____ , the undersigned Contractor, as Principal, and _____, a corporation organized and existing under the laws of the State of _____ duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the _____ in the sum of [WRITTEN NUMBER] [(NUMBER)], said sum being not less than one hundred (100) percent of the total Contract amount payable by the City, under the terms of the Contract, for which payment well and truly to be made, we bind ourselves, our heirs, executors and administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, THAT, if the Contractor, its heirs, executors, administrators, successors, and assigns or subcontractors shall fail to pay for any materials, provisions, provender or other supplies or teams, implements or machinery used in, upon, for or about the performance of the work contracted to be done, or shall fail to pay for any work or labor thereon of any kind, or shall fail to pay any persons named in Civil Code section 9100, or shall fail to pay for amounts due under the Unemployment Insurance Code with respect to such work or labor thereon of any kind, or shall fail to pay for any amounts required to be deducted, withheld, and paid over to the Employment Development Department from the wages of employees of the Contractor and subcontractors pursuant to Section 13020 of the Unemployment Insurance Code with respect to such work or labor, and provided that the claimant shall have complied with the provisions of that code, the Surety or Sureties hereon will pay for the same in an amount not exceeding the sum specified in the Contract; otherwise, the above obligation shall be void. In case suit is brought upon this bond, the Surety will pay reasonable attorneys' fees to the prevailing party to be fixed by the court.

This bond shall insure to the benefit of any and all persons, companies and corporations entitled to file claims under Section 9100 of the Civil Code, so as to give a right of action to them or to their assigns in any suit brought upon this bond.

It is further stipulated that the Surety of this bond shall not be exonerated or released from the obligation of the bond by any change, extension of time for performance, addition, alteration, or modification in, to, or of any contract, plans, specifications, or agreement pertaining or relating to any scheme or work of improvement described above or pertaining or relating to the furnishing of labor, materials, or equipment therefor, nor by any change or modification of any terms of payment or extension of the time for any payment pertaining

or relating to any scheme or work of improvement described above, nor by any rescission or attempted rescission of the Contract, agreement, or bond, nor by any conditions precedent or subsequent in the bond attempting to limit the right of recovery of claimants otherwise entitled to recover under any such contract or agreement or under the bond, nor by any fraud practiced by any person other than the claimant seeking to recover on the bond, and that this bond be construed most strongly against the Surety and in favor of all persons for whose benefit such bond is given, and under no circumstances shall Surety be released from liability to those for whose benefit such bond has been given, by reason of any breach of contract between the City and original contractor or on the party of the obligee named in such bond, but the sole conditions of recovery shall be that claimant is a person described in Sections 8400 and 8402 of the California Civil Code and has not been paid the full amount of its claim and that Surety does hereby waive notice of any such change, extension of time, addition, alteration, or modification.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ day of _____ , 20___.

_____
(Contractor as Principal)

(Seal) By _____

(Seal) By _____

NOTE: If Contractor is a Partnership, all partners should execute Bond.

IMPORTANT: 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 California.

PERFORMANCE BOND

The CITY OF SAN FERNANDO, hereinafter "City," entered into a Contract dated ___ _____, 20___ with _____ hereinafter Contractor," for the work described as follows:

[NAME OF PROJECT HERE]

WHEREAS, said Contractor is required under terms of said Contract to furnish a bond for the faithful performance of said Contract; and

WHEREAS, the Contract is by reference made a part hereof.

NOW, THEREFORE, we, _____, the undersigned Contractor, as Principal, and _____ [corporate surety]_____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business under the laws of the State of California, as Surety, are held and firmly bound unto the City in the penal sum of [WRITTEN NUMBER] [(NUMBER)], lawful money of the United States, said sum being not less than one hundred percent (100%) of the total Contract amount, for the payment of which sum be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, THAT, if the above-bounded Contractor, its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and perform the covenants, conditions, and agreements in said Contract and any alterations thereof made as therein provided, on its part, to be kept and performed at the time and in the manner therein specified, and in all respects according to their true intent and meaning, and shall indemnify and save harmless the City, its officers and agents, as therein stipulated, then this obligation shall become null and void; otherwise it shall be and remain in full force and virtue.

As a condition precedent to the satisfactory completion of said Contract, the above obligation in said amount shall hold good for a period of one (1) year after the completion and acceptance of said work, during which time if the above-bounded Contractor, its heirs, executors, administrators, successors or assigns shall fail to make full, complete, and satisfactory repair and replacements or totally protect the City from loss or damage made evident during said period of one (1) year from the date of acceptance of said work, and resulting from or caused by defective materials or faulty workmanship in the prosecution of the work done, the above obligation in said sum shall remain in full force and effect. However, anything in this paragraph to the contrary notwithstanding, the obligation of the Surety hereunder shall continue so long as any obligation of the Contractor remains.

And the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the specifications accompanying the same shall, in any way, affect its obligations on this bond and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the Contract or to the work or the specifications. Said Surety hereby waives the provisions of Sections 2819 and 2845 of the Civil Code of the State of California.

In the event suit is brought upon this bond by the City and judgment is recovered, the Surety shall pay all costs incurred by the City in such suit, including reasonable attorneys' fees to be fixed by the Court.

IN WITNESS WHEREOF, we have hereunto set our hands and seals this _____ _____ day of _____, 20___.

_____
(Contractor as Principal)

(Seal) By

(Seal) By

NOTE: If Contractor is a Partnership, all parties must execute the Bond.

IMPORTANT: 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 California.

DOCUMENT NUMBER 00700
GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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DOCUMENT NUMBER 00700
GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1 - DEFINITIONS

1.1 The term "Contract" refers to a single identified portion of the construction which may be the whole or a part of the Project. The Project is the total construction and consists of one or more Contracts performed by the same or separate contractors or by the Owner. A single set of drawings, specifications and contract conditions may include more than one Contract; when combined with the Agreement for an individual Contract they become the Contract Documents for that Contract. The construction performed under a set of Contract Documents is the Work required by an individual Contract.

1.2 The "Contract Documents" consist of the Invitation to Bid, Bid Proposal, Designation of Subcontractors, Agreement, Bid Security, Payment Bond, Performance Bond, Non-Collusion Declaration, Certification Regarding Worker's Compensation, General Conditions, Supplementary Conditions, Drawings, Specifications, all documents made a part of this Contract under the terms of the Bid Solicitation Packet, Addenda issued prior to executing the Agreement, modifications issued after executing the Agreement and all Change Orders approved by the Owner.

1.3 The term "Contract Price" refers to the total monies payable to the Contractor for completion of the Work in accordance with the Contract Documents.

1.4 The term "Design Engineer" refers to the firm that prepared the Contract Documents - Kennedy/Jenks Consultants - and includes all of their officers, directors, shareholders, employees and consultants.

1.5 The term "Drawings" refers to the graphic and pictorial portion of the Contract Documents, showing the design, location, dimensions, details, scope and character of the Work. Drawings may include plans, elevations, sections, schedules, details and diagrams.

The terms Plans, Plan, Drawing and similar terms shall have the same meaning as the term "Drawings."

1.6 The term "Engineer" refers to the person or entity designated by the Owner to provide administration of the Contract.

1.7 The term "Notice to Proceed" refers to a written notice by the Owner to the Contractor authorizing it to proceed with the Work and establishing the date of commencement from which the Contract Time is measured.

1.8 The term "Owner" is the person or entity referred to in the Agreement and includes all of its officers, employees, and consultants.

1.9 The term "Work" means the entire construction required by the Contract Documents completed or in progress and includes all labor, materials, equipment and services necessary to fulfill the Contractor's obligations. The Work does not include the Contractor's tools, equipment, scaffolding, shoring, barricades, guardrails or any other temporary construction or safety devices employed by the Contractor to complete the Work.

1.10 Definitions of other terms are included at the beginning of each Article or in Division 1 Section 01010.

ARTICLE 2 - CONTRACT DOCUMENTS

Contract Relationships

2.1 The Contract Documents constitute the entire Agreement between the Owner and the Contractor for the Work and supersede prior agreements written or oral.

2.2 The Contract Documents shall not be construed to create a duty of any kind (1) on behalf of the Design Engineer or the Engineer and toward the Contractor, any subcontractor, worker, or any other party, or (2) on behalf of the Owner and toward any subcontractor, worker, or any other party.

2.3 Provisions in referenced standards, specifications, manuals, publications, installation instructions, operation and maintenance instructions or codes shall not change the duties or responsibilities between any of the parties involved in this work from those described in these General Conditions.

Correlation, Intent

2.4 It is the intent of the Contract Documents to include everything necessary for the proper execution of the Work as a complete functioning facility that

serves the intended purpose. The Contractor shall provide all labor, material, equipment and services required by the Contract Documents or that may reasonably be inferred from the Contract Documents as being required to produce the intended result.

2.5 The Contract Documents are complementary: What is required by one shall be as binding as if required by all. Organization of the Specifications into sections and the arrangement of the Drawings on separate sheets for Mechanical, Electrical, etc. shall not control the Contractor in dividing the Work among subcontractors or among trades.

Order of Precedence

2.6 If any portion of the Contract Documents shall be in conflict with any other portion, the various documents comprising the Contract Documents shall govern in the following order of precedence: Change Orders; Addenda; Shop Drawings, Drawings, Supplementary and Special Conditions; Designation of Subcontractors; Construction Contract; General Conditions; Payment Bond to Accompany Contract; Performance Bond to Accompany Contract; and Contractor's Certification Regarding Workers' Compensation.

.1 General Conditions take precedence over the Specifications including Division 1;

.2 Provisions in Division 1 General Requirements apply to all sections of the Specifications.

.3 Specifications take precedence over the Drawings;

.4 Stated dimensions take precedence over scaled dimensions;

.5 Larger scale drawings take precedence over smaller scale drawings;

.6 Detail drawings take precedence over general drawings.

.7 As between schedules and other information given on Drawings, the schedules shall govern.

.8 If an item is shown on any Drawing and not specifically included in Specifications specific to this project, the Drawing shall govern.

.9 Notes, descriptions or schedules take precedence over graphic representations on drawings.

.10 Higher quality takes precedence over lower quality.

.11 Greater number, amount or size takes precedence over lesser number, amount or size.

Any conflict or inconsistency between or in the Contract Documents shall be submitted to the Engineer for clarification as soon as the Contractor becomes aware of such inconsistency.

2.7 The Contractor will be furnished three (3) one-half (½) size Drawings sets, 3 copies of the Project Manual, 1 PDF copy of each and the Contractor may obtain additional copies at their cost of reproduction.

Use of Contract Documents

2.8 The Drawings, Specifications and other documents prepared by the Design Engineer, are instruments of service to which the Design Engineer retains legal title, including copyright rights. These instruments of service shall not be used on other projects, for subsequent changes to this project, and shall not be changed or modified without the written permission of the Design Engineer.

2.8.1 Nothing herein shall relieve the Contractor of its obligation to notify the Owner of any inconsistencies in the Contract Documents. Should it appear that the Work to be done or any of the matters relative thereto are not sufficiently detailed or explained in the Contract Documents or in the event of a conflict, inconsistency or discrepancy in the Contract Documents, the Contractor shall immediately submit an RFI to the Owner in writing for such further written explanations as may be necessary. Any adjustment(s) to the Work made by Contractor without first obtaining written clarification from the Engineer shall be at Contractor's risk and expense and shall be subject to removal if required by Owner.

2.8.2 Contractor Deviations. No deviation by the Contractor from the Contract Documents relating to any portion of the materials, labor services or equipment required for the Work shall be construed to set a precedent with respect to subsequent interpretation of the Contract Documents or performance of the Work unless such a deviation is documented in a Change Order to the Contract.

ARTICLE 3 - LAND, EXISTING CONDITIONS, LAYOUTS

Land

3.1 The Owner shall furnish access to the land on which the Work is to be performed including rights-of-way and easements for access. The Contractor shall confine its operations to the land furnished or to that portion of the land indicated on the Drawings. The Contractor shall provide all other land that it may require.

Existing Conditions

3.2 Execution of the Agreement by the Contractor is a representation that the Contractor has visited the site and has become familiar with existing and local conditions which may affect the Work and has included all costs associated therewith in its Bid.

Subsurface Soil Conditions

3.3 If information on subsurface soil conditions was obtained for design purposes, the Contractor may rely on the boring logs as a representation of soils that existed at the location of the boring at the time the borings were made but may not rely on the interpretations or opinions contained in the report nor on the completeness or adequacy of the information for the Contractor's bidding or construction purposes.

Existing Utilities and Underground Facilities

3.4 Information shown with respect to existing concealed or underground utilities and underground facilities is based on data provided by the utility or facility owners or by others. The Contractor may rely on the information shown in the Contract Documents for purposes of establishing the Scope of Work included in the Contract Price but the Owner and the Design Engineer are not responsible for the adequacy or completeness of such information for the Contractor's bidding or construction purposes.

Existing Structures

3.5 Information on existing structures and facilities including concealed utilities was obtained from such records as were available from facility owners and not from exhaustive field investigations. The Contractor may rely on technical data for existing structures and facilities including concealed utilities when such data are shown in the Contract Documents but not on the completeness or adequacy of such data for the Contractor's bidding or construction purposes.

Contractor Responsible for Damage

3.6 The Contractor shall be responsible for:

.1 verifying the existence and location of all utilities and underground facilities, including the use of potholing, hand excavations and hand demolition;

.2 coordinating work with utility and facility owners;

.3 protection of concealed and underground utilities and underground facilities from damage;

.4 the repair or replacement of utilities or underground facilities damaged by the Contractor's failure to exercise reasonable care; and

.5 damage to others due to loss of utility service resulting from the Contractor's operations.

Differing Conditions

3.7 If the Contractor encounters: (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character covered by these Contract Documents, (3) material that the Contractor believes may be hazardous waste as defined by law, the Contractor shall immediately report them to the Engineer. Failure to notify the Engineer of a differing condition prior to performing additional work shall prejudice the Owner and shall be a waiver by Contractor of any and all claims arising from the differing conditions. If the Engineer determines that conditions encountered are materially different from those indicated in the Contract Documents or ordinarily encountered in work of the character required and that the differing conditions cause a change in the Contractor's cost or time, it will recommend an equitable adjustment in Contract Price and/or Time. The Contractor's failure to notify the Owner of differing conditions that cause a reduction in the Contractor's cost or time shall not affect the Owner's right to make a Claim for adjustment in Contract Price and/or Time. If either the Contractor or the Owner disagrees with the Engineer's recommendation, they may make a Claim under Article 10.

Contractor Responsible for Safety Precautions

3.8 The Contractor shall take all precautions required to protect workers and others from known and unknown or concealed hazards including verifying the location of concealed and underground utilities and underground facilities with utility and facility owners, potholing, hand excavation and hand demolition and shall not rely on the adequacy, accuracy or completeness of information provided in the Contract Documents or elsewhere by the Owner, the Engineer or the Design Engineer. The Contractor shall be solely responsible for and take all responsibility for safety in, on, or about the site.

Reference Points, Layout

3.9 The Owner shall provide reference points to establish property corners, a baseline and an elevation. The Contractor shall protect reference points provided by the Owner and shall reset any that are damaged. The Contractor shall hire a surveyor licensed in the state

where the project is being built to reset and document baseline reference points, elevation bench marks and property corners that are damaged.

3.10 The Contractor shall layout the Work from the reference points provided and shall be responsible for accurate location, alignment, elevation and level of the completed Work.

ARTICLE 4 - BONDS AND INSURANCE

Performance and Payment Bonds

4.1 The Contractor shall furnish Performance and Payment Bonds, each in an amount equal to the Contract Price as security for the faithful performance and payment of the Contractor's obligations under the Contract Documents. The Payment Bond shall remain in effect for at least two (2) years after final acceptance. The Performance Bond shall remain in force the greater of: (a) four (4) years after final completion and final acceptance of all work, or (b) until the expiration of all Warranties and Guarantees as required by the Contract Documents. All Bonds shall be in the forms prescribed by law and by the Contract Documents and be executed by Sureties named in the current list of "Certified Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds or Certified Reinsurer Companies Holding Certificates Of Authority As Acceptable Reinsuring Companies" published in Circular 570 (most recent amendment) by the Audit Staff Bureau of Accounts, U.S. Treasury Department (www.fms.treas.gov/c570/index.html) and is admitted to issue bonds in the states in which the Project is located and all Work is performed. If the Surety is declared bankrupt or becomes insolvent or its right to do business is terminated by the state where the Work is located or if it ceases to meet the foregoing listing requirement, the Contractor shall provide another Bond meeting the stated requirements. All Bonds signed by an agent must be accompanied by a certified copy of the agent's authority to act.

4.2 Sureties shall specifically waive all rights of notice of and consent to change, extension of time, alteration or addition to the terms of the Contract. The Contractor shall be responsible for notifying Sureties of all events that may affect them.

Insurance Requirements

4.3 The Contractor shall, at its sole cost, obtain and maintain, in force and effect for the duration of the Contract, including the Guarantee and Warranty periods, insurance of the following types with limits not less than those set forth below, in a company or companies with a Best's rating of no less than A:VII and admitted to issue insurance in the jurisdiction(s) in which all work is to be performed, where the site is located and where any waste is transported or deposited. The Contractor shall require compliance with these Insurance Requirements by its lower tier subcontractors:

.1 Workers' Compensation Insurance, including occupational illness or disease coverage, in accordance with the laws of the nation, state, territory or province having jurisdiction over the Contractor’s employees and Employer’s Liability Insurance with limits the greater of the statutory requirements, or $1,000,000 per accident and, for bodily injury by disease, $1,000,000 per employee. Coverage shall include all work covered under the U.S. Longshoreman’s and Harbor Workers’ Compensation Act and Jones Act. The Contractor shall not utilize occupational accident or health insurance policies, or the equivalent, in lieu of mandatory Workers’ Compensation insurance, or otherwise attempt to opt out of the statutory Workers’ Compensation system. This insurance shall contain a waiver of subrogation against the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants.

.2 Commercial General Liability Insurance (Occurrence Form) ISO Form CG 00 01 12 04 with a full defense and indemnity, and unless modified in the Supplementary Conditions, shall include:

(a) a minimum combined single limit of liability of $3,000,000 or the limits required by law, whichever is greater for each occurrence for bodily injury and property damage;

(b) a minimum limit of liability of $3,000,000 each person for personal and advertising injury liability;

(c) a minimum limit of liability of $3,000,000 each occurrence for products/completed operations liability. The products/completed operations liability shall be maintained in full force and effect for not less than 10 years following completion of any of the Contractor’s work;

(d) a general aggregate limit of not less than $3,000,000, which shall be provided on a per project basis by means of ISO Endorsement CG 25 03 11 85 or approved equivalent;

(e) an endorsement that names the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants as additional insureds. Such endorsement shall be made upon an ISO Endorsement CG 20 10 04 13 or approved equivalent, Additional Insured - Owners, Lessees or Contractor (Form B) and shall state "insurance is primary and all other insurance shall be noncontributory" and shall waive all rights of subrogation against the additional insureds;

(f) XCU coverage for claims arising from explosion, collapse and underground damage;

(g) Contractual liability coverage for all oral and written contracts including the indemnity provisions contained herein;

(h) Deductibles shall not exceed $25,000 per occurrence and shall be the sole responsibility of the Contractor;

(i) Cross Liability, Separation of Insureds endorsement, or coverage for Severability of Interest shall be included;

(j) Claims made policies are not acceptable;

(k) Coverage for Work performed on or within 50 feet of a railroad, by deletion of any limitation or exclusion of coverage on or within 50 feet of a railroad or by a Railroad Protective Liability policy which complies with Article 4.3.2 (a), (d), (e), and (h)-(k).

.3 Automobile Liability Insurance covering use of all owned, non-owned and hired automobiles with a minimum combined single limit of liability for bodily injury and property damage of $3,000,000 per occurrence, and shall include:

(a) An endorsement that names the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants as additional insureds, states such "insurance is primary and all other insurance shall be noncontributory", and waives all rights of subrogation against the additional insureds;

(b) Cross Liability, Separation of Insureds endorsement, or coverage for Severability of Interest;

.4 Property Insurance shall be on an all-risk policy form and shall include:

(a) A minimum limit of liability in the amount of the initial Contract Price as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis without voluntary deductibles;

(b) The interests of the Owner, the Contractor, the Engineer, and the Design Engineer and each of their officers, employees, agents, consultants, and all tiers of subcontractors, all of whom shall be listed as insureds or additional insureds and the policy shall, by endorsement, waive all rights of subrogation against the insureds and additional insureds and the endorsement shall state: “Subrogation: This insurance shall not be invalidated should the named Insured waive in writing prior to a loss, any right of recovery against any person for loss occurring to the property described.”;

(c) Coverage for the Completed Value. If the Owner is damaged by the failure of the Contractor to maintain such insurance, the Contractor shall bear all reasonable costs properly attributable thereto;

(d) Coverage against the perils of fire and extended coverage and all physical loss or damage including, without limitation or duplication of coverage:

(i) lightning, windstorm, hail, smoke, explosion, riot, riot attending a strike, civil commotion, aircraft and vehicles;

(ii) theft, vandalism, malicious mischief, and water damage;

(iii) collapse, flood including tidal waves or overflow from bodies of water, landslide, water pressure or earth movement and earthquake;

(iv) removal of debris resulting from an insured loss and demolition occasioned by enforcement of any applicable legal requirements;

(v) falsework, temporary buildings and safety devices used by the Contractor to perform the Work;

(vi) portions of the Work stored on and off the site and in transit when such portions of the Work are included in an Application for Payment (including Inland Marine coverage and Installation and Equipment Floater coverage as applicable);

(vii) and shall cover compensation for the services of the Design Engineer and the Engineer required as a result of the insured loss.

(viii) flood and tidal wave insurance coverage shall be for the maximum percentage of the Contract Price permitted by law.

(e) Remaining in full force and effect until the Final Payment has been made to the Contractor. The property insurance policy shall be endorsed to allow for partial use or occupancy by the Owner without permitting a cancellation or lapse of insurance coverage;

(f) Deductibles shall not exceed $25,000 per occurrence with a deductible aggregate of $25,000. The Contractor shall pay for deductible losses at no cost to any other insured or additional insured.

.5 Boiler and Machinery Insurance shall be provided as required by the Supplementary Conditions or by law.

Certificates of Insurance

4.4 Prior to beginning any Work, the Contractor shall file with the Owner, Design Engineer and Engineer, Certificates of Insurance in a form satisfactory to Owner and Engineer (ACCORD form) along with a copy of all endorsements as required in Article 4.3. The certificates shall name each additional insured required by these General Conditions, shall state "insurance is primary and all other insurance shall be noncontributory", shall waive all rights of subrogation against the additional insureds; and shall also contain a provision that the Owner, Design

Engineer and Engineer shall be notified in writing 30 days before the policies may be canceled or allowed to expire or any reduction in coverage. An additional certificate shall be submitted with the final Application for Payment showing required continuation of coverage beyond the Final Payment.

Property Insurance: Adjustment of Loss

4.5 A loss insured under the Contractor's property insurance shall be adjusted with the Contractor and made payable to the Contractor as fiduciary for the insured, as their interests may appear subject to the requirements of any applicable mortgage clause. The Contractor shall deposit the insurance proceeds in a separate account, and shall distribute payment to the parties in proportion to their cost for repairing or replacing the damaged Work. The Contractor shall provide a complete audited accounting of the distribution of insurance proceeds to all parties of interest.

ARTICLE 5 - CONTRACTOR

5.1 As a material inducement to enter into this Agreement, Contractor represents it and its subcontractors are skilled in the type of work required by the Contract Documents and is licensed in accordance with applicable law. The Contractor shall perform at least ten percent of the dollar value of the Work using personnel on its own payroll.

Supervision

5.2 The Contractor shall supervise and direct the Work using its best skill and attention. The Contractor shall employ a competent superintendent to represent the Contractor at the site at all times work is being performed. The Superintendent shall not be replaced without reasonable cause and notice to the Engineer. Communications given to the Superintendent shall be as binding as if given to the Contractor.

Contractor Responsible for Means and Methods

5.3 The Contractor shall be solely and completely responsible for and have control over construction means, methods, techniques, sequences, procedures and safety and for coordinating all portions of the Work under the Contract Documents. The Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants shall not be responsible for any construction means, methods, techniques, sequences, nor for safety in, on or about the site, nor for coordinating any part of the Work.

Labor, Material and Equipment

5.4 The Contractor shall provide and pay for labor, material, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, communications, and other facilities and services necessary for the proper execution and completion of the Work.

5.5 The Contractor warrants to the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants that materials and equipment furnished under the Contract will be of good quality, that the Work will be free from defects, that all material, equipment, hardware, software and firmware products provided to the Project will strictly conform with the requirements of the Contract Documents. If required by the Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. Work not conforming to these requirements, including Proposed Equivalents not Favorably Reviewed, may be considered defective. The Contractor's warranty excludes remedy for damage caused by the Owner's abuse, modification, improper maintenance, improper operation, or normal wear.

5.6 The Contractor shall enforce strict discipline and good order among persons performing the Work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

5.7 The Contractor shall be responsible to the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants for the acts and omissions of the Contractor's employees, subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

Subcontractors and Suppliers

5.8 Unless listing subcontractors at the time of bidding is required by the bidding documents, the Contractor shall furnish a list of all subcontractors whose work amounts to one-half percent or more of the Contract Price prior to beginning construction. The Contractor shall not contract with any subcontractor to whom the Owner or the Engineer has made reasonable and timely objection.

5.9 Contracts between or among the Contractor, suppliers and subcontractors shall (1) require each supplier and subcontractor to be bound to the Owner, Engineer and Contractor by the terms of these Contract Documents, and to assume toward the Contractor, the

Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants all the obligations and responsibilities including but not limited to insurance and indemnity requirements which the Contractor, by these Contract Documents, assumes toward the Owner, the Design Engineer and the Engineer, and (2) at the Owner's option, provide for the assignment of subcontracts to the Owner at Owner's request.

Taxes, Permits, Fees and Notices

5.10 The Contractor shall pay sales, consumer, use, and other similar taxes which are legally enacted when bids are received. The Contractor shall secure and pay for the building permit (less the Plan Review fee) and other permits and governmental fees, licenses and government required inspections necessary for proper execution and completion of the Work including utility connection fees. The Owner will submit the Drawings, Specifications and other required data to the Building Official prior to bidding and will pay for the Plan Review fee. The Owner will pay capital cost assessments such as plant investment fees required by utility owners.

5.11 The Contractor shall give all notices and shall comply with all laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on furnishing and performing the Work.

Patents

5.12 The Contractor shall include in its bid and shall pay royalties and license fees required for the use of all patents. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants harmless from loss on the account thereof.

Documents at the Site, Record Drawings

5.13 The Contractor shall keep a complete set of Contract Documents including all modifications and all favorably reviewed submittals at the site. The Contractor shall prepare Record Drawings by neatly adding the following information in ink at least once a week to a set of Contract Drawings: (1) references to Contract modifications including Responses to Request For Information, minor changes and Change Orders; (2) as-built work that differs from work shown on the Contract Drawings; and (3) the dimensioned, as-installed location of major underground and concealed utilities, conduits, piping, tanks, facilities and similar items. Record Drawings shall be made on a clean copy of the Contract Drawings furnished under General Conditions paragraph 2.7 and not used for any other purposes. The Contractor shall make Record Drawings available to the Engineer to verify progress. The Contractor shall submit and obtain favorable review of the Record Drawings prior to Final Acceptance.

Review of Contract Documents and Field Conditions

5.14 Before starting work, the Contractor shall carefully study and compare the Contract Documents with each other and with existing site conditions and field measurements. The Contractor shall immediately report any discovered deficiencies including code violations to the Engineer, in writing. The Contractor is not responsible for finding all deficiencies but will be held responsible for construction required to correct deficiencies or code violations that the Contractor had knowledge of or should reasonably have had knowledge of and did not report to the Engineer in writing.

Contractor's Construction Schedule

5.15 Within 10 days after the date in the Notice to Proceed and prior to the commencement of any onsite work, Contractor shall submit:

.1 a temporary construction schedule covering the first 60 days of the Contract Time. The submittal shall be graphic and in electronic form. The electronic information submitted shall include files using the specified scheduling software format, if specified, and an easily readable file such as Adobe Acrobat PDF;

.2 a proposed Critical Path construction schedule, which shows each constituent operation, quantity, rate and period required to accomplish the Work;

.3 the proposed method of procedure, which enumerates the methods and equipment to be employed during each phase of the Work; and

.4 a plan, which indicates the storage and working areas desired to accomplish the construction and is acceptable by the Engineer and the Owner.

5.16 Within 30 days after the date in the Notice to Proceed, the Contractor shall prepare and submit for the Owner's and the Engineer's information a construction schedule for the Work. Unless a specific type of schedule is specified in Division One, the form of schedule may be selected by the Contractor if acceptable by Engineer, and the schedule shall show the beginning and ending date for each major construction task by each trade and the interdependencies between tasks, and shall identify the

critical sequence of tasks (or "Critical Path") that determines the shortest time required to complete the Work. The construction schedule shall: (i) not exceed the Contract Time and Milestone dates established in the Contract Documents; (ii) be updated at monthly intervals or as requested by the Engineer; (iii) be related to the entire Project; and (iv) provide for expeditious and practicable execution of the Work. The schedule shall reflect input from the Contractor's subcontractors and suppliers, shall include an allowance for normal unfavorable weather and enough float time to accomplish all clarifications, requests for information, all submittals and changes required in the Contract Documents, and shall not exceed time limits specified in the Contract Documents. If the Contractor's schedule shows a shorter construction period than provided in the Contract Documents, the Contractor's schedule shall be a Critical Path Method (CPM) type schedule, shall be prepared in sufficient detail to demonstrate the feasibility of early completion and shall be submitted within 30 days after beginning construction. This CPM schedule shall show all required submittals and dates for ordering, shipping and receiving critical materials and equipment. Contractor's submittals shall be submitted with sufficient time to permit 30 days for a response and not impact Contractor's schedule. The submittals shall be graphic and in electronic format . The electronic information submitted shall include files using the specified scheduling software format, if specified, and an easily readable file such as Adobe Acrobat PDF.

5.16.1 Format. Unless otherwise provided in the Specifications, the construction schedule shall be in a detailed precedence Critical Path Method ("CPM") or Primavera-type format satisfactory to the Engineer, which shall also: (i) provide a graphic representation of all activities and events that will occur during performance of the Work; (ii) identify each phase, design, construction and maintenance; and (iii) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents (hereinafter referred to as Milestone dates). At a minimum the Construction Schedule shall depict the schedule or Work on a discipline by discipline and trade by trade basis and tasks within each discipline and trade. The Construction Schedule shall include (i) proposed activity sequences and durations showing the amount of Float for each activity; (ii) Milestone dates for receipt and acceptance of pertinent information, including Owner-supplied information and approvals by public authorities having jurisdiction over the Project; (iii) dates for preparation and processing of Submittals; (iv) dates for delivery of materials or equipment requiring long-lead time procurement; (v) Owner's occupancy /use requirements showing portions of the Project having occupancy priority; (vi) the dates of Substantial and Final Completion; and (vii) other information reasonably required by Owner.

5.16.2 Updates. With each Application for Payment submitted by Contractor (other than the final Application for Payment), the Contractor shall submit to the Engineer an updated construction schedule revised to indicate the portion of the Work executed, all progress slippages, corrective actions taken, or slippage carry-over, for all anticipated delays of difficulties, and all other information required to accurately present the actual status of the progress of the Work as of the date of the Application for Payment. If the Contractor does not submit an updated construction schedule with an Application for Payment, Owner shall withhold payment, in whole or in part. In the event any update to the Project Schedule indicates any delays to the Contract Time that are the fault of Contractor or others for whom Contractor is responsible, the Contractor shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any construction schedule update constitute an adjustment in the Contract Time, any deadline, or the Contract Price unless any such adjustment is agreed to by the Owner and authorized pursuant to Change Order.

5.16.3 Daily Logs. Contractor shall maintain a daily log containing a record of weather, Contractor's own forces working on Site; Subcontractors working on the Site; number and labor classification of workers or each Subcontractor on Site; materials delivered; major equipment on Site, Work started, completed and accomplished that day; approximate count of all personnel at the Project Site; inspections tests and visitors; accidents, any Work stoppages, delays, shortages or losses; problems encountered and other similar relevant data as the Owner may reasonably require. The daily log shall be signed by Contractor's Superintendent, submitted by 4:30p.m. on the next Working Day to Engineer and shall be made available to others as directed by Owner.

5.16.4 Performance. The Contractor shall perform the Work in accordance with the most recent construction schedule and schedule of Submittals accepted by the Owner. The Contractor shall monitor the progress of the Work or conformance with the requirements of the Construction schedule and shall promptly advise the Engineer and Owner of any delays or potential delays.

5.16.5 Extraordinary Measures. In the event the Owner determines that the performance of the Work has not progressed or reached the level of completion required by the Contract Documents, the Owner shall have the

right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including without limitation: (i) working additional shifts or overtime, (ii) supplying additional manpower, equipment, and facilities and (iii) submitting a recovery schedule for re-sequencing performance of the Work or other similar measures . Such corrective measures shall continue until the progress of the Work complies with the stage of completion as required by the Contract Documents. The Contractor shall not be entitled to an adjustment in the Contract Price in connection with the corrective measures required by the Owner under or pursuant to this section. The Owner may exercise these rights pursuant to this section as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with the Contract Time or interim completion dates set forth in the Contract Documents. If Contractor or its Subcontractors fail to implement or commence corrective measures within ten (10) calendar days of Owner's written demand, Owner may, without prejudice to other remedies take corrective action at the expense of the Contractor and shall reduce the Contract Price.

5.17 It is agreed that the Contract Price includes the Contractor's office and field overhead, profit and related charges for the full Contract Time. The Contractor may, at its option, complete the Work in a shorter period than the Contract Time but the Contractor may not make a claim for extended overhead or other charges for: (1) delays that extended completion beyond the date planned by the Contractor but not beyond the Contract Time, and (2) delays contemplated by the Contractor and the Owner. All float in the schedule shall first be for the benefit of the Owner, the Engineer, the Design Engineer and then for the benefit of the Contractor. To the fullest extent permitted by law, the Contractor on behalf of itself and its subcontractors, waive any and all claims for damages attributable to delays, interference, or acceleration caused by the Owner, the Engineer, the Design Engineer and each of their officers, employees, agents and consultants and the Contractor and its subcontractors shall be entitled to an extension of the Contract Time as their exclusive remedy.

5.18 The construction schedule shall provide for expeditious and practicable execution of the Work and shall be revised and submitted monthly unless excused by the Engineer in writing. The Contractor shall conform to the most recent schedule.

5.19 The Contractor shall prepare and keep current, for the Engineer's information, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows 30 days for the Engineer's review of each submittals and 30 days for review of each resubmittal.

Safety of Persons and Protection of Property

5.20 The Contractor shall be solely and exclusively responsible for construction safety means and methods and for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of this Contract.

5.21 The Contractor shall take all necessary precautions for safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's subcontractors or sub-subcontractors; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

5.22 The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

5.23 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, necessary fences and other safeguards for safety and protection of persons and property on and off the site and shall: (1) post danger signs and other warnings against hazards, (2) promulgate safety regulations, and (3) notify owners and users of adjacent sites and utilities when the Contractor's operations may affect them.

5.24 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry out such activities under supervision of properly qualified personnel.

5.25 The Contractor shall promptly remedy damage and loss to property that the Contractor is required to protect caused in whole or in part by the Contractor, a subcontractor, a sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone

for whose acts they may be liable. The Contractor shall not be responsible for damage or loss resulting solely from the acts or omissions of the Owner or the Engineer or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under the Indemnification clause in this Article 5.

5.26 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's Superintendent unless otherwise designated by the Contractor in writing to the Owner and Engineer.

5.27 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs required in connection with the Work and shall send copies of all accident, injury or work-related illness reports and of all notices of unsafe conditions to the Engineer.

5.28 The Contractor shall not load or permit heavy weights to be placed on any part of the construction or site so as to endanger its safety.

Hazardous Materials

5.29 If the Contractor encounters material on the site which it reasonably believes may contain asbestos, polychlorinated biphenyl (PCB) or other hazardous material, the Contractor shall stop work in the affected area and shall notify the Owner in writing. The Owner shall have the suspected material tested and if found to contain asbestos, PCB or other hazardous material, the Owner shall have the material removed or rendered harmless. Work in the affected area may be resumed when the Owner gives written notice that the material containing asbestos, PCB or other hazardous material has been removed or made harmless. If halting work in the affected area impacts the Contractor's critical path for construction, the delay will be regarded as an Excusable Delay and the Contract Time will be extended.

Owner's Indemnification for Hazardous Materials

5.30 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Engineer, Design Engineer, and each of their consultants, agents, employees, officers, and shareholders from and against all claims, damages, losses and expenses, including, but not limited to, attorney's fees, arising out of or resulting from work in areas affected by asbestos, polychlorinated biphenyl (PCB) or other hazardous material, the presence and location of which has not been identified by the Owner in writing.

Emergencies

5.31 In an emergency affecting safety of persons or property, the Contractor shall act as required to prevent threatened damage, injury or loss without instruction or authorization from the Owner or Engineer. Additional compensation or extension of time claimed by the Contractor on account of such an emergency shall be determined as provided under Article 10.

Indemnification

5.32 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, the Engineer and the Design Engineer and each of their agents, consultants, officers, employees, and shareholders from and against all claims, damages, losses and expenses, including but not limited to attorney's fees, caused in whole or in part, or arising out of, connected with, or resulting from the performance of the Work, regardless of whether or not such liability, claim, damage, loss or expense was caused in part by any negligent act or omissions, whether active or passive, by a party indemnified hereunder. The Contractor stipulates that this provision has been negotiated in accordance with applicable law to be fully enforceable.

5.33 The obligation of the Contractor under this indemnity and hold harmless agreement shall not apply to liability for damages arising from the sole negligence or willful misconduct of the Owner, the Engineer, or the Design Engineer or their agents, consultants, employees, officers, shareholders or independent contractors (other than the Contractor).

5.34 The Contractor's liability to the Owner, Engineer and Design Engineer under this Indemnification Clause shall not be limited by any legal limitation on the amount or type of damages, compensation or benefits payable under workers' compensation acts, disability benefit acts or other employee benefit acts.

5.35 The Contractor's liability insurance shall provide coverage for the Contractor's obligations under this Indemnification Clause in accordance with paragraph 4.3.

Escrowed Bid Documents

5.36 Contractor shall submit, within twenty-four (24) hours after award of the Contract, one copy of all

documentary information generated in preparation of Bid prices for the Work and shall include all Subcontractor and Material Supplier estimates. This material is hereinafter referred to as "Escrowed Bid Documents" and shall be submitted in sealed containers and clearly marked "Escrowed Bid Documents." The Escrowed Bid Documents of the successful Contractor will be held in escrow for the duration of the Contract.

5.36.1 The Escrowed Bid Documents are, and shall always remain, the property of the Contractor, subject to joint review by the Owner, Engineer Contractor and their agents, as provided for herein.

5.36.2 The Owner stipulates and expressly acknowledges that all or parts of the Escrowed Bid Documents, as defined herein, constitute trade secrets. This acknowledgement is based on the Owner's express understanding that the information contained in the Escrowed Bid Documents may not be known outside Contractor's business, may be known only to a limited extent and only by a limited number of employees of the Contractor, is safeguarded while in the Contractor's possession, is extremely valuable to Contractors and could be extremely valuable to Contractor's competitors by virtue of it reflecting Contractor's techniques of construction. Owner further acknowledges that Contractor expended substantial sums of money in developing the information included in the Escrowed Bid Documents and further acknowledges that it would be difficult for a competitor to replicate the information contained therein. Owner further acknowledges that the Escrowed Bid Documents and the information contained therein are being provided to Owner only because it is an express prerequisite to award of the Contract. Owner further acknowledges that the Escrowed Bid Documents include a compilation of information used in Contractor's business, intended to give Contractor an opportunity to obtain an advantage over competitors who do not know of or use the contents of the documentation. Owner further agrees to safeguard the Escrowed Bid Documents against disclosure to the fullest extent permitted by law. In the event a third party requests disclosure of all or parts of the Escrowed Bid Documents, the Owner shall immediately notify the Contractor and cooperate with Contractor's efforts to prohibit disclosure.

5.36.3 The Contractor agrees, acknowledges, represents and warrants that as a condition of award of the Contract, that the Escrowed Bid Documents constitute all the information used in the preparation of the Bid and that no other bid preparation information shall be considered in resolving disputes or claims. The Contractor also agrees that nothing in the Escrowed Bid Documents shall change or modify the terms or conditions of the Contract Documents.

5.36.4 Purpose. The purpose of the "Escrowed Bid Documents" procedure can best be explained by defining what this program is intended to accomplish and what this program is not intended to accomplish.

5.36.5 To Be Accomplished.

.1 Create a spirit of cooperation in an atmosphere of honesty and candor between the Owner and the Contractor.

.2 Establish a base line of the Contractor's accepted proposal.

.3 Provide an objective data bank to facilitate the determination and negotiation of changes/additions/deletions.

.4 Minimize Owner/Contractor disputes and streamline the resolution of these disputes.

.5 Creates risk sharing between the Owner and Contractor thereby eliminating contingency costs to the Owner for conditions which may never occur.

5.36.6 Not To Be Accomplished.

.1 Not to be used by the Owner to evaluate the Contractor's anticipated construction methods and procedures.

.2 Not to be used to any extent to furnish information from the Contractor's bid to any organization, company or individuals other than the Owner's and Engineer's staff and claims consultants associated with the Project.

.3 Not to be reproduced by the Owner except by mutual agreement.

.4 Not to create additional expense to the Contractor during bid preparation.

Content of Escrowed Bid Documents.

5.37 Contractor may submit Escrowed Bid Documents in its usual estimating format; a standard format is not required. It is not the intention of this requirement to cause the Contractor extra work during the preparation of the bid but to ensure that the Escrowed Bid Documents will be adequate to, enable complete understanding and proper interpretation for their intended use

5.37.1 It is required that the Escrowed Bid Documents clearly itemize the estimated costs of performing the

Work as required to present a detailed cost estimate and allow a detailed cost review. Crews, equipment, takeoff quantities, and rates of production shall be detailed. Estimated costs shall be broken down into the Contractor's usual estimate categories such as direct labor, repair labor, equipment ownership and operation, expendable materials, permanent materials, and Subcontract costs as appropriate. Plant and equipment and indirect costs shall be detailed in the Proposer's usual format.

5.37.2 All costs shall be identified. For items amounting to less than $10,000, estimated unit costs are acceptable without a detailed cost estimate, provided that labor, equipment, materials, and Subcontracts, as applicable, are included and provided that indirect costs, contingencies, and markup, as applicable, are allocated.

5.37.3 The Escrowed Bid Documents shall include all quantity takeoffs, calculations of rates of production and progress, copies of quotes from Subcontractors and Material Suppliers, and memoranda, narratives, add/deduct sheets and all other information used by the Contractor to arrive at the prices contained in the Bid.

5.37.4 The Escrowed Bid Documents shall be accompanied by the certification signed by a corporate officer authorized by the Contractor stating that the material in the Escrowed Bid Documents constitute all the documentary information used in preparation of the bid and that the Contractor has personally examined the contents of the Escrowed Bid Document container and has found that the documents in the container are complete.

Initial Examination

5.38 Escrowed Bid Documents of the Contractor will be examined, organized, and inventoried immediately upon receipt by a representative of the Owner and a representative of the Engineer.

5.38.1 This examination is to ensure that the Escrowed Bid Documents are legible and complete. It will not include review of and will not constitute approval of proposed construction methods, estimating assumptions, or interpretations of Contract Documents. Examination will not alter any condition or term of the Contract.

5.38.2 Should the examination and inventory by the Owner or Engineer indicate that data is incomplete or missing, the representatives will describe such incomplete or missing data to the Contractor who shall supply it within twenty-four (24) hours.

5.38.3 If all the itemized cost breakdowns and allocations required previously mentioned herein have not been made, due to last minute bid revisions, the detailed breakdown of estimated costs shall be reconciled and revised by agreement between the Contractor and Owner before making the award.

Subsequent Examinations

5.39 The Escrowed Bid Documents may be examined at any time deemed necessary by both the Owner and the Engineer in order to determine the Contractor's bid concept and assumptions and to assist in the negotiation of price adjustments and Change Orders and the settlement of disputes and claims.

5.39.1 Examination of Escrowed Bid Documents is subject to the following conditions:

(a) The Escrowed Bid Documents are proprietary and confidential as to trade secrets contained therein.

(b) The Owner and the Contractor shall each designate in writing to the other party and within ten (10) calendar days after execution of the Contract, representatives who are authorized to examine the Escrowed Bid Documents. No other person shall have access to the Escrowed Bid Documents. The designated representatives may be amended from time to time by either party.

(c) Access to the Escrowed Bid Documents may take place only in the presence of duly designated representatives of both the Owner and Contractor.

(d The Owner will take reasonable steps to protect the Escrowed Bid Documents from disclosure not permitted by this agreement.

Conditions for Return to Contractor

5.40 Upon completion of the Contract issuance of Final Payment by the Owner, verification that all litigation has been completed, and verification that future litigation does not exist, the Escrowed Bid Documents will be sealed and promptly returned to the Contractor by the party in charge of the Escrowed Bid Documents. Reproducing of any portion of the Escrowed Bid Documents will not be permitted at any time without written permission from the Contractor.

ARTICLE 6 - OWNER

Owner's Right to Perform Work and Award Separate Contracts

6.1 The Owner reserves the right to perform construction within, related to or adjacent to the Work as a separate activity using its own workers or by contracts with separate contractors under contract conditions similar to those in Article 4 with respect to insurance and subrogation. The Owner shall provide coordination of these separate activities with the Work of the Contractor.

6.2 The Contractor shall cooperate with the Owner's separate contractors and workers and shall afford them access to their work areas and space to store materials, tools and equipment. The Contractor shall adjust its construction schedule to reflect agreed upon interfaces with the Owner's separate activities.

Mutual Responsibility

6.3 If part of the Contractor's work depends on or must interface with work performed by the Owner as a separate activity, the Contractor shall (1) cooperate with the Owner's coordination of the work efforts, (2) inspect work provided by the Owner's separate activities for compatibility with work provided or intended to be provided by the separate contractor, and (3) report to the Owner and the Engineer, prior to proceeding with work that may be affected, any deficiencies in work planned or executed by the Owner that would render it incompatible with work planned or completed by the separate contractor.

6.4 If the Contractor is caused delay or additional cost because of the Owner's separate activities, it may make a Claim as provided under Article 10.

Owner's Right to Stop the Work

6.5 If the Contractor fails to correct defective work or continues to perform defective work, the Owner may issue a signed order directing the Contractor to stop the Work or a portion of the Work until the defective work has been corrected. This right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

Owner's Right to Carry Out The Work or Correct Defective Work During Construction

6.6 If the Contractor fails to remove and replace or correct Defective Work, or if the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails to cure the defect, fault or neglect within 7 days after receipt of written notice from the Owner, the Owner may issue a second notice warning the Contractor that if it does not correct the defect, fault or neglect within the second 7-day period the Owner will, without prejudice to other remedies the Owner may have, correct such deficiencies. In which case, the Owner will deduct the cost of correcting such deficiencies, including compensation for any additional engineering services required, from payments due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. The Owner's right to correct Defective Work during the Guarantee Period is covered in Article 12.

ARTICLE 7 - ADMINISTRATION OF THE CONTRACT

7.1 At the Owner's option, either the Owner or the Engineer designated by the Owner will provide administration of the Contract and will be the Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the Guarantee Period. If an engineer other than the Design Engineer is appointed to be the Engineer to administer the Contract during construction, the duties and responsibilities of the Engineer and the Design Engineer during construction will be defined in the Supplementary Conditions, in Division One of the Specifications or in a modification to the Contract.

7.2 The Engineer may visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine in general if the Work is being performed in accordance with the Contract Documents. However, the Engineer will not be required to make exhaustive or continuous on-site inspections to check quality or quantity of the Work. The Contractor shall not rely upon the Engineer’s site visits nor raise as a defense to any claims of defective work, that the Engineer visited the site or observed the site.

7.3 The Engineer shall not have control over or charge of and shall not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Article 5. The Engineer shall not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

7.4 The Engineer shall not have the authority to authorize extra work or to change the Contract Time or Price. The Engineer shall not have the authority to stop the Work. The Engineer's duties, responsibilities and limitations of authority are set forth in the Agreement between the Owner and the Engineer and shall not be modified by any action or inaction of any parties and can only be changed by a fully executed Amendment to the Agreement between the Owner and the Engineer.

7.5 The Engineer will have authority to reject Defective Work. The Engineer will have authority to require additional inspection or testing of the Work whether or not such Work is fabricated, installed or completed. Neither this authority of the Engineer nor a decision not to exercise such authority shall give rise to a duty or responsibility of the Engineer to the Contractor, subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.

7.6 The Owner may arrange for the Engineer to provide a full-time on-site Resident Engineer with additional staff as appropriate. The duties, responsibilities and limitations of authority of the Resident Engineer and his staff shall be the same as defined for the Engineer in the Agreement between the Owner and the Engineer.

Communications

7.7 Communications between the Owner or the Design Engineer and the Contractor shall be through the Engineer. Communications between the Contractor and the Design Engineer shall be through the Engineer, and communications between the Contractor and the Design Engineer's consultants shall be through the Engineer and the Design Engineer. Communications between the Engineer and the subcontractors shall be through the Contractor.

Requests for Information and Responses

7.8 The Engineer will endeavor to issue Responses to Requests for Information within 30 days of the date a Request for Information is received by the Engineer unless the Engineer requests more information from the Contractor in which case the Response will be issued 20 days after receipt of the additional information. The Contractor shall use the Request for Information form, attached as Exhibit GC-1. The Engineer's Response to a Request for Information shall not authorize a change in Contract Time or Price. If the Contractor disagrees with the Engineer's interpretation of the Contract Documents, it shall notify the Engineer in writing in accordance with Article 9. The Engineer shall not be required to answer Requests for Information when the information is contained in the Contract Documents or when the Request for Information form is incomplete or not used.

ARTICLE 8 - SUBMITTALS

Definitions

8.1 Definition of Terms:

.1 "Shop Drawings" are drawings, diagrams, schedules and other data custom prepared by the Contractor or one of its subcontractors or suppliers to illustrate some portion of the Work.

.2 "Product Data" are catalogue pages, brochures, schedules, performance charts, diagrams, instructions and other information which have been highlighted or marked and certified (if required in the Technical Specifications) by the Contractor to indicate the specific items, including options, that are being submitted for some portion of the work.

.3 “Submittal for Informational Purpose Only” is an item required for the Owner's permanent records relating, in part, to future maintenance, repair, modification, replacement of work or as otherwise required. Submittals for Informational Purpose Only will only be received and logged to document that the required submittals have been made. Neither the Owner nor Engineer will respond to a Submittal for Informational Purpose Only.

.4 A "Proposed Equivalent" is an item proposed for use by the Contractor in lieu of the first specified item and warranted by the Contractor as being at least equal in quality, utility, function and appearance to the first specified item. The Contractor shall assume all costs and be fully and solely responsible for the Proposed Equivalent.

.5 "Favorable Review" by the Engineer means that based on information submitted by the Contractor and in consideration of the Contractor's warranty required by General Conditions paragraph 8.8 the Contractor may provide the Favorably Reviewed item or work subject to the limitations in General Conditions Article 8, the General Requirements of Division 1, and the Engineer's review comments.

.6 The term "first specified item" or "first named maker" refers to the first product identified in the Specifications by a model number or trade name and/or by a maker's name for a specified item.

Specified Items, Proposed Equivalents ("Or Equal")

8.2 When the first specified item is followed by a second maker's name and "or equal," the Contractor may submit Proposed Equivalent items for the Engineer's review. Proposed Equivalent items that are in the Engineer's judgment equal to the first specified

item in quality, utility, and appearance, will be Favorably Reviewed. Where a product description and first maker's name is followed by "or equal" with no second maker's name, it means the specifier knows of no equivalent product and the Contractor may submit Proposed Equivalent products by other makers for review. Where the term "or equal" is omitted, it means that the named item is required to meet the Owner's needs; no products or makers other than those specified will be considered.

8.3 Proposed Equivalent items must be submitted as required for Product Data submittals on the form attached as Exhibit GC-3 and shall include adequate technical information to fully describe the function and quality of the item. Submittals of Proposed Equivalent items that are not made within 35 days of the Notice to Proceed will be rejected unless the Engineer has agreed in writing to a later submittal date and the Contractor agrees to comply with all conditions of the Engineer for the late submittal. If the Contractor's second attempt to obtain Favorable Review of a Proposed Equivalent item is unsuccessful, the Contractor shall submit the first specified item.

8.4 Inclusion of a second maker's name indicates the maker is acceptable but does not necessarily indicate the maker offers a standard product equal to the first specified item.

.1 Items by the second named maker are subject to the same conditions of review and compatibility as other Proposed Equivalent items.

.2 Inclusion of a maker's name and/or model number after a specification description is not a representation that the maker will furnish an item meeting the Contract requirements at bid time or at time of need. It is the Contractor's sole responsibility to furnish items meeting the Contract requirements.

8.5 Where items are specified with a description followed by a maker's name and trade name or model number, the item shall be provided with all of the custom modifications, special features, accessories and options described even though such things may not normally be included by the maker or provider as part of the model specified. Where there is a conflict between the written description of an item and maker's trade name and/or model number, the written description shall take precedence.

8.6 The design is based on first specified items including all described custom modifications, special features, accessories and options as made by the first named maker. The Contractor shall be responsible for all cost including redesign required to accommodate a Proposed Equivalent item including items by the second named maker.

8.7 The Engineer's review of Proposed Equivalent items is based solely on information provided by the Contractor and on the Contractor's warranty that the proposed item is at least equal in quality, utility, function and appearance to the first specified item. Favorable Review of a Proposed Equivalent item has the same meaning and is subject to the same limitations that apply to the Favorable Review of Product Data and Shop Drawings described in this Article.

Shop Drawings, Product Data, Samples and Proposed Equivalents

Intent of Contractor's Review

8.8 The Contractor shall make required submittals including Shop Drawings, Product Data, Samples and Proposed Equivalent items in time to allow for the Engineer's review and resubmittal, if required, without causing delay to the Work. The Contractor and appropriate subcontractor shall review, stamp, date and sign submittals before sending them to the Engineer. By making such a submittal, the Contractor makes the following warranty and shall include that warranty statement on its letter of transmittal.

"The Contractor warrants:

1. Work or items submitted are complete, accurate and meet the requirements of the Contract Documents, or else any deviations are identified and described in a separate letter accompanying the submittal form, Exhibit GC-2.

2. Work or items submitted have been coordinated with and meet the requirements of other submittals, field conditions and the Work as a whole and quantities and dimensions are correct.

3. Proposed Equivalent items are at least equal in quality, utility and appearance to the first specified item, or else any deviations are identified in a separate letter accompanying the submittal form, Exhibit GC-3.

4. Adjustments to other work required to accommodate Proposed Equivalent items including second named items have been delineated on the submittal and will be made at the Contractor's expense.

5. This submittal includes all items needed for a particular specification section or assembly for which submittals are required.

6. And represents that all material, equipment, hardware, software and firmware product provided to the Project will perform without error, loss of data or loss of functionality arising from any failure to process, calculate, compare or sequence date data accurately.

Intent and Limitations on Engineer's Review

8.9 The Engineer's review of the Contractor's submittals is done solely for the Engineer's and Owner's benefit. The Contractor agrees that the Engineer has no duty to the Contractor or any of its subcontractors or suppliers for the accuracy, completeness or adequacy of the Engineer's review of its submittals.

8.10 The Engineer's review of submittals is for compliance with the design intent and requirements of the Contract Documents and is based solely on information provided by the Contractor and on the Contractor's warranty that the work or items submitted meet the requirements of the Contract Documents, and the Work as a whole. If later information reveals that work or items submitted or furnished do not meet the requirements of the Contract Documents or the Work as a whole, the Engineer's Favorable Review shall be void and the items or work shall be considered Defective. The Engineer's Favorable Review shall not include an examination of methods or means of construction or required safety precautions. The Engineer's Favorable Review: (1) shall not include a review of quantities or dimensions, (2) shall not relieve the Contractor from responsibility for errors or omissions in submittals, (3) shall not relieve the Contractor from responsibility for complying with the requirements of the Contract Documents, (4) shall not constitute a Change Order, and (5) shall not constitute final acceptance of a product, item or portion of the Work.

8.11 The Engineer's Favorable Review of submittals shall not relieve the Contractor from responsibility for deviations from the requirements of the Contract Documents unless the deviations are specifically called to the Engineer's attention in a separate letter accompanying the submittal form, Exhibit GC-2, and the Engineer favorably reviews the specific deviations in writing.

8.12 The Engineer's Favorable Review of a re-submittal does not include a review of changes made by the Contractor to a previous submittal that were not requested by the Engineer unless the Contractor specifically calls the Engineer's attention to the non-requested changes, in a separate letter accompanying the resubmittal of form Exhibit GC-2.

8.13 Where performance type specifications are used or where pre-engineered or Contractor designed systems, elements, equipment or components are called for, the Owner, the Design Engineer and the Engineer shall have the right to rely on the Contractor's design. Favorable Review of the Contractor's design submittal shall be limited to acknowledgment that the design was prepared with the intent of meeting the specified performance criteria, but the Engineer's review shall not constitute a review of the design itself, of the designer's calculations, or of the effectiveness of the design in actually satisfying the specified criteria.

8.14 The Contractor shall allow 30 days for the Engineer's review of each submittal and 30 days for each resubmittal unless a different period is specified by the Engineer in writing. If the Engineer requests additional information or clarification of a submittal, the 30 days shall be measured from the date the additional information or clarification is received. If the Contractor requires more than two submittals to obtain the Engineer's Favorable Review, the Contractor shall compensate the Owner for the cost of the Engineer's additional review time. The Contractor shall not perform work for which reviewed submittals are required without obtaining Favorable Review of submittals.

8.15 Submittals required for the Owner's or Engineer's information and on which the Engineer shall not be expected to take responsive action are identified in the Contract Documents.

ARTICLE 9 - CHANGES IN THE WORK

Changes

9.1 The Owner may order changes in the Work after executing the Agreement by issuing a written Change Order or Work Directive Change.

9.2 The Contractor expressly agrees that it shall not consider any order, instruction, Clarification, Response to a Request for Information or any other communication either written or oral given intentionally or unintentionally by the Engineer, Owner or any other person as authorization or direction to do work that would cause a change in Contract Time or Price unless it is a Change Order or Work Directive Change signed by the Owner.

Requests for Quotation

9.3 If a change involving Contract Price or Time is being considered, the Engineer will issue a Request for Quotation describing the proposed change. The Contractor shall submit a quotation promptly so not to delay or interfere with the progress of the Work, in accordance with the requirements for determining the cost of changes described in this Article.

Change Orders

9.4 If the Owner and the Contractor agree on the change in Price and Time for a proposed change, a Change Order will be issued and signed by the Engineer, Contractor and the Owner. An executed Change Order shall be conclusive and final settlement of the change in Contract Time and Price for the work covered by the Change Order including the effect of the change on all other portions of the work completed or not and shall include compensation for all related claims for disruption, impact, delay or extended overhead, if any, that may result from the change. Implied in every Change Order, unless expressly reserved by the Owner or Contractor, is a waiver of all known and unknown claims arising out of the Change Order, including a waiver of Section 1542 of the California Civil Code as well as under any other state or federal statute or common law principle of similar effect which provides as follows:

"GENERAL RELEASE CLAIMS EXTINGUISHED.

A general release does not extend to claims which the creditor does not know or suspect to exist in his favor at the time of executing the release, which, if known by him, must have materially affected his settlement with the debtor."

9.5 The Owner reserves the right to have changed work performed by a separate contractor or its own workers if the Contractor and the Owner cannot agree on the change in Price and Time required.

Work Directive Change

9.6 If the Owner and the Contractor have not agreed on the change in Price or Time required for a proposed change, or if time does not permit preparation of a quotation, the Owner may direct the Contractor to proceed with the work on a cost accounting basis by issuing a Work Directive Change.

9.7 All Work Directive Changes must be signed by the Owner and will state the maximum sum the Owner is obligated to pay.

.1 If the Contractor has agreed to do the work on a cost accounting basis and to complete the work for an amount not to exceed the stated maximum sum, the Contractor shall sign the Work Directive Change.

.2 If the Contractor cannot agree to a maximum sum to complete the work, the Contractor shall not sign the Work Directive Change. In that case the maximum sum shall limit the amount the Owner is obligated to pay to the Contractor but shall not obligate the Contractor to complete the work for that sum.

9.8 When the Owner and the Contractor agree on the change in Price and Time for a Work Directive Change, the Work Directive Change shall be converted into a Change Order.

Information, Interpretations and Minor Changes

9.9 The Engineer has the authority to order minor changes in the Work including interpretations which are consistent with the intent of the Contract Documents. The Engineer does not have authority to order any changes which involve:

.1 a change in Contract Price, or

.2 a change in the Contract Time, or

.3 means, methods, techniques or sequence of Work, or

.4 safety in, on or about the site.

If the Contractor considers that any minor changes so ordered causes a change in Contract Price or Time, the Contractor shall notify the Engineer in writing within 15 days of receipt of the order and shall not proceed with the work except in the case of an emergency endangering persons or property.

9.10 If, after reviewing the Contractor's objection to a minor change, the Engineer determines the work is required by the Contract Documents and does not involve a change in Price or Time, the Owner may direct the Contractor, in writing, to proceed with the work. If so directed, the Contractor may (1) accept the Engineer's determination and proceed with the work or (2) give the Engineer written notice 5 days in advance of beginning work stating that it intends to make a claim under Article 10 and will document costs in accordance with paragraphs 9.11 through 9.14.

Determining Cost of Changes

9.11 The Contractor's quotations of cost on proposed changes and cost reported for work performed on a cost accounting basis shall be determined as the sum of the following:

.1 costs of labor including foremen engaged on the work but not of the Superintendent, field engineer, project manager, and other supervisory or support personnel except as provided in paragraph 9.11.5. Labor costs shall include the cost of social security, old age and unemployment insurance, fringe benefits required by labor agreements and workers' or workmen's compensation insurance;

.2 costs of materials, supplies and equipment, including cost of transportation, incorporated in the Work;

.3 rental costs of machinery and equipment, exclusive of portable power or hand tools, supplied by the Contractor or rented from others;

.4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the change;

.5 the increased or decreased cost of the Contractor's supervision and field office personnel but only if the change affects the "critical path" of construction activities and requires a change in Contract Time;

.6 the reasonable cost of any tier of subcontractors' work computed as required for the Contractor's work. The mark-up charged by a subcontractor for overhead and profit shall be the lesser of: i) subject to negotiation, ii) as included in the original bid for the Work, or iii) not to exceed 10% for work performed directly by the subcontractor and 5% for work performed by a subcontractor one tier below it, and

.7 for the reasonable work performed by the Contractor, the mark-up for overhead, profit and all other costs shall be the lesser of: i) subject to negotiation, as included in the original bid for the Work and contained in escrowed bid documents, or iii) not to exceed 10% for work performed directly by the Contractor and 5% for work performed by a subcontractor.

.8 Limitations on Markup for Changes. Where multiple tiers of Subcontractors are involved in a change in the Work, the maximum total amount of adjustment to the Contract Price and for markup for all tiers of Subcontractors and for Contractor self-performed Work shall not exceed twenty percent (20%) of the direct costs incurred by Contractor and the Subcontractors and Material Suppliers actually performing the Work.

Work shall be done making the most effective use of labor; materials shall be purchased at the lowest available price and all discounts shall be passed on to the Owner; equipment shall be rented at the most favorable rate available for the term of use required.

9.12 When both additions and deletions are related and pertain to the same work item and are included in the same Change Order, the mark-up for overhead and profit shall be computed on the net increase, if any. No deductions for overhead and profit will be made on deductive changes except for deductive changes that materially change the scope of the work or deductive changes issued pursuant to the Owner's right to correct defective work, the Owner's right to remedy the Contractor's default or neglect or the Owner's right to terminate the Contract for cause.

9.13 The Contractor shall keep the Engineer informed as to when and where work is being performed on a cost accounting basis and shall submit complete auditable records of the cost of such work including daily time sheets signed daily by the Engineer.

9.13.1 Contractor Maintenance of Daily Records for Changes. In the event that Contractor is directed to perform any changes to the Work, or should Contractor encounter conditions which the Contractor believes would obligate the Owner to adjust the Contract Price and/or the Contract Time, Contractor shall maintain detailed records of the cost of such changes on a daily basis and a summary in a daily report supplemented by back-up records. Such records shall include without limitation hourly records for labor and construction equipment, itemized records of materials, including delivery tickets, and equipment used each day in connection with the performance of any change to the Work. In the event that more than one change to the Work is performed by Contractor in a calendar day, Contractor shall maintain separate records of labor, construction equipment, materials, and equipment for each such change. In the event that any Subcontractor of any tier shall provide or perform any portion of any change to the Work, Contractor shall require that each such Subcontractor maintain records in accordance with this Article. Each daily record maintained hereunder shall be signed by the Contractor; such signature shall be deemed Contractor’s representation and warranty that all information contained therein is true, accurate, complete, and relates only to the change referenced therein. All records maintained by Subcontractors of any tier, relating to the costs of a change in the Work shall be signed by such Subcontractor’s authorized Project Manager or Superintendent as a representation and warranty that all information contained therein is true, accurate, complete, and relates only to the change referenced therein. All such records shall be delivered to Engineer not later than on the day the Work is performed (same day) for independent verification. The Engineer shall attempt to review and reconcile costs of changes on a daily basis. The Engineer’s signature on the report shall indicate agreement with the information reflected therein, not that the Contractor is entitled to payment of the costs in the report. If the Engineer disagrees with the response, the Engineer shall note the areas of disagreement on the report. In the event that the Contractor shall fail or refuse, for any reason, to maintain or make available for inspection, review and/or reproduction such records, adjustments to the Contract Price or Contract Time, if any, on account of any change to the Work may be deemed waived for that day. Contractor’s obligation to maintain back-up records hereunder is a material inducement to and in addition to, and not in lieu of, any other Contractor obligation under the Contract Documents with respect to changes to the Work.

9.13.2 Labor. The daily report shall show the names, trade, labor, classifications, and hours worked, for the workers.

9.13.3 Material. The daily report shall describe and list quantities of materials used, attaching delivery tickets.

9.13.4 Equipment. The daily report shall show type of equipment, size, identification number, and hours of operation, including loading and transportation, if applicable.

9.13.5 Other Services and Expenditures. Other services and expenditures shall be described in such detail in the daily report as the Owner or Engineer may require.

9.13.6 Cost. The report shall provide dollar values for each category of cost.

9.14 Any work for which the Contractor may wish to make a claim shall be done in accordance with these requirements for work done on a cost accounting basis.

Change in Contract Time Due to Changes in the Work

9.15 If the work required by a Change Order affects the "Critical Path" of construction tasks and is the sole, unavoidable cause for changing the length of time required to complete the Work, the Contract Time will be adjusted accordingly.

ARTICLE 10 - CLAIMS AND DISPUTES

Claims

10.1 A Claim is a written demand by one of the parties to the Contract for an interpretation of Contract terms or an adjustment in Contract conditions including Price or Time and may involve questions of performance under the Contract including acceptability of work, progress of work, the extent to which work has been completed, whether work is included in the Contract, and other matters in question between the Owner and the Contractor.

10.2 Content of Claim. Claims shall be made in writing and shall include complete documentation including:

.1 The Contractor’s certification, by its owner or an officer, under penalty of perjury, that (a) the claim is made in good faith, (b) supporting data are accurate and complete to the best of the Contractor’s and subcontractor’s knowledge and belief, and (c) the amount requested accurately reflects the Contract adjustment for which the Contractor believes the Owner is liable.

.2 Full disclosure of facts and detailed reasons supporting the Claim and citing relevant provisions in the Contract Documents.

.3 Complete documented cost of doing the work for which it is making a Claim and such cost and documentation shall be submitted in accordance with General Conditions paragraphs 9.11 through 9.14.

Engineer's Decisions

10.3 The Engineer, as an arbiter of disputes, will make an initial decision on all Claims made prior to the date the final payment is due including Claims alleging an error or omission by the Engineer. The Engineer's decision will be in writing, will be consistent with the intent of the Contract Documents and will cite the basis on which it is made. The Engineer will endeavor to make decisions that are impartial and will not be liable for results of decisions made in good faith. The Engineer's decision is a condition precedent to a demand by either party that a Claim be settled by litigation, or if agreed to in advance by both parties or if required by law, be settled by mediation or arbitration.

Time Limits for Submitting and Deciding Claims

10.4 The Contractor shall give written notice 5 days prior to beginning any work for which it intends to make a Claim for an increase in Contract Time or Price and expressly waives any right to make a Claim if the required notice is not given. All other Claims must be made within 14 days of the time the condition giving rise to the Claim becomes known to the claimant. The Engineer, as an arbiter of disputes, will issue a written decision on the Claim within 30 days after receipt of the Claim unless additional information is requested from the claimant or the claimant amends the Claim and then a decision will be issued within 30 days after receipt of additional information, or an amended Claim. Should a Claim be presented that is in part timely and in part untimely, the Engineer shall reject the untimely Claim and decide the timely claim. All Claims must strictly follow the notice requirements of this agreement.

10.5 A demand to appeal the Engineer's decision and settle a Claim by litigation, mediation or arbitration can only be made after the Engineer has made a written determination, or in the absence of a determination, 7 days after the Engineer's determination became due. If no demand to settle a Claim by litigation, mediation or arbitration is made within 15 days after the Engineer's written decision was issued, the Engineer's decision shall become final and binding on the Owner and the Contractor and if a change in Contract Time or Price is involved, a Change Order shall be signed by both parties.

10.6 Provisions of law notwithstanding, the Owner and Contractor hereby agree that neither the Engineer, the Design Engineer, nor any other third party shall, without its specific written consent, be required to participate as a party in any litigation, arbitration or mediation proceedings between the Contractor and the Owner initiated to resolve disputes under the Contract Documents.

Mediation

10.7 If any dispute, controversy, or Claim (hereinafter referred to as a dispute) arises out of or relates to this Contract, or breach thereof, and if the dispute cannot be settled through direct discussions, then the parties first agree to try to settle the dispute by mediation before resorting to litigation or some other dispute resolution procedure. The mediator shall be an attorney experienced in mediating construction disputes and shall be chosen by agreement of the parties, but if no agreement then appointed by the Presiding Judge of the Superior Court in the jurisdiction of the site. Each party shall bear its own costs and expenses of the mediation, including attorney's fees. The fees and costs of the mediator shall be borne equally by the parties.

Work Continued During Disputes

10.8 The Contractor shall continue to work in conformance with the requirements of the Contract Documents and the progress schedule during any dispute and when waiting for decisions on Claims by the Engineer or for resolution of Claims by litigation, mediation or arbitration, unless otherwise directed in writing by the Engineer or Owner.

ARTICLE 11 - CONTRACT TIME AND DELAYS

Definitions

11.1 Definitions of Terms:

1 "Contract Time" is the period of time including authorized adjustments allowed for completion of the Work and is measured from the date of commencement in the Notice to Proceed to the date of Final Completion.

.2 "Day" is a calendar day beginning and ending at midnight.

.3 "Unusual Weather" is defined as when either the number of Wet Days or the number of Freezing Days exceeds the most recent published mean number of Wet or Freezing Days for the period of record, for the same month and for the weather observing station closest to the project site as reported in "Comparative Climatic Data" published by the National Oceanic and Atmospheric Administration, Ashville, NC 28801. "Wet Days" are defined as days that have at least 0.01 inch of rainfall unless modified in the Supplementary Conditions. "Freezing Days" are defined as days with a minimum temperature of 32 degrees F or lower.

Computation of Time

11.2 Any period of time referred to in the Contract Documents measured in days shall mean consecutive calendar days and shall exclude the first and include the last day. If the last day falls on a Saturday, Sunday or legal holiday, it shall be omitted from the calculation.

Contract Time

11.3 Time limits stated in the Agreement are the essence of the Contract. The Contractor confirms that the Contract Time is a reasonable period for performing the Work and includes enough float time to allow for normal unfavorable weather and other reasonably anticipated delays.

Damages for Late Completion

11.4 Liquidated damages if applicable are stipulated in the Agreement. If liquidated damages are not stipulated, the Contractor will be assessed actual damages suffered by the Owner as a result of completion after the Contract Time.

Commencing Work

11.5 The Contractor shall not commence work (1) prior to the date in the Notice to Proceed, (2) prior to giving the Engineer 5 days written notice and (3) prior to the effective date of insurance coverage required under Article 4.

Accelerated Work If Required to Meet Schedule

11.6 The Contractor shall proceed expeditiously with adequate forces and shall achieve Final Completion within the Contract Time. If the Contractor's performance falls behind schedule, the Contractor shall accelerate the work as required to get back on schedule at no additional cost to the Owner. Accelerated work shall include air or express delivery of materials and equipment, increasing the number of workers, working overtime, working Saturdays, Sundays, and holidays and working additional shifts. The Contractor shall pay the Owner for any extra cost of inspection made necessary by accelerated work required under this provision.

Excusable Noncompensable Delay

11.7 "Excusable Delay" means unforeseeable delay beyond the Contractor's or Owner's control and not

resulting from the Contractor's fault or negligence. Excusable Delay includes labor disputes, fire, Unusual Weather, unavoidable casualties and unusual delays in transportation. The Contractor may make a Claim under Article 10 for an extension of Contract Time due to an Excusable Delay if it can show that the Excusable Delay is the sole and unavoidable cause increasing the time actually needed to complete the Work. The Contractor shall not be entitled to an increase in Contract Price due to an Excusable Delay.

Compensable Delays

11.8 The Contractor may make a Claim under Article 10 for extension of Contract Time due to delays that are not due to the fault or neglect of the Contractor and which could not have been reasonably anticipated, including delays: (1) caused by the Owner or Engineer or by the Owner's separate contractors or workers, (2) resulting from the Owner's failure to provide access to lands or rights-of-way on which the Work is to be performed, or (3) due to suspension of the Work ordered by the Owner. In making such a Claim, the Contractor must demonstrate that the delay was the sole and unavoidable cause for increasing the length of time required to complete the Work on the critical path. In the case of a delay which was caused in part by the Contractor and in part by the Owner (Concurrent Delay), Contractor shall only be entitled to an extension of the Contract Time or Milestone(s) and Contractor shall not be liable for Liquidated Damages during the period of Concurrent Delay, but Contractor shall not be entitled to any additional compensation whatsoever during the period of Concurrent Delay. For purposes of settlement of Claims under this paragraph, the Contractor's cost shall be determined in accordance with paragraph 9.11 except that no mark-up for profit will be allowed and therefore, the maximum percentage mark-ups allowed under subparagraphs 9.11.6 and 9.11.7 shall be reduced by one-third.

11.9 Changes in Contract Time associated with changes ordered by the Owner are covered under Article 9.

11.10 An executed Change Order covering changes ordered by the Owner under Article 9 or the resolution of Claims made under Article 10 shall be the final and conclusive settlement of the change in Contract Time and Price for the work or Claim covered by the Change Order including all related costs in accordance with Article 9.4.

10.11 Early Completion Delay Damages. While the Contractor may schedule completion of all the Work, or portions thereof, earlier than the Contract Time established in the Agreement, the Owner and Engineer are exempt from liability for and the Contractor shall not be entitled to an adjustment of the Contract Price or to any additional costs, damages, or compensation whatsoever, for use of Float or for Contractor's inability to complete the Work earlier than the Contract Time established in the Agreement, for any reason whatsoever, including but not limited to, delay caused by Owner, Engineer or other compensable delay.

ARTICLE 12 - INSPECTION, DEFECTIVE WORK, GUARANTEE

Defective Work

12.1 Defective Work is work that (1) is unsatisfactory, faulty, deficient, or leaks, breaks, fails or does not conform to the Contract Documents; or (2) does not meet the requirements of reference standards, tests or approvals specifically referred to in the Contract Documents; or (3) has been damaged prior to final acceptance; or (4) does not meet applicable industry or trade standards; or (5) a submittal is required and Favorable Review has not been obtained.

Access to Work and Notice

12.2 The Contractor shall provide the Owner, the Engineer and each of their representatives safe access to every part of the Work at all times work is in progress for observation, inspecting and testing. The Contractor shall give 2 days notice of work being ready for required inspection, test or approval or of intent to cover work up.

Tests and Inspections

12.3 Unless otherwise specified, the Contractor shall arrange and pay for tests, inspections and approvals required by laws, ordinances, rules, regulations, orders of public authorities having jurisdiction or by the Contract Documents. All such tests, inspections and approvals shall be performed by an independent testing laboratory or inspection agency acceptable to the Engineer or to the appropriate public authority. Samples to be tested and items of work to be inspected will be selected by the Engineer or the public authority requiring the test or inspection. Test reports, inspection reports and certificates shall be submitted directly to the Engineer by the performing laboratory or agency. The Contractor shall notify the Engineer at least 2 days prior to all tests and inspections to permit observation by the Engineer.

Reinspection

12.4 If the Engineer determines that portions of the Work require additional testing or retesting, the

Contractor shall provide material to be tested, safe access to test locations, power, light and other services. The cost of retesting shall be paid for by the Owner, but if the additional tests or retesting indicate that said portion of the Work is Defective, the Contractor shall pay the Owner all costs associated with additional testing or retesting including the cost of the Engineer's additional service.

Uncovering Work

12.5 If work is covered or concealed without giving the Engineer 2 days notice to permit observation, it shall be uncovered or exposed at the Contractor's expense to permit observation if so requested.

12.6 If the Engineer wishes to have work uncovered for observation after having been given the required notice to observe it, the Contractor shall uncover the work on a cost accounting basis. If the work is found to be in accordance with the Contract Documents, the Owner shall pay the cost of uncovering and replacing the work. If the work is found to be Defective, the Contractor shall pay the cost of uncovering and correcting the work and the cost of required additional engineering and testing service.

Correction of Defective Work

12.7 The Contractor shall promptly correct or replace: (1) work rejected by the Engineer as being Defective, and (2) work that is Defective whether or not rejected by the Engineer. The Contractor shall correct Defective Work prior to installing subsequent related or connected Work. The Contractor's obligation to correct Defective Work applies to latent as well as patent defects and whether or not the work is fabricated, installed or completed and whether observed before or after Substantial Completion. The Contractor shall bear the cost of correcting Defective Work including consequential costs, engineering services and attorneys' fees made necessary thereby.

Acceptance or Use of Defective Work

12.8 The Owner may elect to accept Defective Work in which case a deductive Change Order shall be signed by the Contractor reflecting the decreased value of the Work. If final payment has been made, the Contractor shall pay to the Owner a sum reflecting the decreased value of the Work.

12.9 The Owner may use Defective Work without negating its rejection or decreasing the Guarantee Period which shall commence when the work is finally corrected or replaced and accepted. When all or part of the Work is being used by the Owner, the Contractor shall schedule correction or replacement of Defective Work at the Owner's convenience.

Tests and Inspections Do Not Reduce Contractor's Responsibility for Performance

12.10 Observations by the Engineer or tests, inspections or approvals by others shall not relieve the Contractor from its obligation to perform the Work in accordance with the Contract Documents.

Guarantee Period

12.11 Within 7 days of receipt of written notice from the Owner, the Contractor shall correct or replace work found Defective within one year after the date of Final Completion of the Work and Acceptance by the Owner or such longer period as covered by any Special Guarantee required by the Contract Documents or by law. For work first performed or first made acceptable after the date of Final Completion, the one-year or longer Guarantee Period shall commence to run at the time the Work is completed or made acceptable.

Owner's Right to Correct Defective Work During Guarantee Period

12.12 If the Contractor fails to correct Defective Work within 7 days of receiving notice to do so, the Owner may correct the Work and recover the cost of correction from the Contractor. If the Defective Work creates an emergency where delay would cause unsafe conditions or serious risk of loss or damage, the Owner may proceed to correct the Defective Work without giving the Contractor notice.

12.13 If the Owner corrects Defective Work under this paragraph, the Contractor shall pay the Owner all direct, indirect and consequential cost and all required engineering services and attorney's fees.

12.14 The Contractor shall be responsible for the cost of removing and replacing work provided by the Owner when such removal and/or replacement is necessary to permit correction of Defective Work for which the Contractor is responsible.

Contractor's Liability for Defective Work Not Limited by Guarantee

12.15 Nothing contained in this Article 12 nor in any Special Guarantee required under Division 1 General Requirements shall be construed to limit the period of the Contractor's obligations under the Contract Documents or under law. Establishment of a time period for the Contractor's specific obligation to correct work places no limit on the time within which the

Contractor's obligation to comply with the Contract Documents may be enforced nor on the period during which the Contractor may be held liable for the effect of Defective Work.

12.16 Nothing contained in this Article 12 nor in any Special Guarantee required under Division 1 General Requirements shall be construed to limit the Contractor's, subcontractor's, material or equipment supplier's liability for damages sustained as a result of latent or patent defects in equipment or materials furnished or caused by the negligence of the Contractor or his subcontractors or suppliers. The guarantees contained in this Article 12 shall not be a waiver of nor shall they reduce any guarantee or warrantee offered by the suppliers of materials or equipment furnished under this Contract nor shall they reduce any responsibilities imposed on manufacturers or suppliers of such equipment under law.

ARTICLE 13 - PAYMENT AND COMPLETION

Schedule of Values

13.1 At least 20 days prior to the first Application for Payment Date, the Contractor shall submit a Schedule of Values, in a form acceptable to the Engineer, allocating the Contract Price to various trades, types of work, pieces of equipment, and major tasks to assist the Engineer in evaluating the percentage completion for each part of the Work. The Contractor's overhead and profit shall be uniformly pro-rated over all items in the Schedule of Values. The Schedule of Values shall represent the actual cost of each segment of the work and shall not allocate higher costs, overhead or profit to work items scheduled for early completion. If the Engineer objects to the allocation of cost or the level of detail provided, the Contractor shall revise and resubmit the Schedule of Values.

Application for Payment

13.2 The period covered by each Application for Payment shall be one calendar month. Payment shall be based on work completed as of the Application for Payment Date which shall be the last day of the month unless otherwise stated in the Agreement. Within 7 days after each Application for Payment Date, the Contractor shall meet with the Engineer to review the line item amounts proposed by the Contractor for payment. When the amounts proposed are acceptable to the Engineer, the Contractor shall prepare and submit within 3 days, the Application for Payment form, attached as Exhibit GC-4, and Conditional Lien Releases from the Contractor, each subcontractor, supplier and materialman whose work is included in the Application. The Contractor shall sign and certify on the Application for Payment, subject to penalty of perjury, the following: "The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents and that all Work for which previous payments have been received is free and clear of liens, claims, security interests or encumbrances of any kind. The Contractor further warrants that title to all Work covered by this Application for Payment will pass to the Owner no later than the time of payment."

13.2.1 Taxes. The Contractor shall pay all applicable sales, consumer, use, and similar taxes for the Work provided by the Contractor and such taxes shall be included in the Contract Price.

13.2.2 Liability for Employee Payments. Contractor accepts full liability for the payment of any and all contributions, deductions, or taxes for social security, unemployment insurance, old age and survivor's benefits, medical and health benefits, or for any other purpose now or hereafter imposed under any applicable law measured by the wages, salary or other remuneration paid to persons employed by or on behalf of Contractor for the Work. Contractor covenants and agrees to observe and fully comply with all applicable law, including procurement of any necessary occupational licenses, permits and inspection certificates.

Payment for Items Delivered But Not Installed

13.3 If recommended by the Engineer, Applications for Payment may include the percentage of value stipulated in the Agreement for major equipment and custom fabricated items that have been delivered, stored and protected at the site providing proof is furnished that title will pass to the Owner upon payment. Payment will not be made for material stored at the site that is not custom fabricated. Payment will not be made for items stored off the site. Payment will not be made for stored or installed items that are not protected from physical, environmental or other damage. Payment for successful submittal of Shop Drawings or Product Data will be made only when specifically provided for in Division 1.

Engineer's Recommendation for Payment

13.4 Within 7 days after receipt of the Contractor's Application for Payment, the Engineer will either issue a Recommendation for Payment for such amount as the Engineer determines is due or will notify the Contractor and the Owner of reasons for withholding recommendation. The Engineer's recommendation will

not be an evaluation or interpretation based upon legal theories or principles but will be based upon sound engineering judgment. The Owner will seek independent legal services, if necessary to assist it in determining if withholds are appropriate. Retainage to be withheld by the Owner is stipulated in the Agreement.

13.5 The Engineer's Recommendation for Payment will constitute a representation that to the Engineer's best knowledge, information and belief the Work has progressed to the point indicated and is generally in conformance with the Contract Documents but is subject to re-evaluation during subsequent site visits and upon final completion. The Engineer's Recommendation for Payment shall not be taken as a representation that the Engineer has (1) made exhaustive or continuous onsite inspections to check the quality of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Price, or (5) offered its legal opinion in any respect.

13.6 If, in the Engineer's opinion, the representations in paragraph 13.5 cannot be made or if the Engineer has knowledge of any of the faults listed below, then the Engineer may decline to issue a Recommendation for Payment or may recommend a reduced amount of payment or may rescind previously issued Recommendation for Payment. Faults for which payment may be withheld, reduced or rescinded include:

.1 Defective Work not corrected;

.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

.3 Failure of the Contractor to make payments properly to subcontractors or suppliers for labor, materials or equipment;

.4 Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Price;

.5 Damage to property, the Work, the Owner, another contractor or a third party;

.6 Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

.7 Work performed for which submittals are required prior to obtaining Favorable Review of submittals;

.8 Persistent failure to carry out the Work in accordance with the Contract Documents;

.9 Failure to submit a construction schedule or to update the construction schedule in accordance with General Conditions paragraph 5.18;

.10 Failure to update Record Drawings weekly;

.11 Failure to reinstate required insurance that has been allowed to lapse; or

.12 Non-payment of money owed to the Owner for the extra cost of inspection or engineering services provided for in the General Conditions.

Completion and Acceptance

13.7 Definitions

.1 "Substantial Completion" means the Work has progressed to the point that: (1) the Work is ready for beneficial use and occupancy by the Owner for the intended purpose, (2) all fire and life safety work has been completed, inspected and accepted, (3) all mechanical and process systems and equipment are complete and have been put in automatic operation, (4) the total value of uncompleted work is less than one-half of one percent of the Contract Price and (5) completing the Work will not significantly interfere with the Owner's convenience, use or cost of operation.

.2 "Semi-Final Inspection" determines if the Work is Substantially Complete.

.3 "Final Inspection" determines if the Work has reached Final Completion.

.4 "Final Completion" indicates that the Work has been fully completed in accordance with the Contract Documents and is ready for acceptance and final payment by the Owner.

.5 "The Final Punch List" contains items that remain uncompleted after Substantial Completion but that must be completed prior to Final Completion.

Owner's Right to Partial Use

13.8 When provided for in the Contract Documents or agreed to in writing by the Owner and the Contractor, the Owner may notify the Contractor and begin using a portion of the Work even though it is not Substantially Complete. The Contractor, the Owner and the Engineer shall agree on and document responsibilities for security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that portion of the Work being used by the Owner. The Owner, the Contractor and the Engineer shall inspect such portion of the Work and shall prepare a list of work to be completed or corrected before final acceptance. The Owner's use of any portion of the Work shall not constitute final acceptance of that portion of the Work prior to Final Completion and acceptance of the Work as a whole. The Owner shall

allow the Contractor reasonable access to complete or correct work in areas being used by the Owner. Partial beneficial occupancy shall not relieve the Contractor of Liquidated Damages unless the Contract Documents expressly provide for and identify the portion of Work that may be considered Substantially Complete before the remaining portions of the Work.

Contractor's List of Deficiencies

13.9 When the Contractor considers the Work nearly complete, the Contractor shall review the Contract Documents, inspect the Work and prepare a list of deficiencies (Punch List). The Contractor shall complete or correct the items on the Punch List until, in the Contractor's opinion, the Work is Substantially Complete and ready for occupancy and use by the Owner. The Contractor shall then deliver the Punch List to the Engineer and notify the Engineer in writing that the Contractor believes the Work is Substantially Complete and ready for a Semi-Final Inspection.

Semi-Final Inspection, Substantial Completion

13.10 When the Work is ready and the Contractor so notifies the Engineer in writing, the Engineer will make a Semi-Final Inspection and may add additional items to the Contractor's Punch List. As a result of this inspection, the Engineer may determine that (1) the Work is not sufficiently complete to warrant a Semi-Final Inspection, additions to the Contractor's Punch List, or the preparation of a Final Punch List, (2) the Work is sufficiently complete for the Engineer to prepare a Final Punch List but certain incomplete or Defective Work prohibits use of the Work for its intended purpose and therefore, the Work is not Substantially Complete, or (3) that the Work is Substantially Complete and usable for its intended purpose and the Engineer can prepare a Final Punch list. In preceding cases 1 and 2, the Contractor shall continue the Work and call for a second Semi-Final Inspection when the Work is ready. In case (3), the Engineer will prepare a Final Punch List and a notice of Substantial Completion which shall establish the date of Substantial Completion and shall state the time agreed to by the Owner and the Contractor (not to exceed 30 days) in which the Contractor shall complete all work ready for Final Inspection. The date of Substantial Completion shall be revised if necessary such that it is no more than 30 days prior to the actual date of Final Completion. The Engineer shall attach a copy of the Final Punch List to the notice of Substantial Completion. If the Contractor does not achieve Substantial Completion on the second attempt, it shall reimburse the Owner the cost of the Engineer's services for additional inspections.

Final Inspection, Final Completion

13.11 When the Contractor has completed or corrected all the items on the Engineer's Final Punch List and has made all required final submittals, the Contractor shall give the Engineer written notice that the Work is ready for Final Inspection and acceptance and upon receipt of a final Application for Payment, the Engineer shall make a Final Inspection. If the Engineer finds the Work is not fully complete, it shall notify the Contractor of items still requiring completion or correction. The Contractor shall immediately correct these deficiencies and call for a reinspection. When the Engineer finds to the best of the Engineer's knowledge, information and belief, and on the basis of the Engineer's observations and inspections, the Work is acceptable and fully complete in accordance with the Contract Documents, and when all final submittals have been made, the Engineer will recommend that the Owner issue and file a Notice of Completion, designating Final Completion, make Final Payment and Accept the Work in accordance with the terms and conditions of the Contract Documents.

13.12 Neither the Engineer's failure to include an item on the Final Punch List, nor making of the Semi-Final or the Final Inspection, nor recommendation of final acceptance shall alter the Contractor's responsibility to complete all Work in accordance with the Contract Documents.

Final Payment

13.13 Within 10 days after the Contractor has delivered to the Owner a complete release of all liens arising out of this Contract or receipts in full covering all labor, materials and equipment for which a lien could be filed, or a bond satisfactory to the Owner to defend and indemnify the Owner against such liens, the Owner shall accept the Work and file a Notice of Completion. Final Payment shall not become due until 60 days after the Owner files a Notice of Completion and there being no liens or stop notices filed. If any lien or stop notice remains unsatisfied, the Contractor shall immediately take all steps necessary to remove all liens or stop notices before Final Payment is made. If any liens are filed or exist after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such liens, including all costs and reasonable attorneys' fees.

Waiver of Claims

13.14 The making of Final Payment shall constitute a waiver of claims by the Owner except those arising from:

.1 Liens, claims, security interests or encumbrances arising out of the Contract and unsettled;

.2 Failure of the Work to comply with the requirements of the Contract Documents; or

.3 Terms of the one-year guarantee period and special warranties required by the Contract Documents.

.4 Any of the Contractor's continuing obligations under the Contract Documents.

13.15 Acceptance of Final Payment by the Contractor, a subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 14 - TERMINATION

Termination by the Owner for Cause

14.1 The Owner may terminate all or part of the Contract if the Contractor:

.1 Persistently fails to provide enough workers or materials to properly pursue the Work as required to complete the Work within the Contract Time;

.2 Persistently fails to perform the Work in accordance with the Contract Documents including, but not limited to providing monthly updates to the schedule of Work and monthly updates to Record Drawings, or to correct or replace Defective Work when directed to do so;

.3 Fails to make payment to subcontractors or material suppliers;

.4 Becomes insolvent, commences any form of voluntary bankruptcy proceedings, has any petition or action filed against it under any bankruptcy code or law, makes a general assignment for the benefit of creditors, or if a trustee, receiver or agent is appointed under law to take charge of Contractor's property or operations for the benefit of creditors;

.5 Persistently disregards laws, regulations, rules or orders of public bodies having jurisdiction or persistently disregards the authority of the Engineer or Owner;

.6 Fails to retain a valid Contractor's license of the required class in the applicable jurisdiction; or

.7 Otherwise commits a material breach of the Contract.

14.2 When any of the above reasons exist and without prejudice to any other rights or remedies the Owner may have, and after giving the Contractor and the Contractor's Surety 7 days written notice, the Owner may terminate the employment of the Contractor and, subject to any prior rights of the Surety, the Owner may:

.1 Take possession of the site and of all material, tools and construction equipment on the site owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to paragraph 5.9; and

.3 Complete the Work by any reasonable method the Owner may select.

14.3 When the Owner terminates the Contract for cause, the Contractor shall not be entitled to further payment until the Work has been completed.

14.4 If the cost of completing the Work, including additional engineering services, attorney's fees and administrative expenses made necessary thereby, exceeds the unpaid Contract Price, the Contractor shall pay the difference to the Owner. This obligation for payment shall be binding after termination of the Contract. If the cost of completing the Work including costs for engineering, legal, and administrative services minus the Contractor's unearned overhead and profit computed in accordance with paragraphs 9.11.6 and 9.11.7, is less than the unpaid Contract Price, the difference and other consequential costs shall be paid to the Contractor.

14.5 If it has been adjudicated or otherwise determined that the Owner has erroneously or negligently terminated the Contractor for cause, then the termination shall automatically convert to a Termination by Owner for Convenience as set forth in Article 14.7

Suspension by the Owner for Convenience

14.6 The Owner, without cause, may issue written order giving the Contractor 7 days notice to suspend, delay or interrupt the Work in whole or in part. The order shall fix the dates on which the work shall cease and resume.

14.7 If a suspension, delay, or interruption of the Work ordered by the Owner for convenience causes an increase or decrease in the cost of performing the Contract, the Contract Price shall be adjusted as agreed by the Owner and the Contractor or in accordance with the method for determining the cost of changes in Article 9. The Contract Price shall not be adjusted if the Contractor's performance would otherwise have been suspended, delayed or interrupted due to causes for which the Contractor is responsible.

Termination by the Owner for Convenience

14.8 The Owner may terminate all or part of the Contract without cause by giving the Contractor 7 days

written notice. Such termination shall not prejudice any other right or remedy the Owner may have under the Contract. If the Contract is terminated without cause, the Contractor shall be paid for all work executed as of the date of termination plus reasonable termination expenses including direct, indirect and consequential costs but the Contractor shall not be paid for anticipated profit on work not performed.

Contractor May Stop Work or Terminate

14.9 If, through no act or fault of Contractor, the Work is suspended for a period of more than 90 days by the Owner or under an order of court or other public authority, or the Engineer fails to act on any Application for Payment within 30 days after it is submitted, or the Owner fails for 60 days to pay the Contractor any sum finally determined to be due, the Contractor may, upon 7 days' written notice to the Owner and the Engineer, terminate the Agreement and recover from the Owner payment for all Work performed and any expense sustained plus reasonable termination expenses. In addition and in lieu of terminating the Agreement, if the Engineer has failed to act on an Application for Payment or the Owner has failed to make any payment as aforesaid, the Contractor may, upon 7 days' written notice to the Owner and the Engineer, stop the Work until payment of all amounts then due is received. The provisions of this paragraph shall not relieve the Contractor of the obligations to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with the Owner.

ARTICLE 15 - MISCELLANEOUS

Method for Giving Notices

15.1 Written notice shall only be considered to have been given if delivered in person to the individual, partner of the partnership or joint venture, or officer of the corporation for whom intended or if sent by registered or certified mail to the address given in the Agreement unless amended by written notice. Notice to the Contractor's superintendent shall be considered notice to the Contractor. Notice to the Resident Engineer shall be considered notice to the Engineer. Notice to the Owner's Project Representative or Manager shall be considered notice to the Owner.

Rights and Remedies

15.2 Duties, obligations, rights and remedies prescribed by the Contract Documents shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed by or available under law.

Failure to Act Not a Waiver of Rights

15.3 Except as expressly provided in the Contract Documents, no action or failure to act by the Owner, Engineer, Design Engineer or Contractor shall constitute a waiver of a right afforded or duty imposed under the Contract. No such action or failure to act shall constitute approval of or acquiescence in failure to perform in accordance with the Contract Documents or any other breach of contract.

Severability of Provisions

15.4 The finding under law that any one or more provisions or any portion of a provision in the Contract Documents is invalid, unenforceable, or illegal shall not impair the validity or enforceability of any other provision or of the Contract Documents as a whole. In the case of invalidity or enforceability of any provision or portion thereof, the provision shall be rewritten and enforced to the maximum extent permitted by law to accomplish as near as possible the intent of the original provision.

Right to Audit

15.5 Maintenance, Inspection, and Audit of Records. All books, account, reports, files, correspondence, data and other records relating to this contract shall be maintained by the Contractor, its subcontractors and material suppliers and shall be subject to all reasonable times to review, inspection, and audit by the Owner, Engineer and their agents at all times during performance of the Work and for a period of five (5) years after Final Completion of the Work. Such records shall be produced by the Contractor and/or the subcontractor or Material Supplier within a reasonable time at a place designated by the Owner or Engineer, upon written notice to the Contractor.

15.5.1 Accounting System. Contactor shall exercise such controls as may be necessary for proper financial management of the Work. Such accounting and control systems shall comply with prevailing custom and practice for similar projects, be satisfactory to City and shall include preservation of records for a period of four (4) years after Final Completion, or for such longer period as may be required by Applicable Law.

15.5.2 Books and Records. Contractor shall keep, and shall require provisions to be included in all contracts entered into by subcontractors and suppliers requiring the subcontractors and suppliers to keep, full and detailed books, records, information, materials and data, of every kind and character (hard copy, as well as computer readable data if it exists), that have any bearing on or pertain to any matters, rights, duties or

obligations relating to the Project, Work or Contract, including, without limitation, agreements, purchase orders, leases, contracts, commitments, arrangements, notes, change orders, change order requests, estimates, field orders, schedules, diaries, logs, reports, shop drawings, samples, exemplars, drawings, specifications, invoices, delivery tickets, receipts, vouchers, canceled checks, memoranda; accounting records; job cost reports; job cost files (including complete documentation of negotiated settlements); backcharges; general ledgers; documentation of cash and trade discounts earned; insurance rebates and dividends and other documents relating in any way to any claims, charges or time extensions asserted by Contractor of any of the subcontractors.

15.5.3 Inspection and Copying. Contractor shall allow, and shall require provisions to be included in all contracts entered into by subcontractors allowing, Owner, Engineer and their authorized representative(s), auditors, attorneys and accountants, upon twenty-four (24) hour notice to Contractor, full access to inspect and copy all its aforestated books and records at a location designated by Owner or Engineer and within 200 miles of the Project.

15.5.4 Noncompliance by Contractor. Contractor's compliance with this Article 15.5 et seq, shall be a condition precedent to maintenance of any judicial or extra-judicial action by Contractor against Owner or Engineer. In addition to and without limitation upon Owner's or Engineer's other rights and remedies for breach, including any other provisions for withholding set forth in the Contract documents, Owner shall have the right, exercised in its sole discretion, to withhold from any payment to Contractor due under a current application for payment an additional sum of up to ten percent (10%) of the total amount set forth in such application for payment, until Contractor and the subcontractors have complied with any outstanding and unsatisfied request by City under this Article 15.5. Upon compliance with this Article 15.5, any such monies withheld shall be released to Contractor.

15.5.5 Special Enforcement by Owner or Engineer. Contractor agrees that any failure by Contractor or any subcontractor to provide access to books and records as required by this Article 15.5 et seq. shall be specifically enforceable, by issuance of a preliminary and/or permanent mandatory injunction by a court of competent jurisdiction based on affidavits submitted to such curt and without the necessity of oral testimony, to compel Contractor to permit access, inspection, audit and/or reproduction of such books and records or the require delivery of such books and records to Owner and Engineer for inspection, audit and/or reproduction.

Governing Law

15.6 The Contract shall be governed by the law of the place where the project is located.

15.7 Survival of Terms. Any indemnity, warranty or guarantee given by Contractor to Owner or Engineer under this Agreement shall survive the expiration or termination of the Agreement and shall be binding upon Contractor and their subcontractors and suppliers until any action is barred according to terms in the Agreement or by the applicable statute of limitations or statute of repose. All obligations of Contractor under this Contract shall survive the expiration or termination of this Contract.

END OF GENERAL CONDITIONS

From: Company Name
Mailing Address
City, ST Zip
Name

Page: 1 of 2
Date: _____
K/J Job No.: _____
Project Name: _____

Request for Information

Originator: _____ **Drawing Reference:** _____

Requested Date of Response: _____ **Specification Section:** _____

Written requests for information will not be considered without an accompanying completed copy of this RFI. By submission of this form the Contractor represents it has carefully reviewed the Contract Documents, coordinated the Work with the appropriate subcontractors, reviewed the field conditions and hereby certifies that the information requested cannot be determined from such efforts as required by the Contract Documents.

The Contractor requests the following information in accordance with the requirements of the Contract Documents.

Description of Requested Information

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

Contractor's Proposed Method of Resolving Issue

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

Contractor's Proposed Impact on Project

Estimated Contract Cost will be ☐increased ☐decreased ☐unchanged by: _____

Estimated Contract Time will be ☐increased ☐decreased ☐unchanged by: _____ days.

Attachments

Attach supporting documentation sufficient for Engineer to evaluate Request for Information, including documentation of field conditions. Forms submitted without adequate documentation will be returned without comment for further clarification.

Contractor's signature below signifies acceptance of responsibility for accuracy and completeness of information included in this Request for Information Form.

Authorized Signature: _____ **Title:** _____

Company: _____ **Date:** _____

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Response Date: _____ **K/J Job No.:** _____
Specification Section: _____ **Project Name:** _____
Drawing Reference: _____ **Page:** 2 of 2

Response

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

If Contractor estimates an impact on Project time or price based upon Response, submit Reply within 5 working days of receipt.

Respondent: _____ **Signature:** _____
Company: _____ **Date:** _____
Issued for Kennedy/Jenks Consultants by: _____

Contractor's Reply To Response:

Estimated Contract Cost will be □increased □decreased □unchanged by: _____

Estimated Contract Time will be □increased □decreased □unchanged by: _____ Days.

Comments

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

Distribution	RFI	Response	Reply
Owner			
Engineer			
Contractor			
File			

© K/J November 2015

From: Company Name
Mailing Address
City, ST Zip
Name

Page: 1 of 2
Submittal Date: _____
K/J Job No.: _____
Project Name: _____

Specification Section: _____ **Prior Submittal:** _____

Submittal

A. Certification of Completeness and Accuracy

We certify that we have reviewed this submittal in detail and that the submittal is:

1. Complete and accurate and in complete compliance with the Contract Documents.
2. Compliant with the requirements of "Material and Equipment" in Section 01040, especially the subparagraph titled "Compatibility of Equipment and Material".
3. Compliant with the paragraph titled "Performance Specifications and Contractor Designed Items" in Section 01040.
4. Without any deviations from the Contract Drawings, except the following (describe deviation) which have the following advantages and disadvantages:

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

Signed by Subcontractor: _____ Title: _____ Date: _____

Signed by Contractor: _____ Title: _____ Date: _____

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Response Date: _____ **K/J Job No.:** _____

Specification Section: _____ **Project Name:** _____

Page: 2 of 2

Response

Item	K/J Action	Refer to Comment	Manufacturer or Supplier	Title of Submittal / Drawing

A. The action(s) noted above have been taken on the enclosed document(s).

NET = No Exceptions Taken
MCN-N = Make Corrections Noted, No Resubmital Required
MCN-R = Make Corrections Noted, Partial Resubmital Required
A&R = Amend and Resubmit
NR = Not Reviewed
RR = Rejected, Resubmit
RA = Receipt Acknowledged

Comment(s):

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

B. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the Drawings and Specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating its work with that of all other trades, and performing its work in a safe and satisfactory manner.

_____
Responder: type name here - sign above

Distribution	Submittal	Encl.	Response
Owner			
Engineer			
Contractor			
File			

© K/J November 2015

From: Company Name
Mailing Address
City, ST Zip
Name

Page: 1 of 3
Submission Date: _____
K/J Job No.: _____
Project Name: _____

Specification Section: _____ **Prior Submittal:** _____

Proposed Equivalent

A. When the first specified item is followed by a second maker's name and "or equal," the Contractor may submit Proposed Equivalent items for the Engineer's review. Proposed Equivalent items that are in the Engineer's judgment equal to the first specified item in quality, utility, and appearance, will be Favorably Reviewed. Where a product description and first maker's name is followed by "or equal" with no second maker's name, it means the specifier knows of no equivalent product and the Contractor may submit Proposed Equivalent products by other makers for review. Where the term "or equal" is omitted, it means that the named item is required to meet the Owner's needs; no products or makers other than those specified will be considered.

B. This request shall include adequate technical information to fully describe the function and quality of the item. Submittals of Proposed Equivalent items that are not made within 35 days of the Notice to Proceed will be rejected unless the Engineer has agreed in writing to a later submittal date and the Contractor agrees to comply with all conditions of the Engineer for the late submittal. If the Contractor's second attempt to obtain Favorable Review of a Proposed Equivalent item is unsuccessful, the Contractor shall submit the first specified item.

C. Inclusion of a second maker's name indicates the maker is acceptable but does not necessarily indicate the maker offers a standard product equal to the first specified item. Items by the second named maker are subject to the same conditions of review and compatibility as other Proposed Equivalent items. Inclusion of a maker's name and/or model number after a specification description is not a representation that the maker will furnish an item meeting the Contract requirements at bid time or at time of need. It is the Contractor's sole responsibility to furnish items meeting the Contract requirements.

D. The Engineer's review of Proposed Equivalent items is based solely on information provided by the Contractor and on the Contractor's warranty that the proposed item is equal in quality, utility, function and appearance to the first specified item. Favorable Review of a Proposed Equivalent item has the same meaning and is subject to the same limitations that apply to the Favorable Review of Product Data and Shop Drawings described in the Contract Documents.

E. Submit with proposal:

1. Description of item being proposed including the Manufacturer's model number.
2. Manufacturer's representation that item is equal to or superior to specified item in all respects.
3. Manufacturer's product data.
4. Information about several recent similar installations, including project name, owner's name, address, telephone number, and name of knowledgeable person to contact for information on performance of the product.
5. Whether a reduction in the Contract Price is being proposed and, if so, how much.
6. Any differences between the product specified and the Proposed Equivalent, including the warranty.

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Submission Date:
Project Name:
Specification Section:

F. Certification of Equivalency, Completeness and Accuracy:

We certify that we have reviewed this request in detail and that the item proposed is:

1. Equal to or superior to the specified item
2. Complete and accurate and in complete compliance with the Contract Documents,
3. Compliant with the requirements of "Material and Equipment" in Section 01040, especially the subparagraph titled "Compatibility of Equipment and Material",
4. Compliant with the paragraph titled "Performance Specifications and Contractor Designed Work" in Section 01040,
5. Without any deviations from the Contract Documents, except the following (describe deviation) which have the following advantages and disadvantages:

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

We further represent and warrant to be solely responsible for any extra cost or expense necessary to make the proposed item or service fully equivalent to and compatible with the Contract Documents and meet or exceed the design intent.

If we use the Proposed Equivalent, we agree to comply with all additional requirements imposed upon us by the Engineer and Owner.

Signed by Subcontractor: _____ Title: _____ Date: _____

Signed by Contractor: _____ Title: _____ Date: _____

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Response Date: _____ **K/J Job No.:** _____

Specification Section: _____ **Project Name:** _____

Page: 3 of 3

Response

Item	K/J Action	Refer to Comment	Manufacturer or Supplier	Title of Submittal / Drawing / Information

A. The action(s) noted above have been taken on the enclosed document(s).

NET = No Exceptions Taken A&R = Amend and Resubmit NR = Not Reviewed
MCN = Make Corrections Noted RR = Rejected, Resubmit

Comment(s):

Delete or replace this text with your response. Space is limited; attach additional sheets if necessary.

B. Corrections or comments made on the submittal during this review does not relieve the Contractor from compliance with the requirements of the Drawings and Specifications. This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for: confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating its work with that of all other trades, and performing its work in a safe and satisfactory manner.

_____
Responder: type name here & sign above

Distribution	Proposed Equivalent	Encl.	Response
Owner			
Engineer			
Contractor			
File			

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Application for Payment and Engineer's Recommendation No.: 9999 **Kennedy/Jenks Consultants**

To:	Name MailingAddress CityStateZip	**Date:** **K/J Job No.:** **Project:** **Contract Date:** **Period To:**	Date 000000.00 ProjectName Date Date	**Distribution to:**	
Attn:	Name			☐	Owner
From:	ContractorName Mailing Address CityStateZip	**Reviewed By:**	Kennedy/Jenks Consultants, Inc. MailingAddress CityStateZip	☐ ☐	Engineer Contractor
Prepared By:	Name	**Recommended By:**	Name	☐ ☐	Architect _____

Contractor's Application for Payment

1. Original Contract Sum	
2. Net Change by Change Orders	
3. Contract Sum To Date (Line 1 ± 2)	
4. Total Completed & Stored to Date (Column G on Page 2)	
5. Retainage:	
a. _____ % of Completed Work (Column D + E)	
b. _____ % of Stored Material (Column F)	
Total Retainage (Lines 5a + 5b or Total in Column I)	
6. Total Earned Less Retainage (Line 4 less Line 5 Total)	
7. Less Previous Payments (Line 6 from prior Applications)	
8. Current Payment Due (Line 6 less Line 7)	
9. Balance to Finish, Including Retainage (Line 3 less Line 6)	

Change Order Summary	Additions	Deductions
Total Changes approved by Owner in previous months		
Total approved this month		
Totals		
Net Changes by Change Order		

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief, the Work covered by this Application for Payment has been completed in accordance with the Contract Documents and that all Work for which previous payments have been received is free and clear of liens, claims, security interests or encumbrances of any kind. The Contractor further warrants that title to all Work covered by this Application for Payment will pass to the Owner no later than the time of payment.

By: _____ Date: _____
Contractor

State of: _____ County of: _____
Subscribed and sworn to before me this _____ day of _____

Notary Public: _____

My Commission expires: _____

Engineer's Recommendation for Payment: In accordance with the Contract Documents, the Engineer recommends to the Owner that the Contractor is entitled to payment in the amount recommended, subject to withholds, deductions or credits pursuant to the Contract Documents.

Amount Recommended..... _____

By: _____ Date: _____
Kennedy/Jenks Consultants, Inc.

This Certificate is not negotiable. The amount recommended is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

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Continuation Sheet

Kennedy/Jenks Consultants

Contractor's signed certification is attached. In tabulations below, amounts are stated to the nearest dollar. Use Column I on Contracts where variable retainage for line items may apply.

Application No.: #REF!
Application Date: #REF!
Period to: #REF!
K/J Job No.: #REF!

A	B	C	D	E	F	G		H	I
			Work Completed						
Item No.	Description of Work	Scheduled Value	From Previous Application (D+E)	This Period	Materials Presently Stored (not in D or E)	Total Completed and Stored to Date (D+E+F)	% (G÷C)	Balance to Finish (C-G)	Retainage (if variable rate)
Grand Totals									

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DOCUMENT NUMBER 00800

SUPPLEMENTARY CONDITIONS

The following supplementary conditions change portions of Document Number 00700, General Conditions, as noted. When any provision is changed, the unaltered provisions shall remain in effect.

SC-3.4 Insert the following sentence between the first and second sentences in paragraph 3.4.

"Existing service laterals and appurtenances may not be shown and shall be located by the Contractor based on the presence of other visible facilities such as buildings, meter boxes, valve boxes, junction boxes and similar features."

SC 4.3.4 Delete paragraph 4.3.4(d)(viii).

SC 5.4 Add the following paragraph as an additional paragraph to 5.4:

The Contractor acknowledges to and for the benefit of the City of San Fernando ("Purchaser") and the State of California that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

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SC 5.36 Furnishing of Electronic Certified Payroll Records to Labor Commissioner

All contractors and subcontractors must furnish electronic certified payroll records directly to the Labor Commissioner (aka Division of Labor Standards Enforcement). The phase-in timetable for this requirement is as follows:

1. June 20, 2014 [immediate]: Any project that was being monitored by the CMU/Labor Commissioner prior to the adoption of SB 854 will continue to be monitored by the Labor Commissioner afterward; and the contractors on those projects must continue to furnish certified payroll records to the Labor Commissioner until the project is complete.

2. April 1, 2015: For all new projects awarded on or after this date, the contractors and subcontractors must furnish electronic certified payroll records to the Labor Commissioner.

3. Anytime: For projects besides those listed above, the Labor Commissioner may at any time require the contractors and subcontractors to furnish electronic certified payroll records.

4. January 1, 2016: The requirement to furnish electronic certified payroll records to the Labor Commissioner will apply to all public works projects, whether new or ongoing.

SC 8.2 Omit the period at the end of the second sentence of paragraph 8.2 and add:

"... unless the item or system is included on the Base Bid Equipment and Systems List in which case Equipment and Systems by alternate makers proposed by the Contractor will be considered at the sole option of the Owner. If alternate equipment or systems are accepted, the Contract Price will be adjusted by Change Order in an amount equal to the difference in price quoted by the Contractor on the Base Bid Equipment and Systems List.

SC 10.1 Add the following at the end of existing paragraph 10.1.

"Claims by the Contractor for $375,000 or less shall be resolved in accordance with California Public Contract Code Section 20104-20104.6 which is incorporated herein in full. The timing provisions for making and responding to Claims under Section 20104-20104.6 are summarized in the following subparagraphs 10.1.1 through 10.1.7.

1. All claims and responses to claims shall be in writing and shall be fully documented in accordance with General Conditions paragraph 10.2
2. The Owner will respond to Claims of $50,000 or less within 45 days of receipt or may request additional information supporting or refuting the Claim within 30 days of receipt in which case the Owner will respond within the greater of 15 days after receipt of additional information or a period equal to the time taken by the Contractor to furnish additional information.
3. The Owner will respond to Claims of $375,000 or less but greater than $50,000 within 60 days of receipt or may request additional information supporting or refuting the Claim within 30 days of receipt in which case the Owner will respond within the greater of 30 days after receipt of additional information or a period equal to the time taken by the Contractor to furnish additional information.
4. If in either size of claim described above more information is required after the additional information was first requested and furnished, it shall be

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requested and provided pursuant to Public Contract Code Sections 20104-20104.6 and upon mutual agreement of the Owner and the Contractor.

5. If the Contractor disputes the Owner's response or the Owner fails to respond within the time prescribed, the Contractor may, within 15 days of receipt of the Owner's response or within 15 days of the time prescribed for the Owner's response, demand an informal conference to meet and confer for settlement of the issues in dispute. Upon such a demand the Owner shall schedule a meet and confer conference with the Contractor within 30 days for settlement of the dispute. Mediation pursuant to paragraph 10.6 shall satisfy this requirement.
6. If following the meet and confer conference the claim or any portion remains in dispute, the Contractor may file a claim pursuant to Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code. For purposes of those provisions, the running of the period within which a claim must be filed shall be tolled from the time the Contractor first submits its written claim pursuant to this provision until the time that the claim is denied, including any time utilized by the meet and confer process.
7. Public Contract Code Section 20104.4 establishes procedures for civil actions filed to resolve claims subject to this Section. These procedures include mandatory submission of the matter to nonbinding arbitration followed, if necessary, by mandatory submission to judicial arbitration.

"Claims for more than $375,000 shall be resolved in accordance with General Conditions paragraphs 10.2 through 10.5. Arbitration shall not be used to resolve such claims without the express written agreement of both parties except as required by law."

SC-15.7 Add a new paragraph

"**Assignment of Antitrust Claims**

15.7 The Contractor offers and agrees to assign to the Owner all rights, title and interest in and to causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Section 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 purchasing of goods, services or materials pursuant to this Contract. This assignment shall be made and become effective at the time the Owner tenders final payment to the Contractor, without further acknowledgment by the parties."

END OF SUPPLEMENTARY CONDITIONS

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SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The project includes the replacement of an existing 1.0 MG circular concrete reservoir as shown in the contract drawings. This includes but is not limited to site grading; construction of driveways and walkways; demolition of existing reservoir structure; removal of existing sump pump and damaged electrical; installation of new sump pumps; modifications to several existing structures; construction of a new reservoir tank; construction of a new valve vault, offsite construction of modifications to existing in street water mains near Hubbard Street pump station and at the intersection of Foothill and Hubbard; together with associated site work, fencing, water systems piping, electrical work, instrumentation, painting, landscaping and demolition. Project earthwork is unbalanced and requires disposal of unsuitable material and importation of suitable material for engineered fill. Reservoir 3A vents are required to be covered of any debris during construction.

B. The Contractor is advised that the Owner is NOT providing an area for the Contractor's storage, laydown, trailers and parking. The Contractor is responsible to obtain, and maintain, the area(s) for this purpose.

1.02 OWNER-FURNISHED AND INSTALLED ITEMS (N.I.C.)

A. None.

1.03 OWNER-FURNISHED CONTRACTOR INSTALLED ITEMS (O.F.C.I.)

A. None.

1.04 WORK SEQUENCE

A. General Requirements. The City of San Fernando Upper Reservoir is a critical source of drinking water for the area. The Contractor is to conduct work such that the Owner's ability to meet its customer demands for water shall not be impaired or reduced in terms of the required quantity and quality of water. To this end, the adjacent L-shaped Reservoir is be kept in service at all times.
   1. The Contractor is to employ personnel knowledgeable and experienced in reservoir construction.
   2. Work Sequence and Constraints described hereinafter are critical events in work sequence which are presented to underscore the importance of proper sequencing, scheduling and coordination so that it is integrated with the existing L-shaped reservoir. The work sequence and constraints presented do not describe all items affecting the completion of the Work, but are intended to describe important events necessary to minimize disruption of the existing facilities.
   3. It is the Owner's intent that the adjacent reservoir can be maintained in service while connections are made to its inlet and outlet pipelines (16-inch inlet and 20-inch outlet, respectively). Connection to the 16-inch inlet will require that the 20-inch outlet be temporarily modified to function both as inlet

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and outlet by temporarily disabling the check valve located in the reservoir's interior outlet vault. Once that connection is completed and returned to service the 16-inch inlet must be modified to operate and both inlet and outlet. This will require the flap gate on the end of the inlet inside the reservoir must be temporarily disabled.

4. The existing facility where Contractor's work is to be done will be occupied by the Owner throughout the construction period. The Contractor shall provide all necessary access to the Owner's personnel as required to safely and efficiently operate/maintain the facilities. At all times during the Contract duration, the Contractor is to provide the Owner's personnel and representatives safe and immediate access to all control equipment.
5. The Work shall be bid, scheduled and constructed in such a manner as to result in the least possible disruption to the operations and staff of the existing facility. Modifications that affect or may affect the operation of the facility shall not be made without first obtaining written permission from the Engineer.
6. The Contractor shall note that not all valves and gates that may be used to isolate lines and facilities will completely seal. The Contractor shall allow for leakage in planning its work and may, with the Owner's concurrence, test certain valves and gates before work involving isolation is begun. The Contractor shall clean the work areas as required to perform the work. Shutdown and isolation of existing facilities by closing existing valves/gates and operating electrical control panels, or as specifically provided for in the Contract Documents, will be performed by Owner personnel.
7. Prior to any shutdown or flow diversion all materials, fittings, supports, equipment and tools shall be on the site and all necessary skilled labor scheduled prior to starting any connection work. The Contractor shall provide staff following shutdowns to monitor and ensure the proper operation of systems.
8. The Contractor is advised that any shutdown of facilities will place a considerable burden on the Owner's staff before, during and after the shutdown. If through inadequate planning, lack of preparedness, faulty or inefficient workmanship or other causes controllable by the Contractor, delays, excessive time, or additional shutdowns are required that cause the Owner to incur extra cost, said extra cost will be assessed against the Contractor.
9. The Contractor shall note that only certain structures, tie-ins and constraints are addressed in this Section. All work, whether or not addressed here, shall be governed by applicable parts of this Section, and schedules and procedures further submitted for approval.

1.05 CONTRACTOR'S USE OF SITE AND OWNER'S CONTINUED OPERATIONS

A. The Contractor shall confine its use of the site for work and storage to the Work Area Limits shown on the Contract Drawings. The Contractor's use of adjacent lands and roads for access to move onto and off the site and for daily access of workers, material and equipment shall be arranged and scheduled to minimize interference with the Owner's continued operations.

B. The Owner intends to continue operation of portions of its existing facility during all or most of the construction period. The Contractor shall plan and schedule its work to minimize impacting the Owner's continued operations and shall, at all times, maintain safe access for the Owner's operating personnel and equipment. The

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Contractor shall provide safe access for Owner’s staff to the existing L-shaped reservoir.

C. The Contractor shall be responsible for maintaining safe emergency exiting for the Owner's and Contractor's personnel in all areas affected by the Contractor's work.

D. If operation of the Owner's existing facility is adversely affected by the Contractor's work, the Owner may suffer a financial loss and may make a claim against the Contractor to recovery its loss.

1.06 DOCUMENTING EXISTING

A. Prior to commencing the Work, tour the site with the Owner and the Engineer. Examine and document photographically and in writing the condition of existing buildings, equipment, improvements, and landscape planting on or adjacent to the site. This record shall serve as a basis for determination of subsequent damage due to the Contractor's operations and shall be signed by all parties making the tour. Record existing conditions by making a minimum of 100 digital color photographs and a video showing all areas that may be affected during the Work. Provide two (2) 4x6 prints of each exposure and a CD with digital photos. Provide video on a VCR tape or DVD.

1.07 SHUTDOWN OF EXISTING UTILITIES, SERVICES OR OPERATIONS

A. Obtain the Engineer's approval at least seven (7) days prior to the shutdown of any utility, service or operation of any existing facility. Give required notice and make appropriate arrangements with utility owners and other affected parties prior to shutdown of any utility service.

B. Obtain the Engineer’s approval at least seven (7) days prior to the modifications described in 1.04 – 3 above.

C. Schedule utility service or operations shutdowns for periods of minimum use and at the Owner's convenience. Have all required material, equipment and workers on site prior to beginning any work involving a possible shutdown. Perform work as required to reduce shutdown time to the minimum. In some cases, this may require increased numbers of workers and/or premium time night or weekend work. Power is to be operational throughout project for SCADA alarms and sensors for Reservoir 3A.

D. The Contract Price shall include the cost of additional workers and premium time work required to minimize the impact of utility service or operations shutdowns. If premium time work is required the difference in cost between performing the work during normal working hours and premium time will be covered by a Change Order.

1.08 SHUTDOWN OF EXISTING RESERVOIR 3A

A. New Tee Connections to the existing inlet and outlet pipelines to and from Reservoir 3A are required before the contractor will be allowed to take the existing circular reservoir, Reservoir 4. out of service, demolished and replaced.

B. The contractor is advised that approved shop drawings for the Tee, Valves and fittings will be required before the reservoir shutdown is scheduled. Contractor to provide three (3) working days notice to the city indicating that all equipment is available, Tees, valves and fittings have been delivered and that the connection locations have been excavated and the existing pipe is ready for modifications. The

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contractor will be allowed five (5) working days to complete the connections so Reservoir 3A can be returned to service.

C. Procedure to install Tees and isolation valves on existing inlet and outlet lines from Reservoir three (3) work days for City to isolate the reservoir by closing inlet and outlet valves
   1. Procedure when existing isolation valves hold
      a. Shut 4 isolation valves (to be completed by City crews)
         1) tank outlet (inside tank-valve operator on roof of tank)
         2) Tank inlet (at east wall of tank)
         3) Two valves at Tee in Foothill Blvd
   2. Outlet Pipe
      a. Drain 20-inch outlet using the existing pipeline blowoff in Foothill Blvd.
      b. Cut existing 20-inch ML&C steel pipeline and install Tee (20 x 20) with isolation valves, the valve on the side outlet should have a blind flange mounted for future removal and connection to new outlet from new tank
      c. Weld buttstraps
      d. Mortar line at buttstrap locations and patch mortar coating for continuous covering
   3. Inlet Pipeline
      a. There will still be water in the 16-inch line above the Tee location, so the line will have to be drained to a level below the proposed cut in of the Tee.
      b. Hot tap the 16 inch pipeline with 1” fitting and valve on pipe below centerline of inlet of the new Tee
      c. Drain existing pipeline into hose fitting, once flow stops drain outlet into trench and pump out
      d. Cut existing line and install Tee and new isolation valves, the valve on the outlet side of the Tee will have a blind flange mounted for future
      e. Weld buttstraps
      f. Mortar line at buttstrap locations and patch mortar coating as required
   4. Return tank to service.

D. The process of draining the tank will not commence until the contractor has submitted shop drawings for the new Tees. Valves and buttstraps needed for the installation and the submittals have been approved. Schedule with the city the time for the work, note that the city will require Twenty one (21) calendar days advance notice to drain the reservoir. Once drained, the procedure is:
   1. Procedure when existing isolation valves do not hold
      a. Contractor requests reservoir drain by City when all required equipment and materials are available
      b. Shut 2 isolation valves (to be completed by City crews)
         1) Two valves at Tee in Foothill Blvd
   2. Outlet Pipeline
      a. Drain 20-inch outlet using the existing pipeline blowoff in Foothill Blvd.
      b. Cut existing 20-inch ML&C steel pipeline and install Tee (20 x 20) with isolation valves, the valve on the side outlet should have a blind flange mounted for future removal and connection to new outlet from new tank
      c. Weld buttstraps
      d. Mortar line at buttstrap locations and patch mortar coating for continuous covering
   3. Inlet Pipeline

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a. There will still be water in the 16 inch line above the Tee location, so the line will have to be drained to a level below the proposed cut in of the Tee.
b. Hot tap the 16 inch pipeline with 1’ fitting and valve on pipe below centerline of inlet of the new Tee
c. Drain existing pipeline into hose fitting, once flow stops drain outlet into trench and pump out
d. Cut existing line and install Tee and new isolation valves, the valve on the outlet side of the Tee will have a blind flange mounted for future
e. Weld buttstraps
f. Mortar line at buttstrap locations and patch mortar coating as required

4. Return tank to service.

1.09 REGULATORY REQUIREMENTS

A. The codes and regulations together with local amendments when applicable adopted by the State and other governmental authorities having jurisdiction shall establish minimum requirements for this project. This project shall comply with the following:
1. California Building Code (CBC) 2019 Edition.
2. International Fire Code (IFC) 2018 edition
3. International Mechanical Code (IMC) 2018 edition
4. California Fire Code (CFC) 2019 edition
5. California Mechanical Code (CMC) 2019 edition
6. California Electric Code (CEC) 2019 edition
7. California Energy Code 2019 edition

B. The latest edition of the requirements in effect at the date of submission of bids shall apply.

C. General Conditions paragraph 5.11 covers the Contractor's responsibility to comply with laws and codes applicable to Means and Methods for performing the Work.

D. General Conditions paragraph 5.14 covers the Contractor's responsibility to report code deficiencies in the design to the Engineer prior to proceeding with the Work.

E. Paragraphs addressing Pre-Engineered Systems and Performance Specifications in other Sections cover the Contractor's responsibility to comply with code requirements when (1) performance specifications are used to describe all or portions of Work or items and (2) when pre-engineered (contractor designed) systems are specified.

F. In cases where the Contract Documents are more restrictive than applicable codes, the Contractor shall comply with the Contract Documents.

1.10 REFERENCE STANDARDS

A. When these specifications state that Work or tests shall conform to specific provisions in a referenced standard, specification, code, recommendation or manual published by an association, organization, society or agency the referenced provisions, as they apply to the Work of the Contractor only shall be considered a part of these specifications as fully as if included in total. When these specifications or applicable codes contain higher or more restrictive requirements than those contained in reference standards these specifications or applicable codes shall govern.

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B. The latest edition of a referenced standard published at the time of submission of bids shall apply unless a specific date for the referenced standard is cited in these specifications.

C. General provisions in referenced standards, specifications, manuals or codes shall not change the specific duties and responsibilities between any of the parties involved in this work from those described in the General Conditions. Provisions in referenced standards with regard to measurement and payment shall not apply to this Work unless specifically cited. See General Conditions paragraph 2.3.

1.11 SPECIFICATION LANGUAGE AND STYLE

A. Many parts of the Specifications as well as notes on the Drawings are written in the active voice and are addressed to the Contractor.
   1. When words or phrases requiring an action or performance of a task are used, it means that the Contractor shall provide the action or perform the task. For example: provide, perform, install, furnish, erect, connect, test, operate, adjust or similar words mean that the Contractor shall perform the action or task referred to.
   2. When words or phrases requiring selection, acceptance, approval, review, direction, designation or similar actions are referred to, it means that such actions are the Owner's or the Engineer's prerogative and that the Contractor must obtain such action before proceeding.

B. Requirements in the Specifications and Drawings apply to all work of a similar type, kind or class even though the word "all" or "typical" may not be stated.

1.12 DEFINITIONS

A. The following terms, when used in the Contract Documents, shall have the meanings listed:

ACCEPTABLE	"acceptable to the Engineer"
PERFORM	"perform all operations required to complete the work referred to in accordance with the intent of the Contract Documents"
PROVIDE	"furnish and install the work referred to including proper anchorage, connection to required utilities or other work, testing, adjustment and startup ready to put in service and perform the intended function"
REQUIRED	"required by the Contract Documents or required to complete the Work and produce the intended results"
SATISFACTORY	"acceptable to the Engineer"
SHOWN	"as indicated on the Drawings"
SITE	"geographical location of the Project and land within the work area shown on the contract drawings and within which the Work will be installed or built"
SPECIFIED	"as written in the Contract Documents including the Specifications and the Drawings"
SUBMIT	"submit to the Engineer"

1.13 ABBREVIATIONS

A. The following acronyms or abbreviations are used in these specifications for the organizations listed.

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Abbreviation	Stands for
AASHTO	American Association of State Highway and Transportation Officials
AAMA	Architectural Aluminum Manufacturers Association
ABMA	American Boiler Manufacturers Association
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AI	Asphalt Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standard Institute (formerly United States of America Standards Institute)
APA	American Plywood Association
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
CAGI	Compressed Air and Gas Institute
CAL/OSHA	State of California Department of Industrial Relations, Division of Industrial Safety
CAL TRANS	California Department of Transportation
CBC	California Building Code
CBM	Certified Ballast Manufacturers
CBR	California Bearing Ratio
CEC	California Energy Code
CI	Chlorine Institute
CISPI	Cast Iron Soil Pipe Institute
CMAA	Crane Manufacturers Association of America
CPSC	Consumer Products Safety Commission
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards for the U.S. Department of Commerce
CTI	Cooling Tower Institute
DFPA	Douglas Fir Plywood Association
EIA	Electronic Industries Association
EPA	U.S. Environmental Protection Agency
ETL	Electronic Testing Laboratory
FM	Factory Mutual Insurance Company
FPS	Fluid Power Society
FS	Federal Specifications
GO 95	General Order No. 95, California Public Utilities Commission Rules for Overhead Electric Line Construction

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Abbreviation	Stands for
GO 128	General Order No. 128, California Public Utilities Commission Rules for Underground Electrical Construction
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
IAPMO	International Association of Plumbing and Mechanical Officials
IBC	International Building Code
ICBO	International Conference of Building Officials
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IFC	International Fire Code
IGCC	Insulating Glass Certification Council
IMC	International Mechanical Code
IPCE	International Power Cable Engineers Association
ISA	Instrument Society of America
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NCPI	National Clay Pipe Institute
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NGVD	National Geodetic Vertical Datum
NSF	National Sanitation Foundation
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Act
PCA	Portland Cement Association
REA	Rural Electrification Administration
SAMA	Scientific Apparatus Makers Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Structural Steel Painting Council
TCA	Tile Council of America
UBC	Uniform Building Code
UFC	Uniform Fire Code
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
USDC	U.S. Department of Commerce
UL	Underwriters Laboratories
WCLIB	West Coast Lumber Inspection Bureau
WIC	Woodwork Institute of California
WQCB	Water Quality Control Board (Regional)
WRCB	Water Resources Control Board

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01040

COORDINATION AND PROJECT REQUIREMENTS

PART 1 - GENERAL

1.01 PROJECT COORDINATION

A. Coordinate scheduling, submittals and work of various Sections of the Specifications and subcontractors to assure efficient and orderly sequence of interdependent construction. Coordinate construction scheduling with plant and utility shutdowns with requirements and limitations in Section 01010.

1.02 MECHANICAL AND ELECTRICAL/CONTROLS COORDINATION

A. The Contractor's superintendent or a specially assigned assistant shall be designated the mechanical/electrical/controls coordinator and shall coordinate the exact location, space priorities and sequence of installation of all mechanical and electrical/controls work with each other and with all other trades. The mechanical/electrical/controls coordinator shall assure compliance with the requirements of this paragraph entitled "Mechanical and Electrical/Controls Coordination".

B. The location of mechanical and electrical/controls work may be indicated diagrammatically on the Drawings. Actual locations shall follow locations shown on the Drawings as closely as practicable, but shall be altered or adjusted in the field by the mechanical/electrical/controls coordinator as required by the following:
   1. In finished spaces install mechanical and electrical/controls work concealed within the space available.
   2. Organize mechanical and electrical/controls work to make efficient use of space. Combine similar items into groups; make all runs parallel to or at right angles with building lines.
   3. Layout and install work to provide adequate space and access for adjustment, servicing, and maintenance and maximize space available for future installation of additional services or replacement of existing services.
   4. Assure that all access hatches required by code or required for adjustment, servicing or maintenance are provided in accordance with Section 08307. Locate access doors to provide convenient access and to coordinate with finished visual elements.
   5. Coordinate location of fixtures, registers, grills, outlets, switches, panelboards, pullboxes, access doors, and other exposed mechanical and electrical items with functional and visual elements. Verify location of questionable items with Engineer before proceeding.

C. Prepare large-scale coordinated detailed installation drawings showing the work of all affected trades to coordinate the actual installed location of all equipment and of all mechanical and electrical/controls work for all areas. Review coordination drawings with Engineer and all affected trades before proceeding.

D. Review Shop Drawings and Product Data prior to submission for the Engineer's Review to assure that physical characteristics and service requirements are compatible with contract requirements, field conditions, and other items submitted.

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E. Verify that required services such as electrical power characteristics, control wiring, and utility requirements of items and equipment submitted and furnished are compatible with services provided. Notify Engineer of potential problems prior to ordering items or equipment and prior to installing services or completing construction in areas where services would have to be installed.

F. Schedule installation sequence of various elements of mechanical and electrical/controls work to achieve optimum compliance with requirements under Mechanical and Electrical/Controls Coordination in this Section.

G. Conduct regular weekly coordination meetings with affected trades and Engineer to establish and maintain coordination and resolve conflicts or disputes.

1.03 CUTTING, FITTING, AND PATCHING

A. Provide cutting, fitting, or patching required to complete the Work and to make all of its parts fit together properly. Include cutting, fitting, and patching required to:
   1. Fit the several parts together and to integrate with other work.
   2. Uncover work to install or correct ill-timed work.
   3. Provide openings in elements of work for penetrations of mechanical and electrical work.
   4. Remove and replace defective and non-conforming work.
   5. Remove samples of installed work for testing.

B. Request guidance from the Engineer prior to beginning cutting or altering construction, which affects:
   1. Structural integrity of any element.
   2. Functional performance of any element.
   3. Integrity of weather-exposed or moisture-resistant elements.
   4. Efficiency, maintenance, or safety of elements.
   5. Visual qualities of sight-exposed elements.
   6. Work by Owner or separate contractor.

C. Execute cutting and patching using workers that specialize in and are skilled in installing the type of work being cut or patched.

D. Perform work in accordance with the Contract Documents or in the absence of specific requirements comply with best trade practice for the work involved.
   1. Execute work by methods that will avoid damage to other work.
   2. Provide proper support and substrates to receive patching and finishing materials.
   3. Cut concrete materials using masonry saw or core drill. Locate all reinforcing steel, conduits and pipes with electronic detecting devices prior to cutting or core drilling existing concrete.
   4. Replace or patch work with new materials meeting the requirements of these specifications or if not specified matching materials and finishes of existing or adjacent work.
   5. Cut wall, ceiling and floor finishes to fit snugly around pipes, sleeves, ducts, conduit, and other penetrations. Provide fire and/or acoustical caulking as required by code or conditions of use.
   6. Maintain integrity of wall, ceiling, or floor construction; completely seal voids against smoke, fire and water.
   7. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.
   8. Report any hazardous or unsatisfactory conditions to the Engineer.

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1.04 ALTERATION PROJECT PROCEDURES

A. Plan, schedule and perform alteration work as required to minimize impacting the Owner's continued operations. See Section 01010 paragraph titled "Contractor's Use of Site and Owner's Continued Operations."

B. The existing L-shaped reservoir must remain in operation during construction. Reservoir 3A vents shall be covered with screening. Schedule utility interruptions, piping connections, and interruption of existing plant operations as required to permit continued compliance with regulatory requirements and to meet Owner's flow and processing requirements.

C. Perform cutting, fitting, and patching in accordance with provisions in other paragraphs of this Section. Where new work abuts or aligns with existing work, perform a smooth even transition. When a smooth unnoticeable transition is not feasible cut existing surfaces along a straight line at a natural dividing point and provide a groove or cover plate as recommended by the Engineer.

D. Provide new construction in accordance with the technical specifications or if not specified provide new construction matching adjacent or similar existing work in material and finish.

1.05 CONNECTIONS TO UNDERGROUND UTILITIES, CONDUITS, OR PROCESS PIPING

A. Obtain best available current information on location, identification and marking of existing utilities, piping and conduits and other underground facilities before beginning any excavation. In areas where utilities participate in DigAlert for projects in Southern California, contact 1-800-227-2600 for information at least 48 hours in advance of beginning work. Give Engineer 24 hours notice before beginning work.

B. The location of existing utilities and underground facilities known to the Design Engineer are shown in their approximate location based on information available at the time of preparing the Drawings. The actual location, size, type and number of utilities and underground facilities may differ from that shown and utilities or underground facilities may be present that are not shown. See General Conditions Article 3 for the Contractor's responsibilities and for differing conditions that warrant a change in Contract Price.

C. Use extreme care when excavating or working in areas that may contain existing utilities, process piping, conduits or other underground facilities. Use careful potholing, hand digging and probing to determine the exact location of underground installation. Some locations contain multiple pipes or conduits. Prior to performing any subsurface work, investigate, determine and prepare a plan to turn off or disconnect each utility believed to be in the within 100 feet of the subsurface work in the event of an accidental breach of a utility conduit.

D. Where connections to existing utilities or other underground facilities is required or where new piping or conduits may cross or interfere with existing utilities or underground facilities, carefully excavate and uncover existing installations to a point 1 foot below the pipe or conduit to determine the actual elevation and alignment. Call the Engineer's attention to differing existing conditions that may require a clarification or change.

E. Shutdown of existing utilities, services or operations shall be done in accordance with Section 01010.

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1.06 FIELD ENGINEERING AND LAYOUT

A. See General Conditions, Article 3.9 regarding reference points provided by Owner.

B. General Conditions, Article 3.10 requires the Contractor to accurately layout the Work including the corners of buildings and other structures and the elevation of every floor, deck, roof, tank bottom, and channel.

C. Employ a Land Surveyor or Civil Engineer to establish and verify the elevation of all elements affecting the hydraulic gradient of the facility including: Invert of all piping, tank bottoms, weirs, overflows and tank tops. Use recognized engineering surveying methods and documentation techniques.

1.07 PRECONSTRUCTION MEETING

A. Prior to beginning the Work, the Contractor and its key personnel and Subcontractors including the Contractor's Superintendent, Project Manager, and Field Engineer shall attend a meeting with the Owner and the Engineer to discuss the following:
   1. Name, Authority, and Responsibilities of Parties Involved
   2. Project Procedures:
      a. Progress meetings
      b. Correspondence
      c. Notification
      d. Submittal of Product Data, Shop Drawing Samples, and Proposed Equivalents
      e. Requests for Information
      f. Response to Requests for Information
      g. Requests for Quotation
      h. Work Directive Change
      i. Change Orders
      j. Engineer's "Items of Concern List"
      k. Application for Payment
   3. Temporary Schedule and Contractor's Construction Schedule
   4. Temporary Facilities and Control
   5. Testing During Construction
   6. Contractors Coordination
   7. Mechanical/Electrical Coordination
   8. Maintenance of Record Drawings
   9. Owner Provided Items or Work and Owner Furnished Contractor Installed items
   10. Early Beneficial or Partial Occupancy
   11. Final Testing, Startup, and Balancing
   12. Punch Lists and Project Closeout Procedures
   13. Final Deliverables including Record Drawings, Operation and Maintenance Manuals, and Special Guarantees.

1.08 PROGRESS MEETINGS

A. The Engineer will conduct bi-weekly progress meetings with Contractor and Owner at job site. Attendance required by Contractor's project manager, superintendent and affected Subcontractors and suppliers. The Engineer will prepare, maintain, and distribute agenda and dated record of: (1) actions required and taken and (2) decisions needed and made.

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B. Agenda:
   1. Review critical items/action list.
   2. Review work progress. Compare actual progress with planned progress shown on Contractor's rolling three-week and CPM Construction Schedule. Discuss corrective action required. Compare actual and projected progress with Contractor's CPM Construction Schedule, propose methods to correct deficiencies.
   3. Review status of Submittals; review delivery dates and delivery dates for critical items.
   4. Review coordination problems.
   5. Schedule needed testing and critical inspections.
   6. Review critical requirements for each trade or major piece of equipment prior to beginning work or installation.
   7. Discuss Contractor Quality Control.
   8. Discuss open items on Engineer's "Items of Concern List."
   9. Discuss impact of proposed changes on progress Schedule.
   10. Other business.

1.09 PERFORMANCE SPECIFICATIONS AND CONTRACTOR DESIGNED WORK

A. Work under this Contract may be specified by a combination of descriptive, performance, reference standard and proprietary specifications. In the event of conflict between any of the various specification methods used to specify a single item the order of precedence shall be the order in which the methods are listed in the preceding sentence. The terms used to describe types of Specifications are taken from the Construction Specification Institute (CSI) Handbook of Practice.

B. Where Specifications are used to define the characteristics of Contractor designed systems, items or components, the Contractor shall be fully responsible to design, engineer, manufacture, and install the systems, items and components to meet the specified functional requirements, performance requirements, quality standards, durability standards and conditions of use as well as all applicable codes, regulations and referenced trade or industry standards. The Contractor shall perform such design by employing engineers licensed in the State in which the Work is being constructed. The Contractor's design submittals shall include calculations and assumptions on which the design is based and shall be stamped and signed by appropriately licensed engineers.

C. In accordance with General Conditions paragraph 8.13, the Owner and the Engineer shall have the right to rely on the expertise and professional competence of the Contractor's design. Favorable review of the Contractor's design submittal shall not relieve the Contractor from full responsibility for the adequacy of the Contractor's design.

1.10 MATERIAL AND EQUIPMENT

A. General:
   1. Verify that products delivered meet requirements of Contract Documents and the requirements for Favorably Reviewed submittals.

B. Compatibility of Equipment and Material:
   1. Similar items, equipment, devices or products furnished under a single specification section shall all be made by the same maker and have interchangeable parts.

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2. In addition, but only if so stated in each affected Specification Section, similar items furnished under two or more Specification Sections shall be made by the same maker and have interchangeable parts.
3. All similar materials or products that are interrelated or used together in an assembly shall be compatible with each other.

C. Transportation and Handling:
1. Transport and handle products in accordance with manufacturer's instructions.
2. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
3. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. Storage and Protection:
1. Store and protect products in accordance with manufacturer's instructions. Seals and labels shall be intact and legible.
2. Store moisture-sensitive products including finish woodwork, gypsum products, acoustical products, motors, electrical equipment, instruments and controls in weather-tight, humidity- and temperature-controlled enclosures.
3. For exterior storage of fabricated products, place items on sloped supports, aboveground.
4. Cover products subject to deterioration from moisture, dust, or sunlight with opaque watertight but breathable sheet covering. Provide ventilation to avoid condensation.
5. Provide offsite storage and protection including insurance coverage when site does not permit onsite storage or protection.
6. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
7. Provide facilities, equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
8. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

E. Installation Standards and Manufacturers' Recommendations:
1. Install all products and materials in strict compliance with the most restrictive of the following:
a. The manufacturer's or provider's written instructions or recommendations. Follow step-by-step installation procedures.
b. Recommendations of referenced trade associations or standards.
c. The Contract Specifications and Drawings.
2. Where conflicts exist, present alternatives with advantages and disadvantages to Engineer for decision.

F. If reference standards or manufacturer's instructions contain provisions that would alter or are at variance with relationships between the parties to the Contract set forth in the Contract Documents, the provisions in the Contract Documents shall take precedence. See General Conditions paragraph 2.3.

1.11 BACKING, SUPPORTS AND FASTENERS

A. Provide backing, supports, bracing, fasteners and other provisions required for the proper support and attachment of all work. Backing, supports, bracing and fasteners shall be sized to resist vertical and horizontal loads including seismic and

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wind loads required by codes listed under Regulatory Requirements in Section 01010 and in accordance with Seismic Design Requirements in Section 01190. Where finishes in existing facilities must be removed to install backing or where finishes are installed in new construction prior to installing backing the Contractor shall remove finishes, install backing and reinstall finishes.

B. Use of explosive powder-driven fasteners is NOT PERMITTED.

C. Low velocity, pneumatic-type, power-driven fasteners may be used only where specifically shown, specified or approved and only where they meet the structural requirements for a particular assembly with a safety factor of at least 400 percent. Power-driven fasteners may not be used for electrical or mechanical installations or to attach any items loaded in withdrawal or subject to vibration.

1.12 SAFETY

A. In accordance with generally accepted construction practice, applicable law and the General Conditions, especially paragraphs 5.3, 5.20 through 5.28 and 7.3, the Contractor shall be solely and exclusively responsible for and have control over:
   1. Construction means, methods, techniques, sequences, procedures and for coordinating all portions of the Work under the Contract Documents.
   2. Safety of employees engaged in the work while on and off the site.
   3. Safety of the Owner, the Engineer, the Design Engineer, and others who may visit or be affected by the work.
   4. Safety of the work itself including material and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's subcontractors or sub-subcontractors.
   5. Safety of other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.
   6. Safety programs, equipment and protective devices required to assure the safety of persons and property for whom/which the Contractor is responsible.

B. The Owner, the Engineer, and the Design Engineer and each of their officers, employees, agents and consultants shall not be responsible for any construction means, methods, techniques, sequences, nor for safety in, on or about the site, nor for coordinating any part of the Work.

C. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

D. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, necessary fences and other safeguards for safety and protection of persons and property on and off the site and shall: (1) post danger signs and other warnings against hazards, (2) promulgate safety regulations, and (3) notify owners and users of adjacent sites and utilities when the Contractor's operations may affect them.

E. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's Superintendent unless otherwise designated by the Contractor in writing to the Owner and Engineer.

F. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs required in connection with the Work and shall

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send copies of all accident, injury or work-related illness reports and of all notices of unsafe conditions to the Engineer.

G. The Contractor shall not load or permit heavy weights to be placed on any part of the construction or site so as to endanger its safety.

H. The duties of the Owner, the Engineer and the Design Engineer in conducting review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's work methods, equipment, bracing, scaffolding or safety measures in, on, or near the construction site. See General Conditions, paragraph 7.3.

I. The Contractor is hereby informed that work on this project could be hazardous. The Contractor shall carefully instruct all personnel working in potentially hazardous work areas as to potential dangers and shall provide such necessary safety equipment and instructions as required to prevent injury to personnel and damage to property, and to comply with all applicable laws and regulations including State OSHA, Federal OSHA, and other regulations referenced in these Contract Documents.

J. The Contractor shall, at all times, maintain the job in a condition that is safe for the Owner, the Engineer and their consultants to make site visits and to conduct construction reviews. If the Owner or the Engineer cannot allow personnel to visit the job because it is not safe, the Contractor is not providing required safe access to the Work as required by General Conditions, paragraph 12.2.

K. The Contractor shall prepare a Safety Plan meeting the requirements of applicable regulations. As a minimum, the Contractor's Safety Plan shall set forth definite procedures for informing workers about safety, for instructing workers in safe practices, for assuring that workers are using appropriate safety equipment and safe work practices and for reporting accidents.

1.13 EXCAVATION AND TRENCHING; WORK WITHIN CONFINED SPACES

A. Submit specific plans to the Owner showing details of provisions for worker protection from caving ground in accordance with Section 6705 of the California State Labor Code. The detailed plans shall show the design of shoring, bracing, sloping banks or other provisions and shall be prepared, signed and stamped by a Civil or Structural Engineer licensed in the State in which the Work is performed and retained by the Contractor. The Owner's acceptance of the detailed plans submitted is only an acknowledgment of the submission and does not constitute review or approval of the designs, design assumptions, criteria, completeness, applicability to areas of intended use, or implementation of the plans, which are solely the responsibility of the Contractor and its Registered Engineer.

B. Work within Confined Spaces: Work within confined spaces is subject to applicable laws, regulations and safety orders including applicable California Tunnel Safety Orders.

C. The foregoing provisions do NOT reduce the requirement for the Contractor to maintain safety in ALL operations performed by the Contractor or its Subcontractors.

1.14 CONTRACTOR'S QUALITY CONTROL

A. The Contractor shall be fully responsible for inspecting the work of its suppliers and subcontractors to assure that the work when completed will comply with the

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standards for materials and workmanship required by the Contract Documents. See General Conditions paragraph 13.9.

B. Inspections, periodic observations and testing performed by the Owner or the Engineer are for the Owner's benefit and information only and shall not be construed as partial or incremental acceptance of the work and shall not be deemed to establish any duty on the part of the Owner or the Engineer to the Contractor, its subcontractors or suppliers. See General Conditions paragraphs 7.5 and 12.10.

C. The Engineer will have authority to reject Defective Work. The Engineer will have authority to require additional inspection or testing of the Work whether or not such Work is fabricated, installed or completed. Neither this authority of the Engineer nor a decision not to exercise such authority shall give rise to a duty or responsibility of the Engineer to the Contractor, subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the Work.

D. Observations by the Engineer or tests, inspections or approvals by others shall not relieve the Contractor from its obligation to perform the Work in accordance with the Contract Documents.

E. The Contractor shall:
   1. Monitor quality control over suppliers, manufacturer, products, services, site conditions, and workmanship, to produce work of specified quality.
   2. Comply fully with manufacturer's installation instructions, including performing each step in sequence as recommended by the manufacturer.
   3. Submit a Request for Information (RFI) to the Engineer before proceeding with work when manufacturers' instructions or reference standards conflict with Contract Documents.
   4. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
   5. Perform work by persons specializing in the specific trade and class of work required and qualified to produce workmanship of specified quality.
   6. Secure products in place with positive anchorage devices designed and sized to withstand seismic, static and dynamic loading, vibration, and physical distortion or disfigurement.

F. If reference standards or manufacturers' instructions contain provisions that would alter or are at variance with relationships between the parties to the Contract set forth in the Contract Documents, the provisions in the Contract Documents shall take precedence.

G. The Contractor shall provide assistance required by the Engineer to adequately inspect the Work including ladders, scaffolding, lighting, ventilation and other aids to facilitate access and provide a safe working environment.

1.15 TESTING LABORATORY SERVICES AND CERTIFIED LABORATORY REPORTS

A. Provide testing services in accordance with General Conditions Article 12 and specific requirements contained in each technical specification section. Submit Certified Laboratory Reports required by technical specification sections.

B. Unless otherwise specified, the Contractor shall arrange and pay for tests, inspections and approvals other than Special Inspections that are required by laws, ordinances, rules, regulations, orders of public authorities having jurisdiction or by

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the Contract Documents. All such tests, inspections and approvals shall be performed by an independent testing laboratory or inspection agency acceptable to the Engineer or to the appropriate public authority. Samples to be tested and items of work to be inspected will be selected by the Engineer or the public authority requiring the test or inspection. Test reports, inspection reports and certificates shall be submitted directly to the Engineer by the performing laboratory or agency. The Contractor shall notify the Engineer at least two (2) days prior to all tests and inspections to permit observation by the Engineer.

C. The Contractor shall provide access for Special Inspections and notify the Owner two (2) working days in advance of when work requires Special Inspection.

PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01140

TEMPORARY CONTROLS FOR ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.01 SCOPE

A. This project is exempt from the California State Water Resources Control Board Construction Activities Storm Water General Permit No. 2009-0009-DWQ as amended by Order No. 2010-0014-DWQ and 2012-0006-DWQ (NPDES No. CAS000002) (Permit), effective July 17, 2012, for the reasons stated below. However, protection of water resources must still be considered as discussed in Section 1.04-C.10.
   1. The project will disturb less than one acre of land surface. Exempt from CA General Permit but covered by local municipal storm water permit.

B. During the progress of the work, keep the work areas occupied by the Contractor in a neat and clean condition and protect the environment both onsite and offsite, throughout and upon completion of the construction project.

1.02 SUBMITTALS

A. Submit a non-permitted Storm Water Pollution Prevention Plan (SWPPP) in electronic format and in hard copy. Submit in accordance with Section 01300.

B. Develop an Environmental Protection Plan within thirty (30) days from the date of the Notice to Proceed. The Environmental Protection Plan shall include, but not be limited to, the following items:
   1. Copies of required permits.
   2. Proposed disposal site(s).
   3. Copies of any agreements with public or private landowners regarding equipment, materials storage, borrow sites, fill sites, or disposal sites. Any such agreement made by the Contractor shall be invalid if its execution causes violation of local or regional grading or land use regulations.

C. Distribute the favorably reviewed Environmental Protection Plan to all employees and to all subcontractors and their employees.

1.03 ENVIRONMENTAL IMPACT MITIGATION MEASURES

A. Comply with all environmental mitigation measures that are included in the Contract Documents.

B. Mitigation and Monitoring Requirements: Review and comply with the environmental impact mitigation and monitoring requirements listed in Table 1. Comply with all Federal, State and local regulations pertaining to environmental mitigation.

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Table 1: Mitigation and Monitoring Requirements

Environmental Factor	Mitigation and Monitoring Requirements
Air Quality	• Fugitive dust control BMPs • Vehicle emissions control BMPs • **NESHAP notification**
Biological Resources	• Construction monitoring and temporary fencing
Construction Storage Areas	• Proper storage of materials
Cultural Resources	• Cultural resources management during construction
Fire Prevention	• Proper material storage • Provide fire extinguisher • Control ignition sources
Fish and Wildlife Resources	• BMPs to minimize fish and wildlife disturbances
Hazard & Hazardous Materials, Hydrology/ Water Quality	• Preparation of a Spill Prevention Control and Countermeasures (SPCC) Plan
Land Resources	• Tree protection BMPs
Noise Control	• Follow local noise ordinances
Odor Control	• BMPs to minimize creation of nuisance odors
Revegetation of Disturbed Areas	• Follow tree and shrub planting guidelines
Sanitation	• Properly dispose of sanitary and construction wastes
Water Resources	• Follow applicable regulations to protect water resources on construction site including but not limited to erosion and sediment control

1.04 MITIGATION AND MONITORING OF ENVIRONMENTAL FACTORS

A. Requirements: All operations shall comply with all Federal, State and local regulations pertaining to water, air, solid waste, and noise pollution.

B. Definitions of Contaminants:
   1. Sediment: Soil and other debris that have been eroded and transported by runoff water.
   2. Solid Waste: Rubbish, debris, garbage and other discarded solid materials resulting from construction activities, including a variety of combustible and non-combustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves and tree trimmings.
   3. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalies, herbicides, pesticides, disinfectants, organic chemicals and inorganic wastes. Some of the above may be classified as "hazardous."
   4. Sanitary Wastes:
      a. Sewage: That which is considered as domestic sanitary sewage.
      b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing and consumption of food.
   5. Hazardous Materials: As defined by applicable laws and regulations. Undisclosed hazardous material contamination, if encountered will constitute a changed site condition as specified in Section 02050.

C. Protection of Natural Resources:
   1. General: It is intended that the natural resources within the project boundaries and outside the limits of permanent work performed under this

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Contract be preserved in their existing condition or be restored to an equivalent or improved condition upon completion of the work. Confine construction activities to areas defined by the public roads, easements, and work area limits shown on the Drawings. Return construction areas to their pre-construction elevations except where surface elevations are otherwise noted to be changed. Maintain natural drainage patterns. Conduct construction activities to avoid ponding stagnant water conducive to mosquito breeding.

2. Air Quality:
    a. Employ measures to prevent the creation of air pollution.
        1) Unpaved areas where vehicles are operated shall be periodically wetted down or given an equivalent form of treatment, to eliminate dust formation.
        2) Store all volatile liquids, including fuels or solvents in closed containers.
        3) No open burning of debris, lumber or other scrap will be permitted.
        4) Properly maintain equipment to reduce gaseous pollutant emissions.
    b. Contractor shall submit a National Emissions Standards for Hazardous Air Pollutants (NESHAP) notification included in Appendix C at least ten (10) days prior to beginning construction. In addition, the Contractor shall adhere to asbestos containing materials regulations, 40 Code of Federal Regulations (CFR), Subpart M, Section 61 and California Code of Regulations, Title 8, Section 1529. Refer to Section 02050.
3. Construction Storage Areas:
    a. Storage of construction equipment and materials shall be limited to the designated Contractor's storage area.
    b. Store and service equipment at the designated Contractor's storage area. No dumping of surplus concrete or grout on the site will be permitted.
4. Fire Prevention: Take steps to prevent fires including, but not limited to the following:
    a. Provide spark arrestors on all internal combustion engines.
    b. Store and handle flammable liquids in accordance with the Flammable and Combustible Liquids Code, NFPA 30.
    c. Provide fire extinguishers at hazardous locations or operations, such as welding.
5. Hazards:
    a. Oil wastes shall not be allowed to flow onto the ground or into surface waters. Containers shall be required at the construction site for the disposal of materials such as paint, paint thinner, solvents, motor oil, fuels, resins and other environmentally deleterious substances.
    b. Contractor shall not cut or break, by any means, any asbestos cement pipeline. Contractor shall remove asbestos cement pipeline as shown on the Drawings and properly dispose in accordance with applicable regulations at the approved, classified landfill identified in the Environmental Protection Plan (Paragraph 1.02 B). Refer to Section 02050.
6. Land Resources:
    a. Do not remove, cut, deface, injure or destroy trees or shrubs outside the work area limits. Do not remove, deface, injure or destroy trees within

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the work area without permission from the Engineer or unless noted on the Drawings.

b. Temporary Construction: Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, or any other vestiges of construction as directed by the Engineer. Level all temporary roads, parking areas and any other areas that have become compacted or shaped. Any unpaved areas where vehicles are operated shall receive a suitable surface treatment or shall be periodically wetted down to prevent construction operations from producing dust damage and nuisance to persons and property, at no additional cost to the Owner. Keep haul roads clear at all times of any object that creates an unsafe condition. Promptly remove any contaminants or construction material dropped from construction vehicles. Do not drop mud and debris from construction equipment on public streets. Sweep clean turning areas and pavement entrances as necessary.

7. Noise Control: The following noise control procedures shall be employed:
   a. Maximum Noise Levels within 1,000 Feet of any Residence, Business, or Other Populated Area: Noise levels for trenchers, pavers, graders and trucks shall not exceed 90 dBA at 50 feet as measured under the noisiest operating conditions. For all other equipment, noise levels shall not exceed 85 dBA at 50 feet. Construction employing noise-producing equipment shall not be performed outside the hours of 7:00 a.m. to 4:30 p.m. Monday through Friday without the Owner's permission.
   b. Equipment: Jack hammers shall be equipped with exhaust mufflers and steel muffling sleeves. Air compressors should be of a quiet type such as a "whisperized" compressor.
   c. Operations: Keep noisy equipment as far as possible from noise-sensitive site boundaries. Machines should not be left idling. Use electric power in lieu of internal combustion engine power wherever possible. Maintain equipment properly to reduce noise from excessive vibration, faulty mufflers, or other sources. All engines shall have properly working mufflers.
   d. Scheduling: Schedule noisy operations so as to minimize their duration at any given location.
   e. Monitoring: To determine whether the above noise limits are being met and whether noise barriers are needed, the Contractor shall use a portable sound level meter meeting the requirements of American National Standards Institute Specification S1.4 for Type 2 sound level meters. If non-complying noise levels are found, the Contractor shall be responsible for monitoring and correction of excessive noise levels.
8. Odor Control: Employ measures to prevent the creation of odors.
   a. Store all volatile liquids, including fuels or solvents in closed containers.
   b. No open burning of debris, lumber or other scrap will be permitted.
   c. Properly maintain equipment to reduce gaseous pollutant emissions.
9. Sanitation: During the construction period, provide adequate and conveniently located chemical sanitation facilities, properly screened, for use of construction crews, the Engineer and visitors to the site
10. Water Resources: Comply with all applicable Federal, State and local regulations concerning the discharge (directly or indirectly) of pollutants to the underground and natural waters. This project is not required to be covered under the CA Construction General Permit but a non-permitted SWPPP is still

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required to address the requirements in the Municipal Permit. See subsection 1.06 for requirements for implementation of Best Management Practices (BMPs) that shall be considered and implemented to minimize the potential for impacts to water resources.

a. Exercise every reasonable precaution to protect streams, lakes, reservoirs, bays and coastal waters from pollution with fuels, oils, bitumens, calcium chloride and other harmful materials and conduct and schedule operations so as to avoid or minimize muddying and silting of said streams, lakes, reservoirs, bays and coastal waters.
    1) Water pollution control work is intended to provide prevention control and abatement of water pollution to streams, waterways and other bodies of water, and shall consist of constructing those facilities that may be shown on the Drawings, or directed by the Engineer. In order to provide effective and continuous control of water pollution, it may be necessary for the Contractor to perform the Contract work in small or multiple units, on an out-of-phase schedule, and/or with modified construction procedures. The Contractor shall provide temporary water pollution control measures, including but not limited to, dikes, basins, and ditches, and shall apply straw and seed, which become necessary as a result of its operations. The Contractor shall coordinate water pollution control work with all other work done on the Contract.
b. Submit a plan to control water pollution effectively during construction of the Work. Such program shall show the schedule for the erosion control work included in the Contract and for all water pollution control measures, which the Contractor proposes to take in connection with construction of the project to minimize the effects of his operations upon adjacent streams and other bodies of water. The Contractor shall not perform any clearing and grubbing or earthwork on the project, other than that specifically authorized in writing by the Engineer, until such plan has been accepted. The Contractor may request the Engineer to waive the requirement for submission of a written plan for control of water pollution when the nature of the Contractor's operation is such that erosion is not likely to occur. Waiver of this requirement will not relieve the Contractor from responsibility for compliance with the other provisions of this Section. Waiver of the requirement for a written plan for control of water pollution will not preclude requiring submittal of a written plan at a later time if the Engineer deems it necessary because of the effect of the Contractor's operations.
c. Implement the following Erosion and Sediment Transport Controls:
    1) Discharge construction runoff to avoid buildup of large potentially erosive flows.
    2) Prevent runoff from flowing over unprotected slopes.
    3) Keep disturbed areas to the minimum necessary for construction.
    4) Keep runoff away from disturbed areas during construction.
    5) Direct flows over vegetated areas prior to discharge into public storm drainage systems. Do not discharge into public drainage systems or natural drainages without the necessary approvals and permits.
    6) Trap sediment before it leaves the site, using BMPs such techniques as straw wattles, check dams, sediment ponds, or siltation fences.

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7) Remove and dispose of all project construction-generated siltation that occurs in offsite retention ponds, if used.
8) Provide erosion and sediment transport control measures and materials on-site and ready for implementation prior to the onset of the first major storm of the season or subsequent storms.
9) Stabilize disturbed areas as quickly as possible.

d. Temporary erosion and sedimentation BMPs are intended to provide prevention control and abatement of water pollution to streams, waterways and other bodies of water, and shall consist of constructing those facilities that may be shown on the Drawings, or directed by the Engineer.

e. Coordinate erosion and sedimentation BMPs with all other work.

f. If the measures being taken by the Contractor are inadequate to control water pollution effectively, the Engineer may direct the Contractor to revise its operations and its water pollution control program. Such directions will be in writing and will specify the items of work for which the Contractor's water pollution control measures are inadequate. No further work shall be performed on said items until the water pollution control measures are adequate; and if also required, a revised water pollution control plan has been accepted.

g. Where erosion which will cause water pollution is probable due to the nature of the material or the season of the year, the Contractor's operations shall be so scheduled that permanent erosion control features will be installed concurrently with or immediately following grading operations.

D. Execution: Training.
1. Provide pre-construction training to ensure staff is aware of project specific environmental impacts
2. Provide weekly training to review staff awareness of environmental factors
3. Ensure photographic and ongoing compliance documentation is acquired and properly kept.

1.05 DISPOSAL OPERATIONS

A. Solid Waste Management:
1. Daily remove all debris such as spent air filters, oil cartridges, cans, bottles, combustibles and litter. Take care to prevent trash and papers from blowing onto adjacent property. Encourage personnel to use refuse containers. Convey contents to a sanitary landfill.
2. Washing of concrete containers where wastewater may reach adjacent property or natural water courses shall not be permitted. Provide temporary, lined concrete washout stations per non-permitted SWPPP. Remove any excess concrete to the sanitary landfill. Remove temporary concrete washout station(s) at completion of the project.

B. Chemical Waste and Hazardous Materials Management: Furnish containers for storage of spent chemicals used during construction operations. Dispose of chemicals and hazardous materials in accordance with applicable regulations.

C. Dispose of vegetation, weeds, rubble, and other materials removed by the clearing, stripping and grubbing operations off site at a suitable disposal site in accordance with applicable regulations.

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D. Excavated Materials:
   1. Native soil complying with the requirements of Section 02300, Earthwork, may be used for backfill, fill and embankments as allowed by that section.
   2. Spoil Material:
      a. Remove all material which is excavated in excess of that required for backfill, and such excavated material which is unsuitable for backfill, from the site and dispose of offsite in accordance with applicable regulations. Remove rubbish and materials unsuitable for backfill immediately following excavation. Remove material in excess of that required for backfill immediately following backfill operations.
      b. Rubbish shall consist of all materials not classified as suitable materials or rubble and shall include shrubbery, trees, timber, trash and garbage.

1.06 NON-PERMITTED STORMWATER POLLUTION PREVENTION PLAN REQUIREMENTS

A. The Contractor shall prepare and submit a draft non-permitted SWPPP before work shall begin on the site. The non-permitted SWPPP shall address the requirements of the Municipal Permit and identify and mitigate pollutant sources that could affect the quality of stormwater discharges from the construction site. Control practices shall include those that effectively target pollutants in stormwater discharges.

B. Definitions and Abbreviations for non-permitted SWPPP:
   1. BMP - Best Management Practice
   2. Contractor - The person or persons, firm, partnership, corporation or combination thereof, private or municipal, who enters into the Contract with the Owner to construct the project. The Contractor shall also assume responsibility of the non-permitted SWPPP, including having the responsibility to ensure full compliance with and implementation of all elements of the non-permitted SWPPP, including the preparation of revisions, preparation of inspection reports and elimination of all unauthorized discharges.
   3. Discharger - The entity subject to the requirements of this non-permitted SWPPP. For the purpose of this non-permitted SWPPP, the Discharger is the City of San Fernando.
   4. Designated SWPPP Manager - The Contractor's employee or individual(s) retained by the Contractor who is/are assigned responsibility for non-storm water and storm water visual observations, and responsibility to ensure full compliance with, and implementation of all elements of, the non-permitted SWPPP, including elimination of all unauthorized discharges.
   5. Municipal Permit – Los Angeles County Phase I MS4 Permit (ORDER NO. R4-2012-0175-A01).
   6. SWPPP - Storm Water Pollution Prevention Plan

C. The Contractor shall incorporate the actual construction means and methods to be employed to be in compliance with the non-permitted SWPPP. The Contractor shall submit an updated non-permitted SWPPP when significant changes occur for the project and in accordance with Section 01300.

D. The Contractor shall have a Designated SWPPP Manager prepare updates to the non-permitted SWPPP during construction and be on site to oversee the implementation, respond to changed conditions, and monitor the non-permitted SWPPP.

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E. The Contractor will be responsible for amending, implementing, and maintaining the non-permitted SWPPP, as necessary.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01190

SEISMIC REQUIREMENTS
(STRUCTURAL COMPONENT AND EQUIPMENT PERFORMANCE REQUIREMENTS)

PART 1 - GENERAL

1.01 SUMMARY

A. This Section is applicable to the following secondary structural system elements, non-structural components, and/or equipment supported by structures.
   1. Mechanical, electrical, and plumbing equipment and appurtenances, including, but not limited to:
      a. Water level staff gage and level indicator.
      b. Instrument and control panels.
      c. Electrical junction boxes.
      d. Pipe supports and brackets.
   2. Conduit, piping, cable trays, raceways, ducts and similar systems.
   3. All equipment specifically listed in this specification.
   4. Light fixtures (both pole and structure mounted).
   5. Architectural features and other non-structural components.
   6. Precast concrete vaults and structures including covers, rungs, ladders, etc.
   7. Fence, gates and gate operators.
   8. Retaining walls.
   9. Irrigation pedestal mounted controller and irrigation pump and enclosure.

1.02 REFERENCES

A. American Society of Civil Engineers Standard ASCE 7 10, Minimum Design Loads for Buildings and Other Structures, Chapters 11, 13, 15.

B. Additional Building Codes as referenced in 01040.

C. California Building Code, 2019 Edition.

1.03 DEFINITIONS

A. Engineer of Record: The Design Engineer responsible for the preparation of Contract Documents.

B. Specialty Engineer: Structural or Civil Engineer licensed in the State where the project is being built responsible for specific elements of the primary structural system, the secondary structural system, non-structural elements and/or equipment supported by structures. The Specialty Engineer shall be provided by the Contractor.

1.04 GENERAL DESIGN REQUIREMENTS

A. The Contractor and Specialty Engineer are responsible for producing structural designs that resist applicable loads including: Dead, Live, Wind, Seismic, Fluid, Snow, Rain, Earth, operational, or other special loads applicable to the component being designed.

B. Minimum design loads shall be based on guidelines given in this Section, the Drawings, ASCE 7-10, CBC Chapter 16, equipment manufacturer's

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recommendations and/or other industry accepted design standard for the component being designed (i.e. AWWA D100, API 650, ANSI MH16.1).

1.05 SEISMIC DESIGN REQUIREMENTS

A. The Contractor is responsible for producing designs that resist the total seismic forces in accordance with the seismic design criteria. The Contractor is responsible for coordinating between the Engineer of Record and the Specialty Engineer. The Contractor is responsible to coordinate the favorably reviewed design in the field, and shall provide the proposed design, including any modifications required to the primary structure, at no additional cost to the owner.

B. The seismic design for non-structural components and equipment shall be in accordance with the CBC Chapter 16, and the required coefficients and factors for determining the total design seismic forces are provided in the Seismic Design Criteria in Paragraph E below.

C. Coordinate the layout so that adequate space is provided between items for relative motion. Provide additional supports and restraints between items of different systems when necessary to prevent seismic impacts or interaction.

D. Total seismic forces shall be determined in accordance with the following seismic design criteria coefficients for elements of structures, non-structural components, equipment supported by structures, and nonbuilding structures:
   1. Spectral Acceleration 1-Second Period, SD1 = 0.836
   2. Spectral Response Acceleration at Short Period, SDS = 1.695
   3. Seismic Design Category = F
   4. Importance Factor, I = 1.50
   5. Component Importance Factor, Ip = 1.50
   6. Components Coefficient, ap = ASCE 7 Tables 13.5-1, 13.6-1, 15.4-1 and 15.4-2
   7. Components Coefficient, Rp = ASCE 7 Tables 13.5-1, 13.6-1, 15.4-1 and 15.4-2.
   8. Response Modification Factor, R = ASCE 7 Table 15.4-1 and 15.4-2.

E. Design non-building structures in accordance with Chapter 15 of ASCE 7-10; all designs utilizing Chapter 15 shall include the design and anchorage of the entire non-building structure.

F. Design anchorages of all elements of structures, nonstructural components, and equipment supported by structures, to resist static and dynamic operational loads, plus total seismic loads specified in the CBC, ASCE 7 10 Section 13.3.1, and as follows:
   1. For suspended equipment, multiply dead load by 1.2 and add 0.2SDS to account for vertical seismic effects in the downward direction.
   2. For anchorage uplift, multiply dead load by 0.9 and subtract 0.2SDS if used to reduce vertical seismic effects.
   3. Post-installed anchors installed in concrete shall be prequalified for seismic application in accordance with ACI 355.2.

G. Design Basis and Coordination: Contractor shall note that the layout of the structure and equipment pads is based on the first named manufacturer and model for the equipment to be anchored.
   1. Contractor shall coordinate all attachments and related work and shall provide connections as noted in the favorably reviewed shop drawings.

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2. For all suppliers, if the dimensions required by the Contractor's submitted anchorage calculations deviate from those provided on the Contract Drawings, Contractor shall note the deviation in the submittal for review and provide the favorably reviewed pad at no additional cost to the Owner.
3. If a model or manufacturer other than the first name supplier is submitted for use by the Contractor, Contractor shall coordinate all related work and deviations from the Contract Drawings.
4. Where Contractor's specialty engineer proposes a deviation from the contract drawings for any manufacturer, and that deviation is favorably reviewed by the Engineer, Contractor shall provide that modification to the structure at no additional cost.

1.06 DESIGN REQUIREMENTS FOR PIPING, CONDUIT, AND DUCTS

A. The Contractor is responsible for producing designs for support of piping, conduit, duct or other systems to resist total seismic forces based on the seismic design criteria coefficients specified above, unless shown on the Contract Documents. Except where the technical specifications give specific exemption from resistance of seismic forces, all supports shall be designed to meet seismic criteria. Support systems for piping, conduit, duct or other systems greater than 5 inches in diameter are shown on the Contract Documents.

B. Where possible, pipes, conduit, and their connections shall be constructed of ductile materials (e.g., copper, ductile iron, steel or aluminum and brazed, welded or screwed connections). Pipes, conduits and their connections, constructed of nonductile materials (e.g., cast iron, no-hub pipe and plastic), shall have the brace spacing reduced to one-half of the spacing allowed for ductile material.

C. Seismic restraints may be omitted for the following conditions, where flexible connections are provided between components and the associated ductwork, piping and conduit:
1. All other piping suspended by individual hangers 12 inches or less in length from the top of the pipe to the bottom of the structural support for the hanger, where the hangers are detailed to avoid bending of the hangers and their connections, OR piping of 3 inches nominal pipe size and less (Ip=1.0), OR piping of 1-inch nominal pipe size and less (Ip greater than 1.0).
2. Electrical conduit less than 2.5 inches trade size OR raceways supported by individual hangers 12 inches or less in length from raceway support point to the bottom of the structural support for the hanger, where the hangers are detailed to avoid bending of the hangers and their connections.

D. All trapeze assemblies supporting pipes, ducts and conduit shall be braced to resist the total seismic forces considering the weight of the elements on the trapeze. Pipes, ducts and conduit supported by a trapeze where none of those elements would individually be braced need not be braced if connections from the pipe/conduit/ductwork to component or directional changes do not restrict the movement of the trapeze. If this flexibility is not provided, bracing will be required when the aggregate weight of the pipes and conduit exceed 10 pounds/foot or ducting exceeds 17 pounds/foot. The weight shall be determined assuming all pipes and conduit are filled with water.

E. As an alternative to designing the supports and anchorage, where an approved national standard provides a basis for the earthquake-resistant design, submit standard, data, and details for piping, conduit, duct or other systems:

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1. For ductwork, mechanical piping, process piping and electrical conduits, follow Guidelines for Seismic Restraints of Mechanical Systems by SMACNA modified as follows:
    a. Seismically brace piping regardless of size or location. Provide transverse braces at all changes in direction and at the end of all pipe runs. Space transverse braces not more than 20 feet apart. Provide longitudinal braces at 40-foot centers.
    b. Seismically brace all ductwork regardless of size or location. Provide transverse braces at all changes in direction and at each end of run. Space braces not over 20 feet apart. Provide longitudinal braces at 40-foot centers.

1.07 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Shop Drawings for non-building structures and contractor designed components: Submit signed and sealed structural calculations and detailed drawings for the following listed elements and where required in Divisions 2 through 17 of the primary structural system and their attachments, the secondary structural system and their attachments, permanent non-structural components and their attachments, and the attachments and anchorage for permanent equipment supported by the structure:
    1. Mechanical, electrical, and plumbing equipment and appurtenances, including, but not limited to:
        a. Water level staff gage and level indicator.
        b. Instrument and control panels.
        c. Electrical junction boxes.
        d. Pipe supports and brackets.
    2. Conduit, piping, cable trays, raceways, ducts and similar systems.
    3. All equipment specifically listed in this specification.
    4. Light fixtures (both pole and structure mounted).
    5. Architectural features and other non-structural components.
    6. Precast concrete vaults and structures including covers, rungs, ladders, etc.
    7. Fence, gates and gate operators.
    8. Retaining walls.
    9. Irrigation pedestal mounted controller and irrigation pump and enclosure.

C. Shop Drawings for Anchorage Calculations: Where required in the equipment specifications in Divisions 2 through 17 or listed below, submit signed and sealed structural calculations and detailed drawings from the Contractor's Specialty Engineer.
    1. Required anchorage items include:
        a. Pipe supports.

D. Structural calculations and detailed drawings shall be prepared by the Contractor's Specialty Engineer.

E. Structural calculations and detailed drawings shall clearly show the total design seismic forces which will be transferred from the elements of the structural system, non-structural components, and/or equipment and their attachments to the primary structure. Calculations must be reviewed by Engineer of Record for general conformance with the design criteria and building code and therefore calculations shall include:

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1. Seismic and wind load criteria used to determine design lateral and uplift forces. For external equipment, a statement should be made as to whether wind controls for all equipment.
2. Derivation of forces used, including at least one complete sample calculation, showing the process used so that Engineer of Record may determine general compliance. Printouts of spreadsheets without explanation of calculations used to determine values are not acceptable.
3. Adequacy of anchorage to concrete and masonry or attachment to the primary structure to transfer the design forces from the element.
4. Detail drawings shall note:
    a. Required concrete strength,
    b. Anchor type, dimensions, and materials. Coordinate material selection with Section 05090.
    c. Edge distance, spacing, embedment depth, substrate thickness and any supplementary reinforcing required for anchors installed in concrete.
    d. Required dimensions of equipment pads based on equipment size and edge distance. The Contractor shall coordinate dimensions of equipment pads, including any revisions required to meet the requirements of the favorably reviewed submittal by the Specialty Engineer at no additional cost to the Owner.

F. The Engineer of Record's review of items within a Specification Section cannot be completed until all related items have been coordinated and submitted for review.

G. Quality Assurance Submittals
1. Test Reports: Submit test reports for tension testing of anchors.

1.08 QUALITY ASSURANCE

A. Qualifications: The Contractor is responsible for submitting signed and sealed structural calculations and detailed drawings from a Specialty Structural or Civil Engineer licensed in the State where the project is being built.

B. Regulatory Requirements: Comply with the jurisdictional State's adopted and amended versions of the California Building Code (CBC) Section 1613, the referenced sections of ASCE 7 plus clarifications and additions specified in this Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

PART 4 - FIELD QUALITY CONTROL

A. Site Tests: Tension testing of expansion or adhesive anchors utilized for anchorage shall be done in the presence of the Owner's Representative and a report of the test results shall be submitted. See Specification Section 05090 for additional requirements.

B. Inspection: Special Inspection shall be provided for high strength bolting or bolts installed in concrete. See Specification Section 05090 for additional requirements.

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SECTION 01200

PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 TYPE OF CONTRACT

A. The Work covered by these Contract Documents shall be provided under a single lump sum Contract.

1.02 ALLOWANCES

A. Funds will be paid out of the allowance by the Contractor on the Engineer's recommendation at net invoice cost to the Contractor exclusive of the Contractor's overhead, profit or handling changers, which are considered to be included in the Contract Price. The Contractor shall submit copies of invoices against the allowance account with Applications for Payment (General Conditions paragraph 13.2 and Exhibit GC-4).

B. Retesting or Rebalancing caused by the Contractor's failure to provide Work complying with the Contract Documents shall be paid for by the Contractor and shall not be paid out of the allowance account.

C. Prior to Final Payment, the allowance account shall be brought to zero by Additive or Deductive Change Order.

1.03 SUBSTITUTIONS

A. See Section 01300, paragraph 1.06 Proposed Equivalents (Substitutions), Article 9 of Section 00100 and Article 8 of the General Conditions for submission, review and acceptance procedures and requirements.

1.04 CONTRACT MODIFICATIONS

A. Methods of modifying the Contract Documents are covered in General Conditions, Article 9.

B. The following documents may be used by the Engineer:
   1. Request for Quotation: Issued by the Engineer, a Request for Quotation is used to describe a proposed change and request a cost quotation from the Contractor but does not authorize a change in the Work or in the Contract Time or Price.
   2. Change Order: Signed by the Engineer signifying its recommendation, and signed by the Contractor and Owner signifying their acceptance, a Change Order changes the Scope of Work and possibly the Contract Price and/or Contract Time.
   3. Work Directive Change: Signed by the Owner (and in some cases by the Contractor) signifying their acceptance and issued by the Engineer, a Work Directive Change is used: (1) to direct the Contractor to do extra work on a cost accounting basis with a fixed maximum sum when the Owner and Contractor have not agreed on the price and time for the change, and (2) to direct the Contractor to do work that the Contractor contends is not included in the contract scope. Work done under Case 1 will be converted to a Change Order when the Contractor and Owner agree on the change in price and time.

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The Contractor may make a claim under General Conditions Article 10 for recovery of cost and time extension for work done under Case 2; but if the claim is denied because the work is determined to be included in the contract scope, then the Contract Time and Price will not be changed. Work done under both Cases 1 and 2 shall be done in accordance with the requirements for work done on a cost accounting basis described in General Conditions paragraphs 9.11 through 9.14.

4. Response to Request for Information: Issued by the Engineer, a Response to Request for Information is used to order or document minor changes in the work consistent with the intent of the Contract Documents and NOT involving a change in price or time. Information issued on a Response to Request for Information shall NOT authorize a change in Contract Price or Contract Time and shall not be considered a Constructive Change Order. If the Contractor considers that a Response to Request for Information would cause a change in Contract Price or Time, it shall notify the Engineer in writing within fifteen (15) days of receipt of the Response to Request for Information and shall not proceed with the work. See General Conditions paragraphs 7.8, 9.9 and 9.10.

C. The Contractor hereby expressly waives any claim or right to make a claim for an increase in Contract Time or Price without written notice to the Engineer of the Contractor's intent to make a claim five (5) days prior to proceeding to execute the work or portion thereof giving rise to such claim. See General Conditions paragraph 10.4.

D. The Contractor agrees that it shall not consider any Response to Request for Information, order, instruction, clarification, suggestion or any other communication either written or oral, given intentionally or unintentionally by the Engineer, Owner or any other person as authorization or direction to do any work that would cause a change in Contract Time or Price unless it is a formal written Change Order or Work Directive Change signed by the Owner.

1.05 SCHEDULE OF VALUES

A. Specific provisions are described in Article 13, paragraph 13.1 of the General Conditions.

B. The Contractor's Schedule of Values shall be in a form acceptable to the Engineer and have at least the following level of detail: a separate line item for each technical specification section, for site mobilization, for Construction Scheduling, for bonds and insurance, for final cleanup and for final deliverables. Subdivide final deliverables into: Record Drawings; Operation and Maintenance Manuals with Parts Lists; and Special Guarantees. Include the appropriate specification section and paragraph number for each line item. Subdivide major trades or portions of the work into multiple line items that relate to observable milestones to aid monthly progress evaluations in accordance with the following example:

Concrete Work
- Foundations
- Slab on grade
- First floor walls and columns
- Second floor beams and slabs
- Second floor walls and columns, etc.

C. The Engineer may recommend payment for the cost of making a successful Shop Drawing Product Data or Sample submittals required for Product Review not to exceed 2% of the value of the work or item submitted.

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1.06 APPLICATION FOR PAYMENT

A. Applications for Payment may be made only on General Conditions Exhibit GC 4, in accordance with General Conditions paragraph 13.2. Line items on the Application for Payment shall be the same as those used on the Schedule of Values. Applications for Payment shall contain the Contractor's Certification required by General Conditions paragraph 13.2.

PART 2 - PART 2 - PRODUCTS (NOT USED)

PART 3 - PART 3 - EXECUTION (NOT USED)

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SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SUBMITTAL PROCEDURES

A. Accompany each submittal with a Submittal form, General Conditions Exhibit GC-2, which contains the following information:
   1. Contractor's name and the name of Subcontractor or supplier who prepared the submittal.
   2. The project name and identifying number.
   3. Description of the submittal and reference to the Contract requirement or technical specification section and paragraph number being addressed.

B. Unless otherwise specified, provide submittals in electronic PDF searchable format.

C. Submittals which include more than one (1) item or piece of equipment shall include a Table of Contents following the standard submittal form and cover sheets

D. Each submittal shall include a copy of the specification section and all referenced and applicable sections with addendum updates included. For each specification section, check-mark each paragraph to indicate specification compliance with the full paragraph as a whole or marked to indicate requested deviations from specification requirements. Each deviation from the specifications requested by the Contractor shall be underlined and referenced by a unique number in the margin to the right of the identified paragraph. The submittal shall include a detailed written explanation of the reasons for requesting the deviation that is clearly labeled to correspond with the unique number provided in the margin. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal on the basis that the submittal is incomplete and will be returned to the Contractor REJECTED – RESUBMIT with no further consideration.

E. Where applicable, a copy of the contract document control diagrams and process and instrumentation diagrams relating to the submitted equipment, with addendum updates that apply to the equipment in this Section, marked to show specific changes necessary for the equipment proposed in the submittal. If no changes are required, the drawing or drawings shall be marked "no changes required". Failure to include copies of the relevant drawings with the submittal shall be cause for rejection of the entire submittal with no further review.

F. Project Initiation Submittals. At a minimum, provide the following project initiation submittals prior to mobilization.
   1. Designation of Superintendent: Include name, address, home telephone number and a brief resume.
   2. List of Subcontractors and Major Suppliers: Include address, telephone number and name of responsible party.

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3. Schedule of Values, in a form acceptable to the Engineer: See General Conditions Article 13.

G. The Contractor shall allow 30 days for the Engineer's review of each submittal and 30 days for each resubmittal unless a different period is specified by the Engineer in writing. If the Engineer requests additional information or clarification of a submittal, the 30 days shall be measured from the date the additional information or clarification is received. If the Contractor requires more than two submittals to obtain the Engineer's Favorable Review, the Contractor shall compensate the Owner for the cost of the Engineer's additional review time. The Contractor shall not perform work for which reviewed submittals are required without obtaining Favorable Review of submittals.

1.02 SCHEDULE OF SUBMITTALS

A. See General Conditions Article 5. Within fifteen (15) days after the Notice to Proceed, submit a Schedule of Submittals showing the date by which each submittal required for Product Review or Product Information will be made. Identify the items that will be included in each submittal by listing the item or group of items and the Specification Section and paragraph number under which they are specified. Indicate whether the submittal is required for Product Review of Proposed Equivalents, Shop Drawings, Product Data or Samples or required for Product Information only.

1.03 PLAN OF OPERATIONS

A. Before beginning on site work, submit a plan showing Contractor's intended use of the site assigned to it. Show location of enclosing fence, access points and gates. Show location for Contractor's, Subcontractor's, and Engineer's field office and parking. Show location of Contractor's and Subcontractor's work areas and storage areas.

1.04 CONSTRUCTION SCHEDULE

A. See General Conditions Article 5.

B. The Contractor's Construction Schedule shall be in the form of a computer-generated network analyses diagram and supporting mathematical analysis using the Critical Path Method (CPM) under concepts and methods outlined in the Associated General Contractor's publication, "The Use of CPM's Construction - A Manual for General Contractors and the Construction Industry." Provide a copy of the software used to the Engineer.
   1. Draw network diagram to scale using actual calendar dates. Show work subdivided into identifiable activities within each trade such that no activity has a duration longer than **five (5)** working days. Show order and interdependencies of each activity.
   2. Use actual calendar dates to show planned and actual performance and show:
      a. Preceding and following event numbers.
      b. Activity description.
      c. Estimated duration of activity.
      d. Earliest start date.
      e. Earliest finish date.
      f. Actual start date.
      g. Actual finish date.

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h. Latest start date.
i. Latest finish date.
j. Total and free float.
k. Monetary value of activity, keyed to Schedule of Values.
l. Percentage of activity completed.
m. Dates for making submittals of Proposed Equivalents, Product Data and Shop Drawings.

B. If the Construction Schedule does not reflect the CPM format requirements, the specified work, or the Contract Time, it will be returned to the Contractor for modification.

C. Revise the Construction Schedule and resubmit within seven (7) days following any monthly meeting to review Contractor's Application for Payment when Contractor's work is fifteen (15) days or more behind schedule.

D. Accelerated Work if Required to Meet Schedule: See General Conditions Article 11 Give Engineer three (3) days prior notice of construction that will take place outside of normal work hours or work days. Compensate Owner for extra inspection cost caused by Accelerated Work required to meet Schedule.

E. Give Engineer three (3) days prior notice of normal work days on which construction will not take place or of scheduled construction that will not take place. Compensate Owner for extra inspection cost resulting from failure to give notice.

1.05 SHOP DRAWING, PRODUCT DATA AND SAMPLES SUBMITTED FOR PRODUCT REVIEW

A. This paragraph covers submittal of Shop Drawings, Product Data and Samples required for the Engineer's review referred to as Product Review submittals in the Technical Specifications (Divisions 2 through 32). Submittals required for information only are referred to as Product Information submittals in the Technical Specifications and are covered in paragraph 1.07. Also see General Conditions Article 8. All shop drawings, product data and samples shall be considered as Product Review submittals unless specifically called out as a Product Information submittal in a technical specification.

B. The Contractor shall make all Product Review submittals early enough to allow adequate time for the Engineer's review, for manufacture and for delivery at the construction site without causing delay to the Work. Submittals shall be made early enough to allow for unforeseen delays such as:
1. Failure to obtain Favorable Review because of inadequate or incomplete submittal or because the item submitted does not meet the requirements of the Contract Documents.
2. Delays in manufacture.
3. Delays in delivery.

C. Content of Submittals:
1. Each submittal shall include all of the items and material required for a complete assembly, system or Specification Section.
2. Submittals shall contain all of the physical, technical and performance data required by the specifications or necessary to demonstrate conclusively that the items comply with the requirements of the Contract Documents.
3. Include information on characteristics of electrical or utility service required and verification that requirements have been coordinated with services provided by the Work and by other interconnected elements of the Work.

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4. Provide verification that the physical characteristics of items submitted, including size, configuration, clearances, mounting points, utility connection points and service access points, are suitable for the space provided and are compatible with other interrelated items that are existing or have or will be submitted.
5. Label each Product Data Submittal, Shop Drawing and Sample with the information required in paragraph 1.01A of this Section. Highlight or mark every page of every copy of all Product Data submittals to show the specific items being submitted and all options included or choices offered.
6. Additional requirements for Product Review submittals are contained in the Technical Specification sections.
7. Designation of work as "NIC" or "by others," shown on Shop Drawings, shall mean that the work will be the responsibility of the Contractor rather than the subcontractor or supplier who has prepared the Shop Drawings.

D. Compatibility of Equipment and Material: Verify that items contained in the same or in different submittals meet the requirements in the paragraph titled "Material and Equipment" in Section 01040 especially the subparagraphs titled "Compatibility of Material and Equipment."

E. Requirements for Contractor Designed Items and for First Specified (Named) Items: Verify that items meet the requirements in the paragraph titled "Performance Specifications and Contractor Designed Items" in Section 01040.

F. Requirements for the Contractor's review and stamping of submittals prepared by the Contractor or by Subcontractors or suppliers prior to submitting them to the Engineer are covered in General Conditions Article 8.

G. Submittals that contain deviations from the requirements of the Contract Documents shall be accompanied by a separate letter explaining the deviations. See General Conditions Article 8. The Contractor's letter shall:
1. Describe the deviation from the specifications requested and identify with a unique number and reference to the Specification Section paragraph or Drawing requirement. The letter shall include a detailed written explanation of the reasons for requesting the deviation that is clearly labeled to correspond with the unique number provided.
2. Describe the proposed alternate material, item or construction and explain its advantages and/or disadvantages to the Owner.
3. State the reduction in Contract Price if any that is offered to the Owner.

H. Engineer's Review Procedure and Meaning:
1. The Engineer will stamp and mark each Product Review submittal prior to returning it to the Contractor. The stamp will indicate whether or not the review was favorable and what action is required of the Contractor. Review categories" No Exceptions Taken" and "Make Corrections Noted" both indicate Favorable Review.
2. At a minimum, Favorable Review is contingent on:
   a. The compatibility of items included in a submittal with other related or interdependent items included in previous or future submittals.
   b. Future submittal of items related to or required to be part of this submittal that were not included with this submittal.
3. Favorable Review of a submittal does not constitute approval or deletion of items required as part of the submittal but not included with the submittal. Favorable Review of items included in the submittal does not constitute

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deletion of specified features, options or accessories that were not included in the submittal.

4. The action required by the Contractor for each category of review is as follows:
   a. **NO EXCEPTIONS TAKEN**. NO RESUBMITTAL REQUIRED.
   b. **MAKE CORRECTIONS NOTED**:
      1) NO RESUBMITTAL REQUIRED. The Contractor shall make corrections noted prior to manufacture.
      2) PARTIAL RESUBMITTALS REQUIRED. The Contractor shall submit related accessory or optional items as noted which are required but were not included with the submittal and/or shall resubmit unsatisfactory portions or attributes of items as noted. The Contractor may proceed to manufacture those portions of the submittal that will be unaffected by required resubmittals.
   c. **AMEND AND RESUBMIT**. The Contractor shall amend and resubmit the submittal as noted or required to comply with the Contract Documents.
   d. **REJECTED - RESUBMIT**. The item submitted does not comply with the Contract Documents. Resubmit items that comply with the requirements of the Contract Documents.
   e. **NOT REVIEWED**. The item submitted is incomplete or does not comply with the Contract Documents. The item has not been reviewed and is returned to the Contractor for correction.
   f. **RECEIPT ACKNOWLEDGED**. Receipt of a submittal that is not subject to the Owner's review and approval is acknowledged; and, is being filed for information purposes only. Generally used in acknowledging receipt of Product Information. No further submittal activity is required by the Contractor.
5. The letter of transmittal accompanying the returned Product Review submittal may contain numbered notes. Marking a corresponding number on a Shop Drawing or Product Data submittal shall have the same effect as applying the entire note to the submittal.

I. Re-submittals that contain changes that were not requested by the Engineer on the previous submittal shall be accompanied by a letter explaining the change.

J. Favorable Review Required Prior to Proceeding: Do not proceed with manufacture, fabrication, delivery or installation of items prior to obtaining the Engineers Favorable Review of Product Review submittals. See General Conditions Article 12.

K. Intent and Limitation on Engineer's Review:
   1. See General Conditions Article 8.
   2. The Contractor has primary responsibility for submitting and providing work that complies with the requirements of the Contract Documents. That responsibility cannot be delegated in whole or in part to subcontractors or suppliers. Neither the Engineer's Favorable Review nor the Engineer's failure to notice or comment on deficiencies in the Contractor's submittals shall relieve the Contractor from the duty to provide work, which complies with the requirements of the Contract Documents.

1.06 PROPOSED EQUIVALENTS (SUBSTITUTIONS)

A. See General Conditions Article 8.

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B. The term "first specified item" or "first named maker" refers to the first product identified in the Specifications by a model number or trade name and/or by a maker's name for a specified item. When the first specified item is followed by a second maker's name and "or equal," the Contractor may submit Proposed Equivalent (Substitution) items for the Engineer's review. Proposed Equivalent (Substitution) items that are in the Engineer's judgment equal to the first specified item in quality, utility, and appearance, will be Favorably Reviewed. Where a product description and first maker's name is followed by "or equal" with no second maker's name, it means the specifier knows of no equivalent product and the Contractor may submit Proposed Equivalent (Substitution) products by other makers for review. Where the term "or equal" is omitted, it means that the named item is required to meet the Owner's needs; no products or makers other than those specified will be considered.

C. Submit Proposed Equivalent (Substitutions) submittal form, General Conditions Exhibit GC-3 and comply with the submittal requirements for Shop Drawings, Product Data, and Samples submitted for Product Review in another paragraph of this Section.

D. Time of Submittal:
   1. General Conditions Article 8 requires submittal of Proposed Equivalents (Substitutions) within thirty-five (35) days of the Notice to Proceed. The Engineer may agree to a later submittal date if requested in writing within thirty-five (35) days of the Notice to Proceed. The request shall identify the item; give the Specification reference, and proposed manufacturer and model number of the item that will be submitted and the proposed submittal date.
   2. The Engineer's agreement to a later submittal date shall be in writing and shall not be construed as Favorable Review or acceptance of the manufacturer or item proposed.

E. Content of submittals shall be the same as that required for Product Data, Shop Drawings and Samples submitted for Product Review in another paragraph of this Section. In addition, the Contractor shall provide information on several recent similar installations of the item to verify its suitability. The information shall include the project name and location, the Owner's name, address, telephone number and name of a knowledgeable person to contact for information on performance of the product.

F. When the Contractor has listed specific maker's products submitted with its Bid, no changes will be permitted without submittal of acceptable evidence justifying the change and the Engineer's written approval.

G. If a non-equivalent substitute is submitted for review, it shall be accompanied by a proposed reduction in Contract Price which shall include the increased cost of Engineering service required to evaluate the proposed substitute (which shall be paid to the Owner whether or not the substitute is accepted) plus the greater of 1) the difference in price between the first specified item and the item submitted and 2) the difference in value to the Owner between the two items.

1.07 PRODUCT INFORMATION SUBMITTALS

A. See General Conditions Article 8. Submittal for Informational Purpose Only is an item required for the Owner's permanent records relating, in part, to future maintenance, repair, modification, replacement of work or as otherwise required.

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The Contractor shall clearly separate information for Product Review from information for Product Information in submittals that include both.

B. Make Product Information submittals prior to delivering material, products or items for which Product Information submittals are required.

C. The Contractor has the sole and exclusive responsibility for furnishing products and work that meets the requirements of the Contract Documents.

D. The Engineer reserves the right to comment on any submittal and to reject any product or work delivered, installed or otherwise at any time that the Engineer become aware that it is defective or does not meet the requirements of the Contract Document. See General Conditions Article 12.

1.08 OPERATION AND MAINTENANCE MANUALS AND PARTS LISTS

A. Operation and maintenance (O&M) information shall be submitted in a format best suited for the type of manual to be provided to the Owner. Unless otherwise specified, provide information in electronic PDF searchable format.

B. Provide operation and maintenance manuals and parts list for all equipment furnished under this Contract. Comply with the detailed requirements in Technical Specification sections. Include instructions for delivery, storage, assembly, installation, lubrication, adjusting, startup, operation and maintenance. Provide PDF bookmarks for all items listed in subparagraphs 1 through 5 below.

1. For all equipment include:
    a. Startup instructions
    b. Normal operation instructions.
    c. Trouble shooting instructions.
    d. Lubrication instructions.
    e. Maintenance and reinstallation instructions, and manufacturer's recommended preventative maintenance schedule.
    f. Parts identification.
    g. List of spare parts recommended to have on hand.
    h. Operator safety instructions.
    i. Cleaning instructions.
    j. Theory of operation to discrete component level.
    k. Schematic diagrams, flow diagrams, wiring diagrams, logic diagrams, etc. to discrete component level.
    l. Parts list showing all discrete components with part number,
    m. Manufacturers' service and maintenance technical manuals.
2. For all Electrical Equipment, provide the following additional information:
    a. Equipment ratings.
    b. Calibration curves and rating tables if appropriate.
3. For Complex Equipment provide in addition:
    a. Alternate specified operating modes.
    b. Emergency shutdown instructions.
    c. Normal shutdown instructions.
    d. Long-term shutdown instructions.
4. Operation and maintenance manuals for systems composed of separate pieces of equipment shall include a system explanation of items 1, a, b, and c, and 3a through c, as well as the instructions for each separate piece of equipment.

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C. Submit at least fifteen (15) days prior to Facility Startup and Training specified in Section 01650.

D. When standard manufacturer's literature is used highlight or mark all copies to shop specific items and options provided.

1.09 MANUFACTURER'S CERTIFICATES

A. When specified in Technical Specification section, submit manufacturers' certificate to Engineer for review. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate. Certificates may be recent or previous test results on material or product, but must be acceptable to the Engineer.

1.10 CONSTRUCTION PHOTOGRAPHS

A. Submit digital photographs in electronic JPEG format each month to Engineer with Application for Payment.

B. Take five (5) site photographs from different directions and five (5) interior photographs to show progress of the Work. Take photographs within five (5) days of each Application for Payment date.

C. Identify photographs with date, time, orientation and project identification.

1.11 LIST OF SUBMITTALS FOR DIVISIONS 0 AND 1

A. Submittals required with the Bid are not listed.

Description	Required by	Time of Submittal
1. Performance & Payment Bonds	GC Article 4	Prior to signing Agreement
2. Liability Insurance Certificates	GC Article 4	Prior to beginning Construction
3. Property Insurance Certificates	GC Article 4	Prior to beginning Construction
4. List of Subcontractors	Doc 00430, GC Article 5	Prior to beginning Construction
5. Plan of Operations	01300	Prior to beginning work on the site
6. Temporary Construction Schedule	GC Article 5	Within 10 days of the date in the Notice to Proceed
7. Schedule of Submittals	01300	Within 15 days of Notice to Proceed
8. Schedule of Values	GC Article 13, 01010	20 days prior to the first Application for Payment
9. Application for Payment	GC Article 13, 01010	5 days prior to each Application for Payment date
10. Construction Schedule	GC Article 5, 01300	Within 30 days of Notice to Proceed.
11. Environmental Protection Plan	01300 01140	Submit within 30 days from the date of the Notice to Proceed
12. Submittal of All Proposed Equivalent Items	GC Article 8, 01300 and Technical Sections	Within 35 days of the Notice to Proceed unless Engineer has agreed to a later submittal date in writing
13. Manufacturer's Certificates	01300, and Technical Specifications	Prior to delivering material or equipment and in accordance with Technical Specifications
14. Construction Photographs	01300	Submit monthly

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Description	Required by	Time of Submittal
15. Operations and Maintenance Manuals and Parts Lists	01300 01650	Submit 15 days prior to Facility Startup and Training
16. Manufacturer's Affidavits	01300 01650	During equipment startup. For equipment for which affidavits are called for in the Technical Specifications
17. Record Drawings	GC Article 5	Prior to Final Acceptance
18. Extra Materials	01700 and Technical Specifications	Prior to Final Acceptance
19. Special Guarantees	01700 and Technical Specifications	Prior to Final Acceptance
20. Maintenance Contracts	01700 and Technical Specifications	Prior to Final Acceptance
21. Release of Liens	GC Article 13	With Progress Payments Prior to Final Payment
22. Contractor's Waiver of Claims	GC Article 13	Prior to Final Payment
23. Insurance Certificate for insurance coverage beyond Final Payment including completed operations coverage and liability coverage when the Contractor is correcting defective work under the Guarantee.	GC Article 4	Prior to Final Payment

1.12 LIST OF SUBMITTALS FOR TECHNICAL SPECIFICATIONS

A. A list of submittals required in Technical Specification Sections is appended to this Section. This list may not be all-inclusive; refer to Technical Specification Sections for detailed submittal requirements.

LIST OF SUBMITTALS

SECTION	PARA-GRAPH	PRODUCT REVIEW	PRODUCT INFOR.	SAMPLES	FACTORY TEST PLAN OR LAB	FACTORY OR MATER-IALS TEST REPORT	FIELD TEST PLAN	FIELD(3) TEST REPORT	O&M MANUAL & PARTS LIST	AFFI-DAVIT
02050	1.06									
02300	1.05									
02516	1.05									
02705	1.03		X							
02775	1.03		X							
02825	1.03	X	X	X					X	
03100	1.03	X		X						
03150	1.03	X				X				
03200	1.03	X								
03300	1.03	X	X	X		X				
03305	1.03	X				X				
03306	1.03	X	X			X				
03330	1.04	X	X	X						
03340	1.04	X	X			X	X			
03350	1.03	X		X						
03600	1.03	X		X						
03935	1.03	X		X						
05090	1.03	X		X		X				
05100	1.03	X		X						
05500	1.03	X								
05724	1.03	X								
05726	1.03	X								
07136	1.03	X		X						
07140	1.04	X		X						

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SECTION	PARA-GRAPH	PRODUCT REVIEW	PRODUCT INFOR.	SAMPLES	FACTORY TEST PLAN OR LAB	FACTORY OR MATER-IALS TEST REPORT	FIELD TEST PLAN	FIELD(3) TEST REPORT	O&M MANUAL & PARTS LIST	AFFI-DAVIT
08307	1.03	X								
09960	1.04	X	X							
11001	1.04	X					X	X	X	X
11003	1.04						X	X		
11303	1.03	X					X		X	X
15050	1.03	X	X	X				X	X	X
15111	1.03	X	X						X	X
15113	1.03	X	X						X	X
16010	1.03	X							X	
16110	1.03	X	X							
16120	1.03	X								
16124	1.03	X								
16402	1.03	X								
16450	1.03	X								
16950	1.03				X		X	X		
16955	1.03	X								
32840	1.03	X								
32911	1.03	X		X				X		

LEGEND AND NOTES:

S Indicates a single and separate submittal package each within its own transmittal letter from Contractor. This submittal shall be complete for all items in the Section (or portion of Section as designated in table).
M Indicates multiple submittals are acceptable to facilitate project progress.
(1) Include this item with Product Review Submittal Package.
(2) Include documentation of required special warranty or guarantee.
(3) There are certain requirements under various sections for testing, for which submission of a report is not required. Such situations are not included in this listing.
(4) This Section includes submittal requirements for items described in other sections.
(5) Include record/as-built drawings and/or special as-built data as specified.
(6) For Product Review submittals, submit single, complete submittal packages for all items specified within the following Specification groups (i.e., no more than one submittal per group of specification sections):
    a. Sections 16100 through 16199.
    b. Sections 16200 through 16299.
    c. Sections 16900 through 16999.
(7) Submit Division 16 Product Information submittals together in a single package.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01311

CPM CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 GENERAL

A. See General Conditions Article 5. Submit to the Engineer a Temporary Construction Schedule and a Critical Path Method (CPM) Schedule (along with updates) as described below.

B. Temporary Construction Schedule: Submit to the Engineer, within ten (10) days after date of the Notice to Proceed, a Temporary Construction Schedule covering the Contractor's activities over the first sixty (60) days of the Contract Time. The Temporary Construction Schedule shall schedule the progress within the calendar days set forth for completion of the work.

C. CPM Schedule: Acceptable CPM scheduling software includes SureTrak or Primavera. Provide a copy of the selected software to the Engineer. In accordance with General Conditions Article 5, submit an acceptable CPM Schedule to the Engineer within thirty (30) days after beginning construction. Subsequent revisions to said schedule shall be submitted as set forth hereinafter. The requirement for the CPM Schedule is included to assure adequate planning and execution of the Work and to assist the Engineer in appraising the reasonableness of the proposed schedule and evaluating progress of the Work. The CPM Schedule submitted under this specification shall utilize a critical path method (CPM) format, either the precedence or arrow diagramming method. Only one (1) progress payment will be made prior to submission and acceptance of the CPM Schedule.

1. The CPM schedule system shall be submitted on paper and on CD-ROM and shall consist of diagrams and accompanying mathematical analyses. The diagrams shall show elements of the project in detail and an entire project summary. Diagrams shall show the order and interdependence of activities and sequence in which the Work is to be accomplished as planned by the Contractor. The basic concept of a network analysis diagram shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and its completion restricts the start of following activities. Detailed network activities shall include, in addition to construction activities, the submittal and approval of samples of material and Shop Drawings, the procurement of critical materials and equipment, fabrication of special material and equipment and their installation and testing. All activities of the Owner and the Engineer that affect progress and required Contract dates for completion of all or parts of the Work shall be shown. The selection and number of activities shall be subject to favorable review by the Engineer. Summary networks shall be time scaled. Durations shall be in working days and shall not exceed five (5) workdays, except for submittal and delivery items. Where the duration of continuous work exceeds five (5) workdays, work items in the Construction Schedule shall be subdivided by location, approximate stationing or other sub-element of the work.
2. The graphic network diagram shall include for each activity, the description, activity number, the estimated duration in workdays, and all activity

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relationship lines. The network diagram shall be drawn for the early start of all activities. If the precedence technique is utilized, the schedule report shall include a calendar in workdays, a network report sorted by early start and a logic table report sorted by preceding work item. If the arrow technique is utilized, the schedule report shall include a calendar in workdays, a network report sorted by early start, a network report sorted by I J numbers, and a network sorted by slack time and I J numbers.

3. The critical path shall be shown on all reports and on the graphic network diagram. The activities which constitute the critical path shall be identified.
4. The mathematical analysis of the network diagram shall include a tabulation of each activity. The following information shall be furnished as a minimum for each activity:
    a. preceding and following event numbers
    b. activity description and number
    c. estimated duration of activities
    d. earliest start date (by calendar date)
    e. earliest finish date (by calendar date)
    f. actual start date (by calendar date)
    g. actual finish date (by calendar date)
    h. latest start date (by calendar date)
    i. latest finish date (by calendar date)
    j. slack or float
    k. percentage of activity completed
5. The program shall be capable of accepting revised completion dates as modified by approved time adjustments and recomputations of all tabulation dates and float accordingly.
6. Submission and review of the system shall be as follows:
    a. Submit the complete network analysis system, consisting of the detailed network mathematical analysis and network diagrams, within thirty (30) calendar days after receipt of Notice to Proceed.
    b. Participate in a review and evaluation of the proposed network diagrams and analysis by the Engineer. Any revisions necessary as a result of this review shall be resubmitted for review by the Engineer within ten (10) calendar days. When completed, the favorably reviewed schedule shall then be the schedule to be used by the Contractor for planning, organizing and directing the work and for reporting progress. If the Contractor thereafter desires to make significant changes in its method of operating and scheduling, the Contractor shall notify the Engineer in writing stating the reasons for the change.
    c. Submit on paper and on CD-ROM at monthly intervals a report of the actual construction progress. Each monthly report shall cover a period of approximately thirty (30) days ending around the 20th of each month. The monthly reports shall be submitted within ten (10) days of the end of the reporting period.
        1) If the project is proceeding on schedule, the monthly update report may consist of a marked-up copy of the graphical network diagram. This submittal shall clearly indicate the status of any minor shifts in sequence or schedule and the estimated completion date or percent complete of all activities currently in progress. The Contract Completion Date shall also be indicated. Submit a narrative report relating to status of construction, the schedule, and factors which may affect the remainder of the

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schedule. The report shall show the activities or portions of activities completed during the reporting period. The report shall state the percentage of the work actually completed and scheduled as of the report date and the progress along the critical path in terms of days ahead or behind the allowable dates.

2) If, in the opinion of the Engineer, the project is behind schedule, the monthly report shall include a revised network diagram and/or mathematical analysis showing the Contractor's proposed revised schedule. An analysis of the effect that the delay has on progress along other paths shall also be included in the report. Also submit a narrative report with each updated analysis which shall include but not be limited to a description of current and anticipated problem areas, delaying factors and their impact, and an explanation of corrective actions taken or proposed.

3) Periodic reports shall be submitted in sufficient copies to cover Contractor needs plus three (3) copies to be retained by the Engineer.

7. Any omission of work from the detailed schedule, otherwise required for Contract compliance, will not excuse the Contractor from completing such work within any applicable completion date. The CPM Schedule shall be generated by computer methods. If the submitted Construction Progress Schedule does not fully reflect the specified work, the CPM format requirements or time limitation for completion of the Work as provided in these Specification, it shall be returned to the Contractor by the Engineer for modification as necessary.

D. Schedule Review: Once each month, on a date mutually agreed upon, but no later than seven (7) working days after the monthly schedule progress report date, a jobsite meeting will be held to review the Construction Schedule and job progress. Also attend weekly meetings scheduled by the Engineer to review the progress of the Work in the preceding week and in the subsequent work, coordinate the work with public agencies or other contractors as required, and allow the Engineer to plan its activities for testing, inspection, etc.

E. Schedule Revisions: The conditions under which the Engineer will require revisions of the Construction Schedule include the following:

1. When delay in completion of any work item or sequence of work items results in an estimated extension of project completion by either twenty (20) days or by five percent (5%) of the remaining duration of time to complete the Contract, whichever is less.
2. When delays in submittals or deliveries make replanning or rescheduling of the work necessary.
3. When the schedule does not represent actual prosecution and progress of the work.
4. When any change to the sequence of activities, the completion date for major portions of the Work, or when changes occur which affect the critical path.
5. When Contract modification necessitates schedule revision, the Contractor shall submit a schedule analysis of all change order work with its proposal.

F. Cash Flow Projection: A cash flow projection shall be submitted with the Construction Schedule. This cash flow projection shall be revised and resubmitted when revisions of the Construction Schedule will result in changes to the projected cash flow.

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G. Proposed Change Orders: Proposed change orders submitted by the Contractor shall be accompanied by a statement of the time necessary for the work, together with a description of how this time will be incorporated into the current Construction Schedule. The Contractor shall not be entitled to a time extension for delays in activities on non-critical paths of the favorably reviewed schedule unless the duration of the excusable delay exceeds the total float of the activities being delayed. If the duration of an excusable delay does exceed the total float of the activities affected by the delay, the Contractor shall be entitled to an extension equal to the difference. Except as defined in the Contract Documents, the definitions of "non-critical activities" and "total float" shall be as provided in the Associated General Contractors of America book "CPM In Construction, A Manual For General Contractors."

H. Accelerated Work if Required to Meet Schedule: If the Contractor's performance falls behind schedule, the Contractor shall accelerate the work as required to get back on schedule at no additional cost to the Owner. Accelerated work shall include air or express delivery of materials and equipment, increasing the number of workers, working overtime, working Saturdays, Sundays, and holidays, and/or working additional shifts.

I. When, in the judgment of the Engineer, it is necessary to accelerate any part of the work ahead of schedule, the Contractor shall, when directed, concentrate its efforts on such part of the work, but maintain sufficient progress on all other areas of the Project required to maintain the schedule which meets the Contract Completion Date.

J. The Engineer shall be advised in advance by the Contractor when construction work will take place. If the Contractor fails to notify the Engineer in advance of the day or days when no construction work will be done, the Contractor will be charged the cost of inspection for that day or days and such changes may be deducted from any payment due the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 TEMPORARY UTILITIES

A. Sanitary Facilities: Provide and maintain self-contained portable sanitary facilities for the Contractor's, subcontractor's, Engineer's, and Owner's use. Facilities shall comply with applicable regulations and shall be serviced, cleaned and disinfected frequently.

B. Temporary Water, Power and Telephone Service:
   1. Water: No existing water service on the property. Irrigation line only off Reservoir 3A.
   2. Power: Connect to the existing electrical service with a service disconnect switch. Provide overcurrent and ground fault protection. Provide a meter and reimburse Owner for the cost of energy used.

B. Temporary Ventilation: Provide equipment to ventilate enclosed areas to facilitate curing concrete, to dissipate humidity and to prevent accumulation of dust, fumes, or gases. Utilize existing ventilation equipment and supplement with temporary fans to maintain clean air and safe conditions for construction operations. Replace or clean filters on existing or new equipment on completion of the project.

C. Temporary Lighting: Provide and maintain lighting for construction operations to achieve a minimum lighting level of 20 foot-candles for rough work and 60 foot-candles for finish work.

D. Temporary Fire Protection:
   1. Provide and maintain fire protection equipment, including extinguishers, fire hoses, and other equipment required by law or insurance carriers, or as necessary for proper fire protection during the course of the work.
   2. Use fire protection equipment only for fighting fires.
   3. Locate fire extinguishers in field offices, storage sheds, tool houses, temporary buildings, and throughout the construction site. In the area under construction, provide at least one (1) fire extinguisher for each 5,000 square feet of enclosed space and locate fire extinguishers not over 100 feet apart.
   4. Comply with the **Fire Department Construction Site Requirements** from LA County Fire.

1.02 TEMPORARY CONSTRUCTION

A. The Contractor is solely and exclusively responsible for the design, construction and maintenance of all temporary construction including forms, falsework, shoring, scaffolding, stairs, ladders and all other similar items. See General Conditions paragraphs 5.3 and 5.20 through 5.28 and Section 01040.

B. Construct adequate and safe forms and falsework to rigidly support partially completed structures. Provide temporary bridges and decking to maintain vehicular and pedestrian access. Design and construct temporary forms, falsework, bridges and decking in accordance with applicable regulations and codes.

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1.03 BARRICADES, FENCES AND ENCLOSURES

A. See General Conditions paragraphs 5.3 and 5.20 through 5.28 and Section 01040.

B. Barricades: Provide temporary guardrails, ladders, stairs, guards, and barricades to protect persons in accordance with applicable regulations, including California Code of Regulations Title 8 and Cal/OSHA.

C. Fences:
   1. Provide a temporary 6-foot-high chain-link fence wherever the exterior fence has been removed to exclude unauthorized persons from construction areas.

D. Enclosures:
   1. Provide protective dust covering at doors and other openings to contain dust within the construction area.
   2. Provide temporary partitions to prevent dust and moisture from entering Owner-occupied areas and to prevent damage to existing materials and equipment. Temporary partitions shall be of non-combustible construction such as metal studs and gypsum board.
   3. Provide temporary watertight closures for openings in exterior surfaces as required to protect interiors from weather, moisture, humidity and extreme temperature.

1.04 PROTECTION OF INSTALLED WORK

A. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.

B. Cover Reservoir 3A vents with screening.

C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects.

D. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is unavoidable, provide adequate protection to prevent damage to waterproof membranes and comply with recommendations for protection of the waterproofing or roofing material manufacturer.

E. Provide heavy planking to protect curbs, gutters, culverts, paving and similar surfaces from damage by heavy equipment or vehicles.

1.05 SECURITY

A. Provide security and facilities to protect the Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.06 ACCESS ROADS AND PARKING AREAS

A. Access Roads: Use only access roads designated on the Drawings.

B. Parking:
   1. Park workers' vehicles offsite.

1.07 TEMPORARY CONTROLS

A. Cleaning:
   1. During Construction: Maintain the site and all work in a clean orderly fashion free of waste debris and rubbish. Store debris in covered containers. Pick up and remove debris daily if required, but not less frequently than weekly.

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Burning debris on site is not permitted. Remove debris from permanently closed spaces prior to enclosing them. Clean mud from vehicles before leaving the site.

2. If work under this Contract creates dusty, dirty or unsightly conditions in adjacent areas, the Contractor shall immediately cleanup the affected areas.
3. Final cleanup is specified in Section 01700.

B. Dust Control: Employ measures to prevent the creation of dust which may produce damage or nuisance to property or persons. Be responsible for all damage resulting from dust produced by construction operations. Periodically wet down unpaved areas where vehicles are operated. See Division 2 Earthwork specification sections.

C. Erosion and Sediment Control: Employ measures to prevent erosion and trap any sediment created by construction operations before it leaves the site. Prevent sediment from entering streams or other water bodies.

D. Noise Control: Comply with regulations limiting construction noise levels. Use whisper quite air compressors. Use jack hammers with exhaust mufflers. Prevent noise disturbance to the public and adjacent property owners. Employ measures required to limit construction noise to **60** dBA at construction site boundaries.

E. Pest and Rodent Control: Avoid creating conditions conducive to pests and rodents. Comply with regulations governing the use of chemicals to control pests and rodents.

F. Water Control: Maintain excavations free of water. Grade site to drain. OR Protect site from puddling or running water. See Division 2 Earthwork specification sections.

1.08 PROTECTION OF TREES

A. Remove only those trees designated on the Drawings for removal. Protect all other trees on the site.

B. Do not trim any trees without the Engineer's authorization.

1.09 TRAFFIC REGULATION

A. Conduct operations so as to offer the least possible obstruction and inconvenience to public traffic. Do not overload or damage paved or improved surfaces, sidewalks, curbs or gutters.

B. Provide temporary barricades, lights, flag persons and other means to safely control pedestrian and vehicular traffic entering and leaving the project site and on the project site.

1.10 PROJECT SIGN

A. Provide an 8 foot-wide by 6 foot-high project sign using ¾ inch exterior grade plywood and braced wood frame construction. Paint all surfaces with two coats of exterior house paint. Employ a professional sign painter to letter sign in accordance with Engineer's small scale design and color selection (two colors).

1. List project title and names of Owner, Engineer, and Contractor.
2. Erect the sign where directed by the Engineer. Locate bottom edge of the sign 8 feet above the ground.
3. Maintain sign in good condition and remove it on project completion.

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1.11 FIELD OFFICES

A. Contractor's Office at the Site: Maintain a suitable office at the site for the Contractor's Superintendent who shall be authorized to receive submittals, drawings, instructions, or other communications from the Engineer or the Owner. Provide a meeting room suitable for eight (8) people for conducting the regular construction progress meetings.

B. Engineer's Office at the Site:
   1. Office: Provide a trailer-type temporary structure for the Engineer's use as an office with the following features:
      a. All-metal frame, exterior, sides and roof.
      b. Size: 300 square feet minimum, with minimum interior ceiling height of 8 feet.
      c. Number of Rooms: Two (2) minimum and a toilet room.
      d. Windows: Two (2) minimum per office room with horizontal sliders, security guard screens and mini-blinds on all windows.
      e. Lighting: Interior fluorescent ceiling lights with 70 foot-candles of uniform lighting at desk level. Provide outside lights above each door.
      f. Heating, Ventilation and Air Conditioning: Provide at least six (6) air changes per hour in all rooms and provide air conditioning equipment capable of maintaining at least 70°F for heating and 78°F maximum for cooling.
      g. Toilet room with flush toilet, OR chemical toilet - Monogram Industries Jetomatic; Pyrolet; or equal, wash basin, mirror, toilet paper and paper towel dispensers.
      h. Doors equipped with automatic retracting deadbolt locks. Provide four (4) keys.
      i. OSHA-approved staircase with stair handrail and landing with guardrail at entrances.
      j. Electrical service, disconnect switch and a circuit breaker panel. Provide ground fault protected outlets.
      k. Multiple 115-volt, 15 amp receptacles, spaced no more than 8 feet apart.
      l. Smoke detectors and outside alarm.
   2. Equipment and Furnishings: Provide the following:
      a. Two (2) desks each with two-drawer pedestals.
      b. Two (2) swivel chairs.
      c. One (1) 4 drawer filing cabinet.
      d. One (1) 12 stick plan holder.
      e. Two (2) desk lamps.
      f. Two (2) drafting tables and stools.
      g. One (1) paper towel dispenser.
      h. One (1) paper cup dispenser.
      i. One (1) bookcase, 4 feet wide and 3 feet high.
      j. Two (2) wastepaper baskets.
      k. One (1) first-aid kit.
      l. Two (2) telephones, one (1) with speaker.
      m. One (1) telephone answering machine.
      n. One (1) color digital copier/scanner with the following minimum capabilities:
         1) Stack feed 50 original document sheets
         2) Sort and staple 20 copies

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3) Copy rate of 25 copies per minute
4) Ability to reproduce 8.5" x 11", 8.5" x 14", and 11" x 17" documents
5) Enlarge and diminish copy size capability
6) Double-side copy and scanning capability
7) Network capability

o. One (1) 14A 60 BC dry chemical fire extinguisher. Fire extinguisher shall be mounted so as to be plainly visible at all times. The Contractor shall service the fire extinguisher on an annual basis.

3. Utilities: Install sewer and potable water service. Arrange and pay for telephone, high speed internet and electrical service. The Contractor shall pay for periodic water, sewer, and electrical charges. The Owner will pay for periodic telephone charges.
4. Installation and Removal: Install the Engineer's office at the location directed by the Engineer within fifteen (15) days after the Notice-to-Proceed. Provide rigid level supports and seismic and wind tie-downs. Remove the Engineer's office no later than thirty (30) days after recording of the Notice of Completion, but no earlier than the Notice of Completion.
5. Maintenance: Maintain the Engineer's office in good repair. Provide daily cleaning and maintenance service. Replenish paper towels, paper cups, soap, toilet paper, and bottled water daily. Service, pump and clean chemical toilets at least twice weekly. Service the copier machine monthly or more frequently if needed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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SECTION 01550

TRAFFIC CONTROL

PART 1 - GENERAL

1.01 OBJECTIVES

A. Provide for safe movement of vehicular, bicycle and pedestrian traffic through and around Contractor's construction operations. Traffic control requirements set forth herein are the minimum requirements imposed. The Contractor shall be solely responsible for providing all protective measures necessary.

B. Proper traffic movement through the work area depends upon the driver controlling and directing his/her vehicle properly under unexpected situations and pedestrian attention to signs. The means of clarifying such conditions to the public include signs, flaggers, pavement markings, barricades, lights, cones and delineators.

C. No one standard sequence of signs or control devices will suit all conditions, which may result from construction operations. Even for the same work the conditions may vary from hour to hour, requiring adjustment and revision of the traffic control program in effect.

D. The traffic control requirements specified herein are intended to establish general principles to be observed in the control and regulation of traffic through and around construction operations anticipated for this project. All pedestrian and vehicular detours are subject to review by the police chief, sheriff or enforcement officer of the agencies having jurisdiction, and the Contractor shall revise the detours as ordered, at no additional cost.

E. Cleanup site each day after completing work and remove all traffic hazards. Daily traffic control measures shall continue until cleanup activities have been satisfactorily completed and all of the Contractor's equipment has been removed from the traveled way area.

1.02 DESCRIPTION OF WORK

A. Work Included:
   1. At all times, provide safe and adequate passage for vehicular and pedestrian traffic through, around and adjacent to all construction operations by use of detours, bridging, backfilling, paving, traffic barriers or other favorably reviewed means.
   2. Establish and maintain detours and conduct construction operations in such a manner as to minimize hazard, inconvenience and disruption to the public.
   3. Traffic control shall be directed equally to the regulation and protection of pedestrian traffic including pedestrians, bicyclists, joggers, skaters, skateboarders, etc.
   4. Provide for protection of pedestrians and separation of pedestrians from construction operations at all times.
   5. Direct, divert and detour traffic through, around and adjacent to construction operations in accordance with the traffic control plans as specified herein or in accordance with favorably reviewed Traffic Control Plans. Revise the Traffic Control Plan, as necessary, only with the favorable review of the Engineer.

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1.03 REFERENCES

A. Manual of Traffic Controls, California Department of Transportation.

B. Work Area Traffic Control Handbook, Building News Incorporated, P.O. Box 3031, Terminal Annex, Los Angeles, California 90051.

C. Manual on Uniform Traffic Control Devices (MUTCD) (Traffic control for construction and maintenance work zones shall follow Part 6 of the 2006 MUTCD as amended by Part 6 of the 2006 MUTCD California supplement. These two parts must be used together.)

D. Standard Specifications for Construction of Local Streets and Road, July 2006, California Department of Transportation.

E. Standard Plans for Construction of Local Streets and Road, July 2006, California Department of Transportation.

1.04 SUBMITTALS

A. Traffic Control Plan:
   1. Submit a Traffic Control Plan (TCP) in accordance with the procedures specified in Section 01300 under the Product Review category to clearly describe proposed traffic control measures. The plan shall be as shown on the Drawings and shall be generally in accordance with the illustrations included in the Manual of Traffic Control and in the Work Area Traffic Control Handbook.
   2. Submittal shall consist of scaled drawings for each situation anticipated to be encountered, i.e., intersections, mid-block (each during working and non-working hours), etc.
   3. Scaled drawings shall show signs, traffic control devices and flaggers as required.
   4. No traffic control related work shall commence until a TCP is favorably reviewed by the Engineer.
   5. Revise and keep the TCP up to date as the project progresses. Consult with the Engineer on an ongoing basis to assure having a safe and workable plan in place.

PART 2 - PRODUCTS

2.01 CONSTRUCTION SIGNS

A. The term "Construction Area Signs" shall include all temporary signs required for the direction of public traffic through or around the work during construction. These signs are shown in or referred to in the current Manual of Traffic Controls. Construction area signs shall be installed at the locations shown on the Drawings, the TCP and at other locations as directed by the Engineer

B. All construction area signs shall conform to the dimensions, color and legend requirements of the Drawings, the current Manual of Traffic Controls and these specifications. All sign panels shall be the product of a commercial sign manufacturer, and shall be as specified in these specifications. The base material of construction area signs shall not be plywood or cardboard unless specifically identified in these specifications.

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C. Sign panels for all construction area signs shall be visible at 500 feet and legible at 300 feet, at noon on a cloudless day and at night under illumination of legal low beam headlights, by persons with vision of or corrected to 20/20, except that the nighttime requirement shall not apply to fabric sign panels for portable signs

D. Temporary warning signs in construction areas shall have a black legend on an orange background. Color for other signs shall follow the standard for all highway signs.

E. All signs used during hours of darkness shall be reflectorized or illuminated.

F. Stationary Mounted Signs
   1. Stationary mounted signs shall be installed on wood posts in the same manner as shown on the Drawings for installation of roadside signs, except as follows.
   2. The height to the bottom of the sign panel above the edge of traveled way shall be at least 7 feet.
   3. Construction area sign posts may be installed on above ground temporary platform sign supports as favorably reviewed by the Engineer, or the signs may be installed on existing lighting standards or other supports as favorably reviewed by the Engineer. When construction area signs are installed on existing lighting standards, holes shall not be made in the standards to support the sign.
   4. The post embedment shall be 3 feet if post holes are backfilled around the posts with 3,000 PSI batch plant mix concrete.
   5. Sign panels for stationary mounted signs shall consist of Type II, Type III or Type IV retroreflective sheeting applied to an aluminum substrate conforming to the requirements in the California Department of Transportation's "Specifications for Reflective Sheeting Aluminum Signs." Copies of the Department's "Specifications for Reflective Sheeting Aluminum Signs," "Framing Details for Sheet Aluminum Signs," and sign specification sheets may be obtained from the Department's Office of Business Management, Materiel Operations Branch, 1900 Royal Oaks Drive, Sacramento, CA 95815.
   6. Sign panel fastening hardware shall be commercial quality.

G. Portable Signs
   1. Each portable sign shall consist of a base, standard or framework and a sign panel. The units shall be capable of being delivered to the site of use and placed in immediate operation.
   2. Sign panels for portable signs shall conform to the provisions for sign panels for stationary mounted signs in California Department of Transportation Section 12 3.06A, "Stationary Mounted Signs," or shall be Type VI retroreflective sheeting, or shall be cotton drill fabric, flexible industrial nylon fabric or other approved fabric. Fabric signs shall not be used during the hours of darkness. Size, color, and legend requirements for portable signs shall be as described for stationary mounted sign panels in Section 12 3.06A. The height to the bottom of the sign panel above the edge of traveled way shall be at least 1 foot.

H. "No Parking" signs posted shall be of heavy card stock and not less than 1.75 square feet of surface area on the face. Background color shall be white and letters shall be printed in red water-resistant ink, except that day, date, and time of restriction may be printed in black water-resistant ink. The signs shall be printed with the words "Tow Away" and "No Parking" with a character height of not less than 2.75 inches and a stroke width of not less than 0.5 inches. The day, date, and

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time of the particular restriction shall be printed or attached below the above-mentioned wording in characters of not less than 2.0 inches in height and 0.4 inches in stroke width. The day of the week shall be written out or properly abbreviated with three to four letters; date or dates of restriction shall be listed completely; the beginning and ending times shall be clearly listed on the sign.

2.02 CONES AND PORTABLE DELINEATORS

A. Cones:
   1. Traffic cones shall be fluorescent and of good commercial quality, flexible material suitable for the purpose intended. The outer section of the portion above the base of the cone shall be translucent and be of a highly pigmented fluorescent orange polyvinyl compound.
   2. The overall height of the cone shall be at least 28 inches and the bottom inside diameter shall be not less than 10.5 inches. The base shall be of sufficient mass and size or shall be anchored in a manner that the traffic cone will remain in an upright position.
   3. During the hours of darkness traffic cones shall be affixed with retroreflective cone sleeves. The retroreflective sheeting of sleeves on the traffic cones shall be visible at 1,000 feet at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

B. Portable Delineators:
   1. Portable delineators shall be orange in color.
   2. The overall height of the channelizer shall not be less than 36 inches and the width shall not be less than 3 inches. The base shall be of sufficient mass and size or shall be anchored in a manner that the traffic cone will remain in an upright position.
   3. Channelizers shall have affixed white retroreflective sheeting. The retroreflective sheeting shall be 3 inches x 12 inches in size. The retroreflective sheeting shall be visible at 1,000 feet at night under illumination of legal high beam headlights, by persons with vision of or corrected to 20/20.

2.03 BARRICADES

A. Barricades shall be as set forth in the Manual of Traffic Controls.

B. Barricades used during hours of darkness shall be equipped with flashers.

C. Markings for barricade rails shall be alternate orange and white stripes. The entire area of orange and white stripes shall be Type I, engineering grade, or Type II, super engineering grade, retroreflective sheeting. The color of the orange retroreflective sheeting shall conform to PR No. 6, Highway Orange, of the Federal Highway Administration's Color Tolerance Chart. Retroreflective sheeting shall be placed on rail surfaces in such a manner that no air bubbles or voids are present between the rail surface and retroreflective sheeting. The predominate color for barricade components other than rails shall be white, except that unpainted galvanized metal or aluminum may be used. Sign owner identification shall not be imprinted on the reflectorized face of any rail, but may be imprinted elsewhere.

D. Ballasting shall be by means of sand-filled bags placed on the lower parts of the frame or stays, but shall not be placed on top of the barricade nor over any reflectorized barricade rail face facing traffic.

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2.04 TEMPORARY RAILING (TYPE K)

A. Temporary railing shall consist of interconnected new or undamaged used precast concrete barrier units as shown on the Drawings. Exposed surfaces of new and used units shall be freshly coated with white color paint prior to their first use on the project. The paint shall conform to the provisions in California Department of Transportation Section 91 4.05, "Paint; Acrylic Emulsion, Exterior White and Light and Medium Tints".

B. Reinforcing steel shall conform to the provisions in California Department of Transportation Section 52, "Reinforcement". Steel bars to receive bolts at ends of concrete panels shall conform to the requirements in ASTM Designation: A 36/A 36M. The bolts shall conform to the requirements in ASTM Designation: A 307.

C. A round bar of the same diameter may be substituted for the end-connecting bolt shown on the Drawings. The bar shall conform to the requirements in ASTM Designation: A 36/A 36M, shall have a minimum length of 26 inches and shall have a 3-inch diameter by 3/8-inch-thick plate welded on the upper end with a 3/16-inch fillet weld.

D. Temporary railing (Type K) shall be set on firm, stable foundation. The foundation shall be graded to provide a uniform bearing throughout the entire length of the railing.

E. Abutting ends of precast concrete units shall be placed and maintained in alignment without substantial offset to each other. The precast concrete units shall be positioned straight on tangent alignment and on a true arc on curved alignment.

F. Each rail unit placed within 10 feet of a traffic lane shall have a reflector installed on top of the rail. Reflectors shall be as specified and adhesive shall conform to the reflector manufacturer's recommendations. A Type P marker panel shall also be installed at each end of railing installed adjacent to a two lane, two-way highway and at the end facing traffic of railing installed adjacent to a one-way roadbed. If the railing is placed on a skew, the marker shall be installed at the end of the skew nearest the traveled way. Type P marker panels shall conform to the provisions in California Department of Transportation Section 82, "Markers and Delineators," except that the Contractor shall furnish the marker panels.

2.05 FLASHING ARROW SIGNS

A. Flashing arrow signs shall be finished with commercial quality flat black enamel and shall be equipped with yellow or amber lamps that form arrows or arrowheads as required. Each lamp shall be provided with a visor and the lamps shall be controlled by an electronic circuit that will provide between 30 and 45 complete operating cycles per minute in each of the displays and modes specified. The control shall include provisions for dimming the lamps by reducing the voltage to 50 percent, ±5 percent, for nighttime use. Type I signs shall have both manual and automatic photoelectric dimming controls. Dimming in both modes shall be continuously variable over the entire dimming range.

B. Flashing arrow signs shall conform to the Manual of Traffic Controls OR MUTCD legibility requirements. The minimum legibility distance is the distance at which flashing arrow signs shall be legible at noon on a cloudless day and at night by persons with vision of or corrected to 20/20

C. Flashing arrow signs shall be capable of being operated in four (4) different display modes as follows. The display to be used shall be as directed by the Engineer:

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1. Pass Left Display
2. Pass Right Display
3. Simultaneous Display - the lamps forming both right and left arrowheads and the lamps of the arrow shaft shall flash simultaneously.
4. Caution Display - a combination of lamps not resembling any other display or mode shall flash.

D. Flashing arrow signs shall also be capable of operating in one or both of the following modes, at the option of the Contractor:
1. Flashing Arrow Mode - all lamps forming the arrowhead and shaft shall flash on and off simultaneously.
2. Sequential Mode - either arrowheads or arrows shall flash sequentially in the direction indicated.

E. Each flashing arrow sign shall be mounted on a truck or on a trailer and shall be capable of operating while the vehicle is moving and shall be capable of being placed and maintained in operation at locations as shown on the Drawings, as specified or as directed by the Engineer.

F. Flashing arrow signs shall be mounted to provide a minimum of 7 feet between the bottom of the sign and the roadway.

G. Electrical energy to operate the sign shall not be obtained from the vehicle on which the sign is mounted or from a generating plant mounted on the vehicle. Regardless of the source, the supply of electrical energy shall be capable of operating the sign in the manner specified.

2.06 PORTABLE TRAFFIC SIGNALS FOR ONE-LANE WORK ZONES

A. Provide two (2) portable traffic signals for work zone traffic control during the construction that have the following features:
1. Portable traffic signals with adjustable overhead lights that can clear H20 truck height clearance requirements. Provide two (2) lights per unit.
2. Battery powered capable of running for 21 days without being recharged and include a solar panel to recharge the batteries.
3. Motion activation to sense traffic build-up.
4. Work zone light to allow workers to know which signal is red and which is green with a different flashing pattern or other means.
5. Preemption system to allow emergency vehicle immediate pass through the signal work zone.
6. Digital speed display to display vehicle speed through the work zone.
7. Back plates to enhance visibility of the traffic lights.
8. Manual operation of the signals through use of a hand controller module that lets a flagger control the signals. Provide a means to eliminate possible conflicting indications at each signal during manual controller use.
9. The portable signals shall be linked and be able to communicate and assign only the proper right-of-way assignment at a time.
10. Provide for wireless radio communication between the traffic signals that conforms to MUTCD guidelines.

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PART 3 - EXECUTION

3.01 DIVERTING PEDESTRIAN TRAFFIC

A. Whenever construction operations obstruct the flow of pedestrian traffic or present a hazard to pedestrians, take appropriate action to protect and separate pedestrians from the work area.

B. Such action may include placement of barricades between pedestrians and work areas, placement of warning signs, and provision of personnel as required to protect pedestrians as conditions warrant.

3.02 DIVERTING VEHICULAR TRAFFIC

A. Whenever construction operations obstruct the flow of vehicular traffic or present a hazard to vehicles operating in the vicinity of construction operations, take appropriate action to warn, detour and otherwise protect approaching drivers and vehicles.

3.03 MAINTAINING TRAFFIC CONTROL

A. General:
   1. Traffic control devices shall be provided in sufficient quantities and types as required to provide safe and adequate traffic control. To properly provide for changing traffic conditions and damage caused by public traffic or otherwise, the Contractor shall be prepared to furnish on short notice additional construction area sign panels, posts and mounting hardware or portable sign mounts. The Contractor shall maintain an inventory of the commonly required items at the jobsite or shall make arrangements with a supplier who is able, on a daily basis, to furnish the items on short notice.
   2. During hours of darkness, approved lights and/or flares shall be included, in proper working order, to illuminate signs and hazards and alert approaching traffic.
   3. Barricades shall be furnished and maintained along all open trenches in contact with traffic.
   4. No work may begin on any day or at any time before traffic control devices have been placed, test-driven and, if required, adjusted and revised.
   5. When leaving a work area and entering a roadway carrying public traffic, the Contractor's equipment, whether empty or loaded, shall yield to public traffic.

B. Traffic Control Placement:
   1. All traffic control devices shall be placed in accordance with the Manual of Traffic Controls and the favorably reviewed Traffic Control Plan.
   2. Locations of devices shall be adjusted to suit the conditions and circumstances of each detour situation. In all cases, signs shall be placed to most effectively convey their messages to approaching traffic.

C. Maintenance of Traffic Control Devices:
   1. Maintain all traffic control devices, at proper locations and in proper working order, at all times during construction operations and whenever a hazard resulting from Contractor's operations exists.
   2. Adjust and revise traffic control devices, placement, etc., to suit changing conditions around construction operations.
   3. Clean all construction area sign panels at the time of installation and as often thereafter as the Engineer determines to be necessary. Used signs with the

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specified sheeting material will be considered satisfactory if they conform to the requirements for visibility and legibility and the colors conform to the requirements of the current Manual of Traffic Controls OR MUTCD. A significant difference between day and nighttime retroreflective color will be grounds for rejecting signs.

4. Monitor all traffic control on a daily basis and replace or restore any traffic control devices that have been displaced or damaged.

D. Removal of Traffic Control Devices:
   1. Traffic control devices shall remain in place at all times required to alert approaching traffic of upcoming hazards.
   2. After hazard has been removed, all traffic control devices shall be removed. Signs shall be removed or their messages covered until removed.
   3. Existing roadside signs conflicting with the construction area signs shall be removed and reset upon completion of work or securely covered as determined by the Engineer.

3.04 FLAGGERS

A. General: Flaggers shall perform their duties and shall be provided with the necessary equipment in conformance with the current "Instructions to Flaggers" of the California Department of Transportation.

B. Employ flaggers:
   1. As required for each specific detour in the Traffic Control Plan.
   2. At all locations on a construction site where barricades and warning signs are in sufficient to properly control traffic.

C. Placement: Where flaggers are required, they shall be logically placed in relation to the equipment or operation so as to give adequate warning and shall be placed approximately 100 feet ahead of impact point.

D. Warning Signs:
   1. A warning sign shall be placed ahead of the flagger reading: "Flagger Ahead." The distance between the sign and the flagger should be based on the average traffic speed, allowing approximately 50 feet for each 10 miles per hour.
   2. During hours of darkness, flagger stations shall be illuminated such that the flagger will be clearly visible to approaching traffic. Lights for illuminating the flagger station shall receive favorable review by the Engineer before use.

E. Equipment:
   1. Each flagger shall be provided with and wear a red or orange warning garment when flagging. Flaggers shall be provided with approved hand signs and two-way radios for communication.
   2. When flagging during hours of darkness, a flagger shall signal with a red light or flare and shall have a belt and suspender harness outside his/her garment fitted with reflectors or made from reflectorized cloth, unless the garment is well reflectorized in one of these ways.

3.05 NOTIFICATIONS

A. Notify in writing all agencies having jurisdiction and service providers and all affected residents and businesses at least 48 hours, excluding holidays and weekends, prior to instituting any lane closure or detour. At the end of each day's work, inform the ambulance services, police and fire departments and affected

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community service providers of the status of all detours and/or lane or road closures.

B. List of agencies and service providers to be notified:
   1. City of Los Angeles
      a. Fire Department
      b. Police Department
      c. Public Works Department
   2. U.S. Postal Service

3.06 EMERGENCY VEHICLE ACCESS THROUGH DETOURS

A. During all detours and/or street closures, provide for movement of emergency vehicles through the work area.

B. It is essential that the Contractor's work and equipment does not impede egress from any fire or police station to other areas of their service area.

3.07 ACCESS TO PRIVATE PROPERTY

A. General: Schedule and organize operations to minimize disruption of access to private property.

B. Notification: Prior to blocking access to any private driveway or parking lot entrance, notify the resident or business owner or tenant of pending closure at least 72 hours in advance and allow resident to remove vehicles.

C. Nights: During non-working hours no driveway, house or parking lot shall be denied access to a public roadway.

3.08 NIGHT DETOURS

A. General: The Contractor shall not be permitted to maintain any lane closure or road closure during non-working hours without first obtaining written approval of the Engineer.

B. Restoration of Pavement:
   1. During non-working hours, restore travel lanes to their original alignment and configuration by means of backfilling and temporary pavement or bridging the trench with beams and steel plates designed to support H-20 vehicles.
   2. Place "ROUGH ROAD" signs conforming to the Manual of Traffic Control at uneven temporary pavement or bridging.

3.09 PARKING RESTRICTIONS

A. General: Post approved "NO PARKING" signs at all locations necessary to establish work areas and detour traffic.

B. Signs:
   1. Signs shall read: "NO PARKING CONSTRUCTION TOW-AWAY ZONE." Show hours of parking restriction and indicate telephone number of police agency having jurisdiction.
   2. Signs shall be mounted such that the wording "No Parking" is at an elevation at least 3 feet and not more than 7 feet above the adjacent flow line. Signs may be tied with string to trees and power poles, taped to existing sign poles, or mounted to stakes or barricades provided by the Contractor. The signs shall be placed as needed to control the parking of cars within the

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construction zone; signs shall be placed at intervals of 75 feet or less along each side of the roadway.

3. Signs shall be placed at least 24 hours in advance of restriction. Upon completion of the work, all signs, stakes, and barricades shall be promptly and completely removed and disposed of by the Contractor. The Contractor shall promptly reset or replace all damaged or defective signs.

C. Towing of Vehicles:

1. The Contractor shall be fully responsible for the adequate removal of all parked cars. All vehicle removal shall be coordinated by the Contractor with the Police Department. The Contractor shall notify the Police Department upon posting of the parking restrictions for a particular street. For removal of parked vehicles, the Contractor shall notify the Police not less than two (2) hours prior to the needed removal with the address nearest the parked vehicle, make, model, color and license number. The Owner shall not be responsible for any delay or additional costs associated with the removal of parked cars that obstruct the construction operation.
2. If a vehicle owner successfully contests a towing citation in court, and their citation is dismissed for causes related to the Contractor's failure to perform the requirements of this section, the Contractor shall reimburse the vehicle owner for the cost of any claims associated with the towing citation.

3.10 BRIDGING OVER TRENCHES AND EXCAVATIONS

A. General:

1. For excavations not backfilled or permitted to remain open, bridging shall be placed across all trenches and excavations in existing streets and at driveways when work is not in progress.

B. Design of Bridging:

1. Bridging for vehicular traffic shall be of sufficient width to accommodate the required number of travel lanes.
2. Bridging shall be designed to support H 20 vehicular traffic.
3. All bridging shall be set flush with travel surface or a satisfactory transition from travel surface to top of bridging shall be provided.
    a. A satisfactory transition shall mean a change in elevation between the levels of not less than 12 inches horizontal to 1 inch vertical.
    b. Transition may be accomplished by means of temporary pavement.

3.11 TEMPORARY TRAFFIC LANES

A. Temporary traffic lanes shall be at least 10 feet wide, unless otherwise indicated on the Traffic Control Plan. Provide an additional 2 feet of clearance from curbs. The length of temporary lanes should be limited to the area under construction and the distance necessary to divert traffic.

3.12 TEMPORARY PAVEMENT MARKERS

A. Wherever the Contractor's operations obliterate pavement delineation, including pavement markers and painted or thermoplastic lines for lane lines, stop bars, crosswalks, pavement legends, etc., such pavement delineation shall be replaced at the Contractor's expense by either permanent or temporary delineation before opening the traveled way to public traffic.

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B. Temporary delineation shall consist of reflective traffic line tape applied in pieces not less than 12 inches long and not less than 4 inches wide. The tape pieces shall be spaced no more than 12 feet apart on curves and no more than 24 feet apart on tangents. For final resurfacing, provide reflective tabs or 3M 5710 or 5711 removable tape or approved equal at the above listed spacing.

C. Install temporary stop bars, limit lines and crosswalks at any location where the construction operation obliterated the existing delineations. These temporary stop bars, limit lines and crosswalks shall consist of 6-inch-wide 3M 5710 removable tape or approved equal.

D. Reflective line tape or tabs shall be applied in accordance with the manufacturer's instructions. Temporary delineation shall be the same color as the permanent delineation.

3.13 STAGING AREAS

A. The Contractor's equipment shall not be parked within any traffic lanes after working hours.

B. The Contractor shall provide its own staging areas.

3.14 TRUCK TRAFFIC PLAN AND RESTRICTIONS

A. Control the delivery and haul routes of all trucks having three or more axles used in conjunction with this work. This control shall extend to all such trucks owned by the Contractor, subcontractors, second and lower tier subcontractors, material suppliers, commercial haulers, and deliverers of equipment.

B. To reduce tracking of dirt, tack coat, and other objectionable material onto various streets, the Contractor shall limit the number of truck haul routes.

C. Arterial and collector streets shall be used for truck and equipment access.

D. Trucks and equipment shall not be routed or parked on residential streets unless otherwise approved by the Engineer or Owner.

3.15 MAINTAINING EXISTING AND TEMPORARY SIGNAL LIGHTING AND ELECTRICAL SYSTEMS

A. Ensure effective operation of existing traffic signals and street lights within the construction area, in accordance with 86-1.06 "Maintaining Existing and Temporary Electrical Systems" of the State of California Department of Transportation Standard Specifications dated July 2006.

B. When working within 100 feet of any signalized intersection, arrange with the City's Traffic Engineer and Traffic Signal Technician to modify the controller timing as required to properly handle traffic during construction.

C. Damage to Signal Lighting Electrical Systems:
   1. Ascertain the exact location and depth of all existing detectors, conduits, pull boxes, and other electrical facilities before using any tools or equipment that may damage those facilities or interfere with any electrical system.
   2. In the event that traffic signal or street light conductors are damaged, arrange for their repair within 24 hours. If a permanent repair is not possible or infeasible, make temporary repairs to ensure safe and efficient operation, until permanent repairs can be made. Both temporary and permanent repairs

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shall be made at the Contractor's expense and in coordination with the City's Traffic Engineer and Traffic Signal Technician.

3. In the event that in-pavement loop detectors are damaged, contact and coordinate with the City's Traffic Engineer and Traffic Signal Technician to modify the controller timing as required to properly handle traffic during construction. Arrange for immediate replacement of loop detectors upon completion of construction work within the traffic lane where the damage occurred.

END OF SECTION

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SECTION 01650

FACILITY STARTUP

PART 1 - GENERAL

1.01 EQUIPMENT AND FACILITY STARTUP

A. Commission all systems and equipment to verify performance, function, and correct operation by performing procedures to activate, startup, adjust, test, and demonstrate that the work is in operating order in accordance with the general requirements of this Section and the detailed requirements of the technical sections under the system or equipment specified. To ensure that the work is ready for full-time operation, the procedures shall include verification, balancing, calibration, witness testing, documentation, inspection by equipment manufacturers and operator training where specified.

B. Notification: Notify the Engineer five (5) days prior to starting each system or piece of equipment.

C. Coordination: During the startup period, coordinate the operation of the facility with Engineer, subcontractors, Owner's operators, and manufacturer's representatives. Provide regular updates of construction schedule and startup activities to the Owner's PLC/SCADA Programmer (Owner's Programmer).

D. Furnish test equipment, measuring devices and supplies required to conduct tests.

E. Maintain the equipment until acceptance. Provide all lubricants, chemicals, and electricity necessary until acceptance.

F. Furnish all expendable supplies, gas, water, etc., required for startup, demonstration and testing and dispose of all waste or used supplies, water, etc.

G. Favorably reviewed Operations and Maintenance (O&M) Manuals are required twenty (20) days before the startup of new equipment/facilities.

1.02 SUBMITTALS

A. Startup Plan, Forms, and Schedule: Prepare a facility startup plan and schedule. The plan shall include test methods and procedures and sample forms for recording test data. The plan and schedule shall include time for testing and debugging of the PLC control logic and HMI interface for each system. The amount of time necessary shall be coordinated with and approved by the Engineer and the Owner's Programmer.

B. Provide Affidavits as described in paragraph 1.04 B.

C. Submit documentation of tests, balancing reports, and the like.

1.03 INITIAL STARTUP AND OPERATION OF FACILITIES

A. Portions of the work shall be started up and operated during the construction period to permit continued operation of the existing facilities or to permit demolition and conversion of existing facilities to new uses. Refer to the general work sequence and early partial use occupancy requirements of Section 01010. Perform steps 1 through 13 in paragraph B below for the initial startup and operation of the

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systems and equipment that shall be started up and operated during the construction period and before the entire plant work is completed.

B. The following listing is a general sequence of startup activity steps to be used in placing facility systems into operation:
   1. Perform initial lubrication of equipment and have manufacturers check and adjust equipment. Provide all subsequent lubrication and maintenance, and such staff as required for test operation until the Owner assumes equipment maintenance responsibility after Step 15 below.
   2. Perform satisfactory testing of electrical work required prior to energizing of the electrical system.
   3. After completion of Step 2, perform satisfactory electrical testing required after energizing of the electrical system.
   4. Complete calibration of instruments.
   5. Satisfactorily complete system verification of instrumentation work.
   6. After completion of Steps 1 and 3, perform a rotational test of equipment and correct backward rotating drives.
   7. After completion of Steps 5 and 6, test operate the equipment by manually initiating the operation. Where manual operation bypasses alarm or safety monitoring, provide continuous supervision of such parameters. Perform this step using water in lieu of chemicals or other process liquids. Use dry air or nitrogen in lieu of hazardous gases. Following testing with water, chemical lines shall be drained and be fully dried, in accordance with the specifications, prior to introduction of chemical.
   8. Concurrent with Step 7, perform instrumentation and control testing and adjustments as related to the equipment being tested. Then allow time in the construction schedule for the Owner's Programmer to debug and test the PLC control logic and HMI interface. Provide personnel to assist in operation of equipment and adjustments of this system debugging and testing. All SCADA controls, interlocks, alarms, etc. including signals from other parts of the facility shall be tested. Provide simulation of inputs if needed during this step. Note: SCADA operational testing requires an approved test plan.
   9. Concurrent with Step 7 and where possible at this stage of startup, complete the performance testing specified for the equipment.
   10. Concurrent with Step 7, perform adjustments of the electrical work as related to the equipment being tested.
   11. Repeat Steps 1 through 10 as required for other equipment items and plant systems until all plant process components and utility systems are ready for total facility operation. It may be necessary for the Contractor to put portions of the newly constructed facility in service before constructing other portions of the facility or completing the Work as a whole.
   12. Submit the required documentation of testing, calibration, and equipment affidavits.
   13. Notify the Owner and the Engineer 45 days before total facility operation is to occur so that the Owner may order chemicals and make other arrangements for full-time operation. This notification shall have an accuracy of plus or minus seven (7) days. Notify the Owner and Engineer again, exactly seven (7) days before total plant operation is to begin.
   14. 30-Day Plant Startup and Initial Operation Test: Upon completion of all the above steps, the facility shall be started up and operated on a complete full-time basis beginning on the indicated date. The Owner will provide operating personnel, chemicals and untreated water. For five (5) consecutive days beginning with the start-up day, the Contractor shall have at the plant site,

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during the day shift, a mechanic, an electrician and an instrument engineer. Representatives of manufacturers of critical equipment shall also be present for these five (5) days as needed or as required elsewhere in the Specifications. The Contractor shall also provide these personnel, on a 24 hour per day, "on call" basis, if necessary, to adjust, repair, and correct deficiencies as required to keep the facilities in continuous operation for a period of 30 calendar days. The Contractor shall train the operators in the proper operation and the control of the new facilities. The Contractor shall also furnish all such mechanical and electrical workers as required to make adjustments to and perform all required maintenance for the operating equipment until the end of the 30-day initial operation period. Maintenance of operating equipment shall include lubrication, adjustments, replacements, and modifications as required.

15. After successful completion of the 30-day initial operation period, the Owner will take over maintenance duties as well as operation and will begin to provide and pay for lubricants. If continuous process operation is interrupted for a period of four (4) consecutive hours or more due to a failure of the equipment or work provided by the Contractor, then the counting of the 5-day and/or 30-day periods, described in Step 14 above, shall be restarted at day one if these periods have not reached satisfactory completion.
16. Following the commencement of Step 14, satisfactorily complete equipment performance testing, electrical testing and adjustments, and instrumentation/control testing and adjustments to the extent that such testing and adjustments could not be made prior to full facility operation.
17. Submit any remaining documentation of testing, balancing reports, equipment affidavits and the like commissioning before acceptance.

1.04 MANUFACTURER'S FIELD SERVICE AND AFFIDAVITS

A. Field Service: Where specified, manufacturers of equipment shall provide field service. Field service shall be provided by an authorized factory-trained and qualified manufacturer's representative for the specific equipment. Equipment shall not be considered ready for full-time operation until after the manufacturer's representative has checked and adjusted the equipment, and certified by written affidavit that the equipment has been properly installed, tested, adjusted, lubricated, and calibrated, and is ready for full-time operation.

B. Affidavits: Acceptable affidavits shall be submitted prior to completion of the work.
   1. Affidavits shall contain the following specific wording:
      "The *insert name of equipment* has been properly installed, tested, adjusted, lubricated, and calibrated, and is ready for full-time operation. The installation has been inspected and has been found to be in conformance with our (the manufacturer's) standards and requirements."
   2. Except for insertion of the equipment name, no amplification, dilution, or modification of this specific wording will be permitted.

1.05 TRAINING

A. Submit Operation and Maintenance Manuals and Parts Lists specified in Section 01300 at least fifteen (15) days prior to the first training session.

B. Demonstrate the operation, maintenance and safety procedures for all systems and equipment to personnel designated by the Owner.

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PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 FINAL CLEANUP

A. Prior to Final Inspection, the Contractor shall clean the entire construction area and all other areas affected by the performance of work under this Contract. Perform cleaning using personnel specializing in and skilled in cleaning and maintenance work. Perform repair work using personnel skilled in executing the type of work being repaired. Perform all work to the highest trade standards applicable to that type of work.

1. Remove all temporary construction, signs, tools, equipment, excess material and debris.
2. Remove U.S.A markings on site.
3. Remove all lumps, splatters, spots and stains caused by paint, adhesive, asphalt, concrete, mortar, sealant or other foreign material from exposed or finished surfaces. Remove all temporary labels.
4. Repair, patch or replace new or existing work including pavement, sidewalks, curbs, gutters, catch basins, gratings, manholes, covers, landscaping, plant materials and other items that have been damaged, broken, cracked or chipped as a result of performing this Work.
5. Sweep clean and wash down all exterior pavement surfaces. Remove all hazardous material and material that may cause sediment in drainage systems prior to washdown. Remove all grease and oil stains on pavement caused by Contractor's equipment.

1.02 CONTRACTOR'S ACTION LIST OF ITEMS TO BE CORRECTED AND/OR COMPLETED

A. During construction, the Contractor shall maintain an action list of items to be corrected and/or completed. Regularly add items and update the list as information becomes available or as requested by the Engineer. Deliver a current copy of the list to the Engineer at each progress meeting.

1.03 SEMIFINAL INSPECTION/SUBSTANTIAL COMPLETION

A. See General Conditions, paragraphs 13.7 through 13.9. When the Contractor considers the Work nearly complete, the Contractor shall review the Contract Documents, inspect the Work, and use the Contractor's action list to prepare a Contractor's Punch List of all deficient or uncompleted items. Complete or correct the items on the Punch List. When the Work is Substantially Complete in accordance with General Conditions, paragraph 13.7, notify the Engineer in writing that the Contractor has reviewed the Contract Documents, inspected the Work and believes that the Work is Substantially Complete and ready for Semifinal Inspection.

B. See General Conditions, paragraphs 13.9 through 13.10. On receipt of the Contractor's Punch List and notice that the work is ready for Semifinal Inspection, the Engineer will inspect the Work. The Engineer may add additional items to the Contractor's Punch List, may find that the Work is not ready for inspection, may

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find that the Work is ready for inspection but not Substantially Complete or may find that the Work is Substantially Complete. When the Engineer finds the Work is Substantially Complete, he/she will prepare a Final Punch List and a notice of Substantial Complete, which will state the date of Substantial Completion and the time agreed to by the Owner and the Contractor (not to exceed 30 calendar days) in which the Work shall be fully complete and ready for Final Inspection.

1.04 FINAL INSPECTION, FINAL COMPLETION AND FINAL PAYMENT

A. See General Conditions paragraphs 13.11 through 13.15. When the Contractor has completed or corrected all the items on the Engineer's Final Punch List, the Contractor shall give the Engineer written notice that the Work is ready for Final Inspection. When the Engineer finds the Work acceptable and fully complete in accordance with the Contract Documents, and upon receipt of a final Application for Payment and all final submittals, the Engineer will recommend that the Owner issue a Notice of Final Completion, make Final Payment and Accept the Work stating that to the best of the Engineer's knowledge, information and belief, and on the basis of the Engineer's observations and inspection, the Work has been fully completed in accordance with the terms and conditions of the Contract Documents.

B. Final Submittals include:
   1. Operation and Maintenance Manuals and Parts Lists
   2. Record Drawings
   3. Extra Materials
   4. Special Guarantees
   5. Maintenance Contracts
   6. Insurance Certificate showing required continuation of coverage beyond Final Payment. See General Conditions, paragraph 4.4.
   7. Release of Liens. See General Conditions, paragraphs 13.2 and 13.13.
   8. Waiver of Claims by Contractor. See General Conditions, paragraph 13.14.
   9. And any other submittals required by the Contract Documents and not previously received.

C. The Owner will record the Notice of Final Completion at the County Recorders Office.

D. The Owner will make Final Payment to the Contractor 35 calendar days after recording the Notice of Final Completion.

1.05 RECORD DRAWINGS

A. The Contractor shall maintain on the jobsite, a complete set of Contract Documents and a complete file of all addenda, contract modifications and favorably reviewed submittals. The Contractor shall prepare a set of Record Drawings concurrently with the construction of the Work and in accordance with General Conditions, paragraph 5.13 and the following:
   1. Show the invert elevation of all gravity piping and the top of pipe, top of conduit or top of protective concrete encasement for other utilities. Elevations shall be related to a permanent visible elevation benchmark set at the site by the Contractor.
   2. Show the horizontal location of underground utilities measured from permanent visible physical features such as face of building, face of tank, or centerline of manhole.
   3. Comply with detailed requirements in technical specification sections describing the type of information required on Record Drawings. The

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Contractor's copy of Contract Documents, Contract modifications and Record Drawings shall be available to the Engineer for weekly verification that the records are being currently updated.

B. Submit Record Drawings and obtain acceptance prior to completion.

1.06 EXTRA MATERIALS

A. Deliver specified extra materials and parts to Owner. Itemize all items on a transmittal letter in duplicate and obtain signature of receiving party. Submit copies of signed transmittals for all specified extra materials and parts prior to completion.

1.07 SPECIAL GUARANTEES

A. Paragraph 12.11 of the General Conditions covers the Contractor's responsibility to remedy defects due to faulty workmanship and materials, which appear within one (1) year from the date of Final Completion and acceptance by the Owner.

B. Guarantees for more than one (1) year when called for in various sections of the Specifications shall be evidenced by the Contract Documents and in the form of a special guarantee written on the letterhead of the Contractor, subcontractor, or supplier doing the work and/or supplying the item to be guaranteed, and countersigned by the Contractor as follows. Failure to provide the special guarantee on the letterhead shall not relieve the Contractor, subcontractor, or supplier from its obligations for the special guarantees.

Signed _____
(Subcontractor or Supplier)

Company _____

Address _____

Telephone Number _____

Countersigned _____
(Contractor)

C. Submit two (2) notarized original signed copies of each required Special Guarantee prior to completion.

1.08 TWELVE-MONTH INSPECTION

A. Thirty (30) days prior to the expiration of the one-year guarantee period described in General Conditions, Article 12, the Contractor shall tour the project with the Engineer and/or the Owner to prepare a list of corrective work required under the one-year guarantee. The Contractor shall correct all items found to be defective within 20 days of receipt of the list of items to be corrected.

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PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all demolition required to perform the work covered under this contract including without limitation:
   1. Remove existing construction shown to be removed.
   2. Remove and replace existing construction and/or finishes as required to provide access to perform other work included in this contract.
   3. Include removal of mechanical and electrical work that is to be abandoned and is contained in construction to be removed whether or not the mechanical and electrical work is shown. Disconnect and cap off utilities in accordance with applicable codes and safety regulations.
   4. Where utilities that are not shown pass through construction that must be removed and those utilities serve other areas notify the Engineer before disrupting service. If rerouting is required to maintain service, the Owner may issue a Change Order to accomplish the required work.
   5. Store and protect items intended for reuse.
   6. Assume ownership of debris and unwanted materials, remove from the site and dispose of legally.
      a. Special requirements for waste management during deconstruction and construction operations.
         1) Protect the environment, both onsite and offsite, during deconstruction *and* construction operations.
         2) Prevent environmental pollution and damage.
         3) Maximize source reduction, reuse, and recycling of solid waste.
   7. Include the cost of removing and disposing of hazardous material including without limitation asbestos or asbestos-containing material, lead-containing paint, and PCBs.
   8. Comply with all State permit requirements for demolition. The Contractor shall perform a pre-demolition survey to determine whether hazardous material is present. If material is identified as hazardous, retain qualified and State-licensed Contractor to remove and dispose of the materials legally.
   9. If illegal electrical wiring is encountered such as "BX" or nonmetallic sheathed cable, notify the Engineer.
   10. Remove and properly dispose of unwanted fixed equipment, including without limitation unwanted lockers, shelving, hoods, equipment, machinery, and devices built into or attached to the building.

1.02 NOISE AND DUST CONTROL

A. Perform work in accordance with requirements in Division 1. Particular attention is directed without limitation to paragraphs titled: Owner and Contractor's Use of Premises, Cleanup During Construction, Fire Protection During Construction, Maintenance of Exit Routes for Building Users, Temporary Dust Barriers, Noise Control and Care of Existing Facilities.

B. Provide temporary partitions to control dust and noise and exclude unauthorized persons.

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C. Cover Reservoir 3A vents with screening.

D. Perform work in a manner to cause least disturbance to building occupants and least damage to work to remain.

E. Maintain adequate means of safe, clear egress for building occupants.

F. Employ all available techniques for construction noise abatement. Use remote, well-mufflered air compressors and newest noise suppressed pneumatic and electric tools.

1.03 WARNING

A. The Contractor is advised that work under this Section may be hazardous. The Contractor is to take all necessary precautions to ensure the safety of workers and property. Removal of and/or working in areas containing even minor amounts of hazardous material including without limitation, asbestos, lead-based paint, PCBs or other hazardous materials requires special precautions, knowledge, and procedures. If hazardous material is suspected, notify the Engineer.

1.04 QUALITY ASSURANCE

A. Maximize use of source reduction and recycling procedures.

B. Diversion Goals: A minimum 75 percent by weight of total project solid waste to be diverted from landfill.

1.05 PRECONSTRUCTION MEETING

A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Engineer to discuss the proposed Waste Management Plan and to develop mutual understanding relative to details of environmental protection.

1.06 SUBMITTALS

A. Information to be submitted in accordance with Section 01300.

B. Submit copies of all executed permits.

C. Solid Waste Management Plan: Not less than 10 days before the Pre-construction meeting, prepare and submit a Solid Waste Management Plan including, but not limited to, the following:
   1. List of the recycling facilities, reuse facilities, municipal solid waste landfills and other disposal area(s) to be used. Include:
      a. Name, location, and phone number.
      b. Copy of permit or license for each facility.
   2. Identify materials that cannot be recycled or reused. Provide explanation or justification.
   3. Revise and resubmit Plan as required by Owner.
      a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

D. Record Submittals: With Record Submittals as specified in Section 01300 submit the following:
   1. Summary of solid waste disposal and diversion. Submit on form in Appendix A, or similar form as approved by Owner.

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1.07 PERMITS

A. Contractor shall fill out, submit and pay for the following permits:
   1. City of Los Angeles Department of Building & Safety:
      a. Demolition Permit

B. Refer to Appendix A for the City of LA requirements and procedures for the asbestos abatement and building demolition.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 SOLID WASTE MANAGEMENT

A. Develop and implement a waste management program in accordance with ASTM E1609 and as specified herein.

B. Collection: Implement a recycling/reuse program that includes separate collection of waste materials of the following types as appropriate to the project waste and to the available recycling and reuse programs in the project area:
   1. Land clearing debris.
   2. Asphalt.
   3. Concrete and Masonry.
   4. Metal.
      a. Ferrous.
      b. Non-ferrous.
   5. Wood, nails, and staples allowed.
   6. Debris.
   7. Glass, colored glass allowed.
   8. Paper.
      a. Bond.
      b. Newsprint.
      c. Cardboard and paper packaging materials.
   9. Plastic
      a. Type 1: Polyethylene Terephthalate (PET, PETE).
      b. Type 2: High Density Polyethylene (HDPE).
      c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
      d. Type 4: Low Density Polyethylene (LDPE).
      e. Type 5: Polypropylene (PP).
      f. Type 6: Polystyrene (PS).
      g. Type 7: Other. Use of this code indicates the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.
   10. Gypsum.
   11. Non-hazardous paint and paint cans.
   12. Flooring.
      a. Carpet.
      b. Resilient Flooring.
   13. Insulation.
   14. Ceiling Tiles
   15. Others as appropriate

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C. Handling:
   1. Clean materials that are contaminated prior to placing in collection containers. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process).
   2. Arrange for collection by or delivery to the appropriate recycling or reuse facility.
   3. Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

3.02 REMOVAL OF CONSTRUCTION IN AREAS TO RECEIVE NEW WORK

A. In areas intended to receive new work and/or finishes, remove all unwanted non-structural partitions, furred walls, chases, suspended or furred ceilings, doors, windows and finishes.

B. Remove all unwanted mechanical and electrical work (whether shown or not) that is not wanted and is not needed to serve other areas that is in, on, or concealed behind work being removed. Cap off or terminate all mechanical or electrical work in accordance with the requirements of Divisions 15 and 16.

C. Protect mechanical and electrical work that serves other areas. Relocate concealed mechanical and electrical work that is required to preserve service to other areas.

D. Remove structural work designated for removal. Take precautions not to damage structural work intended to remain. Where temporary shoring is needed, submit a design prepared by an appropriately licensed engineer for review before proceeding.

E. If structural elements are encountered that were not shown, protect them from damage and report their presence to the Engineer.

3.03 REMOVAL OF LIMITED PORTIONS OF EXISTING CONSTRUCTION TO PERMIT MODIFICATIONS

A. Provide careful, selective cutting and removal of existing construction as required to permit relocation or modification of partitions, doors, or openings. Cut and remove the least amount of work possible except when a larger area needs to be removed to permit strengthening existing construction or when required to remove finishes to a natural break line such as a corner or change in material.

B. Protect existing construction to remain with temporary coverings.

C. Treat existing mechanical, electrical, or structural work as described in other parts of this Section.

D. When modifications are complete, replace removed work with new construction and finishes to match adjacent existing work. Standards of material and workmanship shall be in accordance with other portions of this Specification or if not covered then in accordance with current practice for this class of work. Salvaged materials may be used for replacement if in good condition.

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3.04 REMOVAL OF EXISTING CONSTRUCTION TO PROVIDE ACCESS TO PERFORM WORK

A. Provide careful selective cutting and removal of existing construction where required to permit installation of new concealed mechanical or electrical work, or installation of equipment, fixtures or devices.

B. Treat existing mechanical, electrical, or structural work as described in other parts of this Section.

C. Replace and/or patch removed construction and finishes in accordance with other parts of this Section.

3.05 PROTECTION OF WORK TO REMAIN

A. Protect all work to remain. Repair damage with materials, workmanship, and finishes matching existing work when new.

B. Most existing floor finishes will not be replaced in this contract. It is essential these floors be protected from any damage due to impact, dirt, abrasion, paints, and solvents.

3.06 CUTTING HOLES IN CONCRETE AND/OR CONCRETE MASONRY UNIT (CMU)

A. The Contractor is cautioned that electrical conduits and reinforcing that are not shown on Drawings may be concealed in concrete CMU construction. Use electronic detection equipment to locate concealed items before cutting holes. Take all required precautions to avoid damage to existing conduits or reinforcing.

B. New openings in existing concrete walls or slabs may be saw cut to opening perimeter lines where Drawings do not call for adding reinforcing trim bars to strengthen openings. Do not run saw kerfs past corners of openings. Complete concrete removal at opening corners by chipping and grinding. Take all required precautions to avoid water damage to existing construction or the Owner's property.

C. Where Drawings call for adding reinforcing trim bars to strengthen openings, limit saw cutting to a depth of 3/4 inch to avoid cutting existing reinforcing steel. Carefully chip out concrete to avoid damaging existing reinforcing steel which is to remain.

D. Use chipping guns to chip out small holes for pipes or conduits. Proceed carefully to avoid damage to concealed conduits. Core drilling is permitted only at the Contractor's risk and only with the Engineer's permission. If core drilling is used, the Contractor shall: 1) use electronic detection equipment to locate conduit before drilling, 2) take precaution to avoid water damage to existing construction or the Owner's property, and 3) replace, at its own expense, any damaged electrical or signal wiring or conduits.

3.07 IF HAZARDOUS MATERIALS ARE ENCOUNTERED

A. If hazardous materials are discovered, comply with paragraph 1.01 of this Section and all applicable laws.

3.08 REMOVAL AND DISPOSAL OF MATERIAL

A. Use debris chutes with covered tops emptying into covered containers.

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B. Use rubber tired covered buggies with rubber bumpers to transport debris through occupied sections of buildings.

C. Store debris in suitable covered containers located where directed by the Engineer OR Owner and remove from site when full. Burning on the site is not permitted.

D. Removed material (other than material to be reused) shall become the property of the Contractor who shall remove it from the site and dispose of it in a legal manner.

3.09 UTILITY LOCATES AND DEMOLITION

A. There are electrical conduits that may nor may not be shown on the Drawings. Locate, demolish, and restore as required for the construction.

END OF SECTION

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SECTION 02200

SITE PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Site preparation shall consist of all clearing, grubbing, stripping, (demolition), and related work necessary to prepare the project site for construction operations.
   2. No open burning of debris, lumber, or other scrap will be permitted.
   3. Trees and vegetation to be left standing shall be protected from damage incident to site preparation and construction operations by the erection of barriers or by such other means as the circumstances require.

B. Related Sections:
   1. Section 01140: Environmental Protection
   2. Section 02300: Earthwork

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 DEMOLITION

A. Demolish and remove any fences, posts, poles, or other structures from within the project site, areas to be cut or areas to receive fill, and pipeline alignments.

3.02 CLEARING

A. Clearing shall consist of the felling, trimming and cutting of trees, and the removal of downed timber, shrubs, grasses, debris and rubble from the project site which will obstruct or otherwise impede construction operations.

B. Clear the following areas:
   1. The improvement area along the eastern boundary where the access driveway and fencing will be installed.

3.03 GRUBBING

A. Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the construction area. This material, together with logs and other organic debris, shall be excavated and removed to a depth of not less than 18 inches below the original surface level of the ground in areas indicated as construction areas under this Contract, such as areas for structures, pavement, fills. Depressions made by grubbing shall be filled with structural backfill material and compacted to make the surface conform with the original adjacent surface of the ground, unless further excavation is required. Grub borrow areas to the extent necessary to obtain material free of stumps and roots.

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3.04 STRIPPING

A. Strip the upper 2 to 6 inches of soil containing vegetation and root matter from all areas to receive fill and from all areas to be excavated.

3.05 DISPOSAL

A. Felled Trees and Downed Timber: Cut up and stockpile where directed by the Engineer.

B. Strippings: Stockpile stripped material and use it to restore the site.

C. Dispose of remaining vegetation and debris in accordance with Section 01140.

END OF SECTION

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SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Perform all excavation, shoring, dewatering, backfilling, compaction, and grading necessary or required for the construction of the work as covered by these Specifications and indicated on the Drawings. The excavation shall include, without classification, the removal and disposal of all materials of whatever nature encountered, including water and all other obstructions that would interfere with the proper construction and completion of the required work.

1.02 REFERENCES

A. ASTM International (ASTM).

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction
3. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3).
4. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
5. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lb/ft3).
6. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
7. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
10. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
11. ASTM D4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
12. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

B. Standards listed below apply when no other more stringent standard is referenced. The order of precedence is as follows:

1. State of California, Department of Transportation, Standard Specifications (Standard Specifications).
2. Standard Specifications for Public Works Construction (SSPWC), aka "Greenbook"

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3. State of California, Department of Transportation, Manual of Test (California Test).
4. State of California, City of Los Angeles, Bureau of Engineering Standards.

1.03 DEFINITIONS.

A. Site: Property owned by City of San Fernando, as shown on the Drawings.

B. Fill: Earth used to fill holes, pits, or depressions necessary to bring the final grade up to the specified elevation or contours.

C. Pipe Zone: Zone of material that extends from 6 inches below the bottom of pipe to 12 inches above the crown of pipe.

D. Pipe Bedding: Zone of material that extends from bottom of the pipe to 12 inches below the pipe.

E. Trench Zone: Zone of material that extends from the top of the pipe zone to the bottom of the pavement subgrade in pavement areas or to the top of the trench in earth areas.

F. Relative Compaction: In-place density divided by the maximum dry density laboratory compaction expressed as percentage.

G. Rock Excavation: Excavation of solid ledge rock that, in the opinion of the Engineer, requires for its removal drilling and blasting, wedging, sledging, barring, or breaking up with power-operated tools. The term "Rock Excavation" indicates a method of removal and not a geological formation.

1.04 QUALIFICATIONS

A. Prepare excavation protection plan (for over 20-foot cuts) under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of California.

1.05 SUBMITTALS

A. Submit in accordance with Section 01300.
   1. Excavation Protection Plan (if applicable): Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations for over 20-foot cuts to support plan. See additional requirements on Drawings.

B. Product Data:
   1. Potholing Report.
   2. Submit gradation reports for bedding materials and import backfill materials.
   3. Geotextile fabric indicating fabric and installation procedure.

C. Samples and Test Results:
   1. Furnish, without additional cost to the Owner, such quantities of import materials as may be required by the Engineer for test purposes. Cooperate with the Engineer and furnish necessary facilities for sampling and testing of all materials and workmanship. Submit test results for import materials. Tests shall be performed within 60 days of the submission. All material furnished and all work performed shall be subject to rigid inspection, and no material shall be delivered to the site until it has been favorably reviewed by the Engineer or used in the construction work until it has been inspected in the field by the Engineer.

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1.06 QUALITY ASSURANCE

A. Source Quality Control: Furnish all bedding material from a single source throughout the work unless otherwise approved. Test import materials proposed for use to demonstrate that the materials conform to the specified requirements. Tests shall be performed by an independent testing laboratory.

B. Field Quality Control:
   1. The Owner will hire a third-party Geotechnical Engineer to provide the following quality control measures:
      a. Review materials proposed for use.
      b. Observe foundations, site grading, and borrow operations.
      c. Observe placement and compaction of fill.
      d. Test soils during placement of fill.
      e. Observe preparation of native ground to receive fill material.
      f. Observe and direct the removal and replacement of loose, soft, disturbed, and other unsatisfactory soils and uncontrolled fill.
   2. Contractor shall excavate holes for in-place soil sampling. Contractor shall be responsible for costs of additional inspection and re-testing resulting from non-compliance.
   3. The Contractor shall hire an independent laboratory approved by the Engineer to perform the following tasks:
      a. Test materials proposed for use and submit results to the Engineer.
      b. Provide representative samples of all materials being used, as compacted fill to obtain information on their physical properties.

C. Testing Methods:
   1. Durability Index: Manual of Test, State of California, Department of Transportation.
   2. Specific Gravity: ASTM D854
   3. Laboratory Compaction: ASTM D1557, Method A or C.
   4. In-place Density: ASTM D1556 or ASTM D2922.
   5. Particle Size Analysis of Soils: ASTM D422.
   6. Plastic Limit and Plasticity Index: ASTM D4318.
   7. Soil Classification: ASTM D2487.
   8. In-place Moisture Content: ASTM D3017.

1.07 DELIVERY, STORAGE AND HANDLING

A. Scheduling of deliveries shall be coordinated with the Engineer prior to material arriving onsite so as not to interrupt existing plant/facility operation.

B. If access to private property is required, coordination with private owners is required prior to material arriving onsite.

C. Earthwork materials shall be stored as indicated on the Drawings or in a location confirmed in writing by the Engineer. Written approval from the Engineer shall be provided if alternative storage locations are to be used.

1.08 SUBSURFACE INVESTIGATIONS

A. Geotechnical investigations for design purposes for this project were made for the City of San Fernando by Converse Consultants in a report dated 29 September 2020. The information presented in the report is intended for use in design and is subject to confirmation of the conditions encountered during construction. The exploration logs and related information depict subsurface conditions only at the

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particular time and location designated on the boring logs. Subsurface conditions at other locations may differ from conditions encountered at the exploration locations.

B. This report is available for examination by bidders from the Owner at City of San Fernando Department of Public Works Engineering Division 117 Macneil Street, San Fernando, CA 91340-2993. While the records of data obtained may be considered by the Contractor to be correct, any conclusions or recommendations made in the reports are for information to the Design Engineer and are not a part of the Contract Documents. Copies of the boring logs are in the Appendix of these Specifications and their locations are shown on the Drawings.

C. The bidders may make additional subsurface investigations at the site prior to the bidding of the project. Prior to making any drillings or excavations, the bidder shall secure permission from the Owner, and property owners if on private property.

D. The Contractor shall satisfy himself as to the nature and location of the work, ground surface and the characteristics of equipment and facilities needed prior to and during prosecution of the work. The Contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications must be brought to the Owner's attention in order to clarify the exact nature of the work to be performed.

1.09 ADDITIONAL SAFETY RESPONSIBILITIES

A. The Contractor shall select, install, and maintain shoring, sheeting, bracing, and sloping as necessary to maintain safe excavations. The Contractor shall be responsible for ensuring such measures: (1) comply fully with 29 CFR Part 1926 OSHA Subpart P Excavations and Trenches requirements, (2) provide necessary support to the sides of excavations, (3) provide safe access to the Engineer's sampling and testing within the excavation, (4) provide safe access for backfill, compaction, and compaction testing, and (5) otherwise maintain excavations in a safe manner that shall not endanger property, life, health, or the project schedule. All earthwork shall be performed in strict accordance with applicable law, including local ordinances, applicable OSHA, CalOSHA, California Civil Code, and California Department of Industrial Safety requirements.

1.10 EXPLOSIVES

A. Do not use explosives unless specifically authorized, in writing, by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crushed Rock: Class 2, 3/4-inch maximum aggregate base, Standard Specifications Section 26.

B. Trench Backfill Materials: Imported soils, if any, used as compacted trench backfill shall be predominantly granular and meet the following criteria:
   1. Expansion Index: Less than 20
   2. Free of all deleterious materials
   3. Contain no particles larger than 3.0 inches in the largest dimension.

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4. Contain less than thirty percent (30%) by weight retained on 3/4-inch sieve.
5. Contain at least fifteen percent (15%) fines (passing #200 sieve).
6. Have a Plasticity Index of 10 or less.

C. Pipe Bedding Materials:
1. Sand: Standard Specifications, Paragraph 19-3.025B.
2. Permeable Material: Standard Specifications, Paragraph 68-1.025 Class I, Type A.
3. Pea Gravel: River-run, rounded pea gravel with a maximum dimension no larger than 1/2 inch, and with no more than 10% passing the No. 200 sieve. The material shall have a durability index of 40 or higher.
4. Bedding materials shall have a Sand Equivalent (SE) greater than or equal to 30, as determined by the ASTM Standard D2419 test method.

D. 3/4-inch Crushed Rock Bedding: Use for all pipelines at depths greater than 15 feet and under all structures unless otherwise indicated on the drawings.

1. Clean, crushed aggregate, conforming to ASTM D448, No. 67:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	90 to 100
3/8 inch	20 to 55
No. 4	0 to 10
No. 8	0 to 5

E. Crushed Rock: Class 2, 3/4-inch maximum aggregate base, Standard Specifications Section 26.

F. Stabilization Rock
1. Stabilization Rock shall be used in areas of unstable subgrade and as directed by the Engineer.
2. Uniformly graded rock ranging from ¾ inch to 1-½ inch.

Sieve Size	Percent Passing
2 inches	100
3/4 inch	0 to 10

G. Reservoir Subgrade: Well-drained granular soils such as sands, gravel or crushed aggregate satisfying the following criteria:
1. Maximum size: Less than 1.5 inches.
2. Percent passing U.S. #200 sieve: Less than twelve percent (12%).
3. Sand equivalent: Greater than 30.
4. The subgrade soils shall be moisture conditioned before placing concrete.

H. Structural Backfill: Compacted fill placed for the support of footings, slabs-on-grade, exterior concrete flatwork, and driveways will be considered structural fill. Structural Backfill consist of approved Native Backfill soils or Imported Backfill that meets the criteria indicated below. All Structural Backfill shall be compacted to at least ninety-five percent (95%) of the laboratory maximum dry density (ASTM Standard D1557) at about to three percent (2%) above optimum moisture.

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I. Native Backfill: All Native Backfill soil particles shall not exceed 2.0 inches in nominal size and shall be free of organic matter and miscellaneous inorganic debris and inert rubble. Native soil prepared as necessary to be free from clods or rocks larger than 2 inches in greatest dimension. Wet, soft, or frozen material, organic matter, asphalt chunks, or other deleterious substances shall not be used as backfill. On-site fine-grained soils (clays and silts) shall not be re-used as Structural Backfill within 2 feet below the proposed shallow foundations and slabs on grade. No more than thirty percent (30%) of the backfill volume shall be larger than 3/4-inches in largest dimension. Rocks shall be well mixed with finer soil.

J. Imported Backfill: All Imported Backfill soil particles shall not exceed 2.0 inches in nominal size and shall be free of organic matter and miscellaneous inorganic debris and inert rubble. Imported Backfill materials shall have an Expansion Index (EI) less than 20. Imported non-expansive soil with liquid limit no greater than 40% and a plasticity index no greater than 15%, free from clods or rocks larger than 2 inches in greatest dimension, and free from organic material.

K. Flow Fill (Flowable Concrete Backfill)
   1. Flow Fill shall be used for bedding and backfill only as directed by the engineer and as indicated on the drawings.
   2. Flow Fill shall be Low Strength Concrete in accordance with Section 02065-Controlled Low Strength Material.

L. Landscape Fill: Imported or native backfill free from chemicals, salts, or other materials harmful to plant growth.

M. Permeable Drain Material: State of California Department of Transportation (Caltrans) Class 2 Permeable Material. The percentage composition by weight of permeable material in place shall conform to the following gradations:

Sieve Size	Percentage Passing
1 inch	100
3/4 inch	90 to 100
3/8 inch	40 to 100
No. 4	25 to 40
No. 8	18 to 33
No. 30	5 to 15
No. 50	0 to 7
No. 200	0 to 3

N. Impervious Material: Clay with a minimum percentage of material passing the No. 200 sieve of 50%. The material shall be free of organics, rocks, or clods greater than 4 inches in diameter.

O. Water: The water used shall be reasonably free of objectionable quantities of silt, oil, organic matter, alkali, salts, and other impurities. Water quality must be acceptable to the Engineer.

P. Aggregate Base: Refer to Section 02700.

Q. Warning Tape: 3-inch-wide, inert, fade-resistant plastic film resistant to acids, alkalis, and other components likely to be encountered in soil. Tape shall be blue, imprinted with *"CAUTION WATER MAIN BELOW"*, Griffolyn Terra Tape; or equal.

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R. Detection Tape: Plastic metallic type consisting of a blue color-coded polyethylene or melinex film, a solid core aluminum foil detection layer and other layers as required. The tape shall be resistant to acids, alkalines and other components likely to be encountered in soils. It shall be designed for both conductive and inductive locating procedures. The tape shall be blue, imprinted *"CAUTION WATER MAIN BELOW",* Terra Tape D by Griffolyn Company; Detectatape by Allen Systems; or equal.

S. Geotextile Fabric: Non-woven, non-biodegradable, needle punched geotextile comprised of polypropylene fibers.

Apparent Opening Size	70	U.S. Sieve
Permittivity	1.8	sec^{-1}
Permeability	0.26	cm/sec
Flow Rate	135	$gal/min/ft^2$
Grab Tensile Strength	120	lbs.
Grab Tensile Elongation	50	%
Trapezoid Tear Strength	50	lbs.
Mullen Burst Strength	240	psi
Puncture	70	lbs.

T. Acceptable Manufacturers:
1. TC Mirafi; Model 140N
2. Or Equal

PART 3 - EXECUTION

3.01 CONTROL OF WATER

A. Prepare and submit a Dewatering Plan in accordance with Paragraph 1.04.A.2.
1. It shall be presumed that the presence of groundwater will require dewatering operations. Dewatering Systems shall be designed to:
   a. Prevent loss of ground as water is removed.
   b. Avoid inducing settlement or damage to existing facilities or completed work.
   c. Relieve artesian pressures and resultant uplift of excavation bottom.

B. All excavations shall be kept free from water and all construction shall be in the dry.
1. It should be presumed that the presence of groundwater will require dewatering operations. Furnish, install, maintain, and operate all necessary pumping and other equipment for dewatering all excavations. At all times have on the project sufficient pumping equipment for immediate use, including standby pumps for use in case other pumps become inoperable.
2. Provide a sufficient number of pumps so as to hold the groundwater level at an elevation of not less than 1 foot below the lowest elevation of the pipe, duct structure or other material or feature to be placed.
3. Dispose of water as required by State and local regulations, and in such a manner as to cause no injury or nuisance to public or private property or be a menace to the public health. It is the Contractor's responsibility to obtain all necessary Storm Water Discharge Permits.
4. The dewatering operation shall be continuous, so that the excavated areas shall be kept free from water during construction, while concrete is setting

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and achieves full strength, and until backfill has been placed to a sufficient height to anchor the work against possible flotation.

5. Continue dewatering during backfilling operations such that the groundwater is at least 1 foot below the level of the compaction effort at all times. No compaction of saturated materials will be allowed.
6. Dewatering devices must be adequately filtered to prevent the removal of fines from the soil.
7. The Contractor shall be responsible for any damage to the foundations or any other parts of existing structures or of the new work caused by failure of any part of the Contractor's protective works. After temporary protective works are no longer needed for dewatering purposes, they shall be removed by the Contractor.
8. If pumping is required on a 24-hour basis, requiring engine drives, then engines shall be equipped in a manner to keep noise to a minimum. Refer to Section 01140 for noise control requirements.
9. Prevent disposal of sediments from the soils to adjacent lands or waterways by employing whatever methods are necessary, including settling basins.

C. The Contractor shall discharge dewatered water as coordinated with the Owner/Engineer.

1. Dispose of water as required by State and local regulations, and in such a manner as to cause no injury or nuisance to public or private property or be a menace to the public health. It is the Contractor's responsibility to obtain all necessary Storm Water Discharge Permits.
2. The Contractor shall be responsible for furnishing temporary drainage facilities to convey and dispose of surface water falling on or passing over the site.
3. Prevent disposal of sediments from the soils to adjacent lands or waterways by employing whatever methods are necessary, including settling basins.
4. Dewatering devices must be adequately filtered to prevent the removal of fines from the soil.

3.02 EXISTING UTILITIES

A. General: The known existing buried utilities and pipelines are shown on the Drawings in their approximate location. The Contractor shall exercise care in avoiding damage to all utilities as he will be held responsible for their repair if damaged. There is no guarantee that all utilities or obstructions are shown, or that locations indicated are accurate. Utilities are piping, conduits, wire, cable, ducts, manholes, pull boxes, and the like, located at the project site and adjoining said site.

B. Potholing:

1. Contact all affected utility owners and request them to locate their respective utilities prior to the start of "potholing" procedures. The utility owner shall be given 7 days written notice prior to commencing potholing. If a utility owner is not equipped to locate its utility, the Contractor shall locate it.
2. Clearly paint the location of all affected utility underground pipes, conduits, and other utilities on the pavement or identify the location with suitable markers if not on pavement. In addition to the location of metallic pipes and conduits, non-metallic pipe, ducts, and conduits shall also be similarly located using surface indicators and detection tape if present and shall then be similarly marked.

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3. After the utility survey is completed, commence "potholing" to determine the actual location and elevation of all utilities where crossings, interferences, or connections to new pipelines or other facilities are shown on the Drawings, marked by the utility companies, or indicated by surface signs. Prior to the preparation of piping shop drawings, or the excavating for any new pipelines or structures, the Contractor shall locate and uncover these existing utilities including services and laterals to a point 1 foot below the utility. Submit a report identifying each underground utility and its depth and location. Any variation in the actual elevations and the indicated elevations shall be brought to the Engineer's attention.
4. Excavations around underground electrical ducts and conduits shall be performed using extreme caution to prevent injury to workmen or damage to electrical ducts or conduits. Similar precautions shall be exercised around gas lines, telephone, and television cables.
5. Excavations shall have a surface dimension of no more than 18-inch by 18-inch. Air spades and vacuum excavators shall be used to limit the size of the excavation and damage to adjacent facilities. Backfill after completing potholing. In existing streets pave with 1 inch of cold mix asphalt concrete.

C. Interferences:
1. If interferences occur at locations other than shown on the Drawings, the Contractor shall notify the Engineer, and a method for correcting said interferences shall be supplied by the Engineer. Payment for interferences that are not shown on the Drawings, nor which may be inferred from surface indications, shall be in accordance with the provisions of Paragraph 3.7 of the General Conditions. If the Contractor does not expose all required utilities prior to shop drawing preparation, he shall not be entitled to additional compensation for work necessary to avoid interferences, nor for repair to damaged utilities.
2. Any necessary relocations of utilities, whether shown on the Drawings or not, shall be coordinated with the affected utility. The Contractor shall perform the relocation only if instructed to do so in writing from the utility and the Engineer.

D. Shutdowns: Planned utility service shutdowns shall be accomplished during period of minimum use. In some cases, this may require night or weekend work. Such work shall be at no additional cost to the Owner. Program work so that service will be restored in the minimum possible time and shall cooperate with the utility companies in reducing shutdowns of utility systems to a minimum.
1. Disconnections: No utility shall be disconnected without prior written approval from the utility owner. When it is necessary to disconnect a utility, the Contractor shall give the utility owner not less than 72 hours' notice when requesting written approval. The Contractor shall program his work so that service will be restored in the minimum possible time.

E. Overhead Facilities: There *are* existing overhead electric and telephone transmission lines at the site. These overhead utilities are not shown on the Drawings. Extreme caution shall be used when working in the vicinity of overhead utilities to prevent injury to workmen or damage to the utilities. The Contractor shall be required to comply with the applicable provisions of the California Construction Safety Orders, WAC 296-24-960, OR-OSHA when working anywhere on this project.

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F. Existing laterals are not specifically shown on the Drawings but do exist along the pipeline routes. Protect all service laterals from damage due to construction operations. If any laterals are damaged, notify the Engineer and the affected utility immediately. The cost of repair shall be borne by the Contractor.

3.03 GENERAL CONSTRUCTION REQUIREMENTS

A. Site Access: Access to the site will be over public and private roads. Exercise care in the use of such roads and repair at own expense any damage thereto caused by Contractor's operations. Such repair shall be to the satisfaction of the Owner or agency having jurisdiction over the road. Take whatever means are necessary to prevent tracking of mud onto existing roads and shall keep roads free of debris.

B. Traffic Regulation: Provide such flagmen, patrols, pilot cars, drivers, lighted barricades, flares, lights, warning signs, and safety devices as may be required for control of traffic adjacent to all areas of work. A minimum of one lane of traffic shall be kept open at all times on public roads. Refer to Section 01550 for Traffic Regulation.

C. Barriers: Barriers shall be placed at each end of all excavations and at such places along excavations as may be necessary to warn all pedestrian and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely restored.

D. Access: Free access must be maintained to all fire hydrants, water valves and meters, and private driveways.

E. Demolition of Pavement: Where trenching or excavation occurs in paved areas, the pavement shall be scored and broken ahead of the trenching or excavation operation. The extent of paving removed shall be limited to the minimum necessary for the excavation. All existing asphalt or concrete surfacing shall be saw cut vertically in a straight line and removed from the jobsite prior to starting the trench excavation. This material shall not be used in any fill or backfill.

F. Dust Control: Take proper and efficient steps to control dust.

G. Permits: Refer to General Conditions.

H. Storage of Materials: Excavated materials unsuitable for backfill shall not be stored on existing streets and shall be disposed of immediately. Neatly place excavated materials far enough from the excavation to prevent stability problems. Keep the materials shaped to cause the least possible interference with plant operations and drainage.

I. Temporary Pavement: Place temporary pavement on trenches in existing streets within 24 hours after the trench has been backfilled. Maintain temporary pavement until permanent pavement is to be placed.

J. Existing Facilities: Maintain access to existing facilities to permit continued operation. Maintain access for firefighting equipment and to fire hydrants.

K. Unfavorable Weather: Fill materials shall not be placed, spread, or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations shall not resume until the Engineer approves the moisture and density conditions of the previously placed fill.

L. Erosion Control: Take all measures deemed necessary during grading to provide erosion control devices in order to protect slope areas and adjacent properties from storm damage and flood hazard originating on this project. Maintain slopes in

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their as-graded form until all slopes are in satisfactory compliance with job specifications, all berms have been properly constructed, and all associated drainage devices meet the requirements of the drawings and specifications.

3.04 TRENCH EXCAVATION

A. Excavation for pipe and other utilities such as duct banks shall be in open cut. The trench shall be as wide as necessary for sheeting and bracing and the proper performance of the work up to the maximum width permitted by the typical cross-sections shown on the Drawings. The sides of the trenches shall be vertical in paved areas. The bottom of the trench shall be constructed to the grades and shapes indicated on the Drawings. Should the Contractor desire to use other equivalent methods, he shall submit his method of construction to the Engineer for favorable review prior to its use.

B. Remove lumped subsoil and rock up to ½ cubic yard, measured by volume.

C. Do not advance open trench more than 400 feet ahead of installed pipe.

D. Take care not to over excavate. Accurately grade the bottom of the trenches to provide uniform bearing and support for each section of the pipe or conduit at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints, and as hereinafter specified. Dig bell holes and depressions for joints after the trench bottom has been graded. For the pipe to rest on the bedding for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the joint. Remove stones as necessary to avoid point bearing.

E. The trench shall not be backfilled until the Engineer reviews the pipe and bedding installation.

F. Backfill and compact over excavations in accordance with the requirements of Paragraph 3.10 with Bedding material or stabilization rock. There shall be no additional payment to the Contractor for over excavations not coordinated with the Engineer. Remove unsatisfactory material encountered below the grades shown as coordinated with the Engineer and replace with Bedding material or stabilization Rock. Payment for removal and replacement of such unsatisfactory material coordinated with the Engineer shall be made in accordance with the provisions of the General Conditions.

G. Grade trenches so that they are uniformly sloped between the pipe elevations shown on the Drawings. If no elevations are shown on the Drawings, provide *3* feet of minimum cover. Comply with the minimum and maximum trench widths shown on the Drawings. Notify the Engineer if the trench width exceeds the maximum allowable width for any reason.

H. For all piping or conduits to be placed in any excavated and backfilled area, such as at manholes or for building connections, the structural backfill shall be first compacted to a level at least 3 feet from the top of the piping or conduit elevation and then retrenched to pipe grade.

I. Provide ladders for access to the trench by construction and inspection personnel.

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3.05 EXCAVATION FOR STRUCTURES

A. All excavation for structures shall be done to the dimensions and levels indicated on the Drawings or specified herein. Excavate to such width outside the lines of the structure to be constructed as may be required for proper working methods, the erection of forms, and the protection of the work.

B. The minimum depth of over-excavation shall be 5 feet below the existing grade, or 2 feet below proposed shallow foundations whichever is deeper. Over-excavation shall extend a least 5 feet beyond the limits of footings, or equal distance of over-excavation depth, whichever is greater, or as limited by the existing structures. Deeper over-excavation will be needed if soft, yielding soils are exposed on the excavation bottom, see below.

C. Excavation activities shall not disturb existing utilities, buildings, foundations, and remaining structures to be protected in place.

D. The subgrade in all areas to receive fill shall be scarified to a minimum depth of 6.0 inches, the soil moisture adjusted within three percent (2%) above optimum, and then compacted to at least ninety-five percent (95%) of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. Compacted fill may be placed on native soils that have been properly scarified and re-compacted. All areas to receive compacted fill will be observed and approved by the Engineer before the placement of fill.

E. Take care to preserve the foundation surfaces shown on the Drawings in an undisturbed condition. If the Contractor overexcavates or disturbs the foundation surfaces shown on the Drawings or specified herein, without written authorization of the Engineer, he shall replace such foundations with concrete fill or other material approved by the Engineer in a manner that will show by test an equal bearing value with the undisturbed foundation material. No additional payment will be made for the added quantity of concrete fill or other material used because of overexcavation.

F. Inspection of Excavation: Notify the Engineer when excavation for the structure is complete. No forms, reinforcing steel, concrete, or precast structure shall be placed until the excavation has been inspected by the Engineer.

3.06 FOUNDATIONS ON UNSTABLE SOILS

A. If the bottom of the excavation is soft or unstable, and in the opinion of the Engineer, cannot satisfactorily support the pipe or structure, the soft or unstable material shall be removed and replaced a minimum of 12-inches below grade with Stabilization Rock or as otherwise specified by the Engineer. Payment for removal and replacement of such unsatisfactory material directed by the Engineer shall be made in accordance with the provisions of the General Conditions.

B. Deeper over-excavation will be needed if soft, yielding soils are exposed on the excavation bottom. The actual depth of removal shall be determined based on observations made during grading.

3.07 SUPPORT OF EXCAVATIONS

A. Adequately support excavation for trenches and structures to meet all applicable requirements in the current rules, orders, and regulations. Excavation shall be adequately shored, braced, and sheeted so that the earth will not slide or settle and so that all existing structures and all new pipe and structures will be fully

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protected from damage. Keep vehicles, equipment, and materials far enough from the excavation to prevent instability.

B. Take all necessary measures to protect excavations and adjacent improvements from running, caving, boiling, settling, or sliding soil resulting from the high groundwater table and the nature of the soil excavated. Attention is directed to Section 832 of the Civil Code of the State of California relating to lateral sub adjacent supports, and wherever structures or improvements adjacent to the excavation may be damaged by such excavation, the Contractor shall comply with this law.

C. The support for excavation shall remain in place until the pipeline or structure has been completed. During the backfilling of the pipeline or structure, the shoring, sheeting, and bracing shall be carefully removed so that there shall be no voids created and no caving, lateral movement or flowing of the subsoils.

3.08 BEDDING AND BACKFILL

A. Trench excavations to receive backfill shall be free of trash, debris, or other unsatisfactory materials at the time of backfill placement.

B. Place bedding and backfill materials true to the lines, grades, and cross-sections indicated on the Drawings and compacted to the degree specified on the Drawings. Standard limits of bedding material shall be from 6-inches below the bottom of the pipe to 12-inches above the top of the pipe. Place bedding and backfill materials in horizontal lifts not to exceed 6 inches in thickness measured before compaction. The difference in level on either side of a pipe shall not to exceed 4 inches.

C. Bedding shall be compacted by vibrating, tamping, or a combination thereof, to 70% relative density for well-graded sand or squeegee material as determined by ASTM D 4253 and D 4254.

D. Backfill material shall not be placed over the pipe or conduit until after the joints have been completed and inspected by the Engineer.

E. It shall be incumbent upon the Contractor to protect the pipe or conduit from damage during the construction period. It shall be his responsibility to repair broken or damaged pipe at no extra cost to the Owner. Carefully place backfill around and over the pipe and do not allow it to fall directly upon the pipe. Tamping of backfill over the pipe shall be done with tampers, vibratory rollers and other machines that will not injure or disturb the pipe.

F. Do not allow construction traffic nor highway traffic over the pipe trench until the trench backfill has been brought back even with existing adjacent grade.

G. Import Backfill: The removal and replacement limits and quantity of import backfill material shall be coordinated and accepted by the Engineer and governing authority prior to proceeding with the installation.

H. Trench backfill shall be compacted to a minimum relative compaction of ninety percent (90%) as per ASTM Standard D1557 test method. Rocks larger than 1.0 inch shall not be placed within 12.0 inches of the top of the pipeline. No more than thirty percent (30%) of the backfill volume shall be larger than 3/4-inches in largest dimension. Rocks shall be well mixed with finer soil.

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3.09 STRUCTURAL BACKFILL

A. Crushed Rock Subgrade: Place a layer of rock, compacted in accordance with the requirements listed above, under structures to the lines, grades and minimum thicknesses shown on the Drawings. Unless shown specifically otherwise in the Drawings, do not use rock as backfill above the elevation of the highest base slab of the structure.

B. Backfill for the Support of Structures:
   1. Compacted fill placed for the support of footings, slabs-on-grade, exterior concrete flatwork, and driveways will be considered Structural Backfill.
   2. Rocks larger than 1.0 inch shall not be placed within the upper 12.0 inches of pavement or structure subgrade.

C. Backfill Adjacent to Structures:
   1. Backfill shall be Structural Backfill compacted in accordance with the requirements listed above less otherwise specified or shown on the Drawings.
   2. Do not place backfill against structures until the concrete has been patched and cured.
   3. Do not place backfill against structures until at least 28 days after the concrete was placed, or until the concrete has achieved a strength of at least 2,500 psi, whichever is earlier. Concrete strength shall be demonstrated by field cured cylinders tested at the Contractor's cost, prepared, and tested in accordance with ASTM C31 and ASTM C39.
   4. Do not place backfill against hydraulic structures until the structure has passed the specified leakage tests.
   5. Place backfill in uniform, level layers, not exceeding 8 inches thick measured before compaction. Fill soils shall be evenly spread, watered, or dried as necessary, mixed and compacted to at least the density specified. The fill shall be placed and compacted on a horizontal plane. Bring backfill up uniformly on all sides of the structure, and on both sides of buried walls.

D. Rock Subgrade Under Structures
   1. 3/4-inch Crushed Rock Bedding shall be used for all pipelines at depths greater than 15 feet and under all structures unless otherwise indicated on the drawings.
   2. Crushed Rock shall be placed as a 6-inch layer, compacted to 95% relative compaction.

3.10 COMPACTION

A. Add water to the backfill material or dry the material as necessary to obtain moisture content within 2% above optimum. Employ such means as may be necessary to secure a uniform moisture content throughout the material of each layer being compacted.

B. After the material has been moisture conditioned, compact it with compaction equipment appropriate for the use to achieve specified compaction.

C. If the backfill material becomes saturated from rains or any other source because it was not compacted to the specified density or was not backfilled and compacted to surface grade, through negligence or otherwise, remove the faulty material and replace it with suitable material compacted to the specified density. No additional payment will be made for doing such work or removal and replacement.

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D. Compaction of embankment and backfill materials by flooding, ponding, or jetting is not permitted.

E. When densities of compacted materials do not meet the requirements, remove and/or recompact the material until the requirements are met. The Contractor will be back charged the cost of retesting all failing tests, including the initial retest. Such back charges will be deducted from the Contractor's Progress Payments.

F. Material Requirements
   1. Pipe Bedding Material: Compact to a minimum 95 percent of maximum density, in accordance with ASTM Standard D1557 unless otherwise specified or shown on the Drawings.
   2. Pipe Zone Material: Compact by hand methods under the haunches of the pipe and in areas not accessible to mechanical tampers unless otherwise specified or shown on the Drawings.
   3. Imported Backfill: Compact to a minimum 95 percent of maximum density, in accordance with ASTM Standard D1557 unless otherwise specified or shown on the Drawings.
   4. Native Backfill: Compact to a minimum 95 percent of maximum density, in accordance with ASTM Standard D1557 unless otherwise specified or shown on the Drawings.
   5. Rock Stabilization: Compact to a minimum 95 percent of maximum density, in accordance with ASTM Standard D1557 unless otherwise specified or shown on the Drawings.
   6. Structural Fill: Compact crushed rock, import or native backfill, or any subgrade materials under floors, footings, and foundations to a minimum 95 percent of maximum density, in accordance with ASTM Standard D1557 unless otherwise specified or shown on the Drawings.
   7. Landscape Fill: Compact to a minimum 90 percent of maximum density, in accordance with ASTM Standard D1557 unless otherwise specified or shown on the Drawings.
   8. Impervious Material: Compact to a minimum 90 percent of maximum density, in accordance with ASTM Standard D1557 unless otherwise specified or shown on the Drawings.

G. Testing Frequency:
   1. Trench Backfill: Test every 200 feet of trench.
   2. Earthwork: Test every one-foot lift of fill, but not less than 500 square feet for each 2 feet of fill.
   3. Structural Backfill:
      a. Sub-base: Test every 200 square feet.
      b. Base:
         1) Test every 200 square feet of building footprint, with no less than two tests per structure.
         2) Test every 200 cubic yards of material placed within 10 feet around the building.

3.11 SITE GRADING

A. Site Clearing: See Section 02200 Site Preparation. Clearing and grubbing shall consist of the removal from structure areas to be graded of all existing grass, trees, structures, pavement, utilities, and other vegetation. Organic and inorganic materials resulting from the clearing and grubbing operations shall be hauled away from the areas to be graded.

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B. Rough Grading: After completion of stripping, rough grade cut areas to the lines, grades and contours shown on the Drawings.

C. Scarifying: Scarify to a minimum 6-inch depth all areas where fills are required. Moisture conditions the scarified surface to within 2% above optimum water content, and compact in accordance with the requirements of Section 3.04 unless otherwise specified or shown on the Drawings.

D. Fills:
   1. Do not place any fill until the Engineer has inspected, tested to his satisfaction, and favorably reviewed the prepared subgrade.
   2. Construct fills as shown on the Drawings, true to line, grade, and cross-section. Construct fills of native backfill or imported backfill. Place material in approximately 8-inch-thick horizontal layers measured before compaction, and carried across the entire width to the required slopes. Compact all fills in accordance with the requirements of Section 3.04 unless otherwise specified or shown on the Drawings. Properly moisture condition before compaction.
   3. Where fills are to be made and compacted on sloping ground surfaces, steeper than 5:1, such slopes shall be benched a minimum of 6 feet horizontally as the work is brought up. Recompact material thus removed by benching along with the new embankment material.
   4. It may be necessary to overbuild slopes and trim back to the compacted core to achieve adequate compaction of slope faces.

E. Ditches: Cut ditches accurately to the cross sections and grades shown. Take care not to overexcavate ditches and backfill excessive excavation to grade. Trim all roots, stumps, rock and other foreign matter from the sides and bottom of the ditches. Compact the surfaces of ditch slopes and bottom.

F. Landscaped Areas: Use Landscape Fill in the top 2 feet of areas to be landscaped, compacted in accordance with the requirements of Section 3.04 unless otherwise specified or shown on the Drawings.

3.12 FINISH GRADING

A. Except where shown otherwise in the Drawings, restore the finish grade to the original contours and to the original drainage patterns. Grade surfaces to drain away from structures at a minimum of 2 percent, unless otherwise noted in the Drawings. The finished surfaces shall be smooth and compacted per Paragraph 3.10.

3.13 DISPOSAL OF EXCAVATED MATERIAL

A. Dispose of unsuitable material or excavated material in excess of that needed for backfill or fill offsite in accordance with the requirements of Section 01140.

END OF SECTION

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SECTION 02516

DISINFECTION AND TESTING OF WATER LINES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes disinfection and testing of potable water distribution systems.

1.02 REFERENCES

A. American Water Works Association:
   1. AWWA B300 - Hypochlorites
   2. AWWA B301 - Liquid Chlorine
   3. AWWA B303 - Sodium Chlorite
   4. AWWA C600 - Installation of Ductile Iron Water Mains and their Appurtenances.
   5. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
   6. AWWA C651 - Disinfecting Water Mains.

1.03 QUALIFICATIONS

A. Testing Laboratory: Independent testing laboratory specializing in testing potable water systems, approved by the local health authority.

B. Submit bacteriologist's signature and authority associated with testing.

1.04 QUALITY ASSURANCE

A. Notify Engineer a minimum of 24 hours in advance of testing. All testing shall be made in the presence of the Engineer.

B. Disinfection shall be accomplished under the supervision of the Contractor by a person skilled and experienced in the operation of water systems.

1.05 SUBMITTALS

A. Testing Schedule, including proposed plans and locations for water conveyance and discharge, submitted in writing to the Engineer for approval a minimum of 14 Calendar Days before testing is to start. Testing shall be coordinated with the Owner

B. Shop drawings shall include the following:
   1. Test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.

PART 2 - PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals
   1. AWWA B300: Hypochlorite
   2. AWWA B301: Liquid Chlorine

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3. AWWA B303: Sodium Chlorite

B. Hypochlorite Tablet Adhesive
   1. Certified to NSF Standard 61
   2. Permatex RTV Clear or approved equal.

2.02 HYDROSTATIC TESTING MATERIALS

A. All test equipment, temporary valves, temporary blow-offs, temporary bulkheads and blind flanges, temporary manual air release valves, or other water control equipment and materials shall be determined and furnished by the Contractor. No materials shall be used which would be injurious to the pipeline or its future function. The Contractor shall be held solely responsible for ensuring that a sufficient water source is available for all operations.

B. Temporary manual air-release valves shall be provided as necessary for pipeline test. The pipe outlet shall be constructed in the same manner as for a permanent air valve and after use, sealed with a blind flange, pipe cap or plug.

C. Air-release and water drainage connections shall be included.

PART 3 - EXECUTION

3.01 SEQUENCE

A. Disinfection / Chlorination

B. Hydrostatic Testing

C. Flush Line, Dechlorination of discharged water, Refill

D. Clearwater / Bacteriological Testing

3.02 DISINFECTION / CHLORINATION

A. All main extensions shall be chlorinated in accordance with AWWA C651.

B. The chlorination of the finished pipeline shall be done prior to the hydrostatic testing.

C. Before filling the pipe with water, the pipe shall be clean and free of debris to the satisfaction of the Engineer.

D. Chlorine tablets may be used for disinfection in 16-inch and smaller pipe. Tablets shall be attached to the inside top of the pipe with an acceptable, food grade approved, adhesive prior to the pipe installation in the trench.

NUMBER OF HYPOCHLORITE TABLETS OF 5-GRAM STRENGTH
REQUIRED FOR A DOSE OF 50 mg/l*

	Pipe Diameter, in			
Pipe Length, ft. 6	8	12	16	
13 or less	2	2	6	8
18	2	4	8	12
20	2	4	8	14

*Based on 3.25 gram available chlorine tablet

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E. 20-inch and larger pipe requires a chlorine slurry or liquid fed into the water to continuously fill the pipe.

F. Chlorinated water shall be held in contact with the pipe for 24 hours.

G. Perform chlorination testing: Upon completion of the 24-hour retention period required for disinfection, the water in the pipeline shall be tested and have a residual chlorine content of not less than 50 mg/l.

H. Obtain one (1) test sample for every 1,000 linear feet of pipe.

3.03 HYDROSTATIC TESTING

A. Conduct hydrostatic testing accordance with AWWA C600.

B. Hydrostatic testing shall be completed after chlorination testing and prior to the clearwater / bacteriological testing and final connection to the existing system.

C. Before applying test pressure, completely expel air from section of piping under test. Provide temporary blow-off(s) or use fire hydrant(s) as necessary so air can be expelled as pipeline is filled with water.

D. Test Pressure: 150 psi or 1.5 times the working pressure at the point of testing, whichever is greater.

E. Slowly bring piping to test pressure and allow system to stabilize. Do not open or close valves at differential pressures above rated pressure.

F. Conduct hydrostatic test for at least a *2-hour* duration.

G. Examine exposed piping, fittings, valves, hydrants, and joints carefully during hydrostatic pressure test. Repair or replace damaged or defective pipe, fittings, valves, hydrants, or joints discovered, following pressure test.

H. Testing Allowance:
   1. Defined as the quantity of makeup water that must be supplied into the tested pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water, brought to test pressure and air expelled.
   2. Shall not be measured by a drop in pressure in a test section over a period of time.
   3. No pipe installation will be accepted if the amount of makeup water is greater than that determined by the following formula and table:

$$L = \frac{SD\,(P)^{1/2}}{148{,}000}$$

L	=	testing allowance, in gallons per hour
S	=	length of pipe tested, in feet
D	=	nominal diameter of pipe, in inches
P	=	average test pressure during leakage test, in psi

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DUCTILE IRON AND PVC PIPE										
Hydrostatic testing allowance per 1,000 ft. of pipeline* - *gph* per AWWA C600 and C605										
Avg. Test Pressure – *psi*	**Nominal Pipe Diameter – *in.***									
	4	6	8	10	12	16	20	24	30	36
250	0.43	0.64	0.85	1.07	1.28	1.71	2.14	2.56	3.21	3.85
225	0.41	0.61	0.81	1.01	1.21	1.62	2.03	2.43	3.04	3.65
200	0.38	0.57	0.76	0.96	1.15	1.53	1.91	2.29	2.87	3.44
175	0.36	0.54	0.72	0.89	1.07	1.43	1.79	2.15	2.68	3.22
150	0.33	0.50	0.66	0.83	0.99	1.32	1.66	1.99	2.48	2.98

I. When leakage exceeds specified acceptable rate, locate source and make necessary repairs. Repeat test until specified leakage requirements are met.

3.04 CLEARWATER / BACTERIOLOGICAL TESTING

A. Upon completion of passing chlorination and hydrostatic tests, the pipeline shall be thoroughly flushed.

B. Disposal of Disinfection Solution: Dechlorinate and dispose of disinfection solution in accordance with applicable regulations and Section 01140.Take care to assure that chlorinated water is not spilled in drains.

C. Refill water line. Before the new water main is finally connected to the distribution system for use, conduct clearwater / bacteriological testing.

D. Conduct clearwater / bacteriological testing in accordance with AWWA C651.

E. Samples for clearwater / bacteriological testing shall be tested for residual chlorine and bacteriological quality.
   1. Residual Chlorine shall not exceed 0.5 mg/l.
   2. Bacteriological test shall show absence of coliform organisms.

F. If bacteriological analyses do not satisfy the above requirements, then disinfection procedure must be repeated until these requirements are met.

3.05 TEST RESULTS

A. Chlorination Testing Report
   1. Type and form of disinfectant used
   2. Date and times of disinfectant injection
   3. Test locations
   4. Name of person collecting samples
   5. Initial and 24 hour disinfectant residuals in treated water in mg/l for each outlet tested
   6. Date and times of flushing
   7. Disinfectant residual after flushing in mg/l for each outlet tested

B. Hydrostatic Testing Report
   1. Length of pipe tested
   2. Test Pressure
   3. Duration of the test
   4. Amount of make-up water
   5. Engineer and the Contractor shall sign report

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C. Clearwater / Bacteriological Testing Report
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Initial and 24 hour disinfectant residuals in mg/l for each outlet tested.
   6. Coliform bacteria test results for each outlet tested.
   7. Certify water conforms, or fails to conform, to absence of coliform bacteria.

END OF SECTION

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SECTION 02705

PAVING AND RESURFACING SHORT FORM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Furnishing all labor, material, equipment, tools, and services required for the placing and compacting of asphalt concrete pavement and aggregate surfacing for roadways, parking lots, and walkways to the lines, grades, and dimensions shown on the Drawings and as specified herein. Also included is the repair and resurfacing of existing roadway and area paving damaged or removed during construction.

B. Related Sections: Repair or replace concrete curbs, gutters and sidewalks damaged by the work in accordance with Section 02775.

1.02 REFERENCE SPECIFICATIONS

A. Whenever the words "Standard Specifications" are referred to, the reference is to the State of California, Department of Transportation, Standard Specifications dated 2018.

B. ASTM International (ASTM):
   1. D1556 Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
   2. D2922 Test Method for Density of Soil and Soil Aggregate in Place by Nuclear Method (Shallow Depth)

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit the following under the Product Information category.
   1. Samples: Furnish, without additional cost to the Owner, such quantities of construction materials as may be required by the Engineer for test purposes. The Contractor shall cooperate with the Engineer and furnish necessary facilities for sampling and testing of all materials and workmanship. All materials furnished and all work performed shall be subject to rigid inspection, and no materials shall be used in the construction work until it has been inspected by the Engineer.
   2. Submit a signed verification from each source of supply for each construction material employed on this project indicating that the materials meet the Specification requirements.
   3. Mix design for asphalt concrete and test results of California Test 367.
   4. Submit manufacturer's certification of the actual volatile organic compound (VOC) content for all pavement paints and bituminous pavement sealers proposed for use on this project. Submit certification of the actual VOC content for coatings manufactured after 1 September 1987. For coatings manufactured before 1 September 1987, submit VOC content and date of manufacture. VOC content shall be measured in grams per liter by weight of coating as applied excluding water and color added to the tint base.

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5. Submit verification that bituminous pavement sealers and paint products furnished meet applicable regulations as to allowable VOC content for the time and place of application and use intended.

1.04 QUALITY ASSURANCE

A. Comply with "Standard Specifications" of State of California, Department of Transportation (CALTRANS) 2018.

1.05 REGULATORY REQUIREMENTS

A. All work, material, procedures and practices under this Section shall conform with requirements of the California Air Resources Board (CARB) and the Air Pollution Control District having jurisdiction.

PART 2 - PRODUCTS

2.01 PAVING MATERIALS

A. Aggregate Base: Standard Specifications, Section 26. Class and size as indicated on the Drawings; or if not indicated on the Drawings, use Class 2, ¾ inch maximum.

B. Prime Coat: Liquid asphalt, Grade MC-70, Standard Specifications, Section 92.

C. Tack Coat and Seal Coat: Emulsified asphalt, Grade SS 1, Standard Specifications, Section 94.

D. Asphalt Concrete: Type B, ½ inch maximum, medium grading, Standard Specification Section 39. Bitumin ratio shall be selected by the supplier in accordance with paragraph 39 2.02 of the Standard Specifications.

2.02 HEADERS

A. At straight sections, wood headers shall be constructed of 2 inch by 6 inch construction heart redwood, held in place by 2 inch by 4 inch stakes, of the same materials, 2 feet long and set at 8 foot centers.

B. At curved sections, wood headers shall be constructed of three ½ inch by 4 inch construction heart redwood bender boards. Boards shall be lapped at one-third of the length of individual boards, with no two boards lapped at the same place. Hold boards in place with stakes same as above.

2.03 PAVEMENT PAINT

A. Comply with Section 84-3.02 of the Standard Specifications.

PART 3 - EXECUTION

3.01 GENERAL

A. This Specification shall cover newly surfaced areas as well as restoration of existing surfacing.

B. Adjust existing and new manholes, meter boxes, cleanouts, etc. to match the new grade.

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3.02 PAVEMENT CUTTING

A. After backfilling trenches and prior to paving, saw cut existing pavement parallel to the trench (using a concrete saw) to a minimum depth equal to or greater than one-half the thickness thereof.

B. The pavement shall be cut back 6 inches on each side of the trench or excavation wall.

C. Re-cut and restore any pavement damaged outside these lines at the expense of the Contractor.

D. Should voids develop under the existing pavements during construction, those affected pavements shall be neatly saw cut in straight lines and replaced after the voids have been filled.

3.03 PLACEMENT OF AGGREGATE BASE

A. Subgrade Preparation:
   1. Water or dry subgrade as required to bring the soil to within 2% of the optimum moisture content for proper compacting.
   2. Compact to a relative compaction of not less than 95% in the upper 6 inches.
   3. When compaction of the subgrade areas on fill and embankments has been properly obtained, only such additional rolling will be required as necessary to obtain a thoroughly compacted subgrade immediately prior to placing the aggregate base thereon.

B. Aggregate Base Tolerance:
   1. Do not place the aggregate base before the subgrade is approved by the Engineer.
   2. The finished aggregate base shall not vary more than 0.05 foot above, nor 0.10 foot below, the planned grade.

C. Aggregate Base Placing:
   1. Spread the aggregate base material on the prepared subgrade by means of suitable spreading devices.
   2. The aggregate base material may be dumped in piles upon the subgrade and spread by bulldozing ahead from the dumped material.
   3. Each layer shall not exceed 0.50 feet.
   4. Segregation of large or fine particles of aggregate shall be avoided, and the material as spread shall be free from pockets of large and fine material.

D. Compaction:
   1. Compact each layer of aggregate base material to not less than 95% relative compaction as determined by Test Method Calif. No. 216 or ASTM D1556 (Sand Cone), or Calif. No. 231 or ASTM D2922 (Nuclear method when approved by the Engineer).
   2. Compaction shall be in accordance with Section 26 1.05 of the Standard Specifications.
   3. Water aggregate base after compaction as provided in Section 17 of the Standard Specifications. Paragraph 17-1.04 is not applicable.

3.04 ASPHALT CONCRETE INSTALLATION

A. Apply prime coat at a rate of 0.15-gallon per square yard. Blot any excess which has not penetrated the base with sand. Remove any loose sand.

B. Apply tack coat a rate of 0.05-gallon per square yard.

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C. Spread and compact asphalt concrete in accordance with Standard Specifications Section 39 to the thickness shown on the Drawings.

D. Protect asphaltic concrete paving until surface has cooled sufficiently to permit traffic without damage.

E. Immediately remove spilled and splattered materials from adjacent surfaces.

3.05 PAVEMENT MARKINGS

A. Replace existing pavement markings that are removed or damaged by the construction.

B. Apply pavement markings in accordance with Section 84 of the Standard Specifications. Paragraphs on measurement and payment are not applicable.

3.06 HEADERS

A. Install wood headers along pavement edges where indicated on the Drawings. Install new headers where existing wood headers are damaged during construction, or removed for construction. Install headers with uniform slope between spot elevation indicated on the Drawings or to conform to existing grades.

END OF SECTION

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SECTION 02775

CONCRETE CURB, GUTTERS, AND SIDEWALKS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Provide concrete curbs, curbs and gutters, gutters, and sidewalks as shown on the Drawings and as specified herein.

1.02 REFERENCE SPECIFICATIONS

A. Wherever the words "Standard Specifications" are referred to, the reference is to the State of California, Department of Transportation, Standard Specifications dated 2018.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit certificate of compliance indicating that the concrete complies with the specifications as Product Information submittals.

PART 2 - PRODUCTS

2.01 CONCRETE

A. Comply with the Standards Specifications, Paragraph 73 1.01.
   1. Cement: Type II Modified.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with the Standard Specifications, Section 73, Paragraphs 1.02 through 1.06, inclusive.

B. Unless shown otherwise on the Drawings, replace existing curbs, curbs and gutters, gutters and sidewalks in kind.

C. Adjust structures such as valve boxes, manhole frames and covers, and electrical vaults to grade after the curb and gutter or sidewalk has been constructed for a reasonable distance on all sides of the structure. Complete the concrete work after the structure is adjusted.

END OF SECTION

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SECTION 02825

ORNAMENTAL STEEL FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Ornamental steel fences.
   2. Ornamental steel swinging gates.
   3. Electric gate operators and controls and related hardware.
   4. Factory painting and field touchup painting.
   5. Concrete foundations.

1.02 REFERENCES

A. American Society for Testing Materials (ASTM):
   1. A 36 Standard Specification for Carbon Structural Steel
   2. A 123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   3. A 500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   4. A 513 Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
   5. A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip
   6. B 26 Standard Specification for Aluminum-Alloy Sand Castings

B. American Welding Society (AWS):
   1. AWS B2.1 Specification for Welding Procedure and Performance Qualification

C. California Building Standards Commission
   1. 2019 California Building Code (CBC) (California Code of Regulations, Title 24).

1.03 SUBMITTALS.

A. Product Data: Fully describe all products proposed for use.

B. Shop Drawings: Show the specific items and assemblies proposed for this project.

C. Operation and Maintenance Manual for electric gate operators.

D. Manufacturer's standard and custom color selections.

1.04 QUALITY ASSURANCE

A. Contractor's Qualifications: Welding procedures, welders, and welding operations shall be qualified for the type of work required in accordance with AWS Standard Qualification Procedures.

B. Comply with requirements of local Fire Marshal Fire and Prevention Department having jurisdiction for emergency operation of gated entry points.

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C. Comply with applicable provisions in the CBC, adopted edition and the National Electrical Code.

D. All work shall be in strict conformance with manufacturer's printed instructions and recommendations.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in good condition and properly protected against damage to factory-finished surfaces.

B. Store materials in a clean, dry location. Cover with protective materials to avoid damage, especially from dust, chemicals and moisture in the air.

C. Handle materials carefully on the job site to protect factory finishes.

PART 2 - PRODUCTS

2.01 ORNAMENTAL STEEL FENCES

A. Provide a minimum three rail, mechanically fastened, heavy industrial grade, galvanized steel, factory painted, ornamental wrought iron picket fence with swinging gates system: Builders Fence Company, Inc.; Amazing Gates; Iron Fence Shop; or equal.

B. Material:
1. Pickets, rails, and posts shall be manufactured from tubing meeting the requirements of ASTM A 513 or A 500 Grade B.
2. Solid steel bars, flat plates and shapes shall be manufactured from steel conforming to the requirements of ASTM A 36.
3. Pickets for gates shall be of the same size and style as those in the fence panels. Frames for fences and gates shall be of sufficient size and thickness to provide adequate support without sag. Adjustable trussing may be required at gates. Gate hardware shall be supplied by the manufacturer and shall be of sufficient size and capacity to support the gate specified.

2.02 FABRICATION

A. Steel used in the manufacturing of panels, gates and posts shall conform to the ASTM standards specified and shall be new prime material.

B. Panels, gates and flanged posts shall be of mechanically fastened and welded (at hinge supports) construction. Where screws and bolts are used, they are to be tamper-proof and vandal resistant; recess bolt heads to prevent chiseling of bolt heads. Mechanically fasten pickets to allow fence panels to follow contours of site. Layout and welding shall be done by experienced craftsmen. Welds shall be made by the gas metal arc method and welds shall be neat, clean and of the sizes indicated on the shop drawings. All flush welds shall be ground smooth.

C. After fabrication, steel panels, gates and posts shall be power washed in a phosphoric acid solution, rinsed and dried.

D. Fence Components:
1. Steel post sizes, maximum spacing and minimum foundation size. Provide barrier coating at dissimilar materials:

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Height	Rails	Max. Spacing	Min. Square Tube Posts	Min. Concrete Foundations
6 feet	3	8 feet	3" x 12 gauge	12" dia. x 36" deep
7 feet	4	8 feet	3" x 11 gauge	15" dia. x 42" deep
8 feet	4	6 feet	4" x 10 gauge	18" dia. x 48" deep

2. Gate posts and foundations: Minimum 4-inch x 10-gauge post and an 18-inch-diameter x 48-inch-deep concrete foundation.
3. Tube or "U" channel rails:
   a. 2-inch x 1-1/2-inch x 0.120-inch-thick (11-gauge) "U" channels
   b. 2-inch x 2-inch x 0.120-inch-thick (11- gauge) tube.
4. Steel plate pickets (or pales):
   a. 2-3/4” wide x 0.075 wall spaced 3-1/4 inches o.c.
   b. Each picket to be corrugated per manufacturer’s architectural style for strength, with 8” curved, pointed top for security. Color to match rails and posts. Points to curve out away from property. Provide barrier coating at dissimilar materials.
5. Post tops:
   a. Zinc alloy die cast domed or pyramid point from manufacturer’s standard caps. Color to match pickets. Provide barrier coating at dissimilar materials.

E. Fabrication:
1. Factory cut all material. Punch rails for pickets. Assemble fence panels in longest sections that can be transported. Provide "U" shaped slip joints for field assembly by using stainless steel 1/4-inch-diameter bolts or 1/4-inch-diameter stainless steel industrial rivets.

F. Finish:
1. All steel material shall be hot-dip galvanized G-90.
2. Rinse and clean.
3. Steel material to be phosphate etch, rinse clean and oven dry.
4. Steel First Coat: Powder coat with zinc-rich epoxy primer.
5. Steel Second Coat: Polyester powder coat, 3.5 mils average dry film thickness and bake at 450ºF.

2.03 STEEL GATES, SWINGING

A. Provide manual-operated personnel gate and electric motor-operated, steel swinging vehicular gate. Builders Fence Company, Inc.; Amazing Gates; Iron Fence Shop; or equal.
1. Swinging gates shall be as shown on the Drawings and shall be constructed as follows:
   a. All components shall be steel tube, plates and shapes to match fence panels. All joints shall be welded. All steel members to be hot-dip galvanized after fabrication. Finish to match fence panels.
2. Gate posts shall be 4-inch x 4-inch x 0.125-inch tube. Gate frames shall be minimum 2-inch x 3-inch x 0.125-inch tube. Weld corners to create a rigid frame. Provide a 2- x 3-inch horizontal rail near the top of the gate that lines up with a similar fence rail.
3. Pickets to be corrugated per manufacturer’s architectural style for strength, with a 8” curved, pointed top for security. Color to match rails and posts. Points to curve out away from property. Provide barrier coating at dissimilar materials.

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4. Gate post tops:
    a. Zinc alloy die cast domed or pyramid point from manufacturer's standard caps. Color to match pickets. Provide barrier coating at dissimilar materials.
5. Gates shall have electric motor operators.

B. Vehicular Gate Hardware: Hinges, operator arms, and idle roller on end of swinging section, shall be Richard-Wilcox; Stanley; or equal.

C. Personnel Gate Hardware: Provide mortise lockset; storeroom function. Keying as per Owner's requirements. Lockset style and finish to match adjacent existing hardware at facility; field verify. Provide for local emergency operation of personnel gate by Fire Department (Knox Box as approved by Fire Department).

D. Finish:
1. All steel material shall be hot-dip galvanized G-90.
2. Rinse and clean.
3. Steel material to be phosphate etch, rinse clean and oven dry.
4. Steel First Coat: Powder coat with zinc-rich epoxy primer.
5. Steel Second Coat: Polyester powder coat, 3.5 mils average dry film thickness and bake at 450ºF.

E. Electric Gate Operator:
1. Extra heavy-duty 1 HP swing type crank arm electric gate operator. Elite Gates; Customline Inc.; or equal.
2. Two stage gear reduction. Automatic limit switches, motor starter for open/close operation and built-in safety switch to reverse gate direction if gate contacts any unintended object. All prewired in a self-contained weatherproof housing. Operation shall be rated for 460 volts, 3 phase electrical service. See also electrical drawings.
3. Locking or latching devices and gates must operate in a "fail safe" mode so that the gates are automatically unlocked and manually operable by one person whenever remote control or electric operation fails.

F. Reversing Safety Edge:
1. Provide a reversing safety edge that will immediately stop the electric gate operator and reverse its direction whenever the leading edge of the gate encounters an obstruction with a force of 4 pounds or more.
2. Miller Edge #ME-123; Anchor Group; or equal.
The contractor shall lubricate the hinges, rollers and other gate hardware after installation. Provide barrier coating at dissimilar materials.

G. Control of Gate Operator:
1. Provide programmable wireless gate controller and three portable operators.
2. Provide for local emergency operation of gate by Fire Department or Owner under both power on and power failed conditions. Provide support and mounting for Knox electric switch for emergency use on both sides of gate.

H. Finish:
1. All material shall be hot-dip galvanized G-90.
2. Rinse and clean.
3. Phosphate etch, rinse clean and oven dry.
4. First coat: Powder coat with zinc-rich epoxy primer.
5. Second coat: Polyester powder coat, 3.5 mils average dry film thickness and bake at 450ºF.

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PART 3 - EXECUTION

3.01 PREPARATION

A. The contractor shall layout the new fence in accordance with the drawings, shop drawings, and all applicable requirements and codes.

B. The contractor shall verify any grade changes or surface irregularities.

C. Discrepancies between the approved shop drawings and field conditions must be approved by the Engineer prior to proceeding with the installation.

3.02 INSTALLATION

A. Fence and gate posts shall be set plumb and level at locations shown on the drawings.

B. Excavate for concrete foundations. All concrete foundations shall be as shown but not less than listed in paragraph 2.02.D.1 of this Section. Place rebar and pour concrete for foundations in accordance with Section 03300.

C. Fence panels shall be welded or bolted to the posts. Field welding of rail to the post shall be a complete 360 degree (all four sides) and shall be the size indicated on the shop drawings. Welds shall be cleaned and coated with a primer the same day the welding is performed. Bolted connections shall use bolts and tabs of the size indicated on the drawings. After tightening bolt, threads shall be peened. Provide barrier coating at dissimilar materials.

D. Gates shall be installed plumb and level and shall be the sizes and style indicated on the drawings. Install swinging gate sections and hardware in accordance with manufacturer's instructions. The contractor shall install any gate stops that may be required. Any padlock provisions or strikes shall be field attached to assure alignment. The contractor shall lubricate the hinges, rollers and other gate hardware after installation. Provide barrier coating at dissimilar materials.

E. All field welds and any abrasions to factory coatings shall be thoroughly cleaned, re-primed and touched up by the contractor with paint of the same quality, color and gloss of that used by the manufacturer.

F. Adjust gates for smooth easy operation.

END OF SECTION

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SECTION 03100

CONCRETE FORMWORK AND FORMWORK ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Design, construction, and treatment of formwork to confine and shape concrete to the required dimensions.
   2. Rigid plastic form liners for texturing architectural concrete. Form liner accessories including, but not limited to, fasteners, sealants, rustication and backup strips, form release agents, and sealers

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 117 Standard Tolerances for Concrete Construction and Materials
   2. ACI 301 Specifications for Structural Concrete for Buildings
   3. ACI 303R Guide to Cast-in-Place Architectural Concrete Practice
   4. ACI 309 Guide for Consolidation of Concrete
   5. ACI 306 Guide to Cold Weather Concreting
   6. ACI 318 Building Code Requirements for Structural Concrete
   7. ACI 347 Guide to Formwork for Concrete
   8. ACI 350 Code Requirements for Environmental Engineering Concrete Structures

B. American Plywood Association (APA):
   1. Material grades and designations as specified in this Section.

C. Standard Specifications for Public Works Construction or “GREENBOOK.”

D. NSF/ANSI 61 – Drinking Water System Components – Health Effects.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Formwork products: Submit technical data including installation instructions, independent laboratory test reports (ICC), handling and storage instructions, and NSF 61 certification for products in contact with potable water.
      a. Forms, if fabricated off construction site.
      b. Form facing materials.
      c. Form ties or through-bolts or coated ties, if utilized.
      d. Form release agents.
      e. Form coatings.
      f. Form liners manufacturer’s installation instructions and product data including fasteners, sealants, rustication and backup strips.
      g. Reshoring or backshoring for suspended slabs and beams.

C. Shop Drawings:

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1. Shop drawings and calculations for formwork beams sealed and signed by a licensed Civil or Structural Engineer in the state where the structures are being constructed.
2. Shop drawings indicating form liner layout and termination details. Indicate backup, rustication, reveal, and chamfer strip locations. Include jointing, form tie location and pattern of placement.
3. Procedures, drawings, calculations, layout and sequence for shoring, reshoring and backshoring suspended concrete slabs and beams sealed and signed by a licensed Civil or Structural Engineer in the state where the structures are being constructed. Include formwork removal procedure and magnitude of construction loads permitted during reshoring or backshoring on shop drawings.

D. Samples:
1. Form ties.
2. Submit two 12-inch square samples of the proposed form liner.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: See Section 03300.

B. Construction Standard: Applicable requirements of the ACI 301.

C. Preconstruction Meeting: See Section 03300.

D. Engineer's review for aesthetic criteria for form liners. Contractor responsible for design of formwork and back-up of formliner for structural stability and sufficiency.

E. Compliance certification by form release agent manufacturer for local regulations controlling VOC's.

F. Provide full scale mockup using actual job specific materials, methods, and workmanship. These include concrete mix, cement type, aggregate gradation, slump, water/cement ratios, plasticizers and additives, forming system ties, form liner, formwork, form release agents, placement rate, form pressures, joint sealing, vibrating and stripping practices. In addition, demonstrate patching and repair procedures for spalled concrete, and voids caused by honeycombing or bugholes. Incorporate formwork accessories and minimum one vertical and one horizontal form liner joint. Accepted mockup will be standard by which remaining work will be evaluated for technical and aesthetic merit. Accepted mockup is a prerequisite prior to use of form liner. Submit variations from mockup materials or techniques for approval prior to use.

1.05 DEFINITIONS

A. Water Containment Structure(s): A reservoir, basin, tank, channel, sump, or conduit.

B. Exposed Concrete: A concrete wall, slab, beam or column which will have surfaces exposed to view in the finished work. It includes similar exposed surfaces in water containment structures from the top of walls to 2 feet below the normal water surface (for concrete finishes for “exposed surfaces” see Specification Section 03350).

1.06 SYSTEM DESCRIPTION

A. Formwork and Formwork Accessories Design Requirements:

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1. Design and engineer formwork. Sign and seal design calculations for formwork and formwork drawings by licensed Civil or Structural Engineer in the state where the work will be done.
2. Design formwork, shores, reshores, and backshores to carry all loads transmitted to them and to comply with the requirements of the applicable building code. Formwork shall be designed in accordance with the requirements of ACI 301, ACI 318, and ACI 347.
3. Design formwork to withstand the pressure resulting from placement and vibration of concrete and to maintain specified tolerances. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete. Should satisfactory concrete placement require any changes in concrete mix design, the formwork shall be re-designed and modified as required for the changed mix designs.

B. Formwork and Formwork Accessories Performance Requirements:
1. Maximum deflection of facing materials reflected on concrete surfaces exposed to view shall be 1/240 of the span between structural members of the formwork, unless noted otherwise on Drawings.
2. Design forms to construct a flat, uniform concrete surface requiring minimal finishing or repairs. Form design shall accommodate all of concrete mix designs being used by the Contractor.
3. Set form facing materials in an orderly and symmetrical arrangement, and keep the number of seams to a practical minimum. Facing materials shall be supported with studs or other backing capable of maintaining deflections within the tolerances. Fit adjacent panels with tight joints.
4. Secure to forms as required or set for embedment as required, all sleeves, inserts, anchors, miscellaneous metal items, reglets, and other embedded items furnished under other Sections and required to be cast into concrete.

1.07 DELIVERY, STORAGE AND HANDLING

A. Lumber: Store all lumber, including plywood for forms, to prevent direct contact with the ground. Protect the stored lumber from the elements by a suitable covering, such as polyethylene film or waterproof building paper, suitably held in place.

B. Cover form liners to protect from oil, dirt, and UV exposure. Handle rigid form liner panels with care at temperatures below 25°F.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide new materials meeting the requirements referenced in this Section.

2.02 FORMWORK PRODUCTS

A. Formwork Materials:
1. Provide form-facing materials that will meet the concrete finish requirements for formed surfaces of Section 03350.
2. Use plywood, tempered concrete-form-grade hardboard, steel, plastic, paper, or other acceptable materials capable of producing the desired finish for form-facing materials.

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3. Use form-facing materials that will produce a smooth, uniform texture on the concrete.
4. Do not use form-facing materials with raised grain, torn surfaces, worn edges, patches, dents, or other defects that will impair the texture of concrete surfaces.
5. Provide facing-materials of clean, smooth surfaces of wood, plywood, metal, or other approved material.
6. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots.
7. Where used for exposed surfaces, dress and match boards.
8. Furnish plywood with a waterproof, synthetic resin bonded face manufactured for formwork.
9. Furnish steel forms that incorporate reinforcement, inserts, pipe fittings, box-outs, and other details shown on the Drawings without modification to these details.

B. Formwork Accessories: Use commercially manufactured accessories for formwork accessories that are partially or wholly embedded in concrete, including ties and hangers. Do not use nonfabricated wire form ties. Moldings for chamfers and rustications and the recesses for joint sealants shall be smooth and of nonabsorbent material.

C. Fabrication and Manufacture:
1. Formwork shall be essentially watertight and shall prevent loss of mortar from concrete. Seal all joints or gaps with an acceptable material.
2. Use ¾-inch minimum chamfer strips in the corners of formwork. Use mill run chamfer strips surfaced all sides.
3. Design temporary openings, where needed, at the base of vertical formwork to facilitate cleaning, inspection, placement, and vibration at construction joints and along form.

D. Column Forms:
1. Rectangular columns shall be formed as specified for wall forms. All corners shall have a ¾-inch chamfer unless otherwise noted on the Drawings.
2. Circular columns shall be formed with steel, fiberglass reinforced plastic, . The forms shall be continuous for the height of the column between construction joints indicated on the Drawings.

2.03 FORM TIES

A. Form ties for Building or Other Structures:
1. Provide commercially manufactured steel rods or through-bolts, Cone-Snap Ties or taper ties capable of withstanding applied pressures.
2. Other ties shall not be used.
3. Provide form ties designed that when forms are removed, no metal shall remain within 1-1/2-inch to the finished concrete surface.

B. Form Ties for Water Containment Structures:
1. Provide form ties that have no metal or other material within 1-1/2 inches of the concrete surface.
2. Provide form tie assembly with cone-shaped depressions at the concrete surface at least 1-inch in diameter and 1-1/2 inches deep to allow for filling and patching.
3. Provide portions of form ties that are to remain in place with an integral water barrier at or near the midpoint of the tie.

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4. Taper form ties that are to be entirely removed from the structure for easy removal and suitable size for filling of the void after removal.
5. Furnish ties adjustable in length or of proper fixed length,
6. Use a plastic cone spacer at each end of the form tie.
7. Provide ties for walls resisting water or earth pressure with integral water barrier of diameter 3/4-inch greater than the rod, bonded to rods at the wall centerline, or with other favorably reviewed water seal devices.
8. Provide tapered form ties or removable through-bolts at least 1-inch in diameter at smallest end.
9. Manufactured neoprene or polyurethane tapered plug to be installed at the wall centerline. X-Plug by Greenstreak, or equal.

2.04 FORMWORK RELEASE AGENTS

A. Use commercially manufactured formwork release agents that prevent formwork absorption of moisture, prevent bond with concrete, and do not stain the concrete surfaces. Coat forming surfaces using an effective, non-residual, bond breaking form coating unless otherwise noted.

B. When concrete surfaces are in contact with potable water, formwork release agents shall be acceptable for potable water contact in accordance with NSF/ANSI 61 – Drinking Water System Components.

C. Do not use and formwork release agents that will impart any material or residue to the concrete surface detrimental or incompatible with any specified paint, concrete or architectural finish, adhesives, waterproofing system, plaster or coating system to be applied later. Do not use oil-based products on formed surfaces that are to be painted, coated, or bonded to other concrete.

2.05 FORM LINER MATERIALS AND ACCESSORIES

A. Form Liner: Thermoformed rigid polymer alloy sheets. Provide form liners for textured finish concrete. Provide special forming materials to produce form surfaces with face design, texture, arrangement, and configuration to match existing structures on the site. Form liners to accommodate form pressures to the height of concrete placed for the walls. Comply with manufacturer's recommendations for support of large or deep patterns which may deform under pressure. Sika UNI-CAST®, MULTI-CAST®, or DURA-CAST® , equivalent systems from Spec Formliners, Inc., or equal.

B. Fasteners: Bugle head self-drilling and tapping screws #8-18 x 1” are the minimum size recommended. Self-drilling and tapping, the flat head fits flush with the form liner and may be used for steel or wood forms. A screw gun with adjustable torque setting is recommended.

C. Form Release: Verified to be compatible with the form liner material. Sika Greenstreak Form Release 7000 or 8000, or equal.

D. Rustication Strip: [1 1/2], [1 3/8], [2 1/8] inch face. Reusable ABS plastic. Sika Rustication Strip, or equal.

E. Chamfer[Radius][Triangle]continuous PVC Strip: [1/2],[3/4],[1],[1 1/2] inch leg. Sika Chamfer[Radius][Triangle]continuous PVC Strip, or equal.

F. Backup Strips: To prevent deflection from the pressure of freshly placed concrete provide wood or styrene foam insulation board back-up strips (see manufacturer’s

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literature for recommendations). The need for back-up strips shall be confirmed from the mockup.

G. Sealant: Neutral cure silicone sealant.

PART 3 - EXECUTION

3.01 CONSTRUCTION AND ERECTION OF FORMWORK

A. At construction joints, lap contact surface of the form sheathing for flush surfaces over the hardened concrete in the previous placement. Ensure formwork is placed against hardened concrete so that offsets at construction joints attain specified tolerances and minimize loss of mortar.

B. Construct formwork so that concrete surfaces conform to the tolerance limits of ACI 117. The class of surface for offset between adjacent pieces of formwork facing material, as defined in ACI 117, shall be Class B for surfaces permanently exposed to view and Class D for surfaces that will be permanently concealed.

C. Provide positive means of adjustment (such as wedges or jacks) of shores and struts. Do not make adjustments in the formwork after concrete has reached its time of initial setting. Brace formwork securely against lateral deflection and lateral instability.

D. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork during concrete placement. Set formwork and intermediate screed strips for slabs accurately to produce designated elevations and contours of the finished surface before removal of formwork. Ensure that edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds.

E. When formwork is cambered, set screeds to a like camber to maintain required concrete thickness. Fasten form wedges in place after final adjustment of forms and before concrete placement.

F. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movement of the formwork system before and during concrete placement.

G. Construct formwork for wall openings to facilitate removal and to counteract swelling of wood formwork.

H. Provide runways for moving equipment and support runways directly on the formwork or structural member without resting on the reinforcement.

I. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for support of adjoining work before concrete placement. Secure all embedments against displacement, fill voids in inserts to prevent entry of concrete, and isolate or coat surfaces of aluminum embedments to prevent reaction with the concrete.

J. Place ¾ inches minimum chamfer strips in the corners of formwork to produce beveled edges on permanently exposed surfaces including the top edges of walls, machinery bases and curbs. Do not bevel reentrant corners or edges of formed joints of concrete. Provide rounded top edges of sidewalks, walkways and where directed.

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K. Seal tie holes in formwork to prevent leakage where ties penetrate the formwork. Place taper form ties with the larger end on the side of the structure that will be in contact with liquid.

L. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign materials before concrete is placed.

M. Cover surfaces of formwork with an acceptable material that will prevent bond with the concrete. A field applied formwork release agent or a factory-applied liner may be used. If a formwork release agent is used, apply to the surfaces of the formwork in accordance with the manufacturer's recommendations before placing reinforcement. Do not allow formwork release agent to puddle in the forms. Do not allow formwork release agent to contact reinforcement or hardened concrete against which fresh concrete is to be placed.

N. Inspect formwork and remove deleterious material immediately before concrete is placed.

O. Do not use earth cuts as forms for vertical or sloping surfaces.

P. If inadequate support is provided by the forms, as evidenced by excessive deflection, formwork failure or leakage, remove placed concrete and replace.

Q. Formed Surfaces:
   1. Ensure that the reinforcement has been favorably reviewed by the special inspector before closing up the wall forms.
   2. Provide exposed, unpainted concrete surfaces that are uniform in appearance and color. Apply non-staining form release agent before placing the forms. Remove any excess coating with cloths. Scrape and clean any reused forms before coating again.
   3. Provide flush fitting caps over any unused form tie holes.

R. Form Ties and Through-Bolts:
   1. Provide sufficient number and strength to prevent spreading of forms while placing concrete.
   2. Remove the removable portion immediately after stripping the forms. Avoid spalling the exposed concrete surfaces.
   3. Provide a separate support system for the curtains of reinforcing, with a minimum 1-inch clearance between rebar and form ties or bolts.

S. Construction Joints:
   1. At ends of the first concrete placement, provide forms that positively locate waterstop. Ensure the end forms of walls are removable without releasing the side forms. Provide seals around reinforcement and waterstop to prevent mortar leaks.

3.02 FORM LINER

A. Form Liner Preparation:
   1. Before placing concrete, verify lines and levels of formwork and form liner patterns are within allowable tolerances.
   2. Custom trim form liners to fit the formwork.
   3. Tie spacing should be a multiple of the form liner pattern repeat.
   4. On multiple-use grades, clean form liner before each use. Replace damaged form liner whose continued use or repair would negatively impact the aesthetics of the concrete finish.

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5. Apply form release at rate recommended by manufacturer. Attempt to schedule concrete placement soon after application of form release agent to avoid precipitation, dust, and debris. Protect reinforcing steel from exposure to release agents.

B. Form Liner Installation:
   1. Keep vertical joints plumb and on the same line. Horizontal joints shall be kept level and in line at the same elevation.
   2. Seal form liner joints, rustication/chamfer joints, and tie holes to prevent cement paste from bleeding.
   3. If a form liner butts against a chamfer or reveal strip, miter the edge of the form liner on the same angle for proper fit.
   4. Provide solid backing at form liner joints where unsupported by formwork to prevent deflection.
   5. Construct form liner and rustications/chamfers to sizes, shapes, lines and dimensions shown.
   6. Provide openings, offsets, keyways, recesses, chamfers, blocking, and screeds as required to achieve architectural concrete textured finish.
   7. Drill or pierce form liner to accommodate form ties.
   8. Fasten form liner to formwork 12” to 24” on center. Increase spacing as necessary to accommodate form stripping pressures without damaging form liner intended for multiple use.
   9. Install backup strips as required to prevent deflection of the form liner due to form pressures.
   10. Rebar supports or spacers shall always rest against the portion of the form liner that is in contact with the formwork. The leg spacing of the bar supports should match the pattern repeat of the form liner.

C. Concrete Placement:
   1. Keep concrete lifts less than 24 inches. Thoroughly vibrate concrete to achieve good consolidation, and eliminate entrapped air thereby minimizing voids. Internally vibrate through to previous lift to avoid lift lines. Avoid vibrator contact with the form liner.
   2. Verify concrete temperatures will not exceed 140°F which will adversely affect the material properties of the form liners.
   3. Use an elephant trunk or tremie during concrete placement to minimize aggregate segregation.

D. Form Liner Accessory Installation
   1. When required, create reveal lines by fastening rustication strips to formwork within tolerances indicated by ACI.
   2. Tightly form corners indicated to be chamfered with rounded or triangular PVC chamfer. Chamfered corners shall be smooth, solid, unbroken, continuous lines.

3.03 ALLOWABLE VARIATIONS FOR FORMED SURFACES

A. General:
   1. Tolerances: ACI 301 and the relevant subsection of ACI 117 except where noted below:
   2. Set and maintain concrete forms to ensure that, after removal of the forms and prior to patching and finishing, no portion of the concrete work will exceed the tolerances. Measure variations in floor levels before removal of supporting shores.

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3. The specified variation for one element of the structure will not be applicable when it will permit another element of the structure to exceed its allowable variation.

B. Variations in Size or Thickness:
   1. Footings:
      a. Length and width: ±1/2-inch
      b. Reduction in thickness: 5%
   2. Slabs and walls:
      a. Thickness of 6 inches or less: +1/4-inch, -0-inch
      b. Thickness of more than 6 inches: ±1/4-inch

C. Allowable Tolerances (Location, Lines and Grades):

1. Horizontal misplacement or eccentricity of footings:	2% of footing width, but no more than 1-inch
2. Variation of vertical dimensions at all floor levels from specified position:	±1/2-inch per 100-foot
3. Variation of vertical dimensions from specified position:	±1/4-inch
4. Variation from level or from slopes specified for floors, ceilings, water channels and conspicuous lines:	±1/4-inch per 20 feet
5. Variation in location from specified position for sleeves, pits, floor, and wall openings:	±1/4-inch

3.04 REMOVAL OF FORMWORK

A. When formed surfaces require finishing, remove forms as soon as removal operations will not damage concrete, and in no case less than required in paragraph H below.

B. Remove top forms on sloping surfaces of concrete as soon as removal will not allow concrete to sag. Perform needed repairs or treatments required at once and follow immediately with specified curing.

C. Loosen wood formwork for wall openings as soon as loosening operations will not damage concrete.

D. Do not damage concrete during removal of formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing.

E. Leave formwork and shoring in place to support construction loads and weight of concrete in beams, slabs, and other structural members until in-place strength of concrete is at least full design strength noted for the mix design.

F. When removal of formwork or reshoring is based on concrete reaching the specified compressive strength, concrete shall be presumed to have reached this strength when test cylinders, field cured the same as the concrete they represent, have reached the compressive strength specified. Mold and cure cylinders in accordance with ASTM C31. Test cylinders in accordance with ASTM C39.

G. When shores and other supports are arranged to allow form-facing material to be removed without allowing structural slabs or members to deflect, form-facing material and horizontal supporting members may be removed at an earlier age.

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H. Minimum duration after completion of concrete placement prior to removal of the formwork, unless the provisions of 03305 or 03306 apply:

1.	Walls and wall or slab construction joints	12 hours
2.	Sides of beams and girders	12 hours
3.	Columns	12 hours
4.	Underside of suspended slabs, walkways, beams, and girders	28 days, or 21 days and full design compressive strength Verified by data from additional field cured cylinders.

I. Cold Weather: See Section 03306.

J. Construct formwork to permit easy removal.

3.05 RESHORING AND BACKSHORING

A. Submit for review, requirement for accelerated partial stripping and reshoring and backshoring of forms that may be necessary to maintain the construction program.

B. During reshoring and backshoring, do not allow concrete in beams, slabs, columns, or any structural member to be loaded with combined dead and construction loads in excess of the loads permitted for the concrete compressive strength.

C. Place reshores and backshores in sequence with stripping operations.

D. Tighten reshores and backshores to carry the required loads without overstressing the concrete members. Leave them in place until tests indicate that the concrete compressive strength has attained the minimum value.

E. For floors supporting shores under newly placed concrete, either leave the original supporting shores in place, or install reshores or backshores. The shoring system and the supporting slabs shall resist the anticipated loads.

3.06 FIELD QUALITY CONTROL

A. Establish and maintain controls and benchmarks in an undisturbed condition until final completion and acceptance of the project.

B. Variations from plumb and designated building lines shall not exceed the tolerances specified in ACI 117.

C. Notify Owner when the forms are complete and ready for inspection at least 16 working hours prior to the proposed concrete placement.

D. Concrete Placement:

1. Verify that forms and reinforcement are accurately placed and secured in position. Confirm that both forms and reinforcement have been favorably reviewed.
2. Verify that tie wire ends have been bent back away from the forms.
3. Verify that sleeves, castings, pipes, conduits, bolts, anchors, and other items required, are accurately and securely placed within or on the forms.
4. Verify waterstop is correctly in place and that splices are watertight.
5. Verify adequate vibrators are available.
6. Verify construction and expansion joint faces have been prepared for the next concrete placement.

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7. Check that the mix design is compatible with the method of placement of the concrete, by pump or by batch.
8. For wall placements, verify that the modified concrete mix required at construction joints is to be delivered.
9. Verify the concrete delivered to site is satisfactory, including checks on the batch tickets, quality assurance tests and direct observation of the batches.

E. Failure of the forms to comply with the requirements specified or to produce concrete complying with requirements of this Section shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and Section 03935.

END OF SECTION

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SECTION 03150

CONCRETE JOINTS AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Construction of joints in concrete, including materials and accessories.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 318 Building Code Requirements for Structural Concrete
   2. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
   1. ASTM A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
   2. ASTM A675 Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
   3. ASTM C881 Epoxy-Resin-Base Bonding Systems for Concrete
   4. ASTM C920 Elastomeric Joint Sealants
   5. ASTM D1056 Flexible Cellular Materials - Sponge or Expanded Rubber
   6. ASTM D1171 Standard Test Method for Rubber Deterioration—Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
   7. ASTM D1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types)
   8. ASTM D1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
   9. ASTM E96 Water Vapor Transmission of Materials

C. U.S. Army Corps of Engineers (COE) Specifications:
   1. COE CRD-C-572 Polyvinylchloride Waterstops

D. Standard Specifications for Public Works Construction or “GREENBOOK”

E. California Building Code (CBC) 2019 Edition**.**

F. International Code Council (ICC)

G. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data: Submit technical data including installation instructions, independent laboratory test reports (ICC), handling and storage instructions, and NSF 61 approval for products in contact with potable water.
   1. Waterstops, including waterstop joints
   2. Expansion joint materials
   3. Premolded joint filler

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4. Bond breakers and bond breaker tape
5. Joint sealants
6. Epoxy bonding compounds
7. Other joint accessories

C. Shop Drawings:
1. Location and details of construction, expansion, and contraction joints.
2. Construction joint layout, including waterstop placement; coordinate with Section 03100
3. Sequence of concrete wall and slab pours.
4. Program and method of concrete placement.

D. Quality Control Certifications:
1. Certification that all materials used within the joint system is compatible with each other.
2. Certification that materials used in the construction of joints are suitable for use in contact with potable water 30 calendar days after installation and NSF 61 approved.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: See Section 03300.

B. Preconstruction Meeting: See Section 03300.

1.05 DELIVERY, STORAGE AND HANDLING

A. Waterstop: Reject any cracked material, any joints with offsets between ribs or incomplete bond. Protect material from oil, grease and dirt and cover against direct sunlight.

B. Joint Fillers, Bond Breakers and Inserts: store in accordance with manufacturer's recommendations, maintain all warranty provisions.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide new materials. All materials used together in a given joint shall be compatible with one another. Coordinate selection of suppliers and products to provide compatibility. Do not use asphaltic bond breakers or asphaltic joint fillers in joints receiving sealant.

2.02 EPOXY BONDING SYSTEM

A. General: Moisture-insensitive, solvent-free, two-component epoxy resin, ASTM C881:
1. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete.
2. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces.
3. Provide Class A if placement temperature is below 40°F, but not less than allowed by the manufacturer; Class B if placement temperature is between 40

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and 60°F; or Class C if placement temperature is above 60°F, but not more than allowed by the manufacturer.

4. NSF/ANSI Standard 61 approved for potable water contact.
5. Provide: Sikadur Epoxy adhesives manufactured by the Sika Chemical Corporation; Concresive compounds manufactured by Master Builders, Inc., or equal.

B. For bonding new to pre-existing concrete, provide Sikadur 32 Hi-Mod (Sikadur 32 Hi-Mod LPL is not allowed for use in contact with potable water) by Sika Chemical Corporation, Concresive Liquid LPL by Master Builders, or equal.

2.03 PREFORMED JOINT FILLER

A. Structures Retaining Water or Earth: ASTM D1752 Type III or equal. Neoprene sponge rubber, closed cell, resistant to oil, medium swell, firm. Supply premolded product, Self-Expanding Cork Expansion Koint by WR Meadows; equivalent product by Armacell; or equal.

B. Miscellaneous Structures Above Grade: ASTM D1752 Type 1, 1-inch thick unless indicated otherwise on drawings.

C. Separation joints between structures: Compressible Joint Filler: The joint filler shall be a non-extruded watertight strip material used to fill joints between structures. The material shall be capable of being compressed at least 40% for 70 hours at 68 degrees F and subsequently recovering at least 20% of its original thickness in the first ½-hour after unloading. Compressible Joint filler shall be Evazote 380 E.S.P, by E-Poxy Industries, Inc., Ravena, NY; Evazote by Capital Services, Albany, NY; or equal.

2.04 BOND BREAKER

A. Bond breaker tape shall be an adhesive backed glazed butyl or polyethylene tape which will satisfactorily adhere to the preformed joint filler or concrete surface as required. The tape shall be the same width as the joint.

B. Bond breaker for concrete other than where tape is specifically called for on the drawings shall be either bond breaker tape or a nonstaining type bond prevention coating such as Super Bond Breaker WB by Burke Co.; Silcoseal 87, by Nox-crete Inc., or equal.

2.05 JOINT SEALANTS

A. General: ASTM C920, polyurethane, grade and class appropriate for use. Use joint sealants in liquid-containment structures suitable for submerged service as recommended by the manufacturer. Provide a compatible primer when recommended by the manufacturer.

B. Where joint sealants will be in contact with potable water, the sealants shall be acceptable for potable water service in accordance with NSF/ANSI 61 – Drinking Water System Components – Health Effects.

C. Provide sealants used in structures for treated water resistant to chlorine exposure at the expected concentrations.

D. Provide an acceptable bond-breaking tape as recommended by the sealant manufacturer.

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E. Water Exposure: NSF 61 approved products; Sikaflex-1a, by Sika Corp., Select Seal U-227 reservoir grade by Select Products Corp., or equal.

F. Exterior Exposure: Sikaflex-2c, by Sika Corp., Select Seal U-200 by Select Products Corp., or equal.

G. Prepare surfaces and provide primer and sealants in strict accordance with manufacturer's recommendations.

H. Backing Rod: Extruded, closed cell, polyethylene foam rod, compatible with sealant. Provide 5/8-inch-diameter rod for ½-inch joint, 1-1/4-inch rod for 1-inch joint.

2.06 WATERSTOPS

A. Polyvinyl Chloride (PVC) Waterstops: Provide for construction or expansion joints in new concrete.
   1. Material: Extruded PVC, manufactured from virgin materials.
   2. Physical properties: COE CRD-C-572. Nominal thickness of flexible waterstops not less than ¼-inch for construction joints or contraction joints and not less than 3/8-inch for expansion joints. Flexible waterstops used in expansion joints and contraction joints shall have a bulb-shaped center section designed to accommodate movement. Minimum width of flexible waterstops shall be 6 inches when used in expansion joints, the minimum width shall be 9 inches
   3. Waterstop Types:
      a. Serrated (Ribbed) Flat: Vinylex R6-38; Greenstreak Style 679.
      b. Serrated (Ribbed) with Centerbulb: Vinylex RB9-38H; Greenstreak Style 735.
      c. Retrofit (Includes construction joints or expansion joints where new concrete will be placed adjacent to existing concrete.): Vinylex Ret638; Greenstreak Style 609. Provide additional components including epoxy gel, 16-gage Grade 304 stainless steel batten bars with holes 6 inches on center, and stainless steel ¼-inch by 2-1/4-inch concrete anchor bolts.
      d. Base Seal: Vinylex BS9-532; Greenstreak Style 771.
      e. Tear Web: Vinylex TWB9-38; Greenstreak Style 700.
   4. Splices:
      a. Make splices in waterstops and use molded pieces at splices and corners. Provide factory fabricated waterstop intersections, leaving only straight butt-joint splices for the field. Waterstop intersections and directional changes to be miter cut and heat welded with centerbulb and ribs aligned to maintain continuity. Splices to be free from defects.
      b. Tensile Strength: 80% of parent material.
   5. Provide factory installed hog rings or grommets, 12-inch on center, ½-inch or less from both edges of the waterstop and tie wire to rigidly locate waterstops in forms.
   6. Manufacturers:
      a. Vinylex Corporation
      b. Greenstreak Plastic Products Company, Inc.

B. Hydrophilic Rubber Waterstop: Includes construction joints where new concrete will be placed adjacent to existing concrete.

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1. Material: Hydrophilic rubber strip with installation adhesive as recommended by the waterstop manufacturer and capable of withstanding a minimum of 150-foot hydrostatic head.
2. Provide Adeka Ultraseal MC-2010M waterstop and P-201 adhesive, manufactured by Asahi Denka Kogyo KK and distributed by OCM, Inc.; or Swellseal 2010 waterstop and Swellseal Gun Grade manufactured by De Neef Conchem Inc.; or Hydrotite CJ-1020-2K waterstop and HydroSwell Swelling Paste by Greenstreak; or equal.

2.07 SOURCE QUALITY CONTROL

A. Forms: Verify that components pre-assembled offsite are satisfactory for the purpose. Verify that designs, products and samples have been submitted for Product Review.

PART 3 - EXECUTION

3.01 CONCRETE JOINTS

A. General:
   1. Provide joints:
      a. As shown on the Drawings and as noted below in these Specifications.
      b. As required for constructability.
      c. After favorable review of layout, sequence and concrete placement program.
      d. Position and support waterstops, joint materials, and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids. Embedded items shall be free of all mud, oil, loose rust, or other material that might inhibit bond.
   2. Provide minimum curing times before the second placement:
      a. 10 calendar days after each adjacent concrete placement for infill pours (i.e. in-between two existing sections) or checkerboard (existing concrete on two or more sides) placement patterns.
      b. 2 calendar days after the first concrete placement at the joint.
   3. During placement of the new concrete, ensure there are no interruptions to the 14 calendar day curing time and 14 calendar day load restriction plan for the adjacent pours.

B. Control Joints:
   1. Space typical control joints in slabs on grade or suspended slabs not exceeding 10 feet, or as shown on the Drawings. Control joints shall not be provided in water containment structures.
   2. If cast-in with the concrete, positively locate the preformed joint filler and hold rigidly in place during concreting.
   3. If saw-cut, use a wheeled power saw as soon as the concrete surface is firm enough. Saw-cut control joints must be constructed within 12 hours after concrete placement. Fill the groove with sealant over a backer rod.

C. Construction Joints:
   1. Produce quality concrete, with full continuity of reinforcing and water tightness across the joints.

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2. Locate horizontal joints in walls and columns at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs.
3. Place beams, girders, haunches, drop panels, and capitals monolithically as part of a slab system, unless otherwise noted.
4. Locate joints such that beams, girders, or slabs supported by columns or walls will not be cast until concrete in the vertical support members is no longer plastic.
5. Make joints perpendicular to the main reinforcement.
6. Space typical slab joints not exceeding 20 feet in the direction of the transverse or secondary reinforcing, typically the smaller reinforcing nearer to the center of the slab thickness. Space typical vertical wall joints no more than 20 feet apart.
7. Provide all joints in walls and slabs, retaining liquids, or earth with 6-inch ribbed waterstops . Continue all reinforcing through the joint unless otherwise noted.
8. After the first concrete placement at the joint, do not walk on or disturb any reinforcing extending into the second placement area for at least 48 hours.
9. Before depositing new concrete on or against concrete that has hardened, remove laitance and thoroughly clean and roughen the entire surface of the joint exposing clean coarse aggregate solidly embedded in mortar matrix. Provide typically ¼-inch roughness or amplitude of the concrete surface measured from the top of the exposed aggregate to the bottom of pockets between stones.
10. Drench the prepared joint with clean water and remove prior to the concrete pour.
11. Cover horizontal wall joints and wall-to-slab joints with a minimum thickness of 2 inches and a maximum of 6 inches of the modified concrete mix, consisting of the designated concrete mix with one-half of the coarse aggregate removed.
12. Use special care in vibrating adjacent to construction joints to ensure thorough consolidation of the concrete around the waterstops and against the hardened portion of the joint. Additional hand tamping may be required.
13. For joints that are shown on architectural drawings as having a continuous reveal or recess, leave the wood form or pour strip used to create the reveal or recess in place or re-insert before roughening. Prevent the next concrete placement from filling the reveal or recess.

D. Expansion Joints:
1. Stop all steel reinforcing clear of the joint at each side.
2. Provide 9-inch ribbed centerbulb waterstop continuously around the joint in walls and slabs retaining liquids or earth.Prepare a smooth first concrete surface with all voids filled.
3. Provide preformed joint filler, securely fastened to the existing concrete as directed by the Manufacturer.
4. Install bond breaker tape and a joint sealant applied in a suitable groove or recess at each accessible face after curing is completed and when directed.
5. Tape all joints in the premolded joint filler to prevent intrusion of mortar.

E. Bonding to Pre-existing Concrete: Mechanically roughen the old surface to a ¼-inch amplitude, as defined in construction joint paragraph above. Apply epoxy bonding system material prior to concreting and in accordance with the manufacturer’s instructions.

F. Embedded PVC Waterstop:

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1. Use pieces of premolded waterstop with a maximum practical length to hold the number of splices to a minimum.
2. Provide continuous waterstops at all corners and intersections.
3. Center waterstops in joints unless otherwise indicated.
4. Waterstops shall be secured in position by acceptable methods.
5. Vertical waterstops shall be anchored back to the reinforcement with wire ties.
6. At flexible waterstops placed horizontally, fold the waterstop upward along its entire length while concrete is placed and consolidated up to the level of the waterstop, and then the waterstop shall be pressed into the top of the fresh concrete. Then complete concrete placement and consolidation so as to provide full encasement of the waterstop in concrete.
7. Terminate waterstops at vertical joints 3 inches below the tops of exposed walls.
8. Where waterstops with a center bulb are used, plug the ends of the center bulb with a flexible material, such as foam rubber, to prevent concrete intrusion at ends where the bulb will be exposed to concrete extrusions.
9. Uncoil waterstop 24 hours prior to installation for ease of handling and fabrication.
10. Restrict field splices to butt joints in straight runs. For PVC type, make by heat welding, using a waterstop splicing iron with non-stick surface set to the correct temperature (per manufacturer’s recommendations). Follow the manufacturer's specifications.
11. Positively locate and support waterstop in the forms so that concrete may be placed, consolidated, and vibrated on both sides of the embedded portion without displacement of the waterstop and without causing voids in the concrete (use copper-clad hog rings or grommets at 12-inch maximum on-center to secure waterstop to adjacent reinforcing steel. Crimped hog ring shall be located between the last two ribs on waterstop leg). Protect the outstanding portion from damage during the first concrete pour and clean and positively support prior to the second pour. Place, consolidate and vibrate the second pour without displacement of the waterstop and without causing voids in the concrete. After first pour, clean unembedded waterstop leg to ensure full contact of second concrete pour. Remove laitance, spillage, form oil and dirt.
12. For retrofit waterstops between new and existing concrete prepare existing concrete by grinding away irregularities. Clean concrete to ensure good epoxy bond. Apply continuous bed of epoxy to concrete. Embed retrofit waterstop in uncured epoxy. Mechanically fasten waterstop to concrete using stainless steel batten bars and anchor bolts staggered 6 inches on center maximum. Use batten bars on top and bottom. Tool continuous layer of epoxy over batten bars and bolts to protection from corrosion. Use expansion joint filler at moving joints to minimize shear stress (expansion joint filler should be large enough to allow waterstop centerbulb to remain completely unembedded in concrete). Expansion material should cover retrofit hardware reaching all the way to waterstop ribs. Allow retrofit waterstop system to cure for 24 hours before placing new concrete. Follow all manufacturer’s preparation and installation instructions.
13. Waterstop Quality Assurance: Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following:

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a. Tensile strength not less than 80% of parent sections.
b. Free lap joints.
c. Misalignment of centerbulb, ribs, and end bulbs greater than 1/16-inch.
d. Misalignment which reduces waterstop cross section more than 15%.
e. Bond failure at joint deeper than 1/16-inch or 15% of material thickness.
f. Misalignment of waterstop splices resulting in misalignment of waterstop in excess of ½-inch in 10 feet.
g. Visible porosity in the weld.
h. Charred or burnt material.
i. Bubbles or inadequate bonding.
j. Visible signs of splice separation when cooled splice (24 hours or greater) is bent by hand at sharp angle.

G. Hydrophylic Rubber Waterstop: At splices, butt ends of profile together and glue with manufacturer suggested adhesive. Locate between reinforcement curtains and maintain concrete cover as required by manufacturer. Fasten to concrete with continuous adhesive paste. Allow time for adhesive to cure, prior to concreting. Keep the materials dry until concreting. Follow the manufacturer's specifications.

H. Compressible Joint Filler: Install compressible joint filler in conformance with the manufacturer's recommendations; including surface preparation, adhesive installation, heat welding and set time.

I. Smooth Dowels: Install smooth dowels used at movement joints at right angles to the surface of the joint. Align dowels and secure to prevent displacement during concrete placing. Install expansion caps and apply bond breaker at one end of the dowel as indicated on the Project Drawings.

3.02 FIELD QUALITY CONTROL

A. See Sections 03100 and 03300.

END OF SECTION

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SECTION 03200

CONCRETE REINFORCEMENT AND REINFORCEMENT SUPPORTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Materials, fabrication, placement, and tolerances of reinforcement and reinforcement accessories.

1.02 REFERENCES

A. ASTM International (ASTM) Standard Specifications:
   1. ASTM A82: Steel wire, plain, for concrete reinforcement.
   2. ASTM A143: Practice for safeguarding against embrittlement of hot-dip galvanized structural steel products and procedure for detecting embrittlement.
   3. ASTM A185: Steel welded wire fabric, plain, for concrete reinforcement.
   4. ASTM A496: Steel wire, deformed, for concrete reinforcement.
   5. ASTM A497: Steel welded wire fabric, deformed, for concrete reinforcement.
   6. ASTM A 572: High-strength low-alloy columbium-vanadium structural steel.
   7. ASTM A615: Deformed and plain billet - steel bars for concrete reinforcement.
   8. ASTM A767: Zinc-coated (galvanized) steel bars for concrete reinforcement.
   9. ASTM A780: Repair of damaged and uncoated areas of hot-dip galvanized coatings.
   10. ASTM A820: Steel fibers for fiber-reinforced concrete.
   11. ASTM A955: Deformed and plain stainless steel bars for concrete reinforcement.
   12. ASTM A970: Headed steel bars for concrete reinforcement.
   13. ASTM A996: Rail-steel and axle-steel deformed bars for concrete reinforcement.
   14. ASTM E329: Agencies engaged in the testing and/or inspection of materials used in construction.

B. American Concrete Institute (ACI):
   1. Details and Detailing of Concrete Reinforcement (ACI 315).
   2. Building Code Requirements for Reinforced Concrete (ACI 318).

C. Concrete Reinforcing Steel Institute (CRSI): Manual of Standard Practice (CRSI Manual).

D. International Code Council (ICC): Evaluation Reports (ICC Reports).

E. American Welding Society (AWS): D1.4 Structural Welding Code - Reinforcing Steel (AWS D1-4).

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1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Bar supports and chairs.
   2. Mechanical bar connectors, including ICC Reports.
   3. Certified mill test results for reinforcement.
   4. Tests on unidentified bars.

C. Shop Drawings:
   1. Bar and wire fabric layouts.
   2. Bar bending diagrams.
   3. Placing drawings showing fabrication dimensions and locations for placement of reinforcement and reinforcement supports including the length and location of lap splices and mechanical connector locations.
   4. Accessories and inserts layout.

D. Quality Assurance/Control Submittals:
   1. Welding: Description of reinforcement weld locations, chemical analysis of reinforcement, welding procedures, and welder qualifications.
   2. Submit a request to relocate any reinforcement that exceeds placement tolerances.

1.04 QUALITY ASSURANCE

A. Testing agencies that perform testing services on reinforcing steel shall meet the requirements of ASTM E329.

B. Material Tests: Not required for bars, wire fabric rolls or sheets delivered in bundles from the mill and tagged with valid Identification Certificate.
   1. Unidentified Bars: Test samples from each five tons or fraction thereof for each size. If already delivered to site, test additional samples from each day of planned concrete placement. Perform one tension and one bend test from each sample for each size.
   2. Test standard: ASTM A615.
   3. Testing Laboratory: Selected by Engineer, to take samples and perform tests. Costs paid by Contractor.
   4. Unidentified Wire Fabric: Not acceptable.

C. Standard: CRSI Manual, except as otherwise indicated or specified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Prevent permanent bending and protect bar surfaces from contact with soil, oil, or other materials that may decrease bond to concrete.

B. Bundle reinforcement and tag with suitable identification to simplify sorting and placing. Transport and store at site so material is not damaged. Store reinforcement off ground, place under cover and keep clean. Store welded fabric in flat sheets, not rolls. Keep an adequate supply of reinforcement at site to avoid delays.

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PART 2 - PRODUCTS

2.01 REINFORCING BARS

A. General: Deformed bars, ASTM A615, Grade 60.

B. Dowels: All dowels are deformed bars unless shown otherwise on the Drawings.
   1. Deformed bars: ASTM A615, Grade 60.
   2. Smooth bars: ASTM A615, Grade 60, or ASTM A675, Grade 60.
   3. Threaded bars: ASTM A572, Grade 50.

C. Spiral Reinforcement:
   1. Deformed bars, ASTM A615, Grade 60, unless otherwise noted.
   2. Cold-drawn steel wire, if noted, plain, ASTM A82, deformed, ASTM A496.
   3. Tack welded cages.

D. Stainless Steel Bars: ASTM A955.

2.02 HOT-DIP GALVANIZED REINFORCING BARS

A. Deformed Bars: ASTM A615, Grade 60 or ASTM A706, Grade 60 and galvanizing per ASTM A767 and ASTM A143. Galvanize bars in conformance with Class 1 coating and perform galvanizing after fabrication and shearing.

B. Repair zinc-coating damage that occurs during shipping, handling, and placing in accordance with ASTM A780. The maximum allowed damaged areas due to shipping, handling, and placing, including previously repaired areas damaged prior to shipment, shall not exceed 2% of the surface area in each linear foot of each bar. The 2% limit on maximum allowed damaged coating area includes repaired areas damaged prior to shipment.

C. Repair Material: Damage of the coating shall be repaired with a galvanizing repair material .

2.03 WELDED WIRE REINFORCEMENT

A. Plain Welded Wire: ASTM A185; sheets with welded intersections spaced not farther apart than 12 inches in the direction of principal reinforcement.

B. Deformed Welded Wire: ASTM A497; sheets with welded intersections spaced not farther apart than 16 inches in the direction of principal reinforcement.

2.04 TIE WIRE

A. Annealed steel, 16-gauge minimum.

2.05 MECHANICAL CONNECTORS

A. Type: Tension-compression, compression, tension.

B. Strength: Develop 125% of the reinforcing yield strength in tension and compression.

C. Manufacturer:
   1. Tension-compression: Lenton by Erico Products, Inc., Dowel Bar Splice Systems by Richmond Screw Anchor Co., or equal.
   2. Compression-only: Speed-sleeve by Erico Products, Inc., or equal.
   3. Tension-only: Quick-Wedge by Erico Products, Inc., or equal.

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4. Future Extension Mechanical Butt Splice: Lenton Form Saver by Erico Products, Inc., DBR by Dayton Superior or equal. Provide plastic taper threaded plugs for “long-term” thread protection.

D. Not all Mechanical Connectors are shown on the drawings, Mechanical Connectors may be required by notes on the drawings for certain splices.

2.06 JOINT SLIP DOWEL SYSTEM

A. Provide Greenstreak two component Speed Dowel System to accept slip dowels of the size shown on the Drawings. The Speed Dowel System is comprised of a reusable base and plastic sleeve. Both pieces shall be manufactured from polypropylene plastic. Do not place concrete directly over the Speed Dowel System.

2.07 SUPPORTS AND ACCESSORIES

A. Secure and support the reinforcement within specified tolerances. Conform to CRSI Manual Chapter 3, for Types SB, BB, BC, JC, HC, CHC, and others of standard types as required. Use Class "1" plastic-coated chairs and spacers at waterbearing surfaces, roofs of waterbearing structures, and at all interior or exterior surfaces exposed to view or weather in the completed structure. Plastic thickness of 3/32-inch or greater at points of contact with formwork and extend the plastic along the wire at least ½-inch from the point of contact with the formwork. Precast concrete block supports with embedded wire ties are not acceptable.

B. Use precast concrete supports that have a surface area of not less than 4 inches^2 and have a compressive strength equal to or greater than specified compressive strength of concrete being placed. Water absorption and porosity of precast concrete supports equal to or less than water absorption and porosity of concrete being placed. Use precast concrete block supports with embedded wire ties or dowels for placement on grade or on membranes. Cast the blocks with concrete equal in strength, cement type and aggregate to the parent concrete.

C. Do not use aluminum or stainless steel supports or accessories.

2.08 FABRICATION

A. General: CRSI Manual Chapters 6 and 7, including tolerances.

B. Splice, development and embedment lengths: Furnish bars with lap lengths equivalent to ACI 318, Section 12, Class B splices for the specified concrete strength, bar size and location, unless noted otherwise.

C. Bending and Forming: Fabricate bars of indicated size and accurately form to shapes and lengths indicated and required. Fabricate by methods not injurious to materials. Bend reinforcement cold. Fabricate reinforcement in accordance with fabricating tolerances of ACI 117. Reject bars with kinks or bends not scheduled.

D. Welding: When welding of reinforcement is approved by the Engineer, comply with the requirements of AWS D1.4. Do not weld crossing bars (tack welding) for assembly of reinforcement, supports, or embedded items.

E. Concrete Cover: Detail and fabricate the reinforcement to provide specified cover to outer edge of rebars and other installed items.

F. Dowels:

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1. Provide deformed reinforcing bar dowels at all construction joints, unless noted otherwise.
2. Provide smooth or threaded dowels where shown on Drawings.
3. Provide same dowel size and spacing as the reinforcing to which they are spliced, unless noted otherwise.

2.09 SOURCE QUALITY CONTROL

A. Testing agencies that perform testing services on reinforcing steel shall meet the requirements of ASTM E329.

B. Verify bend tolerances are not exceeded.

C. Verify bar end cuts are within tolerance when mechanical connectors are to be used.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: CRSI Manual Chapter 8 including placement tolerances. No reduction of concrete cover is allowable for bars at concrete surfaces exposed in liquid or water-containing structures.
   1. Cleaning: Before placing reinforcing, and again before concrete is placed, clean reinforcement of loose mill scale, dried concrete, oil, or other materials deleterious to bond. Do not allow form coatings, release agents, bond breaker, or curing compound to contact reinforcement.
   2. Placement: Place, support, and fasten reinforcement as indicated. Do not exceed the placing tolerances specified in ACI 117. Do not reduce cover requirements for placing tolerances. When necessary to move reinforcement beyond the specified placing tolerances to avoid interference with other reinforcement, conduits, or embedded items, submit the resulting arrangement of reinforcement for review. Accurately place reinforcement and securely wire tie in position, at an adequate number of points, where bars cross so as to prevent displacement. Tie stirrups to bars at both top and bottom. Bend ends of tie wire inward allowing no encroachment into the concrete cover.
   3. Concrete cover: Provide cover for reinforcement as shown on Drawings. Minimum concrete cover for reinforcement for cast-in-place concrete is shown in the table below for the exposure condition noted. Provide minimum cover to the outer edge of bar spacers, hangers, and like items. For bundled bars, minimum concrete cover shall be equal to the equivalent diameter of the bundle but need not be greater than 2 inches, except the minimum cover shall not be less than specified in the table below. Base the equivalent diameter of the bundle on a single bar of a diameter derived from the equivalent total area.

Exposure Condition for Reinforcement	Cover
A. Concrete cast against and permanently exposed to earth	3-inch
B. Concrete exposed to earth, liquid, weather, or bearing on work mat or slabs supporting earth cover	
Slabs and Joists	2-inch
Beams and Columns:	

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Exposure Condition for Reinforcement	Cover
Stirrups, spirals, and ties	2-inch
Primary reinforcement	2-½-inch
Walls	2-½-inch
Footings and Base Slabs:	
Formed surfaces	2-inch
Top of footings and base slabs	2-inch
C. Exposure conditions not covered in A and B above	
Slabs and Joists:	
No. 11 bars and smaller	1-inch
No. 14 and No. 18 bars	1-½-inch
Beams and Columns:	
Stirrups, spirals, and ties	1-½-inch
Primary reinforcement	2-inch
Walls:	
No. 11 bars and smaller	1-½-inch
No. 14 and No. 18 bars	1-½-inch

4. Reinforcement supports: CRSI Manual, Chapter 3. Unless noted otherwise on Drawings, use the following reinforcement supports:
   a. Place reinforcement supported from the ground or mud mat on precast concrete reinforcement supports.
   b. Place uncoated reinforcement supported from formwork on reinforcement supports made of concrete, metal, or plastic.
   c. Place zinc-coated (galvanized) reinforcement supported from formwork on wire reinforcement supports that are galvanized, coated with dielectric material, or made of dielectric material.
   d. Reinforcement and embedded steel items used with zinc-coated (galvanized) reinforcement shall be zinc-coated (galvanized) or coated with nonmetallic materials.
5. Field bending: Not permitted, except where specifically shown, or approved.
6. Bar spacing: Between parallel bars, no less than 1-1/2 times the maximum aggregate size and in no case less than 1-1/2 inches. At splices, bundle and wire together bars to accomplish this.
7. Welded wire reinforcement: Install necessary supports and chairs to hold in place during concrete pours. Straighten reinforcement to lay in flat plane and bend reinforcement to fit work. Tie every other wire at laps. For slabs on soil, extend welded wire reinforcement to within 2 inches of the concrete edge. Lap edges and ends of welded wire reinforcement sheets a minimum of 12 inches. Do not extend welded wire reinforcement through contraction joints. Support welded wire reinforcement during placing of concrete to ensure required positioning in the slab. Do not place welded wire reinforcement on grade and subsequently raise into position in concrete.
8. Column dowels: Furnish and use templates for placement of column dowels.
9. Welding of reinforcing: Proceed after continuous inspection has been authorized. Welding procedure: Satisfy AWS D1.4.
10. Smooth dowels: Straight dowels at movement joints free of loose rust or scale. Include on dowels used at expansion joints an expansion cap at one end designed to allow at least 1-1/2 inches of expansion. Use an acceptable bond breaker on the dowel on one side of the movement joint.
11. Reinforcement termination: Where reinforcement does not extend through a joint, terminate the reinforcement 2 inches from the face of the joint.

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3.02 FIELD QUALITY CONTROL

A. Inspect all reinforcement installations. Provide 48 hours notice for inspection before concrete placement.

B. Verify placement tolerances are not exceeded.

C. Mechanical Connectors: Install favorably reviewed products, following the Manufacturer's recommendations, under continuous inspection.

D. Welding Reinforcement: Perform only when approved by the Engineer and only under continuous inspection. Notify the Engineer at least 48 hours in advance of any procedure involving welding.

E. Coordinate access and notify special inspector 48 hours in advance of any concrete placement so that special inspection and testing may be performed in accordance with the Special Inspection and Testing Schedule.

END OF SECTION

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SECTION 03300

CONCRETE MIXTURES, HANDLING, PLACING AND CONSTRUCTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Requirements for materials, proportioning, production, and delivery of concrete.
2. Production of cast-in-place structural concrete.
3. Methods and procedures for obtaining quality concrete through proper handling, placing, finishing, curing, and repair of surface defects.

1.02 REFERENCES

A. American Concrete Institute (ACI):

1.	ACI 117	Standard Tolerances for Concrete Construction and Materials
2.	ACI 301	Specifications for Structural Concrete for Buildings
3.	ACI 306	Guide to Cold Weather Concreting
4.	ACI 318	Building Code Requirements for Structural Concrete
5.	ACI 347	Guide to Formwork for Concrete
6.	ACI 350	Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:

1.	ASTM C31	Making and Curing Concrete Test Specimens in the Field
2.	ASTM C33	Concrete Aggregates
3.	ASTM C39	Compressive Strength of Cylindrical Concrete Specimens
4.	ASTM C40	Organic Impurities in Fine Aggregates for Concrete
5.	ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
6.	ASTM C87	Effect of Organic Impurities in Fine Aggregate on Strength of Mortar
7.	ASTM C88	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
8.	ASTM C94	Ready-Mixed Concrete
9.	ASTM C131	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
10.	ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
11.	ASTM C138	Density (Unity Weight), Yield, and Air Content (Gravimetric) of Concrete
12.	ASTM C142	Clay Lumps and Friable Particles in Aggregates
13.	ASTM C143	Slump of Hydraulic-Cement Concrete
14.	ASTM C150	Portland Cement
15.	ASTM C156	Water Retention by Concrete Curing Materials
16.	ASTM C157	Length Change of Hardened Hydraulic-Cement Mortar and Concrete
17.	ASTM C171	Sheet Materials for Curing Concrete
18.	ASTM C172	Sampling Freshly Mixed Concrete

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19. ASTM C173 Air Content of Freshly Mixed Concrete by the Volumetric Method
20. ASTM C192 Making and Curing Concrete Test Specimens in the Laboratory
21. ASTM C227 Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
22. ASTM C231 Air Content of Freshly Mixed Concrete by the Pressure Method
23. ASTM C260 Air-Entraining Admixtures for Concrete
24. ASTM C289 Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
25. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete
26. ASTM C494 Chemical Admixtures for Concrete
27. ASTM C595 Blended Hydraulic Cements
28. ASTM C618 Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
29. ASTM C827 Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures
30. ASTM C869 Foaming Agents Used in Making Preformed Foam for Cellular Concrete
31. ASTM C881 Epoxy-Resin-Base Bonding Systems for Concrete
32. ASTM C920 Elastomeric Joint Sealants
33. ASTM C989 Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
34. ASTM C1064 Temperature of Freshly Mixed Hydraulic-Cement Concrete
35. ASTM C1077 Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
36. ASTM C1107 Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
37. ASTM C1240 Use of Silica Fume as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout
38. ASTM C1293 Determination of Length Change of Concrete Due to Alkali-Silica Reaction
39. ASTM C1602 Mixing Water Used in the Production of Hydraulic Cement Concrete
40. ASTM D882 Tensile Properties of Thin Plastic Sheeting
41. ASTM D1056 Flexible Cellular Materials - Sponge or Expanded Rubber
42. ASTM D1752 Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
43. ASTM D2419 Sand Equivalent Value of Soils and Fine Aggregate
44. ASTM E96 Water Vapor Transmission of Materials

C. State of California, Department of Transportation (CALTRANS):
   1. Test 217 Sand Equivalent
   2. Test 227 Evaluating Cleanness of Coarse Aggregate

D. American Association of State Highway and Transportation Officials (AASHTO):
   1. T26 Standard Method of Test for Quality of Water to be Used in Concrete

E. Standard Specifications for Public Works Construction or “GREENBOOK”

F. California Building Code (CBC) 2019 Edition**.**

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G. International Code Council (ICC)

H. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Concrete mix product certification: Submit certified laboratory test results that the mix proportions and materials comply with these Specifications.
      a. Cementitious materials: types, manufacturing location, shipping locations, and certificates showing compliance with ASTM C150, C595, C618, C845, or C989.
      b. Coarse and fine aggregates: types, pit or quarry locations, producers' names, gradations, specific gravities, and evidence not more than 90 days old demonstrating compliance with material requirements.
      c. Admixtures: types, brand names, producers, manufacturer's technical data sheets, and certification data.
      d. Water: source of supply.
      e. Ready-mix plant certification or ASTM C94 certification documentation.
      f. Mixture proportions and characteristics.
      g. Mix test results (see Paragraph 2.05.F for required testing).
      h. NSF 61 certification of submitted mix design where concrete will be in contact with potable water.
      i. Description of conveying equipment.
      j. Proposed method of measuring concrete surface temperature change.

C. Shop Drawings:
   1. After defects are identified and investigated, Contractor to submit design of repair plan specific for each noted defectin accordance with Section 03935.

D. Samples: Submit any item of Product Data not fully assembled by a single manufacturer.

E. Quality Assurance/Control Submittals:
   1. Test Agency Reports: Submit records of test and inspection. Submit report results.
   2. Submit advance notification of concrete placement at least 24 hours in advance.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: 10 years of experience on similar water containment facilities.

B. Construction Standard: Applicable quality requirements of the IBC, ACI 301, ACI 318 and ACI 350.

C. Concrete Products and Materials Tests: Certified by independent commercial testing laboratories. Submit certification on cementitious products and aggregates performed within the past 6 months. Furnish any necessary labor to assist in obtaining and handling samples at the project site or at the source of materials

D. Concrete Mix Designs: By an independent commercial testing laboratory, complying with ASTM C1077 and favorably reviewed by the Engineer. Concrete

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mix design proportions shall be established on the basis of field experience and trial mixtures with the materials to be employed in accordance with ACI 318 Chapter 5.

E. Concrete Mix Test Results:
   1. Submit in accordance with requirements of Paragraph 2.05.F.

F. Preconstruction Meeting:
   1. Attend meeting with Owner and Engineer, bringing representatives of concrete supply, pumping, placement and finishing subcontractors plus testing laboratories.
   2. Review preliminary concrete placing plans for walls and slabs, prior to plan submittals.
   3. Meeting agenda includes:
      a. Mix design.
      b. Schedule of mix review.
      c. NSF Certification Process and Schedule.
      d. Formwork products (Section 03100).
      e. Miscellaneous products.
      f. Construction joint layout (Section 03150).
      g. Concrete placement.
      h. Finishes required (Section 03350).
      i. Curing and protection methods.
      j. Field Testing (Section 03300, paragraph 1.04.G).
      k. Test result distribution and review schedule.
      l. Testing of hydraulic structures (Section 03340).
      m. Other special inspection requirements.
      n. Hot weather concrete requirements.
      o. Cold weather concrete requirements.
      p. Resolve any difficulties foreseen by any interested party.
      q. Other Issues.

G. Concrete Tests, as Placed: Performed by the Owner's Representative:
   1. Testing agencies that perform testing services on concrete materials shall meet the requirements of ASTM C1077.
   2. Provide Owner's Representative with at least 48 hours' notice in advance of operations to allow for completion of quality tests and for assignment of personnel.
   3. Provide and maintain adequate facilities for safe storage and proper curing of concrete test specimens on the project site for initial curing as required by ASTM C31.
   4. Test frequency:
      a. Obtain at least one composite sample for each 100 yd^3, or a fraction thereof, of each concrete mixture placed in any one day.
   5. Concrete samples: In accordance with ASTM C172. Provide all material required.
   6. Compressive strength: A set of six standard 6-inch x 12-inch concrete cylinders shall be cast for each test set for concrete greater than 2,500 psi.
      a. Making, storing, initial cure, and final cure of cylinders: ASTM C31. Provide site storage and initial cure, 16 hours minimum and 24 hours maximum.

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b. Test of cylinders: ASTM C39. Testing laboratory will transport cylinders from site, cure, test, and provide report. Test two cylinders at age of 7 days, two at 28 days, and hold two for additional testing at 56 days, if required.
c. Evaluation: Test results from standard molded and cured test cylinders shall be evaluated separately for each specified concrete mixture. For evaluation, each specified mixture shall be represented by at least five tests.

7. Slump: Test will be performed on each 50 cubic yards or fraction thereof. Test each sample used for strength tests.
   a. Testing: ASTM C143.
   b. Results outside the limits indicate possible cause for rejection of concrete at the sole discretion of the Engineer.
8. Air content: Test will be performed on concrete samples used for strength tests. Use calibrated equipment to perform the test.
   a. Testing: ASTM C231 or ASTM C173.
   b. Air content tests will be made on samples from the first three batches in the placement and until three consecutive batches have air contents within the range specified, at which time every fifth batch will be tested. This test frequency will be maintained until a batch is not within the range specified, at which time testing of each batch will be resumed until three consecutive batches have air contents within the range specified. Air content tests may be taken on composite samples or on samples from the batch at any time after discharge of ¼ yd^3 of concrete.
9. Shrinkage: A set of three standard 4-inch x 4-inch x 11-inch test prisms will be cast for each 200 cubic yards. Test will be performed on concrete used for strength tests.
   a. Testing: ASTM C157 as modified below.
   b. Moist curing: Specimens shall be removed from molds at 23 ±1 hours after batching and shall be placed in water for at least 30 minutes and shall be measured within 30 minutes to determine original length. Specimens shall be submerged in saturated lime water until 7 days after batching.
   c. Measurements: Measurements to determine shrinkage shall be made after 7, 14, 21, and 28 days of drying after 7 days of moist curing. Compare to the preliminary measurement made after 1-day and the basic measurement made after 7 days curing, which will be used for calculations.
   d. Report all test results, with the 28-day of drying results governing acceptance. Field shrinkage results shall meet the requirements stated in Paragraph 2.05.B.
10. Unit Weight: Determine the fresh concrete density. Test will be performed on concrete samples used for strength tests. Use calibrated equipment to perform the test.
    a. Testing: ASTM C138.
11. Temperature
    a. Testing: ASTM C1064.
12. Testing Agency Reports:
    a. Include location in the work where the batch represented by test was deposited and the batch ticket number on strength test reports.

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b. Include detailed information of storage and curing of specimens before testing on strength test reports.
c. Provide final reports within 7days of test completion.

H. Additional Tests:
1. General: Tests on hardened concrete will be performed when concrete test results as placed fail to satisfy the specification requirements. Testing will be performed by Owner's Testing Agency at Contractor's expense. Strength tests shall be considered satisfactory if the requirements of ACI 318 Section 5.6.3.3 are satisfied. If in the opinion of the Engineer, results of tests on concrete cylinders indicate the possibility of substandard concrete in the structure, cored samples may be required to be taken from the concrete.
2. Nondestructive tests: The use of the rebound hammer, pulse-velocity method, or other nondestructive tests are permitted in evaluating the uniformity or for selecting areas to be cored; however, only core tests will be permitted for verifying the concrete strength in place.
3. Core tests: Obtain cores in accordance with ASTM C42. Wipe cores surface-dry immediately after coring and allow to dry in air for a period not exceeding 1-hour after drilling. Seal cores in plastic bags or nonabsorbent containers until testing. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. Submit the location of cores for favorable review by Engineer before testing. Fill core holes with low-slump concrete or mortar of a strength equal to or greater than the original concrete. The Engineer will investigate low-strength test results in accordance with the requirements of ACI 318 Section 5.6.5; however, the requirements of Section 5.6.5.4 are not applicable.
4. Repair: Repair rejected concrete by removing and replacing or other acceptable repair methods as required by Engineer. To bring rejected concrete into compliance, use repair methods that meet specification requirements for strength, function, durability, dimensional tolerances, and appearance. Submit for acceptance the proposed repair methods, materials, and modifications. The Contractor is responsible to bring concrete into compliance with the requirements of the Contract Documents.

1.05 DELIVERY, STORAGE AND HANDLING

A. Cementitious Materials: Store cementitious materials in dry, weather-tight buildings, bins, or silos that will exclude contaminants. If required to be stored at the site, store immediately after delivery in a dry, weather-tight, properly ventilated structure, with adequate provisions for prevention of moisture absorption and overheating of the cement.

B. Aggregates: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other materials or other sizes of aggregates. Store aggregates to drain freely. Do not use aggregates that contain frozen lumps. If required at site, store in piles which afford good drainage and which are protected to prevent the inclusion of foreign material. Stockpile the various sizes or gradations of aggregates separately. Site stored aggregates shall be tested for moisture content on each day of batching operations.

C. Admixtures: Protect stored admixtures against contamination, evaporation, or damage. Provide agitating equipment for admixtures used in the form of suspensions or unstable solutions to ensure thorough distribution of the

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ingredients. Protect liquid admixtures from freezing and from temperature changes that would adversely affect their characteristics.

PART 2 - PRODUCTS

2.01 GENERAL

A. Qualify proposed materials and establish mixture proportions.

B. Obtain materials from an NCRMA certified manufacturer or supplier or one qualified through ASTM C94. Unless allowed otherwise, all materials shall be new.

2.02 CONCRETE MATERIALS

A. Cementitious Materials:
   1. General: Use cementitious materials that are of the same brand and type and from the same plant of manufacture as the cementitious materials used in the concrete represented by the submitted test records or used in the trial mixtures. The color shall not significantly alter the typical grey concrete color.
   2. Portland Cement: ASTM C150, Type II. Comply with the requirements for low alkali cement in ASTM C150 Table 2.
   3. Pozzolan: ASTM C618, Mineral Admixture Class N.
   4. Blended Cement: ASTM C595 Type 1P(MS).
   5. Fly ash: ASTM C618, Class F, with the following restrictions:
      a. Loss on Ignition: 4% maximum
      b. SO3 Content: 3% maximum
      c. Moisture Content: 1% maximum
   6. Ground Granulated Blast-Furnace Slag: ASTM C989.
   7. Silica Fume: ASTM C1240.

B. Concrete Aggregates:
   1. General:
      a. ASTM C33:
         1) Aggregates used in concrete shall be obtained from the same sources and have the same size ranges as the aggregates used in the concrete represented by submitted historical data or used in trial mixtures.
         2) Provide test results confirming conformance with applicable specifications not more than 90 days old. Test results for aggregate soundness, abrasion, and reactivity may be older than 90 days, but not older than 1 year, provided test results for the other properties specified in ASTM C33 indicate that the aggregate quality has not changed.
         3) Provide free from organic materials, waste products, clay balls, shale, and mica and thoroughly washed before use.
      b. Provide aggregate meeting the combined gradation requirements below as specified in Paragraph 2.05.B. For thin sections, such as slabs or walls 10 inches thick or less, or for sections that require special placement due to shape, form or congestion of reinforcing, provide 1-inch maximum size.
      c. Nominal maximum size of coarse aggregate shall not exceed three-fourths of the minimum clear spacing between reinforcing bars, one-fifth

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of the narrowest dimension between sides of forms, and one-third of the thickness of slabs or toppings.

d. Provide aggregates that do not deleteriously react with the alkalies in the cement. Nondeleteriously reactive in accordance with ASTM C227 or ASTM C1293.
e. Grading: ASTM C136. Submit results of sieve analysis.
f. Reactivity: ASTM C289. Submit graphical data showing compliance.

2. Coarse Aggregates:
   a. Provide clean, hard, durable gravel, crushed gravel, crushed rock, or combinations.
   b. Deleterious substances: Submit compliance with ASTM C33, Table 3 and as follows:
      1) Clay lumps and friable particles: ASTM C142. Not more than 5%.
      2) Abrasion: ASTM C131. Not more than 45%.
      3) Soundness: ASTM C88. Not more than 10%.
      4) Cleanness: Caltrans Test 227 : For three tests, not less than 70, with an average greater than 75. Max friable/clay materials in coarse aggregate at 2% for exposed architectural concrete, 3% for liquid retaining concrete structures, and 5% for all other structural concrete.
   c. Do not use aggregate containing more than 10% of inferior materials, including: flat or elongated particles, cracked or laminated rock, or rock than can be readily broken after immersion in water for 1 hour.
3. Fine Aggregate:
   a. Provide natural sand or a combination of natural and manufactured sand, of siliceous, granitic or igneous origin, hard and durable.
   b. Deleterious substances: Submit compliance with ASTM C33 Table 1 and as follows:
      1) Organic impurities: ASTM C40 and C87. Not less than 95% relative strength by ASTM C87.
      2) Sand equivalent: CALTRANS Test 217. For three tests not less than 70, with an average greater than 75.

C. Combined Aggregates: Provide a mixture of fine aggregate and coarse aggregate uniformly graded between the screen sizes specified below.

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	Percentage Passing	
Sieve Size	**1-1/2-Inch Gradation**	**1-Inch Gradation**
2-inch	100	--
1-1/2-inch	90-100	100
1-inch	50-96	90-100
3/4-inch	45-80	55-100
3/8-inch	38-55	45-75
No. 4	30-45	35-60
No. 8	23-38	27-45
No. 16	17-33	20-35
No. 30	10-22	12-25
No. 50	3-10	3-15
No. 100	0-3	0-5
No. 200	0-2	0-2

2.03 WATER

A. Mixing water for concrete and water used to make ice shall be potable water unless alternative sources of water complying with ASTM C1602 or AASHTO T26 are available. Water for washing aggregates, for mixing concrete, for patching grout and for curing shall be free from oil and contain no more than 1,000 parts per million (ppm) of chlorides as Cl, nor more than 1,300 ppm of sulfates as SO_4. Do not allow impurities that will cause a change in the setting time of the Portland Cement of more than 25%, nor a reduction in the compressive strength of mortar at 14 days of more than 5%, when compared to the results obtained with distilled water.

B. Do not allow impurities that cause discoloration of the concrete or produce etching of the surface.

C. The Engineer may require tests of the water should there be a question of the quality. Costs of such tests would be borne by the Owner, unless the quality does not meet the requirements in Paragraph A above.

2.04 ADMIXTURES

A. Admixtures used in concrete shall be the same as those used in the concrete represented by submitted test records or used in trial mixtures.

B. Air Entraining: ASTM C260, MB AE 90 by BASF or equal. AEA-92 or 92S by Euclid.

C. Accelerating: ASTM C494, Type C or E: POZZOLITH® NC 534 by BASF. Accelguard 80 by Euclid. Or equal

D. Retarding: ASTM C494, Type D: Daratard 17 by Grace. Eucon Retarder 75 by Euclid, or equal.

E. Water Reducing: ASTM C494, Type A: WRDA 64 by Grace. Pozzolith 200N by BASF, Eucon WR-91 by Euclid or equal.

F. High Range Water Reducing: ASTM C494, Types F or G, second or third generation type. Add at the batch plant, after all other ingredients have been mixed and initial slump has been verified. ADVA 190 by Grace. Glenium 3030 NS by BASF, Eucon 1037 by Euclid or equal.

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G. Shrinkage Reducing: ASTM C157.

H. Corrosion Inhibition and Permeability Reduction (Silica Fume): ASTM C1240.

I. Controlled Low Strength Material (CLSM) Admixture: See Specification Section 02065.

J. When two or more admixtures are used, they must be added to the mix separately (through dispensers or manually) and must not be mixed with each other prior to adding to the concrete mix. Add admixtures to concrete mix ingredients in liquid form by a special dispensing unit, approved by the manufacturer of the admixture as suitable for accurately dispensing the admixture. Install an alarm or indicator, which will immediately inform the batch plant operator if the dispensing unit malfunctions. Dispense admixtures uniformly into the mixing water as it is added to the concrete batch.

K. When two or more admixtures are used, manufacturer shall certify that the admixtures are compatible with each other and will not detrimentally impact the performance of other admixtures.

L. Admixtures containing calcium chloride or any chloride ions are prohibited.

M. Manufacturers: WR Grace & Co., Master Builders, Inc., or equal.

N. All admixtures shall be NSF 61 Certified.

2.05 CONCRETE MIX DESIGN

A. General:

1. Employ an independent commercial testing laboratory complying with ASTM C1077 and favorably reviewed by the Engineer to design all concrete mixes and carry out all necessary testing. Concrete mix design proportions shall be established on the basis of field experience and trial mixtures with the materials to be employed in accordance with ACI 318 Section 5.3.
2. When the testing laboratory has mix designs meeting the specifications that are available from prior projects, submit material and mixture proportions with supporting test results and test record statistics to demonstrate compliance with the requirements of this Section and ACI 318 Section 5.3. Include calculations for f'cr based on source quality test records.
3. If new mix designs are required, prepare a range of trial batches for each design and submit the mixes that demonstrate satisfactory test results in accordance with ACI 318 Section 5.3.
4. Allow for the variability of concrete strength from test to test by increasing the required average compressive strength over the specified strength as specified in ACI 318 Section 5.3.
5. From results of these tests, plot a curve showing the relationship between *w*/*cm* and compressive strength. From the curve of *w*/*cm* versus compressive strength, select the *w*/*cm* corresponding to the required average compressive strength *f'cr*. This is the maximum *w*/*cm* that shall be used to establish mixture proportions, unless a lower *w*/*cm* is specified in the mix proportions table below. Establish mixture proportions so that the maximum *w*/*cm* is not exceeded when slump is at the maximum specified.
6. Take sole responsibility for selection of laboratory, submittal of materials to laboratory in time for all tests, and overall timing of all aspects of testing program, including submittals.

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7. Prepare mix designs for concrete placement by the batch process and/or by pumping, as required, and state the process on the design submittal.
8. Allow for the hot or cold weather and the time required to transport the concrete from the mixer to the site and to place within the forms. If accelerating or retarding admixtures will be required for only a proportion of the concrete placements, submit test results that include the full range of options.
9. Do not exceed the water-cementitious material ratios. Vary the water-reducing admixtures to accomplish an increase in slump or workability time.
10. Proportion cementitious materials, aggregates, and water by weight.
11. Check periodically the weight of moisture contained within the stockpiled aggregates. Compensate for this water when proportioning the concrete mix and adjust when change occurs. Frequency shall comply with ASTM C94.
12. Do not use chlorides in any concrete mix.
13. Submit any adjustments to mixture proportions or changes in materials, along with supporting documentation, made during the course of the work. If it is necessary to increase the cementitious materials content, submit a request for acceptance of the proposed revised mixture with higher cementitious materials content. Confirm the adequacy of modified proportions has been verified through the submittal of a set of new test data.
14. Resubmit mix design for review for each class of concrete when modification of the mix design is required by ACI 350 or 318 Chapter 5.3. If a class of concrete requires modification based on low strength tests, contractor shall discontinue use of mix design until corrective action can be taken, and a revised mix design is favorably reviewed.

B. Mix Proportions:

Mix Design Requirements	B*	E
Specified 28-Day Compressive Strength (lb/in2) f'c	4,500	2,500
Combined Aggregate Gradation (in)	1-1/2	1
Air Content at Point of Placement (%)	5-1/2	1 OR 4-1/2
Maximum Water-Cementitious Material Ratio	0.42	0.55
Minimum Cementitious Material Content (lb/yd3)	590	510
Maximum 28-Day Drying Shrinkage (%) – Mix Test	0.05	--
Maximum 28-Day Drying Shrinkage (%) – Field Test	0.065	--
Cement Type	II	II
NSF 61 Certification Required	Y	N

C. Cementitious Material: Either Portland Cement, cement with fly ash, cement with natural Pozzolan, blended cement, or cement with slag.

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D. Pozzolan, Slag or Fly ash: Optional. If used, not less than 15%, nor more than 25% of the weight of the cementitious materials. Do not use pozzolan or fly ash as an admixture in concrete made with Portland-Pozzolan cement.

E. Modified Mix Design: Provide a modified mix design of the concrete type indicated in the table above for horizontal concrete joints, as specified in Section 03150, for environmental structures consisting of the designated concrete mix with one-half of the coarse aggregate removed. The remaining constituents shall be adjusted proportionally in the modified mix design to complete the cubic yard. Modified Mix shall meet all other requirements noted for the base mix in Paragraph 2.05.B.

F. Mix Test Requirements:
   1. Testing agencies that perform testing services on concrete materials shall meet the requirements of ASTM C1077.
   2. Compression: ASTM C192 for cylinder preparation. ASTM C39 for cylinder tests. Submit 7-day and 28-day curing test results in accordance with Paragraph A above.
   3. Slump: ASTM C143. Slump range is 3 to 4 inches at point of delivery. Slump tolerances in accordance with ACI 117. When utilizing a Type I or II plasticizing admixture or a Type F or G high-range water-reducing admixture, proportion to a maximum slump of 8 inches at the point of delivery after the admixture is added.
   4. Air Content: ASTM C231 or ASTM C173. Air content tolerance is ±1 ½%.
   5. NSF 61 Certification, submit samples to NSF and receive certification for all mixes indicated in chart. Contractor shall provide all necessary samples and pay for certification costs, and shall contact NSF.
   6. Unit Weight: ASTM C138.
   7. Shrinkage: The mix tests requirements shall be in accordance with ASTM C157, except as described below. NOTE: the following requirements differ from ASTM C157 and must be strictly followed in order to obtain favorable review for a concrete mix design. One set of three test specimens shall be prepared.
      a. Moist curing: Specimens shall be removed from molds at 23 ±1 hours after batching and shall be placed in water for at least 30 minutes and shall be measured within 30 minutes to determine original length. Specimens shall be submerged in saturated lime water until 7 days after batching.
      b. Measurements: Measurements to determine shrinkage shall be made after 7, 14, 21, and 28 days of drying after 7 days of moist curing. Compare to the preliminary measurement made after 1-day and the basic measurement made after 7 days, which will be used for calculations.
      c. Test prism size: 4 by 4 by 11 inches.
      d. Report all test results, with the 28-day tests results governing acceptance. Plot the results at other time intervals as a test of validity of the readings.
   8. After favorable review of the mix design, no variations of the constituents are permitted during the project without prior submittal and favorable review.
   9. Provide and pay for additional testing and inspection required because of changes in materials or mixture proportions.

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2.06 READY-MIX CONCRETE

A. Supply concrete for the project using one of the following methods:
   1. Supply concrete using truck mixers and a ready-mix plant certified by the National Ready-Mix Concrete Association..
   2. Qualify the supplier according to ASTM C94 Sections 8 through 11, inclusive.

2.07 CEMENT REPAIR MORTAR

A. For repairs and patching concrete as noted in Section 03935.

B. Mix repair mortar using the same materials as concrete to be patched with no coarse aggregate. Do not use more than one part Portland-cement to two parts sand by damp loose volume.

C. For repairs in exposed concrete, make trial batches and check color compatibility of repair material with surrounding concrete. Prepare several trial batches and make test samples in an inconspicuous location for review. When the repair is too dark, substitute white Portland-cement for a part of the gray cement to produce a color and texture closely matching the surrounding concrete.

D. Use a repair mortar at a stiff consistency with no more mixing water than is necessary for handling and placing. Mix the repair mortar and turn the mortar frequently with a trowel without adding water. Use mortar at a stiff consistency.

2.08 SOURCE QUALITY CONTROL

A. Concrete:
   1. Maintain records verifying materials used are of the specified and accepted types and sizes and are in conformance with the material requirements.
   2. Provide ready-mix batch plant delivery tickets contain all product information necessary for acceptance of the concrete delivered to site.
   3. Document and record that the mixing and trucking equipment have adequate capacity to deliver the concrete batches to site on time, thoroughly mixed and discharge without segregation.
   4. Submit new data from new trial mixtures for acceptance before use in concrete when brand, type, size, or source of cementitious materials, aggregates, water, ice, or admixtures are proposed to be changed.

PART 3 - EXECUTION

3.01 PROPORTIONING CONCRETE MATERIALS

A. Do not place concrete prior to favorable review of submittals for reinforcing steel, materials specified in this Section and the mix proposed. Unfavorable results of actual placements may require a redesign of mixes in addition to corrective work related to any defects.

B. Do not make substitutions to the constituents tested in the design of concrete mixes without favorable review of the revised mix and the new test results.

3.02 MEASURING, BATCHING AND MIXING CONCRETE MATERIALS

A. General:

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1. Measure, batch, mix, transport and deliver concrete materials and concrete in conformance with ASTM C94. If packaged dry-combined materials are used, they shall conform to the requirements of ASTM C387.
2. Deliver completely mixed to the project site.
3. When concrete arrives at the point of delivery with a slump below that which will result in the specified slump at the point of placement and is unsuitable for placing at that slump, the slump may be adjusted to the required value by adding water up to the amount allowed in the favorably reviewed mixture proportions. Addition of water shall be in accordance with ASTM C94. Do not exceed the specified water-cementitious material ratio (*w*/*cm*) or slump. Do not add water to concrete delivered in equipment not acceptable for mixing. After plasticizing or high-range water-reducing admixtures are added to the concrete at the site to achieve flowable concrete, do not add water to the concrete. Measure slump and air content of air-entrained concrete after slump adjustment to verify compliance with specified requirements. Do not add water unless approved by the Engineer. Do not add mixing water during hauling. Add water after delivery and only from the “hold-out” volume indicated on the mix ticket. Should water be added, revolve the mixing drum not less than 30 revolutions at mixing speed after adding and before commencing discharge.
4. Deliver each load at the job site accompanied by a ticket showing mix design number, volume of concrete, the weight of cement in pounds and the total weight of each ingredient in pounds. Also show the time at which the materials were batched and the reading of the revolution counter at the time the truck mixer was charged.
5. No retempering of partially hardened material is permitted. Do not use partially hardened concrete in the work.

B. Batching in Adverse Weather:
1. Cold Weather: In accordance with Section 03306.
2. Hot Weather: In accordance with Section 03305.

3.03 FORMWORK AND FORMWORK ACCESSORIES

A. In accordance with Section 03100.

3.04 PLACING CONCRETE AND GROUT

A. Preliminary Work:
1. Remove hardened concrete and foreign materials from the inner surface of the mixing and conveying equipment. Remove all debris from the space to be occupied by the concrete.
2. Remove water from the space to be occupied by the concrete before concrete is deposited. Divert any flow of water into an excavation through proper site drainage to a sump, or by other methods. If required by the Engineer, grout up any water vent pipes and drains after the concrete has thoroughly hardened.
3. Remove snow, ice, frost, and other foreign materials from surfaces, including reinforcement and embedded items, against which concrete will be placed.
4. Provide satisfactory redundancy in the delivery system so that work can continue in the event of a breakdown.

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5. Rapidly convey concrete from mixer to final deposition by methods that prevent segregation or loss of constituents and ensure the required concrete quality.
6. Do not use aluminum materials in pumping lines, transfer hoppers or chutes . Provide conveyor belts instead of chutes when the distance is longer than 50 feet. Use a storage hopper at the start of the line.
7. For pumped concrete, provide a hose with an angle-change, to create a back-pressure at the outlet.
8. Provide illumination if necessary inside the forms, so that the placed concrete will be visible from the deck at top of formwork.
9. Before placing a concrete slab-on-grade, clean foreign materials from the subgrade and provide subgrade soils satisfying the following requirements:
    a. Well drained and of uniform loadbearing nature.
    b. Uniform in-place density throughout the area and at least the minimum required in Contract Documents.
    c. Free from frost or ice.
    d. Moist with no free water and no muddy or soft spots.

B. Embedded Items:
1. Place equipment, bolts, anchors, sleeves, inserts, structural steel members, angles and similar items which require embedment in the concrete.
2. Position and secure in place expansion joint materials, anchors, waterstops, and other embedded items.
3. Hot-dip galvanize ferrous metal sleeves, inserts, anchors, and other embedded ferrous items unless shown otherwise. Set anchor bolts for equipment in templates, carefully plumbed and checked for location and elevation with an instrument, and held in position rigidly by double-nutting to the template to prevent displacement while concrete is being placed.
4. Ensure that aluminum items inserted in the concrete are isolated by a bituminous or asphaltic coating in accordance with *Section 05500*.
5. Notify engineer where modifications are necessary to avoid interference with reinforcing steel or embedded items.
6. Inspect the installation of embedded items and reinforcing.
7. Unless noted otherwise on the Drawings do not embed conduit or pipe in concrete.

C. Placing:
1. Place reinforcement in accordance with the requirements of Section 03200.
2. Do not begin to place concrete while rain, sleet, or snow is falling unless adequate protection is provided and acceptance of protection is obtained. Do not allow rain water to increase mixing water or to damage the surface of the concrete.
3. Use metal or metal-lined chutes having rounded bottoms, and sloped between one vertical section to two horizontal sections and one vertical to three horizontal sections of chute. Chutes longer than 20 feet and chutes not meeting slope requirements may be used provided the discharge is into a hopper before distributing into the forms.
4. Use pumping equipment that has sufficient capacity so that:
    a. Initial setting of previously placed concrete does not occur before subsequent placement.
    b. Discharge of pumped concrete does not result in segregation.
    c. Modification of accepted concrete mixture is not required.

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5. Place concrete without separation or loss of ingredients and without displacement of the reinforcement.
6. Do not place concrete that contains foreign material.
7. Do not deposit partially hardened concrete in the work.
8. Do not subject concrete to procedures that will cause segregation.
9. Deposit concrete continuously and as near as practicable to the final position.
10. Deposit concrete in one layer or in multiple layers. Do not deposit fresh concrete on concrete that has hardened sufficiently to cause formation of cold joints. Maintain, until the completion of the placement, a plastic concrete surface, approximately horizontal.
11. Do not place concrete over columns or walls until concrete in columns and walls has reached final set. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as the concrete for adjacent slabs.
12. Maximum height of free fall for concrete during placement:
    a. Concrete with maximum 4-inch slump: 4 feet
    b. Concrete with high-range water reducing admixture and minimum 6-inch, maximum 9-inch slump: 8 feet
13. Place concrete continuously or in layers 12 to 20 inches in depth so that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously as originally planned, locate construction joints during the placement.
14. Provide a dense, impervious, homogeneous concrete, free from voids or pockets. If honeycomb, air, or rock pockets occur, repair the structure in accordance with Section 03935, and modify the placing method or mix design, to prevent recurrence of deficient concrete. Provide such repairs and modifications at no additional cost. Honeycomb or large defects may be cause for rejection of the work.

D. Time Limit: Place all concrete in its final position in slab or forms within 1-1/2 hours of batching or before the drum has revolved 300 revolutions, whichever comes first in accordance with ASTM C94. Alternatively, as part of the mix design, provide admixtures that delay the initial set and state the proposed length of time in the submittal.

E. Temperature Limits: Place all concrete in its final position in slab or forms at:
1. Less than 80°F, measured in the mix.
2. When the average of the highest and lowest ambient air temperature during the period from midnight to midnight is expected to drop below 40°F for more than three successive days, deliver concrete to meet the following minimum temperatures immediately after placement:
    a. 55°F for sections less than 12 inches in the least dimension
    b. 50°F for sections 12 to 36 inches in the least dimension
    c. 45°F for sections 36 to 72 inches in the least dimension
    d. 40°F for sections greater than 72 inches in the least dimension
3. The temperature of concrete as placed shall not exceed these values by more than 20°F. These minimum requirements may be terminated when temperatures above 50°F occur during more than half of any 24-hour duration.
4. Temperature measurements above refer to on-site measurements. Refer to the vibration, concrete joints and curing sections for other requirements.

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5. When the temperatures are outside these ranges, place concrete in accordance with Sections 03305 and 03306.

F. Precast Items:
1. Supply and design vaults and manholes in accordance with the Division 2 sections for these items. Comply with additional requirements below.
2. Items may be cast on or off the site.
3. Apply all applicable portions of Sections 03300, 03100, 03150, 03330, and 03350, including materials, forms, placement, finish and curing.
4. Take particular care when handling and placing the precast items. Lift or move after a minimum of 90% of the specified compressive strength has been attained. Use the average compressive strength of two test cylinders.

3.05 CONSOLIDATING

A. Consolidate concrete by vibration. Consolidate concrete around reinforcement and embedded items into corners of forms to eliminate honeycombing or planes of weakness due to air voids and stone pockets.

B. Use internal vibrators to consolidate the concrete. Workers shall be experienced in the use of vibrators. Do not use vibrators to move concrete within the forms. Spacing of immersion vibrator insertions shall not exceed 1-1/2 times the vibrator's radius of action in the concrete being consolidated.

C. Furnish sufficient vibrators to complete the compaction as specified without causing delay in the depositing of concrete. Provide a minimum of 2 vibrators, and at least one unit in addition to those planned for active use.

D. Operate vibrators with vibratory element submerged in the concrete, with frequency between 8,000 and 12,000 impulses per minute when submerged.

E. Compact the concrete with high frequency, internal mechanical vibrating equipment, and when required, supplement by hand spading and tamping. Consolidate slabs 6 inches or less in depth by hand tampers, spreading and settling with a heavy leveling straightedge.

F. Vibrate by direct action in the concrete for approximately 10 seconds at approximately 12-inch intervals, not against forms or reinforcements. Vibrate the concrete around the reinforcement, and around embedded fixtures and into the corners of the forms. Penetrate 6 to 12 inches into previously placed layers as new layers are placed, provided the running vibrator penetrates by its own weight. To secure even and dense surfaces, free from aggregate pockets, honeycomb, or air pockets, supplement vibration when required by forking or spading by hand or hammering the forms lightly opposite the freshly placed concrete. Revibrate the final layer. Stop vibrating when concrete is thoroughly compacted and has ceased to decrease in volume and give off air bubbles.

G. When placing concrete with 8-inch or more slumps, reduce the time of vibration to 5 seconds and follow the admixture manufacturer's recommendations for technique.

H. *Use immersion-type vibrators with nonmetallic heads when consolidating concrete around epoxy-coated reinforcement.*

3.06 FIELD QUALITY CONTROL

A. Site Tests:

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1. Testing agencies that perform testing services on concrete materials shall meet the requirements of ASTM C1077.
2. Testing Agency Reports:
    a. Include location in the work where the batch represented by test was deposited and the batch ticket number on strength test reports.
    b. Include detailed information of storage and curing of specimens before testing on strength test reports.
    c. Provide final reports within 7days of test completion.
3. Furnish any necessary labor to assist in obtaining and handling samples at the project site or at the source of materials.

B. Inspection:
1. Inspect concrete batching, mixing, and delivery operations.
2. Inspect forms; foundation preparation; reinforcement; embedded items; reinforcement placing; and concrete placing, finishing, and curing operations.
3. Concrete not within the specified limits of air entrainment, slump, and temperature shall not be used in the work.

3.07 PROTECTION OF IN-PLACE CONCRETE

A. Loading and support of concrete: Do not allow construction loads to exceed the superimposed load that the structural member, with necessary supplemental support, is capable of carrying safely and without damage.

B. Protection from mechanical injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, shock, and harmful vibration. Protect concrete surfaces from damage by construction traffic, equipment, materials, rain or running water, and other adverse weather conditions.

END OF SECTION

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SECTION 03305

HOT WEATHER CONCRETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Procedures for concrete to be placed, protected, and cured in hot weather.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 Specifications for Structural Concrete for Buildings
   2. ACI 305 Guide to Hot Weather Concreting
   3. ACI 318 Building Code Requirements for Structural Concrete
   4. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
   1. ASTM C31 Standard Method of Making and Curing Test Specimens in the Field
   2. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   3. ASTM C156 Standard Test Method for Water Retention by Concrete Curing Materials
   4. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete
   5. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   6. ASTM C1064 Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

C. California Building Code (CBC) 2019 Edition.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Shop Drawings:
   1. Program and method of production, transportation, placement, protection, materials, curing, and temperature monitoring of concrete during hot weather.

C. Quality Assurance:
   1. Site Condition Logs: Submit a copy of the ambient temperature, concrete temperature, relative humidity, wind velocity logs and evaporation rate. See FIELD QUALITY CONTROL.

1.04 QUALITY ASSURANCE

A. Construction Standard: Applicable requirements of the CBC, ACI 301, ACI 305, ACI 318, and ACI 350.

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1.05 DELIVERY, STORAGE AND HANDLING

A. During periods of hot weather materials and equipment required for extended protection of concrete shall be available at the project site before hot weather concreting begins.

1.06 DEFINITIONS

A. Hot Weather: Job-site conditions that accelerate the rate of moisture loss or rate of cement hydration of freshly mixed concrete. These conditions include ambient temperatures above 80°F or any combination of ambient temperature, concrete temperature, low humidity and wind that combine to produce an evaporation rate that exceeds 0.2 lb/ft2/h.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION BEFORE PLACEMENT

A. Surfaces in contact with concrete shall be within 10°F degrees of the temperature of freshly placed concrete.

B. Surfaces in contact with freshly placed concrete shall be saturated surface dry (SSD).

C. Do not place concrete against surfaces of dry absorbent materials, soil, or subgrade.

D. Do not place concrete against surfaces that have standing water.

3.02 BATCHING AND MIXING

A. Reduce the temperature of the concrete mix by using some combination of iced mixing water, refrigerated mixing water, liquid nitrogen cooled mixing water, water-spray cooled coarse aggregate, or air cooled coarse aggregate.

B. If water cooled aggregate is used to reduce mix temperature the amount of water shall be offset in the batching of the mix so as not to exceed the maximum specified water-cement ratio.

3.03 PLACING, CURING AND PROTECTION

A. Placing:
   1. Temperature of freshly placed concrete shall not exceed 80°F as measured by ASTM C1064.
   2. Should the provisions noted above not be possible or practicable, postpone the batching until favorable weather conditions prevail, consider scheduling placement at other than normal hours.
   3. Do not place concrete that has resulted in loss of slump, flash set, or cold joints due to temperature of concrete. When temperature of steel reinforcement, embedments, or forms is greater than 120°F, fog steel reinforcement, embedments, and forms with water immediately before placing concrete. Remove standing water before placing concrete.

B. Curing:

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1. General: Refer to Specification Section 03330.
2. Temperature of concrete shall not exceed 90°F during the specified curing period.
3. Use water for moist curing that is no more than 20°F cooler than the temperature of the concrete.

C. Protection:
1. Protect the concrete against thermal shrinkage cracks caused by temperature drops greater than 40°F during the first 24 hours after placement. Means of protection may include insulating blankets, batt insulation with moisture-proof covering, or multiple layers of impervious paper meeting ASTM C171.
2. Provide shade to concrete surfaces exposed to direct sunlight during the specified wet curing period.
3. Liquid curing compounds approved for use after the initial wet curing period shall contain white, heat-rejecting, UV-inhibiting pigment meeting the moisture retention requirements of ASTM C309. Liquid curing compounds shall limit moisture loss in a 72 hour period to 9 lb/yd^3 when tested per ASTM C156.

3.04 CONCRETE FINISHES

A. General: Refer to Section 03350.

B. Apply an evaporation retarder during the finishing operation following the manufacturer's recommendation.

3.05 FIELD QUALITY CONTROL

A. Protection and Monitoring:
1. Monitor site conditions (air temperature, humidity, wind speed, and evaporation rate) beginning no later than 1 hour before the start of concrete placement.
2. Calculate the concrete evaporation rate in accordance with ACI 305 to assess the need for evaporation control measures.
3. Continue monitoring at intervals of 30 minutes or less until specified curing procedures have been applied.
4. Continue monitoring at 2 hour intervals during the specified curing period.
5. Instruments for measuring field conditions shall be certified by the manufacturer to be accurate within 2°F, 5% relative humidity, and 1 mph.
6. Monitor the temperature of protected concrete to evaluate the effectiveness of the protection and to ensure excessive heating does not occur.
7. Temperature measuring devices embedded 2 inches below the face are ideal but surface measurements provide satisfactory results.
8. Record the temperature of the concrete at multiple locations, the daily maximum and minimum concrete temperature, location where temperature was taken, ambient temperature, relative humidity, wind speed, weather conditions, and other special conditions.
9. Submit a copy of the concrete temperature logs and evaporation rates to the Engineer.

B. Additional Compressive Strength Testing:
1. During concrete placement in systems requiring a specified level of strength before shoring can be removed (i.e. suspended slabs, girders and beams), cast four (4) additional 6 inch diameters by 12 inch cylinders to be cured under field conditions in accordance with ASTM C31.

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2. Test two (2) cylinders for compressive strength, in accordance with ASTM C39, at 28 days. Hold two (2) cylinders as back-ups.

END OF SECTION

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SECTION 03306

COLD WEATHER CONCRETING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete to be placed, protected, and cured in cold weather.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 Specifications for Structural Concrete for Buildings
   2. ACI 306 Guide to Cold Weather Concreting
   3. ACI 318 Building Code Requirements for Structural Concrete
   4. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
   1. ASTM C31 Standard Method of Making and Curing Test Specimens in the Field
   2. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   3. ASTM C150 Standard Specification for Portland Cement
   4. ASTM C494 Standard Specification for Chemical Admixture for Concrete
   5. ASTM C803 Standard Test Method for Penetration Resistance of Hardened Concrete
   6. ASTM C873 Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds
   7. ASTM C900 Standard Test Method for Pullout Strength of Hardened Concrete

C. California Building Code (CBC) 2019**.**

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Material proposed for use as insulation during protection period.

C. Shop Drawings:
   1. Program and method of production, transportation, placement, protection, curing, and temperature monitoring of concrete during cold weather. Include in submittal the procedures to be implemented upon adverse changes in weather or equipment failure.

D. Quality Assurance:
   1. Submit a copy of the concrete temperature logs to the Engineer. See FIELD QUALITY CONTROL.

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1.04 QUALITY ASSURANCE

A. Construction Standard: Applicable requirements of the IBC, ACI 301, ACI 306, ACI 318, and ACI 350.

1.05 DELIVERY, STORAGE AND HANDLING

A. During periods of cold weather all materials and equipment required for extended protection of concrete shall be available at the project site before cold weather concreting begins.

1.06 DEFINITIONS

A. Cold Weather: Cold weather is considered to exist when the temperature has fallen below, or is expected to fall below, 40°F during placement and curing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION BEFORE PLACEMENT

A. Remove snow, ice, and frost from surfaces to be in contact with concrete. Remove any standing water created by the removal of snow and ice. Recompact subgrade disturbed by removal of snow, ice and frost.

B. Subgrade shall not be frozen.

C. Formwork, reinforcing, subgrade and embedded items shall be above 32°F.

D. Surfaces in contact with concrete shall be within 10°F of the temperature of freshly placed concrete.

E. Do not attempt to heat reinforcing, formwork, subgrade, or embedded metal items with a blow torch or by water spray.

3.02 BATCHING AND MIXING

A. Heat the materials before mixing, so that the temperature of the mix at the batch plant shall be between 65° and 80°F. Do not heat the mixing water or the cement over 180°F unless it can be reliably demonstrated that flash set is not a problem. Remove lumps of frozen material and ice from the aggregates before they are placed in the mixer.

B. Should the provisions noted above not be possible or practicable, postpone the batching until favorable weather conditions prevail.

3.03 PLACING, CURING AND PROTECTION

A. Provide adequate shelter and equipment for heating the placed concrete during cold weather:
   1. Maintain freshly placed concrete at the temperature listed in Column 2 of Table 3.03-A for the specified protection period.

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Table 3.03A – Protection Period Requirements

1	2	3
Least dimension of section, inches	Minimum temperature of concrete as placed and maintained during protection period, °F	Maximum temperature drop (ΔT) per 24-hour period after end of protection, °F
Less than 12	55	50
12 to less than 36	50	40
Greater than 36	45	30

2. Concrete placement temperature shall not exceed the temperatures in Column 2 of Table 3.03-A by more than 20°F.
3. Keep the housing, covering, or other protection in place and intact at least 24 hours after the artificial heating is discontinued to allow for a gradual decrease in temperature. The maximum decrease in temperature in a 24-hour period shall not exceed the values shown in Column 3 of Table 3.03-A. Do not exceed these limits until the concrete is within 20°F of the ambient temperature.
4. Do not use manure, salt, calcium chloride, or other chemicals on the concrete surface to prevent freezing.

B. Protection Period:
1. Keep cold weather protection in place and maintain concrete within the temperature limits specified in Paragraph A for a minimum of:
   a. Footings, foundations, piers — 2 days
   b. Slabs on grade, below grade walls — 3 days
   c. Above grade walls — 6 days
   d. Suspended slabs, girders, beams — Full design compressive strength to be verified by additional field cured cylinders, see FIELD QUALITY CONTROL.
2. Increase the protection period if the temperature requirements were not met during the specified protection period in accordance with ACI 305.
3. During periods <u>not</u> defined as cold weather all freshly placed concrete surfaces shall be protected from unexpected freezing for at least the first 24 hours after placement.

C. Heating:
1. Vent flue gasses to the outside of the enclosure if combustion heaters are used.
2. Place and direct heaters and ducts to prevent overheating and drying of the concrete surface
3. For the duration of the protection period, do not expose concrete to air temperatures 20°F greater than those listed in Column 2 of the table above.

3.04 REMOVAL OF FORMS

A. Forms shall remain in place for the full protection period or as noted elsewhere in division 3, whichever is longer.

B. Engineer may increase the time for form removal in conjunction with the protection period if the specified temperature and temperature monitoring requirements were not met during the protection period.

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3.05 FIELD QUALITY CONTROL

A. Protection and Monitoring:
   1. Verify procedures have been submitted and equipment is available for controlling concrete temperature during cold weather conditions.
   2. Verify actual time of application of protection measures for each placement.
   3. Monitor the temperature of protected concrete to evaluate the effectiveness of the protection and to ensure excessive heating does not occur.
   4. Temperature measuring devices embedded 2 inches below the face are ideal but surface measurements provide satisfactory results.
   5. Record at least twice a day, for the specified period of protection, the temperature of the concrete at multiple locations including both interior and edges with priority given to corners, the daily maximum and minimum concrete temperature, location where temperature was taken, air temperature, weather conditions, and other special conditions.
   6. Submit a copy of the temperature logs to the Engineer.

B. Additional Compressive Strength Testing:
   1. During concrete placement in systems requiring a specified level of strength before shoring can be removed (i.e. suspended slabs, girders and beams), cast a set of four (4) additional 6-inch diameter by 12-inch cylinders to be cured under field conditions in accordance with ASTM C31.
   2. Test two (2) cylinders for compressive strength, in accordance with ASTM C39, at 28 days. Hold two (2) cylinders as back-ups.

END OF SECTION

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SECTION 03330

CONCRETE CURING AND PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Curing compounds, materials, methods and program.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 301 Specifications for Structural Concrete for Buildings
   2. ACI 306 Guide to Cold Weather Concreting
   3. ACI 318 Building Code Requirements for Structural Concrete
   4. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
   1. ASTM C156 Water Retention by Concrete Curing Materials
   2. ASTM C171 Sheet Materials for Curing Concrete
   3. ASTM C309 Liquid Membrane Forming Compounds for Curing Concrete
   4. ASTM C1315 Liquid Membrane Forming Compounds Having Special Properties for Curing and Sealing Concrete
   5. ASTM D471 Standard Test Method for Rubber Property-Effect of Liquids
   6. ASTM D1056 Flexible Cellular Materials - Sponge or Expanded Rubber
   7. ASTM E96 Water Vapor Transmission of Materials

C. Standard Specifications for Public Works Construction or “GREENBOOK”

D. California Building Code (CBC) 2019 Edition**.**

E. International Code Council (ICC)

F. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.03 DEFINITIONS

A. Water Containment Structure(s): A reservoir, basin, tank, channel, sump, or conduit to be tightness tested regardless of whether it has a closed or open top or is constructed partially or entirely of concrete.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. Curing program, including method selected, materials proposed for use and timing of water and product application, demonstrating compliance with requirements herein.
   2. Curing products: Submit technical data including installation instructions, independent laboratory test reports (ICC), handling and storage instructions, and NSF 61 approval for products in contact with potable water.
      a. Curing materials, including sheet materials and wet blankets if applicable
      b. Liquid applied curing compounds

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c. Evaporation Retardant

C. Samples: Submit any item of Product Data not fully assembled by a single manufacturer.

1.05 QUALITY ASSURANCE

A. Construction Standard: Applicable requirements of the CBC, ACI 301, ACI 318 and ACI 350.

1.06 DELIVERY, STORAGE AND HANDLING

A. Store liquid curing compounds in accordance with the manufacturer's recommendations and do not allow to freeze.

B. Store and handle products to retain original quality. Do not use products stored beyond the manufacturer's recommended shelf life.

PART 2 - PRODUCTS

2.01 GENERAL

A. Obtain materials from an established and experienced manufacturer or supplier. Provide new materials of first-class ingredients guaranteed to perform the service required.

2.02 CURING MATERIALS

A. Cure by fog spray, or by one of the following methods after discontinuance of the fog spray. Slabs shall be continuously wet cured with sheet materials or wet blankets after discontinuance of the fog spray; liquid curing compound alone is insufficient.

B. Liquid Curing Compound: A water-based membrane-forming resin suitable for exterior or interior use as a curing and hardening compound on freshly placed concrete.
   1. Provide an emulsion of synthetic resinous solids dispersed in water containing no waxes, paraffins or oils. Provide the fugitive type that will oxidize and disintegrate completely within 60 days when exposed to sunlight in exterior applications or that can be removed by washing with dilute muriatic acid or TSP in interior applications.
   2. Water retention requirements: ASTM C309, Type I or II, Class B, when tested in accordance with ASTM C156.
   3. Use white pigmented material for exterior applications (exposed to sunlight when applied or within 30 days thereafter) and clear material for interior applications.
   4. Comply with the applicable local air quality district.
   5. NSF 61 certification required for products applied to water contacting surfaces.
   6. Exterior surfaces: Aqua Resin Cure-White by Dayton-Superior; 1200-White by W.R. Meadows; or equal.
   7. Interior surfaces: Clear Cure VOC J7WB by Dayton Superior, E-Cure by SpecChem,Vocomp 30 by W.R. Meadows; or equal.
   8. Exterior surfaces are surfaces exposed to sunlight during the curing process, which includes portions of structures which will be interior surfaces upon

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completion of the structure, but do not have shade or sunlight protection during the curing process.

C. Sheet Materials: ASTM C171. Waterproof paper, plastic sheeting or white burlap-polyethylene sheet.
   1. Plastic sheeting: fungus-resistant, minimum 4-mil thick, clear and free of defects, having ASTM E96 perm rating of not more than 0.5.
   2. Waterproof paper: Two layers of non-staining kraft paper laminated with latex adhesive and reinforced with glass in both directions. Seal joints with 2-inch-wide tape with water-resistant adhesive.

D. Wet Blankets: Clean cotton mats (burlap, except for white burlap-polyethylene sheeting noted above, is unacceptable). Provide material free from any substance that will have a deleterious effect on the concrete. Use a thickness sufficient to retain moisture between programmed applications of water.

E. Evaporation Retardant: Eucobar by the Euclid Chemical Company; E-CON by L&M Construction Chemicals, Inc.; or equal.
   1. NSF 61 certification required for products applied to water contacting surfaces.

PART 3 - EXECUTION

3.01 CURING AND PROTECTION

A. General:
   1. Maintain concrete above 50°F and below 80°F in a moist condition and without external loadings for 14 days after placement, and comply with requirements of 03305 and 03306.
   2. Allow building material storage only after conclusion of cure time and only on plywood sheets and wood sleepers that spread the load and protect the finish.
   3. When high evaporative conditions necessitate protection of concrete immediately after placing or finishing, make provisions in advance of concrete placement for wind-breaks, shading, fogging, sprinkling, ponding, or wet covering.

B. Wet Cure:
   1. Initial moist cure: Provide a 36-hour uniform spray treatment immediately following final troweling and before the surface can dry out, but after bleeding has stopped. Use clean water and special fog spray nozzles of type and number required to keep entire surface moist. Keep all traffic off floors.
   2. Continued cure: After 36 hours for the balance of the 14 days, continue fog curing, or, before the surface dries out, continue curing by utilizing Sheet Material Cure (sheet materials or wet blankets) in order to keep the surface continuously wet. Place waterproof curing paper or polyethylene plastic sheeting as described below.
   3. Final cure: After 14 days, perform Liquid Membrane Cure, if favorably reviewed for this purpose, while slab is still damp as described below.

C. Sheet Material Cure:
   1. Cover entire surface with sheet material for 14 days.
   2. Place and secure sheet as soon as initial concrete set occurs.

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3. Place smoothly upon the moist concrete surface with all joints and edges lapped a minimum of 4 inches and continuously sealed with tape.
4. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet.
5. Repair, replace and reseal, torn or scuffed sheets.
6. Do not use paper that will leave an impression on the finish.

D. Liquid Membrane Cure:
1. Apply the compound in accordance with manufacturer's recommendation and as noted below as soon as water sheen has disappeared from the concrete surface and after finishing operations.
2. Apply over the entire concrete surface.
3. Agitate compound thoroughly by mechanical means during use and apply uniformly in a two coat continuous operation by appropriate power-spraying equipment.
4. Use an application rate of not less than 1 gal. per 150 ft^2.
5. Apply curing compound in two applications at right angles to each other.
6. The material applied in each coat shall not be less than 1 gal. per 150 ft^2 of area.
7. Form a uniform, continuous, coherent film that will not check, crack, or peel and free from pinholes or other imperfections. Apply an additional coat immediately to areas where the film is defective.
8. Do not use curing compound on any surface where concrete or other material will be bonded to overlays, toppings, or future concrete placements unless the curing compound will not prevent bond or unless measures are to be taken to completely remove the curing compound from areas to receive bonded applications.
9. Keep alternate specified covering readily available for use in the event conditions occur which prevent correct application of the compound at the proper time.
10. Respray surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied (when slab reaches a moist condition and there is no standing water) with two additional coats of curing compound by the foregoing method and coverage.
11. Allow foot traffic only after 36 hours of cure time and only when slab is protected with paper or sheeting.
12. Remove curing compound sprayed on reinforcing steel and construction joints. Remove by sandblasting or other favorably reviewed method after curing is completed, or before placing the next pour. If the cones of tie holes are sprayed with curing compound, lightly ream prior to patching.

E. Curing Method Applications:
1. Slabs for Water Containment Structures including roof or topping slabs: Wet Cure
2. Structural Slabs (other than Water Containment Structures): Wet Cure, Sheet Material Cure, or Liquid Membrane Cure.
3. Topping and Composite Slabs: Sheet Material Cure or Liquid Membrane Cure.
4. Slabs on Grade and Footings (not used to contain water): Wet Cure, Sheet Material Cure, or Liquid Membrane Cure.
5. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout or Other Material that Requires Bond to the substrate: Wet cure.
6. Formed Concrete Surfaces:

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a. None, if nonabsorbent forms are left in place 14 days.
b. Keep absorbent wood forms wet until they are removed.
c. Sheet Material Cure or Liquid Membrane Cure if forms are removed prior to 7 days.
d. Exposed horizontal surfaces of formed walls or columns shall be Wet Cured for 14 days or until next placement of concrete is made.

7. Concrete Joints: Wet Cure or Sheet Material Cure.

F. Other Surfaces:
1. Provide a curing program equivalent to either slab or formed system, as appropriate.
2. Include construction joint surfaces when applying curing compound.
3. Cover, or protect joint openings, exposed reinforcing, surfaces to be painted and other areas where curing compound may enter and interfere with a special finish.
4. Remove curing compound sprayed on reinforcing or construction joints by sandblasting after curing is completed, or before placing the next pour. If the cones of tie holes are sprayed with curing compound, lightly ream prior to patching.
5. For curing of certain interior and other slabs using hardening or coloring compounds, refer to Section 03350.

G. Cold Weather Requirements: Provide adequate equipment for heating the placed concrete during freezing or near freezing weather:
1. Whenever the surrounding air temperature is below 40°F, or may fall below 40°F within the 24-hour period after placing concrete, maintain all freshly poured concrete at not less than 50°F for 5 days, defined as the protection period.
2. When the average of the highest and lowest ambient air temperature during the period from midnight to midnight is expected to drop below 40°F for more than three successive days, make provisions in advance of concrete placement to maintain the temperature of the concrete. Use heating, covering, or other means to adequately maintain required temperature without overheating or drying of concrete due to concentration of heat. Do not use combustion heaters unless precautions are taken to prevent exposure of the concrete to exhaust gases containing carbon dioxide.
3. Keep the housing, covering, or other protection in place and intact at least 24 hours after the artificial heating is discontinued.
4. Do not use manure, salt, calcium chloride, or other chemicals on the concrete to prevent freezing.

H. Hot Weather Requirements: Provide additional cooling to concrete when temperatures rise above 90°F, or low humidity, wind and temperature combine to cause high surface evaporation, over 0.2 lb/sq. ft./hour:
1. Provide additional water if curing by fog spray or ponding or saturated blankets.
2. Provide shade to surfaces exposed to direct sunlight.
3. Apply an evaporation retarder during the finishing operation, following the manufacturer’s recommendation.

3.02 CONCRETE FINISHES

A. Refer to Section 03350.

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3.03 FIELD QUALITY CONTROL

A. Concrete Curing:
   1. Verify procedures and equipment is available for controlling concrete temperature during hot and cold weather conditions.
   2. Verify actual time of application of evaporation retardant, fog spray and curing materials for each placement.
   3. For cold weather applications, record at least twice a day for the six days of special concrete curing and protecting procedures the temperature of the concrete at multiple locations (including surfaces, edges and corners), the daily maximum and minimum concrete temperature, location where temperature was taken, air temperature, weather conditions, and other special conditions. Measure concrete temperature in accordance with ACI 306.

3.04 PROTECTION OF IN-PLACE CONCRETE

A. Loading and support of concrete: Do not allow construction loads to exceed the superimposed load that the structural member, with necessary supplemental support, is capable of carrying safely and without damage.

B. Protection from mechanical injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, shock, and harmful vibration. Protect concrete surfaces from damage by construction traffic, equipment, materials, rain or running water, and other adverse weather conditions.

C. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

D. Protect concrete during the curing period such that the concrete temperature does not fall below the specified requirements of Section 03306. Maintain the concrete protection to prevent freezing of the concrete and to ensure the necessary strength development for structural safety. Remove protection in such a manner that the maximum decrease in temperature measured at the surface of the concrete in a 24-hour period shall not exceed the following:
   1. 50°F for sections less than 12 inches in the least dimension.
   2. 40°F for sections from 12 to 36 inches in the least dimension.
   3. 30°F for sections 36 to 72 inches in the least dimension.
   4. 20°F for sections greater than 72 inches in the least dimension.

E. When the surface temperature of the concrete is within 20°F of the ambient or surrounding temperature, protection measures may be removed.

3.05 CLEANUP

A. Upon completion of all work performed under this Section, remove from the site all excess materials, storage facilities and temporary facilities. Smooth and clean of debris all areas that were used or occupied during concrete construction operations and leave in first-class condition.

B. Clean any excess curing compound off the slab after 45 day for interior spaces using water and a stiff brush.

END OF SECTION

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SECTION 03340

HYDROSTATIC TESTING OF CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Materials and methods for hydrostatic (leakage) testing of concrete structures.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 350.1-10 Tightness Testing of Environmental Engineering Concrete Containment Structures

B. California Building Code (CBC) 2019 Edition.

C. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.03 DEFINITIONS

A. Concrete Structure: A reservoir, basin, tank, channel, sump, or conduit to be tightness tested regardless of whether it has a closed or open top or is constructed partially or entirely of concrete.

B. Fitting: An object that passes through the concrete or is embedded in the concrete to facilitate a connection to the concrete structure.

1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Narrative: Written narrative documenting materials and approach for hydrostatic testing of concrete structures.

C. Test Reports: Include description of test locations, dates of testing, water level measurements, amounts of precipitation or evaporation, measured air and water temperatures and volume corrections (if any), retest results, corrective action taken (if any), and final results. Submit final reports within 7 days of test completion.

D. Submit information on changes in flow in underdrain system, if any, after filling the concrete structure.

E. Repair Procedures: Proposed repair methods, materials and modifications to satisfy leakage requirements of this Section. See Section 03935.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications: See Section 03300.

B. Preconstruction Meeting: See Section 03300.

1.06 PROJECT/SITE CONDITIONS

A. Environmental Requirements

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1. Do not schedule the quantitative part of the hydrostatic tightness test for a period when the forecast is for a difference of more than 35°F between the ambient temperature readings at the times of the initial and final level measurements of the water surface.
2. Do not schedule the test when the weather forecast indicates the water surface could freeze before the test is completed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TESTING OF HYDRAULIC STRUCTURES

A. General:
1. Test all concrete structures designed to contain water, after all concrete has been placed for the structure, including top slabs or roof slabs, and the concrete has attained its specified compressive strength.
2. Test by filling the structure with potable water unless noted otherwise.
3. Test prior to backfilling. No backfill shall be placed on the wall footings of the structures to be tested.
4. Test prior to application of any coating system or waterproofing membrane.
5. Each cell of multi-cell concrete structures shall be considered a single concrete structure and tested individually unless otherwise noted. Test adjacent structures separately to confirm no cross leakage between structures.
6. Test in accordance with ACI 350.1-10 as modified herein.

B. Preparation:
1. Provide all water necessary for testing.
2. Provide all evaporation and level measuring devices required.
3. Provide all pumps, power, piping and any other equipment required and make all hook-ups necessary to fill structures for testing.
4. Provide access and equipment and make the measurements and observations necessary for the testing.
5. Provide access for the Owner’s Representative to observe measurements and witness observations, for verification.
6. Clean the exposed concrete surfaces, including the floor, of all foreign material and debris.
7. Visually examine the concrete surfaces including joints and fittings for potential leakage points.
8. Repair areas of potential leakage before filling the structure with water.
9. Furnish and install temporary bulkheads, if required.
10. Monitor structure penetrations and pipe, channel, and conduit inlets/outlets before and during the test to verify the watertightness of these fittings. Repair seepage at these locations before test measurements. No allowance shall be made in test measurements for uncorrected known points of seepage.
11. In structures with underdrain systems beneath the floors with observation points or monitoring manholes, there shall be no flowing water or visible leakage in the discharge points from the underdrain system pipelines unless groundwater was detected prior to filling the structure with water. If flowing water is observed in the underdrain system, the tank floor shall be inspected for point sources of leakage with the tank empty and full.

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12. Do not exceed a rate of 4 feet/hour for initial filling of a new concrete structure.
13. Fill the structure with water to the test level, or either 1-inch below any fixed overflow level in covered structure or 4 inches in open structure, whichever is lower.
14. Maintain full for 72 hours before beginning the test period to permit concrete absorption and adjustment of valves, slide gates, or temporary bulkheads.
15. At completion of tests, remove all temporary piping and connections.
16. Dispose of water after testing is complete, including pumping if necessary. Dispose of test water without creating a nuisance or damage to adjacent property.

C. Hydrostatic Leakage Test for Open or Covered Concrete Structures
1. The hydrostatic leakage test consists of two parts: 1) a qualitative test procedure, and 2) a quantitative test procedure, expressed as the maximum allowable percent volume loss per day.
2. The quantitative criteria for the hydrostatic test shall be 0.050% volume per day.

D. Qualitative Test Procedure:
1. The exterior surfaces of the concrete structure shall be observed in both the early mornings and late afternoons during the 72-hour period before starting the Quantitative Test Procedure.
2. Mark all observed damp areas where moisture can be picked up on a dry hand or facial tissue on exposed surfaces that have not healed autogenously during the test.
3. If any water is observed on the concrete structure exterior surfaces, including joints, repaired honeycombed areas, cracks, wall-floor joints on top of the exterior wall footings, or fittings where moisture can be picked up on a dry hand, the concrete structure shall be considered to have failed the Qualitative Test Procedure of the hydrostatic test.
4. Repair all those areas. Submit acceptable procedures for favorable review prior to repairs.
5. Repairs by painting or surface treatment shall not be allowed.
6. Repairs on the exterior side or negative water side of concrete structures shall not be allowed.
7. Although the Quantitative Test Procedure may begin prior to completion of repairs observed from the Qualitative Test Procedure, all defects causing the failure of the Qualitative Test Procedure of the hydrostatic tightness test shall be repaired before acceptance of the concrete structure. No allowance shall be made in test measurements for uncorrected known points of observed flow or seepage.
8. Continue the hydrostatic leakage test and repair procedures until the concrete structure satisfies both the qualitative and quantitative test requirements.

E. Quantitative Test Procedure:
1. Measure the vertical distance to the water surface to within 1/16-inch from a fixed point on the concrete structure above the water surface.
2. Record measurements at 24-hour intervals.
3. Test Period: Five consecutive 24-hour periods totaling 5 consecutive days.
4. Take daily measurements at the same time of day at the location of the original measurements of the following.

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a. Air temperature.
b. Water temperature at a depth of 18 inches, unless otherwise specified, below the water surface at the start and end of the test.
c. Rainfall.
d. Water level at two locations 180-degrees apart.

5. Include volume corrections for water temperature differences.
6. In uncovered concrete structures, measure evaporation and precipitation. In well-ventilated covered concrete structures, measure evaporation.
7. Continue to observe the concrete structure in both the early mornings and late afternoons to verify compliance with the qualitative part of the hydrostatic tightness testing during the quantitative part of the hydrostatic test.
8. At the end of the test period, record the water surface to within 1/16-inch at the location of the original measurements. Record the water temperature and the evaporation and precipitation measurements.
9. Calculate the change in water volume in the concrete structure and correct, if necessary, for evaporation, precipitation, and temperature. Determine evaporation or precipitation measurements, using a floating, restrained, partially filled, calibrated, open container positioned in the open concrete structures, and record the water level in the container. Do not use a shallow pan-type measuring device for determining evaporation losses. Measure and deduct evaporation losses from the water loss to determine compliance with the acceptance criteria.
10. If the loss exceeds the required criterion, the concrete structure shall be considered to have failed the quantitative part of the test.
11. Continue the hydrostatic leakage test and repair procedures until the concrete structure satisfies both the qualitative and quantitative test requirements.

3.02 RETESTING

A. Restart the test when test measurements become unreliable due to unusual precipitation or other external factors.

B. If leakage from the structure exceeds the specified criteria, in each 24-hour period over a period of five consecutive days, perform a retest after completing repairs.

C. It shall be permitted to immediately retest a concrete structure failing the quantitative part of the hydrostatic test when the qualitative part is passed.

D. If the concrete structure fails the second test or if not immediately retested after the first test failure, observe the interior of the concrete structure for probable problem areas. Only retest the concrete structure after the probable problem areas are repaired.

E. Retest concrete structures until they meet the required qualitative and quantitative parts of the hydrostatic leakage test. Make repairs before each retest.

3.03 REPAIR OF DEFECTIVE CONCRETE

A. See Section 03935

END OF SECTION

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SECTION 03350

CONCRETE FINISHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Finishing formed and unformed surfaces.
   2. Sealers and hardeners for concrete.

1.02 REFERENCES

A. ASTM International (ASTM):

1.	ASTM C156	Test Method for Water Retention by Concrete Curing Materials
2.	ASTM C309	Specification for Liquid Membrane-Forming Compounds for Curing Concrete
3.	ASTM C1028	Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
4.	ASTM E96	Test Methods for Water Vapor Transmission of Materials

B. "Evaluation Reports" published by the International Code Council.

C. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Qualifications: A list of at least five projects completed by the proposed subcontractor within the most recent 3 years that have concrete finishes similar to those specified for this project.

C. Product Data: Describe all products proposed for use.
   1. Manufacturer's data for chemical retarder and recommendations for use when exposed aggregate surface is specified.
   2. Provide verification of compatibility for curing compound with subsequent applied finishes, membranes and adhesives.

D. Field Samples:
   1. 2-foot-square job-prepared samples of each finish and color specified for selection and use as Control Samples. Additionally, provide the following samples for finish selection by the Owner's Representative.
      a. Medium sandblast: One sample each with No. 60 grit and No. 30 grit sand.
         1) On smooth concrete.
         2) On textured concrete.
      b. Fine broom finish.
      c. Coarse broom finish.
   2. Provide samples of mortar for filling voids and form tie holes and grout for all finishes for formed surfaces. Samples shall be applied to an inconspicuous

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area for selection of color match by the Owner's Representative prior to proceeding with finishes.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: Use skilled cement finishers to perform all work.

B. Regulatory Requirements: Comply with applicable requirements in the International Building Code, including without limitation Chapters 10, 11A, 11B, and 19.

PART 2 - PRODUCTS

2.01 MORTAR FOR FILLING VOIDS

A. Mortar for Filling Voids: One part portland cement, two parts sand by volume mixed with only enough water to form a ball when squeezed by hand. A mixture of white and grey portland cement is required for color match (approximately 1 part white to 2 parts grey). Add mineral oxide colors as required to match colored concrete. Substitute non-reemulsifiable, acrylic bonding agent for one-third of mixing water. Test several different mixes for color match and obtain favorable review prior to proceeding.

2.02 GROUT FOR A SACKED FINISH ON FORMED SURFACES

A. Grout for a Sacked Finish: One part by volume portland cement and 1-1/2 parts sand meeting the requirements of ASTM C144 or ASTM C404, with sufficient water to produce the consistency of thick paint A mixture of white and grey portland cement is required for color match. Add mineral oxide colors as required to match colored concrete. Test samples for color match and obtain favorable review prior to proceeding.

PART 3 - EXECUTION

3.01 FINISHING UNFORMED SURFACES

A. General:
   1. Place concrete at a rate that allows spreading, straight-edging, and darbying or bull-floating before bleed water appears.
   2. Strike smooth the top of walls, buttresses, horizontal offsets, and other similar unformed surfaces and float them to a texture consistent with finish of adjacent formed surface.
   3. Provide a surface finish on exterior and interior horizontal concrete slabs that has a coefficient of friction not less than 0.60 for level surfaces and 0.80 for surfaces sloped 1:20 or greater. Measure friction coefficients in accordance with ASTM C1028
   4. Review grades shown and recommend any adjustments necessary to achieve minimum specified slope.
      a. For exterior paving surfaces provide a minimum slope of 1% (1/8-inch per foot) to drain surface water to catch basins, drains or edges of pavement adjacent to landscaping and drainage swales.
      b. Slopes shall conform to the requirements of IBC Chapters 10, and 11.

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5. Slope interior floor surfaces containing floor drains to drain water to the drains. Review elevations shown on Drawings for adequate slopes before setting grades. Report any conditions that will not provide adequate drainage or that will produce excessively steep slopes before proceeding.
6. Finish slabs so they do not deviate more than ¼-inch (6.3 mm) in 10 feet from a straight edge. Finish elevations to within 1/8-inch (3.2 mm) elevations shown or required to match adjacent existing conditions. Provide "as-built" slopes for drainage no less than those shown or specified.
7. Allowed Tolerance for individual risers and treads in any flight of stairs:
    a. ¼-inch (6.3 mm) between the lowest and highest riser.
    b. 3/8-inch (9.5 mm) between the deepest and shallowest tread measured in the direction of travel.
8. Slope all treads 1/8-inch (3.2 mm) down toward the nosing for drainage.
9. Finish edges and surfaces smooth, true and clean.
10. Apply finish to slabs as soon as the concrete can support the weight of the workmen.
11. Increase the humidity of the air directly above the concrete surface, prior to and during finishing operations by adding a fine fog mist of water to the air with mist nozzles when atmospheric conditions (temperature, humidity, and wind) are such that rapid evaporation of mixing water from the concrete is likely to occur.
12. When the finish is not specified, use one of the following finishes:
    a. Scratch Finish: For surfaces intended to receive bonded cementitious mixtures.
    b. Float Finish: For walks, drives, steps, ramps, and for surfaces intended to receive waterproofing, roofing, insulation, or sand-bed terrazzo.
    c. Trowel Finish: For exposed slab surfaces in environmental basin and containment structures. For floors intended as walking surfaces, and floors in processing, storage, and warehousing areas.

B. Float Finish and Preliminary Steps for Other Finishes:
1. Applies to slab surfaces indicated to have a wood or magnesium Float finish. This finish is also the initial step for all other finishes.
2. Place, consolidate, strike off, and level concrete, eliminating high and low spots.
3. Screed to grade using a strike-off board guided on accurately set screeds.
4. Work the surface with a bull or darby float to embed large aggregate, consolidate surface mortar and create a smooth true surface
5. Do not work concrete further until it is ready for floating.
6. When surface has taken initial set and bleed water has disappeared work surface with wood floats followed by magnesium floats (if a magnesium float finish is called for) to even out slight irregularities and further consolidate surface
7. Begin floating with a hand float, a bladed power float equipped with float shoes, or a powered disk float when the bleed water sheen has disappeared and the surface has stiffened sufficiently to permit operation of the specific float apparatus.
8. Produce a finish that will meet tolerance requirements of ACI 117 for a conventional surface. Refloat the slab immediately to a uniform texture.
9. When concrete has set further so that excess water and fine material will not be brought to the surface, either begin the first steel troweling if this is the preliminary step for other finishes or work the surface with magnesium or wood float if this is the final step in a Float finish. Work the surface sufficiently

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to consolidate the mortar and produce a finished surface at the proper grade that is free of voids, ripples or other defects. Apply a final swirl texture finish in a fan pattern with the wood or magnesium float. Retool slab edges and control joints. Leave a uniform smooth border around all slab edges and each side of control joints.

10. Do not overwork the surface or add dry materials such as sand or cement .

C. Trowel Finish:
   1. Applies to all slabs indicated to receive a Trowel finish.
   2. Complete the work required under “Preliminary Steps for Other Finishes.”
   3. Apply a second steel troweling after the concrete has set sufficiently so mortar does not adhere to the edge of the trowel and sufficient pressure can be applied to further consolidate the surface.
   4. Apply a third steel troweling when the concrete has set sufficiently so the trowel produces a ringing sound. Apply sufficient pressure so the trailing edge of the trowel will produce a dense smooth surface without burning.
   5. Apply a fourth troweling and additional trowelings as required to produce a dense smooth finish.
   6. Produce a finish that meets ACI 117 tolerances for concrete floors for a moderately flat surface.
   7. Addition of water to surface during finishing is prohibited.

D. Broom Finish:
   1. Applies to all slabs indicated to receive a Broom finish.
   2. Complete work required under “Preliminary Steps for Other Finishes.”
   3. Apply second and third steel trowelings after the concrete has set sufficiently so mortar does not adhere to the edge of the trowel and sufficient pressure can be applied to further consolidate the surface.
   4. Broom texture the surface of the slab at right angles to the normal direction of traffic. Use a stiff fiber bristled broom for Coarse Broom Finish and a fine hair broom for Fine Broom Finish. Match selected control sample.

E. Detail Work: Applies to all concrete flatwork and to exposed top edges of all formed concrete.
   1. Edging Slabs: Tool a 3/8-inch radius on all exposed edges of slabs, stair treads, curbs and other exposed horizontal edges unless a formed chamfered edge is indicated, or as otherwise noted on the Drawings. Repeat tooling with each floating or troweling operation.
   2. Apply a Trowel finish to the top of the formed walls, curbs and machine bases.
   3. Control Joints and Feature Grooves:
      a. Cut 1-inch-deep control joints with rounded edges in all paving slabs where indicated but not more than 8 feet apart in each direction. Repeat tooling with each floating or troweling operation.
      b. Run decorative feature grooves with a ¼-inch-deep rounded tool before the final troweling in paving where shown.

F. Cement Finishers Finish:
   1. Use for curb faces, stair risers and other vertical formed surfaces customarily stripped and finished the same day they are placed and before the concrete fully sets.
   2. Use form work specially designed for removal before the concrete sets.
   3. Remove forms when concrete has achieved initial set and is stiff enough to retain its own shape but before it fully sets.

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4. Work over surface with a moist wood or rubber float and cement paste to fill minor voids and consolidate the surface. Fill holes and larger voids with mortar but do not build up a coating of mortar over the entire formed surface. Finish with a fine hairbrush.

3.02 FINISHING FORMED SURFACES

A. General:
   1. After form removal, give each formed surface one or more of the finishes specified on Drawings or in the Schedule of Concrete Finishes and as described below.
   2. See the Schedule of Concrete Finishes at the end of this Section and notes and schedules on Architectural and Structural Drawings for the location, and extent and type of finish required.
   3. When a finish is not specified, finish surfaces as noted below:
      a. Environmental Surface Finish 1.0 (ESF-1.0) on concrete surfaces not exposed to view.
      b. Environmental Surface Finish 2.0 (ESF-2.0) on concrete surfaces not exposed to view and expected to contain liquids, gases, or both.
      c. Environmental Surface Finish 3.0 (ESF-3.0) on concrete surfaces exposed to view.
   4. Complete all patching and finishing within 10 days after the curing period is completed.
   5. Where the concrete surface will be textured by sandblasting or bush-hammering, repair surface defects before texturing.
   6. Use form-facing materials meeting the requirements of Section 03100.

B. As-Cast Finish:
   1. Environmental Surface Finish 1.0 (ESF-1.0):
      a. Patch voids greater than 1-1/2-inch wide or ¼-inch deep.
      b. Remove projections greater than ½-inch
      c. Patch tie holes.
      d. Surface tolerance Class C as specified in ACI 117.
      e. Leave surfaces with the texture imparted by the forms.
      f. The minimum taper required to correct offsets is 1:16.
   2. Environmental Surface Finish 2.0 (ESF-2.0):
      a. Patch voids greater than ¾-inch wide or ¼-inch deep.
      b. Remove projections greater than ¼-inch
      c. Patch tie holes.
      d. Surface tolerance Class B as specified in ACI 117
      e. The minimum taper required to correct offsets is 1:16.
   3. Environmental Surface Finish 3.0 (ESF-3.0):
      a. Patch voids greater than ½-inch wide or ¼-inch deep.
      b. Remove projections greater than 1/8-inch
      c. Patch tie holes.
      d. Surface tolerance Class A as specified in ACI 117.
      e. The minimum taper required to correct offsets is 1:16.

C. Smooth-Rubbed Finish or Filled and Rubbed Finish:
   1. Complete work required for Environmental Surface Finish 3.0 (ESF-3.0).
   2. Produce concrete finish no later than the day following formwork removal.
   3. Wet the surface and rub it with an abrasive material, such as carborundum brick, until uniform color and texture are produced.

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4. When insufficient cement paste can be drawn from the concrete itself by the rubbing process, use a grout made with cementitious materials from the same sources as used for in-place concrete.
5. The minimum taper required to correct offsets is 1:32.

D. Grout-Cleaned Rubbed Finish or Sacked Finish:
1. Complete work required for Environmental Surface Finish 3.0 (ESF-3.0).
2. Begin cleaning operations after contiguous surfaces are completed and accessible. Do not clean surfaces as work progresses.
3. Prepare grout in accordance with Part 2
4. Wet concrete surfaces and allow surface water to evaporate leaving the concrete damp but surface dry.
5. Apply grout with rubber floats to the entire surface area to be finished.
6. Work grout into and compress all air bubbles, holes, voids and surface irregularities.
7. Compress grout in voids with cork floats.
8. When grout has become stiff, but is still plastic, remove all excess from surface with rubber squeegees or cork floats.
9. After the surface whitens from drying (about 30 minutes at normal temperature) clean the surface by rubbing vigorously with clean burlap wrapped around wood blocks.
10. Keep the surface damp for 48 hours.

3.03 SCHEDULE OF CONCRETE FINISHES

A.	**SLABS**		**LOCATION OF FINISH**
1.	Float Finish	3.01B	Applies to slab surfaces indicated to receive a "Float Finish". This finish is also the initial steps for all other finishes. Applies to walks, drives, steps, ramps, and for surfaces intended to receive waterproofing.
2.	Trowel Finish	3.01C	Applies to slabs indicated to receive a " Trowel Finish." Applies to exposed slab surfaces in environmental basin and containment structures. Applies to floors intended as walking surfaces Applies to top of formed walls, curbs, equipment pads and machine bases.
3.	Broom Finish	3.01D	Applies to slabs indicated to receive a "Broom Finish" and to all exterior pavingand stair treads. Broom Finish for Exterior pavingand stair treads shall be a Coarse Broom Finish.
4.	Cement Finishers Finish	3.01F	Applies to curb faces, stair risers and other vertical formed surfaces customarily finished the same day they are placed and before the concrete fully sets.
B.	**FORMED SURFACES**		
1.	As-Cast Finish	3.02B	Applies to walls and other vertical and horizontal formed surfaces, including beams and columns indicated to receive an As-Cast Finish and to all concrete surfaces where no specific finish is indicated. When a finish is not specified, finish surfaces as noted below: a. Environmental Surface Finish 1.0 (ESF-1.0) on concrete surfaces not exposed to view. b. Environmental Surface Finish 2.0 (ESF-2.0) on concrete surfaces not exposed to view and expected to contain liquids, gases, or both. c. Environmental Surface Finish 3.0 (ESF-3.0) on concrete surfaces exposed to view.

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2.	Smooth-Rubbed Finish or Filled and Rubbed Finish	3.02C	Applies where indicated and to interior walls and ceilings of of tanks from 1-foot below the lowest operating liquid level to the bottom of the tank.
3.	Grout-Cleaned Rubbed Finish or Sacked Finish	3.02D	Applies where indicated and to interior walls of tanks from 1-foot below the lowest operating liquid level to the top of the wall.

END OF SECTION

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SECTION 03600

GROUTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Non-shrink cementitious grout (non-shrink grout).
   2. Non-shrink epoxy grout.
   3. Cement grout.
   4. Concrete grout. (Masonry grout is covered in Section 04050.)
   5. Swept-in grout.

1.02 REFERENCES

A. ASTM International (ASTM):
   1. C531 Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacings and Polymer Concretes.
   2. C827 Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
   3. 1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
   4. D695 Standard Test Method for Compressive Properties of Rigid Plastics.

B. U.S. Army Corps of Engineers Standard (CRD):
   1. CRD C-621 Corps of Engineers Specification for Non-shrink Grout.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data: Submit product data for all grout products specified in Part 2 of this Section. Product data shall include:
   a. Catalog information,
   b. Technical data,
   c. Storage requirements,
   d. Product life,
   e. Working time after mixing,
   f. Temperature considerations,
   g. Conformity to required ASTM Standards and Material Safety Data Sheet (MSDS),
   h. Type and brand of the cement,
   i. Gradation of the fine aggregate, and
   j. Proposed admixtures and the proposed mix of the grout for non-packaged mixes.
   k. Concrete grout: The submittal shall include data as required for concrete as delineated in Section 03300 and for fiber reinforcement as delineated in Section 03200. This includes the mix design, constituent quantities per cubic yard and the water/cement ratio.

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l. Swept-in grout: The submittal shall include data as required for concrete as delineated in Section 03300 and for fiber reinforcement as delineated in Section 03200. This includes the mix design, constituent quantities per cubic yard and the water/cement ratio.

C. Samples:
1. Field samples for color control, if a color match is required.

D. Quality Control:
1. Laboratory Test Reports:
a. Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.
2. Certifications:
a. Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water per NSF 61 after 30 days curing.
3. Qualifications:
a. Submit documentation that grout manufacturer has at least 3 years experience in the production and use of the proposed grouts which they will supply

1.04 QUALITY CONTROL

A. Qualifications:
1. Grout manufacturer shall have a minimum of 3 years experience in the production and use of the type of grout proposed for the work.

1.05 QUALITY ASSURANCE

A. Special Inspection shall be completed by the Owner’s Representative.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers and printed instructions.

B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 12 months or the manufacturer's recommended storage time, whichever is less.

C. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional cost to the Owner.

D. Non-shrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

E. Non-shrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-shrink Cementitious Grout (Non-shrink Grout):

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1. Non-shrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Non-shrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.
    a. General purpose non-shrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Euco NS by The Euclid Chemical Co.; Five Star Grout by Five Star Products, Inc.; or approved equal.
    b. Flowable (Precision) non-shrink cementitious grout shall conform to the standards stated above and shall be Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Five Star Grout by Five Star Products Inc.; or approved equal.

B. Non-shrink Epoxy Grout:
1. Non-shrink epoxy-based grout shall be a pre-proportioned, three-component, 100% solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30 x 10-6-inch per inch per degree F when tested in conformity with ASTM C531. The grout shall be Five Star HP Epoxy Grout by Five Star Products.; Sikadur 42 Grout-Pak by Sika Corp.; E3-G Epoxy Grout by the Euclid Chemical Co.; or approved equal.

C. Cement Grout:
1. Cement grouts shall be a mixture of one part Portland Cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout:
1. Concrete grout shall conform to the requirements of Section 03300 except as specified herein. Proportion with Type II Portland Cement, pozzolan, coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having an average strength of 3500 psi at 28 days (2500 psi nominal strength). Coarse aggregate size shall be 3/8-inch maximum. Slump shall not exceed 5 inches. Minimum cement content shall be 540 lbs per cubic yard and maximum water-to-cement ratio shall be 0.45.
2. Add synthetic reinforcing fibers as specified in Section 03200 to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Add fibers from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Water:
1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

F. Like materials in areas of common viewing shall be the products of one manufacturer or supplier in order to provide standardization of appearance.

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Baseplate grout thicknesses are typically shown on the Drawings; confirm that the selected grout product is recommended for the grout thicknesses shown.

PART 3 - EXECUTION

3.01 PREPARATION

A. Place grout over cured concrete that has attained its full design strength unless otherwise approved by the Owner's Representative.

B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may affect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.
   1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the airline to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil or other deleterious substances from metal embedments or bottom of baseplates prior to the installation of the grout.

E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the City Representative. Upon completion of the 24-hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the City Representative for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.
   1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Owner's Representative.

3.02 INSTALLATION – GENERAL

A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.

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B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40° and 90° F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with grout are outside of the 60° and 90° F range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.

F. Continue all existing underlying expansion, control and construction joints through the grout.

3.03 INSTALLATION – CEMENT GROUTS AND NON-SHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Owner’s Representative.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is required if recommended by the manufacturer. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3-inch in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement shall proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45-degree angle from the lower edge of bearing plate unless otherwise approved by the City Representative. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved

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means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION – NON-SHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60° or above 90° F.

C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 INSTALLATION - CONCRETE GROUT

A. Inspect slabs finished under Section 03350 and scheduled to receive concrete grout. Protect and keep the surface clean until placement of concrete grout.

B. Clean and Roughen surface in accordance with preparation instructions above. Do not flush debris into structure drain piping.

C. Saturate the concrete surface in accordance with instructions above. . Place cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8-inch thick cement paste. A bonding grout composed of 1-part portland cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.

D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to eliminate high and low spots. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.

E. Provide grout control joints as indicated on the Drawings.

F. Steel trowel finish as specified in Section 03350. Cure the concrete grout as specified for cast-in-place concrete in Section 03300.

3.06 SCHEDULE

A. The following list indicates where the particular types of grout are to be used:

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1. General purpose non-shrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-foot wide by 3-foot long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
2. Flowable non-shrink cementitious grout: Use under all base plates greater in area than 3-foot by 3-foot. Use at all locations indicated to receive flowable non-shrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable non-shrink grout for general purpose non-shrink cementitious grout.
3. Non-shrink epoxy grout: Use for the setting of anchor rods, anchor bolts and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
4. Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, micropiles, etc. It shall not be used when non-shrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.
5. Concrete grout: Use at all locations indicated on the Drawings to receive concrete grout.

3.07 FIELD QUALITY CONTROL

A. Field Testing:
1. Field testing and inspection services other than Special Inspection required shall be provided by the Contractor. The Contractor shall complete the sampling of materials and shall provide any ladders, platforms, etc., for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
2. The field testing of concrete grout shall be as specified for concrete in Section 03300.

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SECTION 03935

REPAIR OF DEFECTIVE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Repair of defective concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 117 Standard Tolerances for Concrete Construction and Materials
   2. ACI 301 Specifications for Structural Concrete for Buildings
   3. ACI 318 Building Code Requirements for Structural Concrete
   4. ACI 347 Guide to Formwork for Concrete
   5. ACI 350 Environmental Engineering Concrete Structures

B. ASTM International (ASTM) Standard Specification or Test Method:
   1. ASTM C881 Epoxy-Resin-Base Bonding Systems for Concrete.
   2. ASTM C882 Bond Strength of Epoxy-Resin Systems Used with Concrete By Slant Shear.
   3. ASTM C883 Effective Shrinkage of Epoxy-Resin Systems Used with Concrete.
   4. ASTM D570 Water Absorption of Plastics.
   5. ASTM D638 Tensile Properties of Plastics.
   6. ASTM D695 Compressive Properties of Rigid Plastics.
   7. ASTM D732 Shear Strength of Plastics by Punch Tool.
   8. ASTM D790 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

C. NSF/ANSI 61 – Drinking Water System Components – Health Effects

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
   1. When stains, rust, efflorescence, and surface deposits must be removed, submit the proposed materials and manufacturer’s instructions for removal.
   2. When crack repair is required, submit the proposed materials and manufacturer’s method of repair.

C. Shop Drawings:
   1. Repair Plan: After defects are identified and investigated, prepare and submit a repair plan that includes a listing of repairs to be made and the detailed surface preparation, products, methods, curing and finishing requirements of repair to be used at each location.
   2. Submit manufacturer’s technical literature on products proposed for use. Include the manufacturer’s installation and/or application instructions.

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D. Samples: Submit any item of Product Data not fully assembled by a single manufacturer.

1.04 QUALITY ASSURANCE

A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until authorization is given by the Engineer.

B. When removing materials or portions of existing structures and when making openings in existing structures, take all precautions and erect all necessary barriers, shoring and bracing and other protective devices to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust and to prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown or specified, sawing and/or line drilling will be required in cutting existing concrete.

C. Manufacturer’s Qualifications: Minimum of ten years’ experience in the manufacture of the products specified and an ongoing program of training, certifying and technically supporting the Contractor's personnel.

D. Contractor Qualifications: Complete a program of instruction in the application of the approved manufacturer's material specified in this Section and provide certification from the manufacturer attesting to their training and status as an approved applicator.

E. Certifications:
   1. Certification that the materials meet the requirements of this Section and have the manufacturer's current printed literature on the specified product.
   2. Certification that materials to be applied to concrete surfaces in contact with potable water or water to be treated for potable use shall be approved by NSF/ANSI 61 – Drinking Water System Components – Health Effects for use in contact with potable water after 30 days.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver the specified products in original, unopened containers displaying the manufacturer's name, labels, product identification and batch numbers.

B. Store and condition products as recommended by the manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide materials to be applied to concrete surfaces in contact with potable water certified by NSF 61 for use in contact with potable water.

2.02 CEMENT REPAIR MORTAR

A. Cement repair mortar may be either site-mixed portland-cement repair mortar for small repairs or commercial cement repair mortar patching products for larger areas. See Section 03300.

B. Site Mixed Portland-Cement Repair Mortar:

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1. Mix repair mortar using the same materials as concrete to be patched with no coarse aggregate. Do not use more than one-part portland cement to two parts sand by damp loose volume.
2. For repairs in exposed concrete, make trial batches and check color compatibility of repair material with surrounding concrete. Prepare several trial batches and make test samples in an inconspicuous location for review. When the repair is too dark, substitute white portland cement for a part of the gray cement to produce a color and texture closely matching the surrounding concrete.
3. Use a repair mortar at a stiff consistency with no more mixing water than is necessary for handling and placing. Mix the repair mortar and turn the mortar frequently with a trowel without adding water. Use mortar at a stiff consistency.
4. For concrete removal resulting in cavities exceeding 3 inches in depth and 1 square foot in area, pack the void with a mixture of cement, concrete sand and pea gravel proportioned as follows:

Material	Volumes	Weights
Cement	1.0	1.0
Sand	1.0	1.0
Pea Gravel	1.5	1.5

C. Commercial Cement Repair Mortar:
1. Portland-cement mortar modified with a latex bonding agent conforming to ASTM C1059 Type II.
2. Epoxy mortars and epoxy compounds that are moisture-insensitive during application and that, after curing, embody an epoxy binder conforming to ASTM C881 Type III. The type, grade, and class shall be appropriate for the application as specified in ASTM C881.
3. Shrinkage-compensating or non-shrink portland-cement grout conforming to ASTM C1107.
4. Packaged dry concrete repair materials conforming to ASTM C928.
5. Products: Poly-Patch by Euclid Chemical Company; Emaco R310 by BASF Chemical Company; Sikatop 122 Plus by Sika Chemical Corporation or approved equal only if approved by the Engineer for use and for color match.

D. Provide cement repair mortar with strength and modulus of elasticity compatible with the parent concrete.

2.03 EPOXY BONDING AGENT

A. See Section 03150.

B. Two-component, solvent-free, asbestos-free moisture insensitive epoxy resin material used to bond plastic concrete to hardened concrete and complying with the requirements of ASTM C881, Type II and the additional requirements specified herein.

C. Provide grey colored epoxy bonding agent.

D. Products:Sikadur 32, Hi-Mod by Sika Corporation, Lyndhurst, NJ; Concresive by BASF, Shakopee, MN; or approved equal.

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2.04 EPOXY PASTE

A. Two-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used to bond dissimilar materials to concrete and shall comply with the requirements of ASTM C881, Type I, Grade 3. It may also be used to patch existing surfaces where the glue line is 1/8-inch or less.

B. Provide grey colored epoxy paste.

C. Products: Sikadur 31 Hi-mod Gel by Sika Corporation, Lyndhurst, NJ; Concresive Paste LPL by BASF, Shakopee, MN; or approved equal.

2.05 NON-SHRINK GROUT AND NON-SHRINK EPOXY GROUT

A. See Section 03600.

2.06 STRUCTURAL CRACK REPAIR EPOXY ADHESIVE

A. Two-component, solvent-free, moisture insensitive epoxy resin material suitable for crack grouting by injection or gravity feed. Formulate for the specific size of opening or crack being repaired.

B. For surfaces containing potable water or water to be treated for potable use that are repaired by the epoxy adhesive injection system , Provide an acceptable epoxy coating approved by the NSF and FDA for use in contact with potable water.

C. For standard applications: Sikadur 35 Hi-Mod LV by Sika Corporation, Lyndhurst, NJ; SCB Concresive 1380 by BASF, Shakopee, MN; or approved equal.

D. For applications thinner than allowed by Hi-mod LV: Sikadur 35 Hi-Mod LV LPL by Sika Corporation, Lyndhurst, NJ; SCB Concresive 1360 by BASF, Shakopee, MN; or approved equal.

E. For potable-water applications: epoxy coatings used to cover crack repairs must be approved by both NSF and FDA for use in contact with potable water.

2.07 FLEXIBLE CRACK REPAIR EXPANDING POLYURETHANE CHEMICAL GROUT

A. High solids, hydrophobic polyurethane, liquid chemical grout suitable for pumping into cracks and voids (honeycombed) to stop water infiltration. Formulate for the specific size of opening or crack being injected. One component product with accelerator. Permanently flexible product.

B. For concrete surfaces containing potable water or water to be treated for potable use Provide a polyurethane expanding chemical grout system with an acceptable polyurethane chemical grout approved by the NSF/ANSI 61 for use in contact with potable water.

C. Products: SikaFix HH by Sika Corporation, Lyndhurst, NJ; Concresive 1230 IUG by BASF, Shakopee, MN; or approved equal.

2.08 ADHESIVE ANCHORS

A. See Section 05090.

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PART 3 - EXECUTION

3.01 GENERAL

A. Inspect concrete surfaces immediately after carefully removing forms. Repair tie holes and surface defects immediately after formwork removal. Defective work includes concrete out of line, level or plumb; cracks; poor joints; rock pockets; honeycomb; voids; spalls and exposed reinforcing. Patch minor defects, including form tie holes, before the concrete is thoroughly dry. Do not interrupt the curing program. Ensure that repairs match the existing surface for color and texture.

B. Large areas involving voids or rock pockets extending through the section may be cause for rejection of the work. If acceptable repairs can be made without adversely affecting the structural integrity of the work, cut out the section and either dry pack, or reform and re-pour to match the adjacent concrete. Do not cut the reinforcing, but cut keyways into the adjacent sound concrete to securely fasten the patch to the original work.

C. Plug tie holes except where stainless steel ties, noncorroding ties, or acceptably coated ties are used, except plug tie holes in concrete surfaces exposed to liquid. When portland-cement patching mortar is used for plugging, clean and dampen tie holes before applying the mortar. When other materials are used, apply them in accordance with manufacturer’s recommendations.

D. Cut, repair, remove, or otherwise modify parts of the existing structures or appurtenances, as indicated on the Drawings, specified, or necessary to complete the work. Finishes, joints, reinforcements, sealants, etc, are specified in their respective sections.

E. Store, mix and apply commercial products in strict compliance with the manufacturer's recommendations.

F. Preserve the isolation between components on either side of the joint in cases where concrete is repaired in the vicinity of an expansion joint or control joint.

G. When drilling holes for dowels/bolts, stop drilling if rebar is encountered. As approved by the Engineer, relocate the hole to avoid rebar. Do not cut rebar without prior approval by the Engineer. Identify rebar at all locations where possible, prior to drilling using nondestructive rebar locator equipment so that drill hole locations may be adjusted to avoid rebar interference.

H. Keep rebar a minimum of 1-inch away from all embedded metallic piping, wall thimbles, spools, sleeves, and similar metals to avoid the creation of an electrically continuous path.

I. Remove stains, rust, efflorescence, and surface deposits.

3.02 CONCRETE REMOVAL

A. Line drilling at limits of removal followed by chipping or jack-hammering, concrete designated to be removed to specific limits as directed by the Engineer. Proceed carefully to avoid damage to reinforcement. When chipping is necessary, leave chipped edges perpendicular to the surface or slightly undercut. Do not feather edges. Remove concrete in such a manner that surrounding concrete and existing reinforcing to be left in place and existing in place equipment are not damaged. Only sawcut at limits of concrete to be removed after obtaining written approval from the Engineer.

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B. Apply a coating or surface treatment of epoxy paste to a thickness of ¼-inch where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the cut surface.

C. Saw cut to a 1-inch depth on exposed surfaces of the existing concrete where the joint between new concrete or grout and existing concrete will be exposed in the finished work

D. Repair concrete specified to be left in place in accordance with repair notes above.

3.03 CONCRETE SURFACE PREPARATION AND REPAIR

A. Prepare connection surfaces as specified below for concrete areas requiring patching, repairs or modification as directed by the Engineer.

B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by mechanical or physical means, i.e. – water blasting, chipping, etc. Uniformly roughen the concrete surface to approximately ¼-inch amplitude with pointed chipping tools. Thoroughly clean surface of loose or weakened material by sandblasting or air blasting. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete.

C. If honeycomb exists around reinforcement or if reinforcing steel is exposed, it must be mechanically cleaned to remove all loose material, contaminants, rust, etc. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1-inch. Reinforcing to be incorporated in new concrete shall not be damaged during the removal operation.

D. The following are specific concrete surface preparation and repair "methods" to be used where directed by the Engineer.

1. Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly saturate with water and maintain saturation for a period of at least 12 hours. Dampen the area to be patched, plus another 6 inches around the patch area perimeter. Prepare bonding grout by mixing approximately one part cement and one part fine sand with water to the consistency of thick cream. Thoroughly brush bonding grout into the surface. When the bonding grout begins to lose water sheen, apply cement repair mortar, in accordance with Section 03300, and thoroughly consolidate mortar into place. Strike off mortar, leaving the patch slightly higher than the surrounding surface to permit initial shrinkage. Leave the patch undisturbed for 1 hour before finishing. Keep the patch damp for 7 days.
2. Method B: After the existing concrete surface has been roughened and cleaned, apply epoxy bonding agent at connection surface. Comply with the manufacturer’s recommendations for the field preparation and application of the epoxy bonding agent. Place new concrete or grout mixture within time constraints recommended by the manufacturer to ensure bond. Thicker repairs may require build-up in successive 1-1/2-inch layers on successive days. Form surfaces as required to prevent sagging.
3. Method C: Install adhesive anchors or dowels; strictly comply with the manufacturer’s recommendations.
4. Method D: Combination of Methods B and C.

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3.04 GROUTING

A. Grouting in accordance with Section 03600.

3.05 CRACK REPAIR

A. Repair cracks in liquid containing concrete structures with widths greater than 0.010 inches and cracks 1/32-inch or wider in other surfaces. Repair leaking cracks.

B. Repair cracks on horizontal surfaces by gravity feeding crack repair epoxy adhesive into cracks per manufacturer's recommendations. Pressure inject if cracks are less than 1/16-inch in width.

C. Repair cracks on vertical surfaces by pressure injecting crack repair epoxy adhesive or expanding polyurethane chemical grout through valves sealed to surface with epoxy paste per manufacturer's recommendations.

D. For structural nonmoving cracks that require structural bonding of cracked surfaces, use epoxy adhesive injection materials and methods.

E. For leaking cracks and cracks that have movement, use expanding polyurethane chemical grouts that have been premixed and injected into the structure in accordance with manufacturers' recommendations.

F. Complete crack repairs before conducting the hydrostatic leakage test.

3.06 WATERSTOPS

A. Where waterstops are called to be placed lying flat against existing concrete, thoroughly clean the concrete surface of all debris and bond the waterstop to the concrete using an approved epoxy bonding agent. See Section 03150.

3.07 CONCRETE FINISHING

A. Refer to Section 03350.

3.08 FIELD QUALITY CONTROL

A. Concrete Curing:
   1. See Section 03330.
   2. Record procedures and equipment is available for controlling concrete temperature during hot and cold weather conditions.
   3. Record actual time of application of curing materials for each placement.

3.09 CLEANUP

A. Upon completion of all work performed under this Section, remove from the site all excess materials, storage facilities and temporary facilities. Smooth and clean of debris all areas that were used or occupied during concrete construction operations and leave in first-class condition.

END OF SECTION

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SECTION 05090

STRUCTURAL METAL FASTENERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. All anchors, including mechanical and adhesive anchors, adhesive rebar dowels, eye bolts, turnbuckles, cable clamps, bolts, nuts, washers, inserts, and other metal fasteners not specified elsewhere.

B. Related Sections:
   1. Section 03200: Reinforcing Steel
   2. Section 03300: Cast-in-Place Concrete
   3. Section 05100: Structural Metal Framing
   4. Section 05500: Metal Fabrications (Miscellaneous Metal)

1.02 REFERENCES

A. American Institute of Steel Construction Specifications:
   1. AISC 360-05 Specification for Structural Steel Buildings

B. Research Council on Structural Connections:
   1. RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2004

C. American Iron and Steel Institute (AISI)

D. American National Standards Institute:
   1. ANSI B18-2-1 Square and Hex Bolts and Screws
   2. ANSI B18-2-2 Square and Hex Nuts
   3. ANSI B18-21-1 Lock Washers
   4. ANSI B18-22-1 Plain Washers

E. American Society for Testing and Materials Standard Specifications:
   1. ASTM A123 Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
   2. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   3. ASTM A325 Structural Bolts, Steel, Heat-Treated
   4. ASTM A370 Test Methods and Definitions for Mechanical Testing of Steel Products
   5. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   6. ASTM A525 Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   7. ASTM A563 Carbon and Alloy Steel Nuts
   8. ASTM B633 Electrodeposited Coatings of Zinc on Iron and Steel
   9. ASTM E8 Test Methods for Tension Testing of Metallic Materials
   10. ASTM F436 Hardened Steel Washers
   11. ASTM F844 Washers, Steel, Plain (Flat), Unhardened for General Use

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12. ASTM F959 Compressible-Washer-Type Direct Tension Indicator for Use with Structural Fasteners
13. ASTM F1554 Anchors Bolts, Steel, 36, 55, and 105-ksi Yield Strength

F. International Code Council (ICC)
1. Evaluation Service Reports
2. AC 193 Acceptance Criteria for Mechanical Anchors in Concrete Elements
3. AC 308 Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements

G. California Building Code (CBC) 2019 Edition.

H. Federal Specifications A-A-1922A Type 2 only, A-A01923A Type 4 only and A-A-55614 for Expansion and Shield-Type Anchors.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data:
1. Adhesive anchors, reinforcing steel dowels and expansion anchors.
2. Insulation between dissimilar metals.

C. Samples: Manufacturer's latest standard product: Specify special or unique products.

D. ICC Evaluation Service Reports for all anchors submitted demonstrating compliance with 2019 CBC and ICC AC 193 or 308 for Mechanical or Adhesive anchors respectively. Report shall demonstrate approval for use in cracked concrete in Seismic Design Categories A-F.

E. List of all anchors to be used including:
1. Location, diameter, number and length of anchors
2. Testing plan for anchors, including percentage of anchors to be tested and allowable loads for anchors and testing loads.

1.04 QUALITY ASSURANCE

A. General:
1. Furnish materials and fabricated items from an established and reputable manufacturer or supplier.
2. Supply all new materials and fabricated items made from first class ingredients and construction and guaranteed to perform the service required.
3. For adhesive anchorage, Contractor shall be trained by anchor product manufacturer representative and be provided with a certificate or card of completion, to be available upon request by the Special Inspector.

B. Codes and Standards:
1. Bolting:
a. General: AISC Specifications.

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C. Tests:
   1. General: The Contractor shall provide Special Inspection, defined by IBC Chapter 17. The Contractor shall provide and pay for Special Inspection for mechanical and adhesive anchoring systems as required by ICC-ES. Installation inspection shall be periodic special inspection. Continuous Special Inspection shall be required for load testing below.
   2. Mechanical expansion and adhesive anchoring systems:
      a. Test required anchors to the loads in this table:

Test Loading for Simpson Set XP Anchors						
Embedment (in)	Edge Distance (in)	Diameter				
		½"	5/8"	¾"	7/8"	1"
$h_e \geq 8$"	$c_{min} > 1.75$	180	100	140	60	90
	$4 \geq c_{min} < 6$	1200	800	1000	600	700
	$6 \leq c_{min}$	2000	2000	2200	1500	1800
$7 < h_e < 8$"	$c_{min} > 1.75$	100	100	100	100	Note 1
	$4 \geq c_{min} < 6$	1200	800	1000	600	Note 1
	$6 \leq c_{min}$	200	200	2200	1500	Note 1
$6 < h_e < 7$"	$c_{min} > 1.76$	100	100	100	Note 1	Note 1
	$4 \geq c_{min} < 7$	1000	1500	800	Note 1	Note 1
	$6 \leq c_{min}$	2100	1500	1900	Note 1	Note 1
$5 < h_e < 6$"	$c_{min} > 1.77$	100	100	Note 1	Note 1	Note 1
	$4 \geq c_{min} < 8$	800	600	Note 1	Note 1	Note 1
	$6 \leq c_{min}$	1900	1300	Note 1	Note 1	Note 1
$4 < h_e < 5$"	$c_{min} > 1.78$	100	Note 1	Note 1	Note 1	Note 1
	$4 \geq c_{min} < 9$	900	Note 1	Note 1	Note 1	Note 1
	$6 \leq c_{min}$	2000	Note 1	Note 1	Note 1	Note 1
Note 1: Configuration requires special approval and consideration from the Engineer. Contractor shall not install or test this configuration without favorable review from Engineer.						

      b. Expansion and adhesive anchors shall be tested as follows:
         1) Test 10% of anchors used for sill plate bolting applications
         2) Test 50% of anchors used for non-structural applications, such as equipment anchorage.
         3) Test 100% of anchors for applications not listed above.
      c. Undercut anchors that allow visual confirmation of full set need not be tested.
      d. Visual inspection of layout including horizontal location, minimum embedment, minimum cover, minimum spacing, and minimum edge distance.
      e. Test anchors by a calibrated torque wrench, direct pull with a hydraulic jack, or a calibrated spring loaded devices.Testing shall be performed on a

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single anchor and shall be done in a “confined” manner. (define confined test)

f. Anchors tested using the torque wrench shall achieve the load within ½ turn of the nut. (need to define how tight nut is before testing)

g. Anchors tested using a hydraulic ram shall be tested to the required load for a minimum of 15 seconds and shall not exhibit any discernable movement during the loading, such as loosening of the washer under the nut or an observable gap.

D. Additional Tests: Provide and pay for all necessary additional tests made on welds or bolts required to repair or replace faulty work performed during the original fabrication.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle, ship and store material in a manner that will prevent distortion, rust, damage to the shop coat or any other damage.

B. Store material in a clean, properly drained location out of contact with the ground.

C. Ensure that dissimilar metals are not in contact with each other.

D. Replace or repair all damaged material in an approved manner.

PART 2 - PRODUCTS

2.01 METAL FASTENERS

A. General

1. For buried, submerged, or conditions where anchors or fasteners will be continuously or intermittently wet, except where otherwise shown or specified, all bolts, anchor bolts, mechanical anchors, adhesive anchors, washers, and nuts shall be 316 stainless steel .
2. For exterior or exposed conditions provide 316 stainless steel except where otherwise shown or specified.
3. For all other exposure conditions provide hot dipped galvanized materials, except where otherwise shown or specified.

B . Bolting – Steel

1. Bolts: High Strength Bolts: ASTM 325, heavy hex, Type 1 (High Strength Bolts) OR ASTM A307, Grade A (Regular Hexagon Bolts)
2. Nuts: ASTM A563, heavy hex, Grade DH (High Strength Nuts) OR ASTM A563, Grade A (Regular Hexagon Nuts)
3. Washers: ASTM F436, Type 1, hardened (High Strength Bolt Washers) OR ASTM F 844 (Regular Bolt Circular Washers)
4. Lock Washers: ANSI B18.21.1
5. High Strength Direct Tension Indicators: ASTM F959.
6. Dimensional Requirements:
   a. Bolts: ANSI B18.2.1.
   b. Nuts: ANSI B18.2.2.

C. Bolting – Stainless Steel

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1. Stainless Steel Bolts: AISI 316. ASTM A193 or F593.18-8 material is not acceptable.
2. Stainless Steel Nuts: ASTM A194 or F594.
3. Washers: AISI 316 washers meeting the dimensional requirements of ASTM F436
4. Dimensional Requirements:
    a. Bolts: ANSI B18.2.1.
    b. Nuts: ANSI B18.2.2.

D. Cast-in-Place Anchor Bolts
1. Headed Anchors: ASTM F1554, Grade 36, unless Grade 55 or 105 is shown on Drawings. High Strength anchors on Drawings shall be Grade 55 minimum.
2. Threaded & Nutted Anchors: ASTM F1554, Grade 36 with threaded ends and double hex nuts at the anchored end, or with washer between anchoring nuts if shown on the drawings. Use heavy hex nuts for rods 1¾" diameter or greater. Provide Grade 55 or 105 if shown on the Drawings and use heavy hex nuts. High Strength anchors on Drawings shall be Grade 55 minimum.
3. Welded Headed Studs or Welded Hooked Studs: AWS D1.1, Grade B, fut = 60 ksi, fy = 50 ksi.
4. Hooked Anchors (J and L Bolts): Are not allowed unless specifically shown on the Drawings as they do not provide equivalent performance. If shown, provide ASTM F1554, Grade 36, unless Grade 55 or 105 is shown on Drawings. High Strength anchors on Drawings shall be Grade 55 minimum.
5. Hooked anchor bolts shall <u>not</u> be used in concrete masonry unit construction.
6. Provide minimum embedment shown on the Drawings, or a minimum of eight bolt diameters.

E. Mechanical Anchoring Systems (friction anchors are not acceptable)
1. Mechanical Undercut Anchoring Systems (required for overhead applications)
    a. Anchor: Undercut anchor shall be of an undercut style with brazed tungsten carbides on the embedded end that perform the self-undercutting process.
    b. Carbon Steel Bolt and Sleeve:
        1) Bolt: ISO 898, class 8.8, or SAE Grade 5.
        2) Sleeve: AISI 1010.
        2) Nuts: ASTM A563 Grade A and meeting the dimensional requirements of ANSI B18.2.2.
        3) Washers: SAE 1005-1033 or AISI 1040 and meeting the dimensional requirements of ANSI B18.2.2 Type A Plain.
        4) Plating: Zinc plated in accordance with ASTM B633, SC1, Type III Fe/Zn 5.
    c. Stainless Steel Bolt and Sleeve:
        1) Bolt: AISI 316 or 316Ti.
        2) Sleeve: AISI 316 or 316Ti or Type 304 stainless steel.
        3) Nuts: DIN 934, grade 8.
        4) Washers: DIN 6796 or Type 18-8 stainless steel.
    d. Submit a product evaluation report by ICC-ES showing Cracked Concrete testing compliance per A.C.193.
    e. Provide embedment depth, edge distance, and anchor spacing as shown on the Drawings and in accordance with manufacturer's recommendations for published allowable loads.
    f. Manufacturer: Hilti, Inc. HDA Undercut Anchor, Simpson Torq-Cut (pending ICC approval) or equal.

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2. Mechanical Expansion Anchoring Systems
    a. Anchor: Expansion anchor shall be preassembled expanding sleeve or wedge type with a single piece three section wedge. Anchors shall meet the description of Federal Specification A-A 1923A or A-A 1922A, Type 4. Anchor will bear a length identification code that is visible after installation. Provide hex head stud style unless flat or rod coupler styles are noted on Drawings.
    b. Carbon Steel Anchors:
        1) Anchor Body: ASTM A510 or AISI 1018 or AISI 12L14 or SAE J403.
        2) Nuts: ASTM A563 Grade A and meeting the dimensional requirements of ANSI B18.2.2.
        3) Washers: SAE 1005-1033 or ASTM F844 and meeting the dimensional requirements of ANSI B18.2.2 Type A Plain.
        4) Plating: Zinc plated in accordance with ASTM B633, SC1, Type III Fe/Zn 5.
    c. Stainless Steel Anchors:
        1) Anchor Body and Wedges: ASTM A276 or ASTM A493 with chemical composition of either AISI 304 or 316 or 316L.
        2) Nuts: ASTM F594 with chemical composition of either AISI 304 or 316 or 316L.
        3) Washers: ASTM A240 with chemical composition of either AISI 304 or 316 or 316L.
    d. Submit a product evaluation report by ICC-ES showing Cracked Concrete testing compliance per A.C. 193.
    e. Provide embedment depth, edge distance, and anchor spacing as shown on the Drawings and in accordance with manufacturer's recommendations for published allowable loads.
    f. Manufacturer: Hilti, Inc. Kwik Bolt TZ, Simpson Strong-Bolt, Powers Fasteners, Power-Stud +SD1 or Power-Stud +SD2 (except ¼" diameter), or equal.
3. Concrete Screw Anchoring Systems
    a. Anchor: Concrete screws shall be self tapping and heat treated. Screw anchors shall have complete contact with the base material and shall not require oversized holes for installation. Anchors will bear a length identification code that is visible after installation.
    b. Carbon Steel Anchors:
        1) Anchor Body: High Yield Strength Carbon Steel (fy > 95 ksi)
        4) Plating: Zinc plated in accordance with ASTM B633, SC1 or Mechanically galvanized per ASTM B695, Class 65, Type 1.
    c. Submit a product evaluation report by ICC-ES showing Cracked Concrete testing compliance per A.C. 193.
    d. Provide embedment depth, edge distance, and anchor spacing as shown on the Drawings and in accordance with manufacturer's recommendations for published allowable loads.
    e. Manufacturer: Simpson Strong-Tie Titen HD Concrete Screw, Hilti Kwik HUS-EZ (Pending ICC approval) or equal.

F. Adhesive Anchoring Systems
1. Adhesive (Epoxy) Injection Anchoring Systems
    a. Adhesive: Adhesive consisting of two-component epoxy base resin and hardener material meeting the requirements of ASTM C-881 Types I and IV, Grade 3, Class C. The adhesive shall be supplied in manufacturer's

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standard side-by-side cartridge and dispensed through a static-mixing nozzle supplied by the manufacturer.

b. Anchor Rod, Reinforcing Steel or Insert: Threaded Rod or insert with chamfered threaded end for ease of starting nut on one end and 45 degree chisel or cut point on opposite end (where insert is required by manufacturer). Furnish nuts and washers to meet the requirements of the rod or insert. Unless noted otherwise on the drawings provide hot dip galvanize rods or inserts or stainless steel. Stainless steel rods or inserts shall be provided in buried or submerged locations. Reinforcing Steel shall meet the requirements of Section 03200. All Reinforcing Steel indicated to be embedded in existing concrete shall be embedded using the epoxy injection systems.
    1) ASTM A36 or A307 (standard carbon steel anchor).
    2) ASTM A193 Grade B7 (high strength carbon steel anchor).
    3) Reinforcing bars as specified in Section 03200 with chisel or cut point.
    4) AISI 304/ASTM A276 or AISI 316L/ASTM A276 stainless steel meeting the mechanical requirements of ASTM F-593 (Condition CW).
c. Submit a product evaluation report by ICC-ES showing Cracked Concrete testing compliance per A.C. 308.
d. Provide embedment depth, edge distance, and anchor spacing as shown on the Drawings and in accordance with manufacturer's recommendations for published allowable loads.
e. For submerged application in potable water provide NSF/ANSI STD 61 certification.
f. Manufacturer: Hilti HIT RE 500-SD Epoxy Anchoring System, Hilti HIT HY-150 MAX-SD, Simpson Strong-Tie SET-XP Epoxy, or equal. For materials with voids and holes like hollow block provide Simpson Strong-Tie ETS screens used with SET Epoxy, or equal.

2. Adhesive (Ester) Injection Anchoring Systems (for use in CMU only)
    a. Adhesive: Adhesive consisting of methacrylate resin or acrylic based adhesive, hardener, cement and water. The injectionable adhesive shall consist of two components and a static mixing nozzle as recommended by the manufacturer.
    b. Anchor Rod or Insert: Threaded Rod or insert with chamfered threaded end for ease of starting nut on one end and 45 degree chisel or cut point on opposite end (where insert is required by manufacturer). Furnish nuts and washers to meet the requirements of the rod or insert. Unless noted otherwise on the drawings provide hot dip galvanized rods or inserts or stainless steel. Stainless steel rods or inserts shall be provided in buried or submerged locations.
        1) ASTM A36 or A307 (standard carbon steel anchor).
        2) ASTM A193 Grade B7 (high strength carbon steel anchor).
        3) Reinforcing bars as specified in Section 03200 with chisel or cut point.
        4) AISI 304/ASTM A276 or AISI 316L/ASTM A276 stainless steel meeting the mechanical requirements of ASTM F-593 (Condition CW).
    c. Submit a product evaluation report by ICC-ES with seismic approvals.
    d. Provide embedment depth, edge distance, and anchor spacing as shown on the Drawings and in accordance with manufacturer's recommendations for published allowable loads.
    e. For submerged application in potable water provide NSF/ANSI STD 61 certification.

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f. Manufacturer: Hilti HIT HY 150 MAX Injection Adhesive Anchor, Simpson Strong-Tie SET, or equal. For materials with voids and holes like hollow block provide Hilti HIT HY 20 Injection Adhesive Anchor with wire mesh screen tubes for Masonry Construction, Simpson Strong-Tie Acrylic-Tie with ATS screens, or equal.

2.02 GALVANIZING

A. Hot-dip galvanize all exterior and exposed steel items, except when specified otherwise.
   1. Steel hardware, nuts, bolts, washers, anchors, and threaded rods: ASTM A153.
   2. Where specified, electroplate nuts, bolts and washers with zinc coating of 0.001-inch minimum thickness in accordance with ASTM B633 Class SC4. Where specified, provide a 4-mil DFT coating of zinc silicate.
   3. Size nuts so that they screw on threaded bolts readily after galvanizing or coating.

B. Repair Materials: Gal-Viz by Thermacote Welco, Pasadena, CA; ReGalv by Rotometals, Inc., San Francisco, CA; or equal.

2.03 NON-SHRINK GROUT

A. See Section 03600.

PART 3 - EXECUTION

3.01 ERECTION

A. Structural Steel Work:
   1. Connections:
      a. Provide anchor bolts and other connections between structural steel and foundations.
      b. Set all anchor bolts by template, with provisions to hold bolts rigid and in correct position with respect to plan and elevation.
      c. Install adhesive and expansion anchorages by personnel with satisfactory previous experience using the same products, following the manufacturer's recommendations and in compliance with the latest ICC-ES report.
      d. Detail any undesigned connections in accordance with the AISC Specification.
      e. Do not increase any hole diameter or slot length without the Engineer’s approval.
      f. Washers:
         1. Provide washers for slotted holes. Washers shall be hardened for high-strength bolts (fy > 36 ksi) and shall be 3/8-thick plate washer for long-slotted holes.
         2. Provide washers under the turned element for bolts installed with the Calibrated Wrench Pretensioning method.
         3. Provide washers for bolts installed with the Direct-Tension-Indicator Pretensioning method.
   2. Install work anchored in sleeves set in concrete with non-metallic non-shrink grout. Allow a 1/4-inch minimum clearance between items anchored and the sleeve.

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3. Where metal is fastened to concrete, make the connections by anchor bolts, or by anchors embedded in concrete, such as adhesive, or expansion anchors.
4. Provide grout pads below base and bearing plates of non-shrink non-metallic grout having a minimum thickness of 3/4-inch unless otherwise noted. Do not bear directly on concrete slabs or equipment bases.
5. Provide leveling nuts on anchor bolts, below base plates, and adjust prior to grouting.

B. Mechanical Anchoring Systems: Mechanical anchoring systems shall be installed in accordance with the ICC-ES Evaluation Report for the specific anchor.
   1. Mechanical Undercut Anchoring Systems (required for overhead applications)
      a. Drill a hole in the base material using drill bit diameter and embedment depth in accordance with the manufacturer's instructions.
         CAUTION: Oversized holes in the base material will reduce the anchor's load capacity and cannot be used.
      b. Remove dust from holes with compressed air.
      c. Assemble the anchor with the nut and washer so the top of the nut is flush with the top of the anchor.
      d. Place the anchor in the fixture and drive into the hole until washer and nut are tight against the fixture.
      e. Install nut and washer and tighten to the required installation torque.
   2. Mechanical Expansion Anchoring Systems
      a. Drill a hole in the base material using drill bit diameter and embedment depth in accordance with the manufacturer's instructions. CAUTION: Oversized holes in the base material will reduce the anchor's load capacity and cannot be used.
      b. Remove dust from holes with compressed air.
      c. Assemble the anchor with the nut and washer so the top of the nut is flush with the top of the anchor.
      d. Place the anchor in the fixture and drive into the hole until washer and nut are tight against the fixture.
      e. Install nut and washer and tighten to the required installation torque.

C. Adhesive Anchoring Systems: Adhesive anchoring systems shall be installed in accordance with the ICC-ES Evaluation Report for the specific anchor. Adhesive anchoring systems <u>are not allowed</u> in overhead applications.
   1. Adhesive (Ester or Epoxy) Injection Anchoring Systems
      a. Drill a hole to the specified depth and diameter.
      b. Clean hole with a wire brush. Remove dust from holes with oil-free compressed air. Jetting holes with water is not permitted.
      c. Install adhesives only in clean holes free of standing water.
         1) Dispense portion of adhesive off to the side to check for proper mixture, and consistent color before using.
         2) Fill hole halfway to 2/3rds, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.
         3) Substrate temperature should be kept above the minimum allowed temperature as specified by the manufacturer for the entire curing process.
         4) Insert anchor, turning slowly until the anchor contacts the bottom of the hole. Do not disturb anchor during the specified cure time.
         5) For holes 10" and deeper contractor shall use a piston plug for adhesive anchor installation

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D. Repair of Connections: The Contractor shall pay for all necessary additional tests made on weld or bolts required to repair or replace faulty work performed during the original fabrication or during erection.

E. Repair of Galvanized Coating:
   1. Repair surfaces damaged by cutting or welding by the heated repair method. Repair handrails or other surfaces that will not be painted and that are field welded or damaged by the heated galvanize repair method.
   2. Heat substrate to 600°F, or apply hot process touch-up material right after welding before metal has cooled below 600°F.
   3. Rub bar of specified galvanize repair material over surface of hot substrate to apply a uniform coating of zinc. Wire brush hot coating with a clean wire brush to smooth out and bond zinc coating to substrate to apply a uniform coating of zinc.

3.02 FIELD QUALITY CONTROL

A. Mechanical and Adhesive Anchoring Systems:
   1. Anchoring systems shall be installed in accordance with the ICC-ES Evaluation Report for the specific anchor. All anchors shall be tested in accordance with paragraph 1.04C.
   2. Set torque-controlled expansion-type anchors to the recommended installation torque using a calibrated torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed or abandoned.
   3. Set displacement-controlled expansion-type anchors to the recommended displacement. If the concrete cracks during installation of the anchor, the anchor shall be removed or abandoned.
   4. Anchors should exhibit no discernable movement during load testing.
   5. Holes drilled for anchors that do not set properly or fail in a tension test may not be reused, and shall be filled with non-shrink grout.

B. Erection Sequence: Verify each stage is completed before proceeding to the next.

C. Tolerances: AISC Standard Practice.

END OF SECTION

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SECTION 05100

STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Structural steel, stainless steel, aluminum, such as beams, channels, angles, tees, bars, pipe, tubing and plates (connection and base plates).
2. Fabricated metal items, such as pipe supports, brackets, hangers, equipment supports, and lift hooks.
3. All anchors, eye bolts, turnbuckles, cable clamps, bolts, nuts, washers, inserts, and other metal items not specified elsewhere.
4. Fabricated tanks, hoppers, and similar structures, if not specified elsewhere.
5. All structural metal framing.

B. Related Sections:
1. Section 05090: Structural Metal Fasteners
2. Section 05500: Metal Fabrications
3. Section 09960: Protective Coatings

1.02 REFERENCES

A. Aluminum Association:
1. AA Manual-Aluminum Design Manual

B. American Institute of Steel Construction Specifications:

1.	ANSI/AISC 360-05	Specification for Structural Steel Buildings
2.	ANSI/AISC 341-05	Seismic Provisions for Structural Steel Buildings Including Supplement No.1
3.	AISC 303-05	Code of Standard Practice for Steel Buildings and Bridges

C. Research Council on Structural Connections:
1. RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts, 2004

D. American Iron and Steel Institute (AISI).

E. American National Standards Institute:

1.	ANSI H35-1	Alloy and Temper Designation Systems for Aluminum

F. ASTM International (ASTM) Standard Specifications:

1.	ASTM A36	Structural Steel
2.	ASTM A53	Pipe, Steel, Black and Hot-dipped, Zinc-coated Welded and Seamless
3.	ASTM A108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
4.	ASTM A123	Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
5.	ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6.	ASTM A276	Stainless Steel Bars and Shapes

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7.	ASTM A370	Test Methods and Definitions for Mechanical Testing of Steel Products
8.	ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
9.	ASTM A653	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
10.	ASTM A992	Specification for Steel for Structural Shapes for Use in Building Framing
11.	ASTM B633	Electrodeposited Coatings of Zinc on Iron and Steel
12.	ASTM C827	Test Method for Early Volume Change of Cementitious Mixtures
13.	ASTM C1107	Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
14.	ASTM E8	Test Methods for Tension Testing of Metallic Materials
15.	ASTM E165	Practice for Liquid Penetrant Inspection
16.	ASTM E709	Practice for Magnetic Particle Examination
17.	ASTM F2329	Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

G. American Welding Society:

1.	AWS D1.1	Structural Welding Code - Steel
2.	AWS D1.2	Structural Welding Code - Aluminum
3.	AWS D10.4	Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing
4.	AWS A4.3-93R	Standard Methods for Determination of the Diffusible Hydrogen Content of Martensitic, Bainitic, and Ferritic Steel Weld Metal Produced by Arc Welding
5.	AWS A5.1	Mild Steel Covered Arc Welding Electrodes
6.	AWS A5.3	Aluminum and Aluminum Alloy Electrodes for Shielded Metal Arc Welding
7.	AWS A5.4	Covered Corrosion-Resisting Chromium-Nickel Steel Welding Electrodes
8.	AWS A5.5	Low Alloy Steel Covered Arc Welding Electrodes
9.	AWS A5.9	Corrosion-Resisting Chromium-Nickel Steel Base and Composite Metal Cored and Stranded Welding Electrodes and Welding Rods
10.	AWS A5.10	Aluminum and Aluminum Alloy Bare Welding Rods and Electrodes
11.	ANSI/AWS B4.0-98	Standard Methods for Mechanical Testing of Welds – U.S. Customary
12.	AWS B5.1-2003	Standard for the Qualification of Welding Inspectors
13.	AWS C4.1	Oxygen Cutting Surface Roughness Gauge and Wall Chart for Criteria Describing Oxygen-Cut Surfaces

H. American Society for Nondestructive Testing (ASNT):

1.	ASNT SNT TC-1a-2001	Recommended Practice for the Training and Testing of Nondestructive Testing Personnel
2.	ANSI/ASNT CP-189-2001	Standard for the Qualification and Certification of Nondestructive Testing Personnel

I. Federal Emergency Management Agency (FEMA):

1.	FEMA 350	Recommended Seismic Design Criteria for New Steel Moment-Frame Buildings, July 2000

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J. International Code Council (ICC)

K. California Building Code (CBC) 2019 Edition.

1.03 SUBMITTALS

A. Submit in Accordance with Section 01300.

B. Product Data:
1. Hangers, pipe and equipment supports (shelf items).
2. Stainless steel items (not fabricated).
3. Certified mill test results on structural metals.
4. Electrode manufacturer’s data and product data, including electrodes to be used for dissimilar metals.
5. Insulation between dissimilar metals.
6. Manufacturer’s product data sheets or catalog data for SMAW, FCAW and GMAW composite (cored) filler metals to be used.
7. Non-shrink grout.

C. Samples: Manufacturer's latest standard product.

D. Shop and Erection Drawings:
1. Structural framing.
2. Connection material specifications.
3. Gusset and base plates drawn to scale.
4. Field assembly or erection sequence.

E. Quality Assurance:
1. Welder performance qualification test records “welder’s certification”.
2. Written Welding Procedure Specifications (WPSs) in accordance with AWS D1.1 requirements for each different welded joint proposed for use whether prequalified or qualified by testing.
3. Procedure Qualification Record (PQR) in accordance with AWS 1.1 for all procedures qualified by testing.
4. Fabricator’s and Erector’s AISC Certifications.

1.04 QUALITY ASSURANCE

A. General:
1. Furnish materials and fabricated items from an established and reputable manufacturer or supplier. Fabricator and Erector shall both be AISC certified for the work that they are performing.
2. Supply all new materials and fabricated items made from first class ingredients and construction and guaranteed to perform the service required.
3. The Contractor is responsible for preparing and submitting written WPSs. WPSs for each joint type shall indicate proper AWS qualification and be available where welding is performed. WPSs shall be included with any shop drawings referencing welds. WPSs shall include the manufacturer and specific electrode.
4. Quality control and quality assurance shall be provided in accordance with AISC 341 Appendix Q.

B. Codes and Standards:
1. Metalwork:
a. Steel: AISC Specification.
b. Aluminum: AA Manual.

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2. Welding:
    a. Steel: AWS D1.1.
    b. Aluminum: AWS D1.2.
    c. Stainless Steel: AWS D10.4.
3. Welders:
    a. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration.
    b. All welding operators are subject to examination for requalification at any time during the progress of the work.

C. Tests:
1. General: The Owner will provide Special Inspection, defined by IBC *OR CBC* Section 1704, for welding and high-strength bolting. Visual welding inspection and nondestructive testing (NDT) shall be conducted in accordance with a written practice by personnel qualified in accordance with AISC 341 Appendix W.
2. Weld Tests: By a testing laboratory, selected by Engineer and paid by Owner.
    a. Visual inspection:
        1) Check fit-up of joint materials. Verify satisfactory alignment of material. Verify gaps and bevels of penetration welds.
        2) Check during welding. Verify satisfactory technique is used.
        3) Check after welding completed and cleaned by wire brush or chipping hammer.
        4) Inspect with magnification when necessary and under strong, adequate light.
        5) Inspect for the following defects:
            a) Surface cracking.
            b) Porosity.
            c) Excessive roughness.
            d) Unfilled craters.
            e) Gas pockets.
            f) Undercuts.
            g) Overlaps.
            h) Size.
            i) Insufficient throat and concavity.
    b. Nondestructive testing: Ultrasonic testing, except where not feasible due to the type or location of the weld. Magnetic particle, liquid penetrant or radiograph tests when ultrasonic testing is not feasible.
        1) Ultrasonic inspection technique and standards: AWS D1.1 Part C.
        2) Particle inspection method: ASTM E709.
        3) Penetrant inspection method: ASTM E165.
        4) Radiography tests: AWS D1.1, Part B.
        5) Charpy V-Notch (CVN).
            a) When they are used as members in the Seismic Resisting Force System, ASTM A6, Group 3 shapes with flanges 1½ inches thick and thicker, ASTM A6 Groups 4 and 5 shapes, and plates that are 1½-inch thick or thicker in built-up cross sections shall have a minimum CVN toughness of 20 ft-lbs. at 70ºF.
            b) All complete joint penetration groove welds used in the Seismic Force Resisting System shall be made with a filler metal that has a minimum CVN toughness of 20 ft-lbs at

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minus 20ºF, as determined by AWS classification or manufacturer certification Ultrasonic inspection technique and standards: AWS D1.1 Part C.

c. Extent of testing:
   1) Visual inspection of all welds.
   2) Measurement of weld profiles for 25% of all welds at random.
   3) Magnetic particle examination or liquid penetrant examination performed on root pass and on finished welds for 25% of all shear plate, stiffener plate, column base plate, gusset plate, and miscellaneous fillet welds.
   4) Ultrasonic contact examination on all complete joint penetration (CJP) welds. See Drawings for CJP welded beam or girder to column moment connections. Defective welds shall be repaired and costs of retesting defective welds shall be borne by the Contractor.

D. Additional Tests: Provide and pay for all necessary additional tests made on welds or bolts required to repair or replace faulty work performed during the original fabrication.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle, ship and store material in a manner that will prevent distortion, rust, damage to the shop coat or any other damage.

B. Store material in a clean, properly drained location out of contact with the ground.

C. Ensure that dissimilar metals are not in contact with each other.

D. Replace or repair all damaged material in an approved manner.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL MEMBERS

A. W-Shapes and WT-Shapes: ASTM A992, f_y = 50 ksi, f_u = 65 ksi.

B. M-, S-, and HP-Shapes and Channels, Angles, Structural Tees, Plates and Similar Items: ASTM A36, f_y = 36 ksi, f_u = 58 ksi. Except plates for W-Shapes and WT-Shapes ASTM A572, Grade 50.

C. Hollow Structural Sections (HSS): Rectangular and square, ASTM A500, Grade B, f_y = 46 ksi, f_u = 58 ksi. Round, ASTM A500, Grade B, f_y = 42 ksi, f_u = 58 ksi.

D. Steel Pipe: ASTM A53 Type E or S, Grade B, f_y = 35 ksi, f_u = 60 ksi.

2.02 STAINLESS STEEL ARTICLES

A. Material: AISI Type 304, unless Type 316 is specifically specified.

B. Channels, Angles and Structural Tees: ASTM A276.

2.03 FABRICATED ALUMINUM ITEMS

A. Material: ANSI H35-1 Alloy and Temper 6061-T6 with an anodized finish.

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B. Surfaces in Contact With Concrete or Masonry: Shop prime with a bituminous mastic or zinc chromate coating.

C. Bolted Connections: Provide stainless steel fasteners.

2.04 METAL FASTENINGS

A. See Section 05090.

2.05 WELDING ELECTRODES, FILLER METALS

A. Steel:
   1. AWS A5.1 or A5.5, E70XX category.
   2. AWS A5.20, A5.29, E7XTX-X except -2, -3, -10, -GS for FCAW.
   3. AWS A5.17 or A5.23, F7XX-EXXX for SAW.

B. Stainless Steel: AWS A5.4 or A5.9.

C. Aluminum: AWS A5.3 or A5.10.

D. For welding dissimilar metals, submit the appropriate electrodes for Product Review.

2.06 GALVANIZING

A. Hot-dip galvanize all exterior and exposed steel items, except when specified otherwise.
   1. Sheet steel, plain or shaped: ASTM A653, coating designation G 90, commercial grade, 115 or heavier, check availability.
   2. Products fabricated from rolled, pressed and forged steel shapes, plates, bars and strip 1/8-inch-thick or heavier: ASTM A123.
   3. Structural tubing and pipe: ASTM A53
   4. Grind smooth fabricated items at welded joints, edges, and corners, and galvanize after fabrication.
   5. Items that are specified to receive paint or a coating after galvanizing shall receive no post treatment baths and shall not be stacked or stored in a wet environment until coated.

B. Repair Materials: Gal-Viz by Thermacote Welco, Pasadena, CA; ReGalv by Rotometals, Inc., San Francisco, CA; or equal.

2.07 NON-SHRINK GROUT

A. See Section 03300 with no shrinkage as measured by ASTM C827. Furnish a pre-mixed product consisting of properly proportioned amounts of non-metallic dimensionally stable material to which water is added.

2.08 MISCELLANEOUS ITEMS

A. Furnish all items required to complete the project, but not specified herein, not specified in Section 05500.

2.09 FABRICATION

A. Structural Steel Work: Comply with the applicable provisions of the AISC Specification, the AISC Standard Practice and AWS D1.1. Weld only in accordance with favorably reviewed WPSs, which are to be available to welders

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and inspectors during the production process. Provide workmanship equal to standard commercial practice in modern structural shops.

1. Fabricate and assemble in the shop to the greatest extent possible, and deliver to the project as a unit ready for installation. Coordinate the work, making all provisions necessary for the passage of all applicable work into, and attachment to, the structures. Make joints carefully and neatly, with corners mitered and spliced, bolted, screwed, or welded together.
2. Make proper allowance for the expansion and contraction of the metals, and of the materials to which they are fastened.
3. Make completely watertight joints on exterior work.
4. Shape all members correctly, with no kinks, twists, dents, or other blemishes prior to erection. Evenly spring all curved work.
5. Make exposed edges free of burrs, sharp edges or corners. Make corners rounded or chamfered. Grind exposed welds smooth when specified.
6. Include supplementary parts necessary to complete each item, even though such work may not be definitely specified. Provide all such miscellaneous metalwork required by the project in accordance with good accepted standard practice.
7. Review monorail supports and splices with the hoist manufacturer.
8. Shop prime all items that are not galvanized or epoxy coated, including connection angles, using a material compatible with the finish coat, as specified in Section 09960. Provide finish paint coats as specified in Section 09960.

B. Stainless Steel Work:

1. Use the proper type of stainless steel electrodes or welding rods complying with AWS D10.4. Grind all welded joints smooth and polished, using wheels never used on carbon steel. Provide welds that eliminate injury to stainless steel parts in appearance, strength and resistance to corrosion.
2. Remove by grinding and polishing, all scratches, marks, pits and other blemishes on exposed surfaces incurred during fabrication of the material, until the entire surface possesses the same finish as the adjacent work.

C. Aluminum Work:

1. Comply with the applicable provisions of the AA Manual and AWS D1.2.
2. Back painting: When aluminum is in contact, such as with concrete, mortar, masonry, or adsorptive materials subject to wetting, including condensation, give the contact surfaces a brush coat of cut-back asphaltic, or coal tar paint. Submit paint for favorable review.
3. Aluminum shall have an anodized finish.

D. Base and Bearing Plates: Furnish under all columns, pipe supports, including rack type, supports for tanks, equipment frames and cabinets, and similar items. Provide rounded or chamfered corners.

E. Dissimilar Metals: Insulate the faying surfaces with a brush coat of cut-back asphaltic or coal tar paint or by gasketing. Submit for favorable review.

F. Metals in contact with cementitous or other material: Provide finish coating prior to erection.

2.10 SOURCE QUALITY CONTROL

A. Material Tests: Not required for materials identified with valid mill test records.

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1. Unidentified materials: Test samples from each 20 tons of each material, or fraction thereof. Perform tension and bend tests, conforming to ASTM A370 for steel. Perform tension tests conforming to ASTM E8 for aluminum.
2. Do not provide unidentified stainless steel.

B. Welding:
1. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration.
2. Weld only in accordance with favorably reviewed WPSs, which are to be available to welders and inspectors during the production process.

C. Tolerances: AISC Standard Practice.

D. Fabrication Tests: Standard and extent: See paragraph 1.04.

PART 3 - EXECUTION

3.01 ERECTION

A. Structural Steel Work:
1. Erect members in accordance with the AISC Specification, and the AISC Standard Practice except as modified.
2. Incorrect fabrication or damaged members:
   a. When a condition exists whereby parts cannot be assembled or fitted properly as a result of errors in fabrication, or of deformation due to handling or transportation, report the condition immediately. The method of correction must be approved before any corrective work is done. Make the corrective work in the presence of the Engineer.
   b. Straighten plates and angles or other shapes using approved methods.
   c. Do not heat already heat-treated parts for straightening.
3. Connections:
   a. Provide anchor bolts and other connections between structural steel and foundations. See Specification Section 05090 for additional connection requirements.
   b. Set all anchor bolts by template, with provisions to hold bolts rigid and in correct position with respect to plan and elevation.
   c. Detail any undesigned connections in accordance with the AISC Specification
   d. Do not increase any hole diameter or slot length without the Engineer's approval.
4. Install work anchored in sleeves set in concrete with non-metallic non-shrink grout. Allow a ¼-inch minimum clearance between items anchored and the sleeve.
5. Where metal is fastened to concrete, make the connections by anchor bolts, or by fastenings embedded in concrete, such as adhesive, or expansion anchors, installed in accordance with Specification Section 05090. Contractor shall not substitute post-installed fasteners for cast-in-place bolts without prior written permission from the Engineer.
6. Provide a 4-inch band of coal-tar epoxy applied, half in concrete and half in air, to galvanized or painted steel, partially embedded in concrete and subject to weathering.

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7. Provide grout pads below base and bearing plates of non-shrink non-metallic grout having a minimum thickness of ¾-inch unless otherwise noted. Do not bear directly on concrete slabs or equipment bases.
8. Provide leveling nuts on anchor bolts, below base plates, and adjust prior to grouting.
9. Complete the work square, plumb, straight and true, accurately fitted, and with tight joints and intersections.

B. Welding:
1. Weld only in accordance with favorably reviewed WPSs, which are to be available to welders and inspectors during the production process. Perform all welding by the shielded electric arc method in accordance with AWS D1.1.
2. Repair and make additional inspections, at the Contractor's expense, of the weld areas which have been rejected as a result of inspection. Follow this procedure until the welds are acceptable to the Engineer.
3. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration.
4. All tack welds shall be of the same quality as the final welds. This includes preheat requirements. All tack welds not incorporated in the final welds shall be removed.

C. Repair of Galvanized Coating:
1. Repair surfaces damaged by cutting or welding by the heated repair method. Repair handrails or other surfaces that will not be painted and that are field welded or damaged by the heated galvanize repair method.
2. Heat substrate to 600°F, or apply hot process touch-up material right after welding before metal has cooled below 600°F.
3. Rub bar of specified galvanize repair material over surface of hot substrate to apply a uniform coating of zinc. Wire brush hot coating with a clean wire brush to smooth out and bond zinc coating to substrate to apply a uniform coating of zinc.

3.02 FIELD QUALITY CONTROL

A. Welding:
1. Qualify welders in accordance with AWS D1.1 for each process, position, and joint configuration.
2. The Owner’s testing agency will inspect shop or field welding for conformance with AWS D1.1 requirements and will verify that welds are made in accordance with favorably reviewed WPSs.

B. Erection Sequence: Verify each stage is completed before proceeding to the next.

C. Tolerances: AISC Standard Practice.

D. Erection Tests: Standard and extent: See paragraph 1.04.

END OF SECTION

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SECTION 05500

METAL FABRICATIONS (MISCELLANEOUS METAL)

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. All metal fabrications and other miscellaneous metal items together with related accessory items and fasteners, including:
      a. Steel stairs and ladders.
      b. Stair treads and nosings.
      c. Steel guardrails, handrails and stair rails.
      d. Chain closures.
      e. Gratings.
      f. Grating support angles.
      g. Floor plates.
      h. Floor plate support angles
      i. Steel angle edgers.
      j. All other metal fabrications and miscellaneous metal not covered under other sections.

B. Related Sections:
   1. Section 05090: Structural Metal Fasteners
   2. Section 05100: Structural Metal Framing
   3. Section 05724: Aluminum Component Railing System
   4. Section 09960: Protective Coatings

1.02 REFERENCES

A. American National Standards Institute:
   1. B18.23.1 Beveled Washers

B. ASTM International (ASTM):
   1. A36 Specification for Carbon Structural Steel
   2. A53 Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless
   3. A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   4. A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   5. A283 Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
   6. A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
   7. A500 Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   8. A501 Specifications for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
   9. A653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Gavannealed) by the Hot-Dip Process

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10. A786 Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy and Alloy Steel Floor Plates
11. A793 Specification for Rolled Floor Plate, Stainless Steel
12. B632 Specification for Aluminum-Alloy Rolled Tread Plate
13. C595 Specification for Blended Hydraulic Cement
14. F844 Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
15. F2329 Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

C. Publications of the National Association of Architectural Metal Manufacturers (NAAMM):
   1. "Metal Product Outline; Division 5 Metal"
   2. "Metal Stair Manual"
   3. "Metal Finishes Manual"
   4. "Pipe Railing Manual"
   5. "Metal Bar Grating Manual"

D. The Society for Protective Coatings (SSPC), Volume 2. Standards for Surface Preparation are specified by SSPC followed by SP and a number indicating the specified type of surface preparation.

E. California Building Code (CBC)

F. International Code Council (ICC).

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data: Fully describe every product proposed for use.

C. Shop Drawings:
   1. Show dimensions, finishes, joining, attachments, inserts, and relationship of work to adjoining construction.
   2. Indicate all shop and erection details including cuts, copes, connections, holes, threaded fasteners and welds. Indicate welds using AWS "Welding Symbols."
   3. Show field measured dimensions of this and adjacent work and location of inserts on fabrication drawings.
   4. Submit a full floor plan layout and details for all gratings and grating support frames.

1.04 QUALITY ASSURANCE

A. Contractor’s Qualifications:
   1. Welding procedures, welders, and welding operations shall be qualified for the type of work required in accordance with AWS Standard Qualification Procedures.
   2. Apply fusion epoxy coating by a specialty contractor regularly engaged in the application of fusion epoxy coatings for industrial corrosion protection applications. Application of decorative epoxy coatings to ornamental iron work is not considered an acceptable qualification.

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B. Regulatory Requirements: Comply with the following codes and reference standards unless higher standards are specified, shown or required by applicable codes:
   1. "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," American Institute of Steel Construction (AISC), latest edition.
   2. Structural Welding Code of the American Welding Society, AWS D1.1, latest edition.
   3. International Building Code (IBC), adopted edition, especially Paragraphs 1013, Guardrails, Paragraph 1012, Handrails and Paragraph 1009, Stairs.
   4. Stair, guardrail and accessibility design requirements in, OSHA and CCR Title 8 Cal-OSHA and the Federal Americans with Disabilities Act (ADA).

C. Testing:
   1. Test materials in accordance with Section 05100.
   2. Test welding in accordance with Section 05100.
   3. Test fasteners in accordance with Section 05090.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver anchorage devices that will be embedded in the work of other trades in sufficient time to permit their timely installation. Provide proper setting drawings, templates, and directions for installation.

B. Store materials above ground on platforms, skids, or other supports. Store all fasteners and welding electrodes in a weathertight and dry location until ready for use. Store packaged materials in their original labeled containers.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Standard Structural Steel Shapes, Bars and Plates: ASTM A36.

B. Architectural and Miscellaneous Steel Items: ASTM A283, Grade A.

C. Steel Tubing: ASTM A500, (cold formed) Grade A, or ASTM A501 (hot formed), welded or seamless.

D. Steel Pipe: Seamless, conforming to ASTM A53, Type E or S, Grade B.

E. Aluminum: ASTM B483, Alloy 6061-T6 or 6063-T5 or T6 with an anodized finish.

F. Bolts and Nuts: ASTM A307, Grade A.

G. Plain Washers: ASTM F844.

H. Beveled Washers: ANSI B18.23.1.

I. Weld Type Bends and Fittings for Pipe Guardrails, Handrails and Stair Rails: R&B Wagner, Inc.; J.G. Braun; or equal.
   1. Provide manufactured preformed side outlet (3-way) elbows, radius elbows, bends, tees, crosses and other fittings of flush design for welded assembly.
   2. Provide elbows with a 1-inch-inside radius.
   3. Provide three-way elbows with a 1/8-inch inside radius.
   4. Provide inside alignment sleeves.

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J. Concrete Inserts for Guardrail Posts: 16-gauge galvanized steel sleeves, or foam polystyrene inserts ½-inch larger than post diameter x 6 inches (150 mm) deep with removable slip-on plastic covers.

K. Anchorages to Concrete and Masonry:
   1. Refer to Section 05090 for anchors carrying shear or tension loads 400 lbs. or more.
   2. Provide cast-in-place, expansion or bonded anchorages with minimum size 3/8-inch-diameter, 3-inch embedment.
   3. Provide a satisfactory evaluation report by ICC.
   4. Do not load the anchorage in excess of half the ICC values without inspection by Engineer.
   5. Material: Stainless steel or as noted on the Drawings.
   6. Do not use for loads in tension or withdrawal or for loads subject to vibration.

L. Drive-Anchors: One-piece deformed spring steel anchor: RAWL-Drives, Buildex, or equal. ¼-inch minimum diameter. Drive anchors shall be long enough so that all of the deformed portion plus ½-inch will be embedded in the concrete or masonry. Use for loads less than 200 pounds.

M. Non-Shrink Grout: See Section 03300, with no shrinkage as measured by ASTM C827. Furnish a pre-mixed product consisting of properly proportioned amounts of non-metallic dimensionally stable material to which water is added.

N. Handrail Wall Brackets for Steel Railing: ¼-inch formed steel drilled for screw attachment to pipe rail and expansion bolt anchor to wall, Wagner H-B-1 Type 1-H; Blumcraft wall bracket; or equal.

O. Safety Stair Nosings: Nosing base to be extruded aluminum Type 6063-T5 filled with resilient epoxy binder (13%) combined with a filler that contains at least 60% aluminum oxide abrasive. Provide a minimum coefficient of friction of 0.50. Furnish in two contrasting colors having a difference in light reflectivity of at least 70% to meet CCR Title 24 and ADA requirements for the visually impaired.
   1. Concrete Stairs: Nosing base to be extruded aluminum Type 6063-T5 filled with resilient epoxy binder (13%) combined with a filler that contains at least 60% aluminum oxide abrasive. Top surface 3 inches wide; ¼-inch thick. American Safety Tread #9511 for concrete filled pan stairs and #3511 for poured concrete stairs; equivalent products by Wooster; or equal.
   2. Metal Stairs: Product meeting requirements above from stair tread manufacturer.

2.02 GALVANIZING

A. Hot-dip galvanize all exterior ferrous metal work and all noted interior ferrous metal work.

B. Hot-dip galvanize all sheet steel, plain or shaped in accordance with ASTM A653, G-90 Commercial Grade.

C. Hot-dip galvanize all products fabricated from rolled, pressed and forged steel shapes, plates, bars and strip 1/8-inch thick or heavier, in accordance with ASTM A123.

D. Hot-dip galvanize all steel hardware, nuts, bolts, washers, anchors, and threaded rods in accordance with ASTM A153 or F2329. Size thread clearance to allow for galvanized coating; rerun threads after galvanizing, if required, to assure a smooth fit.

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2.03 GALVANIZING REPAIR

A. Repair damaged galvanizing by heated repair method. Repair materials: ReGalv by Rotometals, Inc., San Francisco, CA; or equal. Specifier knows of no equal.

2.04 FUSION EPOXY COATING

A. Fusion Epoxy Coating:
   1. Apply fusion epoxy coating to items so noted.
   2. Grind all surface irregularities smooth. Round all sharp corners; no sharp corners will be acceptable. Remove all weld spatter prior to sandblasting. Grind welds smooth; grind fillet welds to a uniform radius.
   3. Sandblast all surfaces to a near-white metal finish in accordance with SSPC-SP 10-94 prior to heating and coating applications.
   4. Use fresh epoxy resins. Submit the hot plate gel time test information to verify that epoxy resins are fresh and suitable for this application.
   5. Apply epoxy powder by the fluidized bed method, in strict accordance with the manufacturer's specifications. Provide a cured coating thickness of at least 12 mils.
   6. Preheated and post heat cure all fabricated items coated with fusion epoxy in accordance with the manufacturer's specifications.
   7. Provide a coating that is uniform, pinhole free and free from excessive roughness. Test all coatings with a low voltage sponge holiday detector at the protective coating applicator's shop. Only ship coated objects to the project site that are free of holidays and pinholes.
   8. Protect fusion coatings on fabricated work from damage. All pinholes shall be marked and repaired if, in the opinion of the Engineer, the surface is repairable. Unrepairable surfaces shall be cleaned, recoated and then cured in accordance with the manufacturer's recommendations, and retested.
   9. Retest fusion coatings for holidays and pinholes after they have been delivered to the project site.
   10. Make field touchup of the coating as recommended by the manufacturer, to a minimum dry mil thickness of 12 mils.

2.05 SHOP PRIMING

A. Refer to Section 09960 for surface preparation, pretreatment, primers, and application techniques.

B. Apply one shop coat of urethane zinc-rich primer in accordance with Section 09960 to all steel fabrications not scheduled to be galvanized.
   1. Apply two coats of primer to surfaces not in contact but inaccessible after assembly.

2.06 ISOLATION COATINGS

A. Coat aluminum in contact with other metals in accordance with aluminum pigmented asphalt paint or two coats of a high build polyamide epoxy paint, Tnemec 66 or equal, with a total thickness of system DF = 8.0 mils, minimum.

B. Coat aluminum in contact with concrete, masonry or plaster with bituminous mastic or zinc chromate coating, Tnemec 46-465 or equal, with a total thickness of system DFT = 8.0 mils, minimum.

C. Provide neoprene or phenolic washers and isolation bolt sleeves or insulating compound at all stainless steel fasteners to aluminum interfaces. Isolation washers

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shall be capped under a stainless steel washer. Insulating compounds shall be Tef-Gel by Ultra Safety Systems Company, Lanocote by Forespar, or equal.

2.07 FABRICATIONS

A. Steel Guardrails and Handrails:
   1. Fabricate from 1-½-inch-nominal-diameter Schedule 40 steel pipe. Maximum post spacing 8 feet.
   2. Hot-dip galvanize, after fabrication, guardrails and handrails exposed to the exterior and where noted to be galvanized.
   3. Avoid posts at inside or outside corners. Locate posts close enough to the corner in each direction so the diagonal distance between posts does not exceed the maximum allowed rail spacing. Form the corner with tight radius pipe bends or manufactured elbows. Miters are not permitted. Where a post at a corner is unavoidable, use a manufactured three-way side outlet flush welded elbow.
   4. Make all wall returns, connections of a top rail to a post at the end of a run and other changes in direction with smooth tight radius pipe bends or flush welded manufactured elbows. Miters not permitted.
   5. Make all pipe bends on bending jigs designed to produce accurate bends without buckling or deforming the pipe walls.
   6. Make tee and cross intersections with manufactured flush weld type fittings or by carefully coping and welding the pipe.
   7. Weld all joints with continuous beads. Thoroughly fuse without undercutting or overlap. Size welds to develop the full strength of the members joined after grinding. Grind and sand all groove welds flush.
   8. Grind all fillet welds to a uniform radius tangent to the members joined after grinding. Round all edges and corners to a minimum radius of 1/8-inch. Sand with progressively finer grits removing all tool marks, imperfections, and scratches before proceeding to the next finer grit. Finish with 80-grit.
   9. Close exposed ends of pipes by welding 3/16-inch-thick closure plate inside and flush with pipe end.
   10. Return ends of handrails 90 degrees to walls, close exposed end and mount with 1/8-inch maximum space between end of rail and wall.
   11. Bend or offset handrails where required to provide 1-½-inch minimum code required clearance between handrail and edge of floor slab, columns, ducts, pipes, pilasters or other obstructions.
   12. Provide sleeve inserts in accordance with Paragraph 2.01 of this Section for guardrail posts set in concrete.
   13. Cut and grind post ends to precise length and angle for where field welding to stair stringers is required.
   14. Provide expansion slip joints at 40-foot centers. Use an internal sleeve 4 inches long fastened to one side. Bevel exposed edges of pipe at joint.

B. Metal Stairs with Grating Treads:
   1. Stringers and connectors: Fabricate from structural steel shapes.
   2. Treads:
      a. Steel bar grating, welded rectangular design, 1-inch x 3/16-inch bearing bars spaced 1-3/16-inch on centers with ½-inch x 3/16-inch cross bars spaced 4 inches on centers.
      b. Safety nosings: Provide a 2-inch-minimum width steel angle or channel nosing with a colored abrasive surface meeting the slip-resistance and visually impaired requirements specified under paragraph 2.01 of this

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Section. Mebac by IKG Industries; equivalent product by Safety Metal Company; or equal.

3. Intermediate Landings:
   a. Steel bar, welded rectangular design gratings with bars spaced 1-3/16 x 4 inches on center or as shown on the Drawings and complying with the paragraph headed "Gratings" in this Section.
   b. Safety nosings: Provide a safety nosing meeting the requirements for nosings on grating treads for grating landings and steel checkerplate landings; meet the requirements of paragraph 2.01 of this Section for concrete landings.
4. For interior stairs the top and bottom nosings shall have a 70% contrast with adjacent surfaces; for exterior stairs all nosings shall have a 70% contrast with adjacent surfaces.
5. Guardrails for metal stairs: Fabricate from steel pipe using same materials and fabrication method described for guardrails above. Attach rail posts to stringers by field welding or with bent anchor plate and four bolts.

C. Metal Ladders:
1. For exposed conditions, steel hot-dip galvanize after fabrication, and for submerged conditions and inside reservoirs, stainless steel AISI 316, and as shown on the Drawings.
2. Rails: 2-½-inch x 3/8-inch flat bar drilled or punched for insertion of rungs.
3. Provide Mcbac surfaces solid steel rungs by IKG Borden or equal.
4. Rungs: 1-inch-diameter solid bar inserted into holes drilled in rails and welded on the outside. Space rungs equal distance apart. Coat rungs with an epoxy base paint containing aluminum oxide grit by Wooster "Safe-Stride" anti-slip paint; or equal or provide Mebac surfaces solid steel rungs by IKG Industries or equal.
5. Provide brackets, welded to rails, spaced 8 feet on centers maximum for attachment to concrete or masonry with two ¾-inch-diameter drilled anchor bolts at each connection.
6. Provide a hinged ladder extension where shown on the Drawings or a retractable ladder extension where ladder does not extend above the highest surface served: Bilco “Ladder Up,” equivalent by Saf-T-Climb; or equal.

D. Steel Angle Edgers: Provide steel angle edgers detailed and sized as shown, with anchors welded to the angle. Galvanize after fabrication in place. Secure angle edgers that will be cast in concrete in the forms so that when the forms are stripped, the concrete and edgers will be flush.

E. Chain Closure: Provide chain closures and related fittings made from 5/16-inch weldless 316 stainless steel, with oblong links. Provide three chains 4 inches longer than the anchorage spacing for each guarded area. Mount chains as shown. Provide each chain with boat type snap hooks at each end. Provide eye bolts with 3/8-inch-shank diameter and with 7/8-inch eye for attachment of chains at each anchorage. Provide fittings of the same material and finish as the chain.

F. Grating and Floor Plate Support Frames:
1. Material: Galvanized steel or stainless steel or as noted on the Drawings.
2. Provide grating support angles for all gratings and floor plates. Fabricate grating support angles in complete, closed frames that will lie completely flat in a true plane. Install support frames so they will support the grating and floor plates with even, uniform, non-rattling bearing. Set frames so that the

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surface of the grating and floor plates are flush with the adjacent floor or surface.

3. Design and fabricate support frames as required to prevent twisting due to any large ratio of length to width. Restrict the length of each closed section of long narrow support frames to 10 feet maximum.
4. Hot-dip galvanize support frames after fabrication. Grind welds smooth on the bearing surface before galvanizing.
5. Coat upper surfaces of steel grating support frames with bituminous mastic.

G. Grating:
   1. General Grating Requirements: Provide gratings that comply with requirements in the NAAMM Metal Bar Grating Manual.
      a. Field measure installed grating frames before fabricating gratings.
      b. Provide grating panels that are absolutely flat, correctly sized, and fabricated to lie in their frames with uniform, non-rattling bearing on all supporting surfaces.
      c. Fabricate with top surface of all bars flush. Install grating flush with adjacent concrete or other walking surfaces.
      d. Provide punch serrated non-slip upper surface on grating in wet areas and areas noted to have a nonslip surface.
      e. Band: Ends of all fixed and removable grating section. Weld banding bars of the same thickness and the same depth than the main bearing bars to the ends of all bearing and cross bars. Weld the banding bars flush with the bearing bars at each panel corner and grind the weld smooth and flush. Round all edges and corners to 1/8-inch radius.
      f. Band all shop and field cutouts and openings. Weld the banding bars to all cut bearing and cross bars.
      g. Leave "split" openings in the gratings when required for the passage of pipes, valve stems or other devices.
      h. Provide "fixed" grating for all operating grating platforms. Bolt “fixed” grating to support members with saddle clips and stud bolts welded to support members.
      i. Where required for access or where noted, provide removable grating sections sized to limit the weight of any one section to 90 pounds.
      j. Bolt removable sections in place by the same method used for fixed grating. Mark removable sections by painting the banding bars red after fabrication.
   2. Steel grating:
      a. Manufacturer: Grating Pacific; IKG industries; or equal.
      b. Welded steel grating: Hot-dip galvanized steel grating except where noted otherwise.
      c. Main bars: As shown but not less than 1-1/4-inch high and 3/16-inch in thickness and spaced 1-3/16 inches on center. Cross bars: Spaced not more than 4 inches on center.
      d. Size steel grating and support members as shown or rated for 150 psf superimposed load in pedestrian areas and 300 psf in vehicle areas with a grating deflection not to exceed ¼ inch.
   3. Stainless steel gratings:
      a. Manufacturer: Grating Pacific; Ohio Gratings Inc.; or equal.
      b. Stainless steel Type 316 rectangular bar gratings with anti-slip top surface, swaged lock, 1-3/16 x 4-inch bar spacing unless otherwise noted.

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c. Furnish gratings with bar sizes and intermediate supports sized as shown or rated for 150 pounds per square foot superimposed load with a grating deflection not to exceed ¼-inch.
d. Anchor stainless steel grating in place with stainless steel bolts and saddle clips.

H. Floor Plates:
1. Raised-pattern steel floor plates, ASTM A786, stainless steel floor plates, ASTM A793.
2. Stainless steel or galvanized steel ¼-inch-thick checkerplate with stiffeners sized and spaced as shown on the drawings or as required to support 100 pounds per square foot superimposed loads with a plate deflection not to exceed ¼-inch.
3. Bolt floor plates to support members with 3/8-inch-diameter countersunk fasteners at 12 inches on center.
4. Limit the weight of any one section to 90 pounds.

2.08 ATTACHMENTS

A. Metal Anchors: Provide metal anchors and fasteners required to secure all frames and other items rigidly in place and detailed for installation into concrete forms prior to placing concrete.

B. Anchor Bolts and Anchorages to Concrete and Masonry: In accordance with Specification Section 05090.

PART 3 - EXECUTION

3.01 ERECTION TOLERANCES

A. Conform to straight plumb and horizontal lines which also form a true flat plane to within 1/8-inch in 2 feet and ¼-inch in 10 feet and 1/2 maximum overall.

B. Curved surfaces shall conform to a true arc of a circle to within 1/8-inch in 12 inches and ¼-inch maximum overall.

3.02 INSTALLATION GENERAL

A. Fabricate and pre-fit metal work in the shop, in transportable components ready for field erection.

B. Make proper allowance for expansion and contraction of the metals and of the materials to which they are fastened.

C. Where metal is fastened to concrete, make the connection by means of sleeves and fastenings embedded in concrete or by expansion shield anchor bolts or wedge anchor bolts. Wood plugs, plastic plugs or powder driven studs are not acceptable.

D. Construct steel work in accordance with AISC Standard practices to withstand the forces normally applied and in compliance with IBC and OSHA requirements.

E. Grind welds smooth on all metal work exposed to view. Provide work that has:
1. Surfaces that are flat, straight, square, plumb and level.
2. Smooth curves, free of flat spots, and of uniform radius or, if intended to be of changing radius, follow a flowing fair curve.

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3. Make transitions between curved and straight portions of work at tangent points to achieve smooth and free flowing lines and surfaces without flat spots or abrupt changes in direction.

F. Provide 1/8-inch radius corners and edges on all exposed work.

G. Perform all welding in accordance with AWS Code D1.1. Employ methods and techniques to achieve strength and good appearance.

H. Field Assembly: Set members to lines and elevations indicated. Align and adjust members before making permanent connections.

I. Galvanized Metal Repair: Repair damaged galvanized metal by the heated substrate method as specified in Paragraph 2.03.

J. Touch-up Painting (Ferrous Metals): After field assembly, clean all bare metal and all abrasions to shop coat, and spot paint with same primer used in the shop.

3.03 GUARDRAILS AND HANDRAILS

A. Provide workmanship of the highest quality performed by mechanics skilled in executing high quality architectural metal work.

B. Set shop fabricated guardrail sections into position and align the top rail so that it is true to specified tolerances. Do field joining neatly and inconspicuously.

C. Install horizontal sections of guardrail with the top rail exactly horizontal. Vary the height of the rail as required to accommodate sloping deck surfaces. Maintain code required minimum and maximum rail heights.

D. Support guardrails with temporary braces and shoring to maintain true alignment until all final connections and grouting are completed.

3.04 STAIRS AND PLATFORMS

A. Furnish anchor bolts and other connectors required for connection to concrete or other materials.

B. Set structural members to lines and elevations shown. Align and adjust members before making permanent connections.

C. Where stairs land on sloping floors, the height of the first riser at the center of the stair shall be equal to the height of all other risers.

3.05 METAL STAIR NOSINGS

A. Provide safety stair nosings in accordance with 2.01 of this Section at all concrete stairs and landings. Make nosings the full length of each tread less 2 inches at each end. Protect exposed surfaces of safety nosings during construction and leave the surfaces clean and free of concrete and staining.

B. For interior stairs, provide a top and bottom nosing that contrast with adjoining surfaces and nosings on intermediate treads. For exterior stairs, provide nosings on all treads that contrast with surrounding surfaces. Adequate contrast is defined as a 70% difference in light reflectivity.

3.06 STEEL LADDERS

A. Install ladders with stainless steel OR galvanized steel expansion anchor bolts.

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B. Locate first rung same distance above surface below it as space between other rungs.

3.07 GRATINGS AND FLOOR PLATES

A. Install support frames so that gratings and floor plates have continuous support and so gratings and floor plates will sit in their frames without rattling or rocking in any direction including across diagonal corners.

3.08 MISCELLANEOUS

A. Furnish the following for field installation:
   1. Miscellaneous metal work not specified in other Sections.

3.09 REPAIRS

A. Repair or replace all defective work including:
   1. Unsightly welds.
   2. Discontinuous welds.
   3. Uneven connections.
   4. Variations exceeding specified tolerances.
   5. Kinks, bends.
   6. Other defects affecting the quality, strength, utility. and appearance of the work.

3.10 CLEANING

A. Wash thoroughly using clean water and detergent.

B. Do not use acid solutions, steel wool or other abrasives.

C. Remove stubborn grease stains with mineral spirits.

END OF SECTION

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SECTION 05724

ALUMINUM COMPONENT RAILING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Guardrails, toeboards and related work employing a stock manufactured Aluminum Component Railing System.
   2. Related custom manufactured items.
   3. Work in this Section requires the highest level of workmanship, skill and care and may require specialized manufacturing equipment and techniques.
   4. For fabricated aluminum items for the platform and catwalk refer to Section 05100. For aluminum grating refer to Section 05500.

B. Related Sections:
   1. Section 05090: Structural Metal Fasteners
   2. Section 05100: Structural Metal Framing
   3. Section 05500: Metal Fabrications
   4. Section 09960: Protective Coatings

1.02 REFERENCES

A. Aluminum Association:
   1. AA ASD-2013 Aluminum Standards and Data
   2. AA SAA46 Standards for Anodized Architectural Aluminum

B. ASTM International (ASTM):
   1. B241 Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
   2. B244 Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and Other Non-Conductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments
   3. B429 Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
   4. B483 Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes and Drawn Pipes for General Purpose Applications
   5. C595 Specification for Blended Hydraulic Cements

C. American Welding Society (AWS)
   1. B2.1 Specification for Welding Procedure and Performance Qualification
   2. WHB Welding Handbook - Materials and Applications

D. National Association of Architectural Metal Manufacturers (NAAMM)
   1. AMP 500 Metal Finishes Manual
   2. AMP 521 Pipe Railings Systems Manual

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E. California Building Standards Commission
   1. 2019 California Building Code (California Code of Regulations, Title 24)

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's fully described product literature.

B. Shop Drawings:
   1. Show dimensions, materials, alloys, finishes, joining, attachments, field splices, control joints, inserts, and relationships of work to adjoining construction.
   2. Indicate all shop and erection details including cuts, copes, connections, slip joints, holes, threaded fasteners and welds. Indicate welds using AWS "Welding Symbols."
   3. Show field measured dimensions of this and adjacent work and field measured locations of cans and inserts.
   4. Provide setting drawings, templates and directions for installation.
   5. Submit calculations or certification that rail system is designed to meet loading criteria noted herein or on the Drawings.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. The fabricator and installer must be a State Licensed Specialty Contractor regularly engaged in fabrication and installation of architectural aluminum component railings systems. Fabricator and installer must be approved by Component Railing System manufacturer.
   2. Welding procedures, welders, and welding operations shall be qualified for the type of material and work required in accordance with American Welding Society (AWS) B 2.1.

B. Comply with the following regulatory requirements:
   1. California Building Code (CBC), adopted edition.
   2. Stair/Handrail, Guardrail and/or Ladder/Stile design requirements of CalOSHA.

C. Comply with the following trade association and reference standards:
   1. "Pipe Railing Systems Manual," the National Association of Architectural Metal Manufacturers (NAAMM).
   2. "Metal Finishes Manual" NAAMM.
   3. "Welding Handbook - Materials and Applications" American Welding Society.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide inserts, sleeves and anchorage devices in time to be incorporated in other work. Provide setting drawings, templates and directions for installation.

B. Store materials above ground on platforms, skids or other supports, and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending. Store all fasteners and welding electrodes in a dry, weathertight place away from uncured concrete and masonry. Store packaged materials in their original containers.

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PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Provide an Aluminum Component Railing System manufactured and installed under the responsibility of a single specialist firm.

B. Furnish a system that employs fittings that are internally welded to vertical members. Vertical post members with non-welded fittings shall be factory pre-assembled with 30” aluminum reinforcing bar included. Systems requiring field assembly of vertical posts with screw and/or rivet fitting attachment will not be acceptable.

C. Manufacturer/Installer and Product Line: CV Pipe Rail by CraneVeyor Corporation (CVC); Series 550 Pipe Railing by The Wagner Companies; or equal.

D. Railing components in this Specification Section are CraneVeyor products and are used to describe the quality and function of the item required.

E. Posts, Rails, Connectors, Toeboards and Related Items for Component Railing System:
   1. 1 ½ inch Aluminum Pipe: Schedule 40, 1.50 inch outside diameter, Alloy 6063 in T6 temper handrail grade, or 6063 T1 or T52 handrail grade where required for bending. Use 6063 T832 where a clear anodized finish is required.
   2. Aluminum Reinforcing Sleeve: Aluminum drawn tube, 6063-T832, 1.2 inch diameter x 0.125 inch thickness. Outside diameter to be a tight fit inside the aluminum pipe.
   3. Aluminum Reinforcing Bar: Solid aluminum bar, 6061 T6, outside diameter to be a tight fit inside the aluminum pipe.
   4. Component Railing System Connectors:
      a. Drawn, forged or fabricated aluminum Alloy 6063 T5, T6, or T832.
      b. Posts shall have a stub or sleeve of reduced diameter to fit snugly inside the connecting member.
      c. When factory assembled, provide an internal bulkhead just inside the point where the connectors are coped to fit the post or connecting member.

F. Attachments:
   1. Adhesive Attachment: Provide structural adhesive (two-part epoxy adhesive per manufacturer's system requirements) at splices. Structural Epoxy Adhesive: #C4907, Scotch-Weld 3M Company; Devon; or equal.
   2. Weld Attachment: Provide ½ inch-diameter hole in the center of the bulkhead and weld the connector to the member to which it is being attached through the hole.
   3. Field mechanical attachment (rivets and/or screws) of fittings to post is NOT ACCEPTABLE; factory pre-assemble only.
   4. At intermediate railing posts use a "T" top rail connector and saddle intermediate rail connectors.
   5. At end railing post, join the top rail to the post with a pipe bend or radius elbow. Miters or "T" connectors with end cap are unacceptable.
   6. At inside and outside corners:
      a. Use two posts located close to the corner in each direction such that clear space between posts does not exceed maximum spacing allowed between horizontal rails. Continue top rails, intermediate rails and

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toeboards to meet at corner No sharp corners; use radius elbows to join components or terminate returns to support posts such that the gap between rail sections at corner is no greater than 4 inches.

b. Where shown or required, use a custom fabricated single corner post with a side outlet elbow (3-way elbow) as a top of post fitting. Attach top rails to posts with "T" top rail connector; attach intermediate rails to posts with saddle connectors.

c. Provide 4 inches high extruded aluminum with "F" shaped flanges along the top and bottom edge. At interior and exterior corners, use special corner connectors and splices.

G. Set guardrail posts in pockets cast in concrete. Form a void in concrete with 16 gauge stainless steel sleeves, 1-inch larger than post diameter by 6 inches deep with closed bottom and removable slip-on plastic covers, or use a removable Styrofoam void forming device of the same size. CVC; The Wagner Companies; or equal.

H. Use a stainless steel base plate for bolt attachment to steel channel stair stringers or existing concrete slabs. Weld a stainless steel tube to a 3/8 inch-thick stainless steel base plate sized to fit inside the aluminum pipe rail post.

I. Socket for Removable Posts: Stainless steel post socket with closed bottom.

J. Aluminum Bars and Plates: 6063 T6 alloy, 35,000 psi yield, 21,000 psi allowable.

K. Toe Boards: Aluminum, 1.5" x 3.5" min. rectangular rail. From single-source supplier, provide all necessary compatible brackets, hardware, splices, etc. for fastening to rail and/or base plates as required. Vertical orientation only, no protruding angled faces allowed to prevent trip hazard.

L. Adhesive Capsule Anchors, and Wedge Anchor Bolts for attaching items to concrete or masonry:

1. Adhesive capsule anchors: Stainless steel, Molly Parabond capsule anchors, by the Molly Division of the Emhart Fastener Group; HVA adhesive anchors by Hilti Fastening Systems; or equal.
2. Wedge anchor bolts, stainless steel, special machine bolts with built-in expanding wedge. Minimum size: 3/8-inch-diameter by 3-inch embedment in concrete or masonry. Do not load in excess of one-fourth of certified test value. Phillips Red Head Wedge Anchors; Wej-it expansion bolts; or equal. Use where noted and for:
   a. Loads less than 200 lbs.
   b. Load in shear only.

M. Grout: Hydraulic quick-setting cement, nonshrinking, unaffected by water after setting and conforming to ASTM C595.

N. Bolts, nuts, washers and screws in contact with aluminum: Stainless Steel, AISI Type 304, with hex head bolts and nuts.

O. Handrail Wall Brackets for Aluminum Railing: Cast aluminum Alloy 214, or Almag 35, extruded aluminum 6063 alloy or formed aluminum 5052 alloy, drilled for screw attachment to pipe handrail and for 3/8 inch-diameter bolt anchor to wall, 2 ½ inch or 3 inch offset.

P. Wall Flanges: Two-part consisting of: 1) an extra-heavy wall attachment flange, ¼ inch-diameter drilled for four ¼ inch-diameter countersunk head expansion anchor bolts and 2) a cover flange.

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2.02 ALUMINUM ANODIZING

A. After fabrication and finishing give all aluminum railings a medium chemical etch and a clear Architectural Class I anodic coating, at least 0.7 mils thick, clear AA-C11-A41. Comply with the "Standards for Anodized Architectural Aluminum," published by the Aluminum Association and referred to in NAAMM "Metal Finishes Manual." Measure thickness in accordance with ASTM B244.

B. Where aluminum is in contact with concrete, grout, plaster or other metals, apply a coating of aluminum pigmented bituminous paint or epoxy paint to the aluminum after anodizing to act as an isolation barrier.

2.03 FABRICATION OF ALUMINUM HANDRAILS, GUARDRAILS, AND STAIR RAILS

A. Make joints with special connectors designed for concealing shop welding to posts and flush slip on epoxy bonding of horizontal railing members in the field. Accurately cope connectors for a smooth hairline fit. Joints shall be weld joints on the inside of the connector so that welds are not visible from the outside. Bolts, screws, pop-rivets or other exposed fasteners are not acceptable. Remove all sharp edges with fine abrasive.

B. Fabricate custom components that cannot be assembled with fittings using aluminum pipe and welding type fittings. Fully weld all joints all around using Alloy 5356 filler wire, grind smooth and finish with progressively finer grits of abrasive ending with 180 grit.
   1. Avoid posts at inside or outside corners. Locate a post close enough to the corner in each direction such that clear space between posts does not exceed maximum spacing allowed between horizontal rails. From the corner with tight radius pipe bends or manufactured welding type elbows. Miters not permitted.
   2. At wall returns, at intersections of top rails with posts at the end of a run, and at other changes in direction, either custom bend the pipe rail or use manufactured formed or bent pipe ells having a minimum 2-inch-inside radius. Make custom bends on a roll type hydraulic tubing bender. Provide bends that are free of buckles, puckers or deformed surfaces.
   3. At all cross and tee intersections, accurately cope members for a tight fit and internally plug weld as described above.
   4. Cap ends of pipes except wall returns with manufactured bulb end caps. Return wall rails to within 1/8 inch of the wall.
   5. Posts: Schedule 40 pipe internally reinforced at the bottom with a 20 inch-long tight fitting solid aluminum bar bonded to the inside of the post with structural epoxy. Space posts no further apart than 6 feet regardless of spacing shown on drawing.
   6. Where posts are bolted to the top edge of stair stringers or at similar situations where a flanged connection is required, fabricate the flange from a ¼ inch-thick stainless steel plate. Round corners to a ¼ inch radius and ease all exposed edges to a 1/16 inch radius. Weld a stainless steel sleeve to the plate. Size the sleeve to be a snug fit inside of the aluminum pipe post. Slide the post over the stainless steel sleeve and bond with epoxy.
   7. Where chains and snap rings are required, provide a continuous aluminum reinforcing sleeve inside of the aluminum post. Provide 1-inch-diameter 304 stainless steel eye bolts, a 304 stainless steel chain with 13 welded 3/16 inch-diameter wire links per foot, and chrome plated brass snap fasteners.

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Locate the eyes of the eye bolts on the outside of the post away from the walking side of the rail and not facing the opening that the chain closes.

8. Provide expansion joints consisting of a 6 inch-long solid aluminum sleeve sized to slip inside the members and bonded on one side of the joint only to allow for the thermal movement. Allow a minimum of ¼ inch space for expansion in each 24 foot section. Allow more space if required to accommodate anticipated temperature changes. Locate expansion joints within 6 inches of a post. Ease exposed edges of pipe rail to a 1/16 inch radius.
9. Mix and apply structural epoxy in accordance with the manufacturer's instructions.
10. Provide 3/16 inch-diameter holes in inconspicuous locations to vent interior of members.

C. Anodizing:
1. Anodize all parts after the exposed welding is complete in accordance with paragraph 2.02 of this Section. Internally welded connectors may be attached to posts after anodizing.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Shop weld/factory assemble all connectors and fittings to vertical post assemblies. Field cut horizontal railing members and epoxy bond to connectors on post assemblies.

B. Pipe cuts should be square and accurate for minimum joint gap. Cuts shall be clean and free of chamfer from deburring, nicks and burrs. Holes shall be drilled the proper size for a tight, flush fit of rivets and screws. All posts grouted in concrete must have one 1/4″ diameter weep hole – 1/2″ above post collar – in the plane of the rail.

C. Install work to a straight line or flat plane to within 1/8 inch in 6 feet and to within ¼ inch total deviation. Install curved surfaces conforming to a true arc of a circle to within 1/16 inch.

D. Equally space posts in any run and not more than 6 feet on center. Space posts in parallel rows so they are in alignment.

E. Make proper allowance for expansion and contraction of the metals and of the materials to which they are fastened.

F. Set posts 6 inches deep in sleeves cast in concrete or in core-drilled holes in concrete using waterproof, nonshrinking grout. Attach wall or floor flanges to concrete with stainless steel epoxy capsule anchor bolts or to other construction with stainless steel machine bolts.

G. Attach posts to existing concrete by setting the post in a hole core drilled into the concrete 1-inch larger than the post and 6 inches deep.

H. Component Adhesive Attachment: Clean and dry areas to be joined thoroughly. Mix epoxy adhesive according manufacturer's directions (mixing only enough to use within ½ hour) Apply to inside surface of pipe, then slip splice sleeve into the pipe. Wipe off excess adhesive after components are properly joined. Leave

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connected areas undisturbed for eight (8) hours (longer in cold weather per manufacturer's recommendations).

I. Construct work to withstand the forces required by CBC and CalOSHA.

J. Round and grind smooth all exposed corners and edges.

K. Component Weld Attachment: Weld all the way around the perimeter of the hole in the bulkhead to develop the full strength ½ inch-diameter weld with a fully concealed weld

L. Perform all welding in accordance with AWS manual "Welding Handbook". Employ methods and techniques to achieve the full strength of the members joined and architectural appearance.

M. Field Assembly: Set members to lines and elevations indicated. Align and adjust members before making any permanent connections.

3.02 GUARDRAILS AND HANDRAILS

A. Provide work of the highest quality performed by mechanics skilled in executing high quality architectural metal work.

B. Set shop fabricated guardrail sections into position and align the top rail so that it is true to specified tolerances. Do field joining with structural epoxy adhesive. Mix and apply adhesive in accordance with manufacturer's instructions.

C. Support guardrails with temporary braces and shoring to maintain true alignment until all final connections and grouting are completed. Build surface of grout up at post, ¼ inch higher than surrounding surfaces to direct water away from post.

D. Attach toeboards to posts using two self-tapping, stainless steel machine screws minimum at each connection. Use special toeboard connectors at corners and special splice plates at end joints.

E. Coat surfaces of aluminum in contact with concrete, grout, plaster or dissimilar metals with specified coating material.

3.03 REPAIRS

A. Replace all defective work including:
   1. Unsightly welds.
   2. Discontinuous welds.
   3. Uneven connections, surfaces, finishes or coatings.
   4. Variations exceeding specified tolerances.
   5. Kinks, bends, tool marks, grinding marks.
   6. Other defects affecting the quality, strength, utility and appearance of the work.

3.04 CLEANING

A. Wash thoroughly using clean water and detergent.

B. Do not use acid solutions, steel wool or other abrasives.

C. Remove stubborn grease stains with mineral spirits.

END OF SECTION

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SECTION 05726

ARCHITECTURAL METAL WORK – STAINLESS STEEL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes items of stainless steel used for functional purposes.

B. Items Covered in This Section:
   1. Stainless steel handrails, guardrails, stair rails and ladders.

C. Related Work Specified Elsewhere:
   1. Section 05100: Structural Metal Framing - structural steel
   2. Section 05500: Metal Fabrications (Miscellaneous Metal) - all other miscellaneous metal work
   3. Section 05724: Aluminum Component Railing System

1.02 REFERENCES

A. National Association of Architectural Metal Manufacturers (NAAMM).
   1. “Pipe Railing Manual,” 1977 edition.
   2. “Metal Finishes Manual,” 1976 edition.

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit shop drawings showing dimensions, materials, alloys, finishes, joining, attachments, field splices, control joints, inserts, and relationships of work to adjoining construction.
   1. Indicate all shop and erection details including cuts, copes, connections, slip joints, holes, threaded fasteners and welds. Indicate welds using AWS "Welding Symbols."
   2. Show field measured dimensions of this and adjacent work and field measured location of cans and inserts.

1.04 QUALITY ASSURANCE

A. Comply with the following regulatory standards:
   1. California Building Code (UBC), adopted edition, especially Chapters 17 and 33.
   2. Stair and Guardrail design requirements of OSHA and Cal-OSHA.

B. A sample illustrating the required level of workmanship for:
   1. Grinding and finishing welds and for,

1.05 QUALIFICATIONS

A. The fabricator and installer must be a State Licensed Specialty Contractor regularly engaged in custom fabrication and installation of fully welded and properly finished architectural railings. Acceptable fabricators are:
   1. C.E. Toland, 2635 Peralta Street, Oakland, California, (415) 834-1480.

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2. Meddco Metals, 31626 Hayman Street, Hayward, California 94544, (415) 489-4680.
3. Or equal.

B. Welding procedures, welders, and welding operations shall be qualified for the type of work required in accordance with AWS Standard Qualification Procedures.

1.06 DELIVERY, STORAGE AND HANDLING

A. Provide inserts, sleeves, and anchorage devices in time to be incorporated in other work. Provide setting drawings, templates and directions for installation.

B. Store materials above ground on platforms, skids, or other supports. Store all fasteners and welding electrodes in a weathertight and dry place. Store packaged materials in their original containers.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Stainless Steel Handrails, Guardrails, and Stair Rails:
1. 1-½-inch stainless steel pipe: Schedule 10, 0.109 in wall thickness, 1.90- to 2.0-inch outside diameter, Grade 18-8 Type 304.
2. 1-¼-inch stainless steel pipe: Schedule 10, 1.66-inch outside diameter, Grade 18-8 Type 304.
3. Steel tube: Seamless carbon steel, cold drawn mechanical tubing, 1-¼-inch o.d., 0.219 wall thickness weighing 2.411 pounds per lineal foot.
4. Bent pipe ells and other fittings: Roll or die formed, smooth bends free of deformed or puckered surfaces, R&B Wagner; J.G. Braun Company; Julius Blum & Company; or equal.

B. Sleeve inserts for guardrail posts set in concrete: 16-gauge galvanized steel sleeves, 1-inch larger than post diameter x 6 inches deep with closed bottom and removable slip-on plastic covers, or a removable void forming device of the same size. R&B Wagner, Inc.; J.G. Braun Company; Julius Blum & Company Inc.; or equal.

C. Round bars, flat bars and plates: Type 304 (316) stainless steel, annealed and cold drawn, conforming to ASTM A276.

D. Expansion shield anchor bolts and drive pins for attaching items to concrete or masonry, stainless steel AISI Type 304:
1. Expansion anchor bolts shall be stainless steel machine bolts inserted in separate double metal wedge lead expansion shields. Minimum bolt size ½-inch-diameter. Minimum embedment in concrete or masonry 3 inches. Do not load in excess of 1/4 of certified test value. RAWL doubles; Keystone Double Wedge; or equal. Use where noted and for
   a. Loads of 1,000 pounds or over.
   b. To attach all machines and devices with moving parts.
   c. For all loads in tension or withdrawal.
2. Wedge anchor bolts, special stainless steel machine bolts with built-in expanding wedge. Minimum size: 3/8-inch-diameter by 3-inch embedment in concrete or masonry. Do not load in excess of 1/4 of certified test value. Phillips Red Head Wedge Anchors WS series; Wej-it expansion bolts; or equal. Use where noted and for:

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a. Loads less than 1,000 pounds.
b. Loads in shear only.

E. Grout: Hydraulic quick-setting cement, non-shrinking, unaffected by water after setting and conforming to ASTM C595. Super Por-Rock; or equal.

F. Wall Brackets for Stainless Steel Handrails:
1. For attachment to concrete or masonry wall: Cast stainless steel, drilled for screw attachment to handrail and with 7/16-inch-diameter hole for 3/8-inch expansion anchor bolt to wall, 3-inch offset, Wagner 1772; Julius Blum; or equal.
2. For attachment to gypsum board wall: Cast stainless steel, drilled for screw attachment to handrail and with three ¼-inch-diameter countersunk bolt holes with filler plate for anchoring to backing through 5/8-inch gypsum board wall, 3-1/8-inch offset, Wagner Style P-3; Julius Blum; or equal.

G. Structural Epoxy Adhesive: Scotch-Weld 3M Company; Devon; or equal.

2.02 FABRICATION OF HANDRAILS, GUARDRAILS, AND STAIR RAILS

A. General: Railings shall be shop fabricated in the largest practical sections. They shall have closely fitted, continuously and fully welded connections, and shall have the welds ground smooth and blended into adjacent surfaces. Stainless steel parts shall be given a NAAMM No. 7 mirror polished finish (NAAMM No. 4 satin finish). All carbon steel parts are to be given a NAAMM medium satin 180-grit finish.

B. Connections:
1. All shop joints shall be fully and continuously welded all around at all contact edges on the outside with groove or fillet welds using a gas shielded electric arc process. Welds shall be at least the minimum size, after grinding, required to develop the full strength of the members joined. Use weld filler material that will provide a close color match to the base material. Grind and sand all groove welds flush. Grind all fillet welds to a uniform radius, tangent to the members joined. Sand with progressively finer grits of abrasive cloth removing all tool marks, imperfections and scratches before proceeding to the next finer grit. Finish with 180-grit. Finished welds shall be an imperceptible match to the adjacent pipe. Form corners or changes in direction with tight radius pipe bends or manufactured elbows. Miters not permitted.
2. At wall returns, custom bend the pipe rail or weld in manufactured formed or bent pipe ells having a 2-inch inside radius. Custom bends shall be made on a roll type hydraulic tubing bender and shall be free of buckles, puckers or deformed surfaces. Manufactured formed or bent ells shall be groove welded, ground and sanded flush and smooth.
3. At all cross and tee intersections, accurately cope members for a tight fit and continuously butt or fillet weld all around. Grind weld to a uniform radius tangent with the joined members and sand smooth.
4. Cap ends of pipes except wall returns with a 1/8-inch or thicker disc. Weld all around and grind smooth. Return wall rails to within 1/8-inch of the wall.

C. Finishing:
1. Give all welds a uniform medium satin directional textured finish with progressive grits of aluminum oxide abrasive cloth.
2. Finish stainless steel with finer grits and finally polish to a NAAMM No. 7 mirror finish. (NAAMM No. 4 satin finish.)

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3. On carbon steel, finish with 180-grit meeting the requirements of an AA-M32 medium satin finish as defined by the "Metal Finishes Manual," NAAMM. Finish fillets with an abrasive charged felt wheel. Blend textured areas into adjacent pipe so that the entire assembly will have the same overall appearance and that the welds and adjacent smoothed areas will be indistinguishable from the rest of the rail. Remove all tool marks and irregularities from grinding and previous operations. Round or bevel all exposed edges to a 1/8-inch radius.

2.03 FABRICATION OF STAINLESS STEEL LADDERS

A. General: All joints shall be tightly fit and fully welded all around. Size of weld shall be adequate to develop the full strength of members joined. Grind welds smooth and/or to a uniform radius. Round all exposed edges, corners and ends to a 3/16-inch radius. Sand weld and blend in to match finish of adjacent metal.

B. Rails: ½-inch x 2-½-inch flat bar drilled for insertion of rungs. Ease all edges, ends and corners of rails to a 3/16-inch radius.

C. Rungs: 1-inch-diameter solid bar inserted through holes drilled in the rails and welded on the outside.

D. Brackets: ½-inch x 2-½-inch bent brackets spaced 5-foot maximum on center and within 1-foot of each end. Shop weld to rails. Connect each bracket to the wall with two ¾-inch stainless steel bolts and drilled expansion shields.

E. Ladders are to be detailed and installed so that all steps including the first and last are of equal height and are 12 inches or less.

F. Provide a hinged ladder extension where shown on the Drawings or retractable ladder extension where ladder does not extend above the highest surface served: Bilco “Ladder Up,” equivalent by Saf-T-Climb; or equal.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Insofar as possible, fabricate and fit metal work in the shop, in transportable components ready for field erection.

B. Finished work shall conform to a straight line or flat plane to within 1/8-inch in 8 feet and to within ¼-inch total deviation.

C. Curved surfaces shall conform to a true arc of a circle to within 1/16-inch.

D. Make proper allowance for expansion and contraction of the metals and of the materials to which they are fastened.

E. Where metal is fastened to concrete, make the connection by means of embedding at least 6 inches deep in sleeves set in concrete or by expansion shield anchor bolts. Wood plugs, plastic plugs or powder driven studs are not acceptable.

F. Construct work to withstand the forces required by UBC and OSHA.

G. All work subjected to contact by personnel shall have all corners rounded or chamfered, all edges ground smooth.

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H. Perform all welding in accordance with AWS manual. Employ methods and techniques to achieve the full strength of the members joined and architectural appearance.

I. Field assembly: Set members to lines and elevations indicated. Align and adjust members before making permanent connections.

3.02 GUARDRAILS AND HANDRAILS

A. Set shop fabricated guardrail sections into position and align the top rail so that it is true to specified tolerances. Do field joining with slip joint.

B. Support guardrails with temporary braces and shoring to maintain true alignment until all final connections and grouting are completed. Build surface of grout up at post, ¼-inch higher than surrounding surfaces to direct water away from post.

3.03 LADDERS

A. Install ladders with fasteners adequate to take a 1,000-pound working load applied in any direction at any point.

B. Install so that top and bottom step are the same height as every intermediate step and do not exceed 12 inches.

3.04 REPAIRS

A. Replace all defective work including:
   1. Unsightly welds.
   2. Discontinuous welds.
   3. Uneven connections, surfaces, finishes or coatings.
   4. Variations exceeding specified tolerances.
   5. Kinks, bends, tool marks, grinding marks.
   6. Other defects affecting the quality, strength, utility, and appearance of the work.

3.05 CLEANING

A. Wash thoroughly using clean water and detergent.

B. Do not use acid solutions, steel wool, or other abrasives.

C. Remove stubborn grease stains with mineral spirits.

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SECTION 07136

MODIFIED BITUMINOUS SHEET MEMBRANE WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Modified Bituminous Sheet Membrane Waterproofing System.
2. Related sealant work.
3. Protection board.
4. Prefabricated drainage composite.

1.02 REFERENCES

A. The following standards and publications are applicable to the extent referenced in the text.

B. ASTM International (ASTM):

1.	C177	Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
2.	D146	Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing
3.	D3767	Standard Practice for Rubber - Measurement of Dimensions
4.	D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
5.	D570	Standard Test Method for Water Absorption of Plastics
6.	D5385	Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
7.	D882	Standard Test Method for Tensile Properties of Thin Plastic Sheeting
8.	D903	Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
9.	D1876	Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)
10.	E96	Standard Test Methods for Water Vapor Transmission of Materials
11.	E154	Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs, on Walls, or as Ground Cover

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data: Submit manufacturer’s product date, installation instructions, use limitations and recommendations. Include certification of data indicating volatile organic compound (VOC) content of all components of waterproofing system. Also submit material manufacturer’s certification of installer’s qualifications.

C. Samples: Submit representative samples of the following for approval:
1. Sheet Membrane.

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2. Protection board.
3. Prefabricated drainage composite.

1.04 QUALITY ASSURANCE

A. Manufacturer: Sheet Membrane Waterproofing Systems shall be manufactured and marketed by a firm with a minimum of 10 years of experience in the production and sales of modified bituminous self-adhesive Sheet Membrane Waterproofing. Submit evidence of ability to meet all requirements specified, and include a list of projects of similar design and complexity completed within the past 5 years.

B. Installer:
   1. A firm exclusively engaged in waterproofing membrane installation and having at least 3 years of experience in work of the type and scope required by this Section.
   2. A firm certified in writing by the material manufacturer as being qualified and experienced in the work required by this Section.

C. Materials: Provide materials, which are the products of one manufacturer for all work under this Section.

D. Manufacturer's Representative: Make arrangements necessary to have a trained employee of the manufacturer on site periodically during membrane waterproofing work to review installation procedures and certify that all work was done correctly prior to backfill placement.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage due to sunlight, weather, excessive temperatures, and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
   1. Do not double-stack pallets of membrane on the job site. Provide cover on top and all sides, allowing for adequate ventilation.
   2. Protect primer, mastic, and adhesive from moisture and potential sources of ignition.
   3. Store protection board flat and off the ground. Provide cover on top and all sides.

B. Sequence deliveries to avoid delays, but minimize onsite storage.

1.06 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive Sheet Membrane Waterproofing.

1.07 WARRANTY

A. Sheet Membrane Waterproofing: Provide written 5-year warranty against water intrusion issued by the membrane manufacturer upon completion of the work.

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PART 2 - PRODUCTS

2.01 MATERIALS

A. Modified Bituminous Sheet Membrane Waterproofing System:
   1. Provide all required materials for a complete Sheet Membrane Waterproofing system made by a single manufacturer. All products described in this Section are made by W. R. Grace and Company and are for use with the Bituthene modified bituminous Sheet Membrane Waterproofing system. Equivalent systems by other manufacturers may be submitted for evaluation if they include all of the products required made by a single manufacturer.
   2. Liquid-applied membranes and bentonite products are not considered equivalents.
   3. Acceptable Manufacturers and Systems:
      a. Bituthene 3000 by W. R. Grace and Company; or equal.
      b. CCW MiraDRI 860/861 by Carlisle Coatings & Waterproofing, Inc;
      c. Laurenco System Single Ply, by Laurenco Systems of Ohio, LLC;
      d. or equal.

B. System Components:
   1. Modified Bituminous Membrane: A self-adhesive .060 inch-thick cold-applied composite sheet consisting of .056 inch of rubberized asphalt and .04 inch of cross-laminated, high-density polyethylene film. Provide rubberized asphalt membrane covered with release paper, which is removed during installation. No special adhesive or heat shall be required to form laps. Bituthene 3000 or Bituthene Low Temperature by Grace Construction Products; CCW MiraDRI 860/861 by Carlisle; Laurenco System Single Ply, by Laurenco Systems; or equal.
      a. Physical Properties:

Property	Bituthene 3000
Color	Gray-black
Thickness, ASTM D 3767, Method A	.060 inch
Low Temperature Flexibility, ASTM D 1970	Unaffected at -32°C (-25°F)
Tensile Strength, Membrane, ASTM D412, Die C Modified	2240 kN/m^2 (325 psi minimum)
Tensile Strength, Film, ASTM D 882 Modified	34,500 kN/m^2 (5,000 psi minimum)
Elongation, Ultimate Failure or Rubberized Asphalt, ASTM D412 Modified	300%
Crack Cycling, 100 Cycles, ASTM C836	Unaffected at -32°C (-25°F)
Lap Adhesion at Minimum Application Temp ASTM D1876 Modified	700 N/m (4.0 lb./in. width)
Peel Strength, ASTM D 903	1576 N/m (9.0 lb./in. width)
Puncture Resistance, Membrane, ASTM E 154	222 N (50 lb. minimum)
Resistance to Hydrostatic Head, ASTM D 5385	60m (200 ft. minimum)
Permeance, ASTM E 96, Water Method	2.9 ng/m^2-sPa (0.05 perms maximum)
Water Absorption, 72 hours, ASTM D 570	0.1% maximum

   2. Drainage Composite: Composed of a minimum 0.44 inch (11 mm) thick geocomposite drainage sheet system. The system has a hollow studded polystyrene core, with a nonwoven, needle punched polypropylene filter fabric on one side and smooth polymeric film on the other side. Hydroduct 220 by W. R. Grace and Company; CCW MiraDRAIN by Carlisle; or equal.

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3. Protection Board:
    a. Bituminous Board, minimum 1/4-inch-thick, premolded, semi-rigid protection board consisting of a bitumen and mineral core between two reinforcing liners. Grace Protection 03 by W. R. Grace and Company; or equal.
4. Liquid Membrane: A two-component, elastomeric, cold-applied, trowel-grade material designed for use with the specified membrane waterproofing system.
5. Mastic: A rubberized asphalt-based mastic designed for specific uses such as fillets, patching of damaged areas and inadequately lapped seams. Bituthene Liquid Membrane by Grace Construction Products; CCW-703V Liquiseal by Carlisle; or equal.
6. Miscellaneous Materials:
    a. Use products manufactured by the maker of the Sheet Membrane Waterproofing System and recommended by the maker for the applications listed below.
    b. Surface conditioners.
    c. Primers:
    d. Primer: Grace Primer B1.
        1) Primer for Uncured Concrete: Grace Primer B2
        2) Deck Prep: Bituthene Deck Prep Surface Treatment
    e. Protection Board Adhesive: Bituthene Protective Board Pak Adhesive
    f. Two-sided tape for use with protection boards and drainage composites: Bitustik 4000 Double-Sided Tape.
    g. Edge Guard Tape: A specially formulated tape designed for applications where resistance to hydrocarbon contaminated soil is required. Two inches (51 mm) wide and constructed of a 2-mil (0.025 mm) polyester film with a 1-mil pressure sensitive solvent-resistant acrylic adhesive on one face. Bituthene Edgeguard Tape by Grace Construction Products; or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions of substrates and other conditions under which this work is to be performed. Have unsatisfactory conditions corrected by appropriate trades before proceeding with work under this Section.

3.02 PREPARATION OF SUBSTRATES

A. Review Sheet Membrane Waterproofing System manufacturer’s requirements for preparation of substrates. Apply membrane only to surfaces that are structurally sound and free of voids, spalled areas, loose aggregate, and sharp protrusions. Remove contaminants such as grease, oil, and wax from exposed surfaces. Remove dust, dirt, loose stone, and debris. Use repair materials and methods, which are acceptable to manufacturer of Sheet Membrane Waterproofing. Cure concrete with clear resin-based curing compounds free of oil, wax, and pigment. Remove all traces of curing compound prior to installing membrane.

B. Cast-in-Place Concrete Substrates:
    1. Do not proceed with installation until concrete has properly cured and dried, minimum 7 days for normal structural concrete.
    2. Fill form tie rod holes with concrete and finish flush with surrounding surface.

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3. Repair bugholes over 1/2-inch in width or length and finish flush with surrounding surface.
4. Remove scaling to sound, unaffected concrete and repair exposed area.
5. Grind irregular construction joints and offsets to suitable flush surface.

C. Related Materials: Treat joints and install flashings as recommended by waterproofing manufacturer.

3.03 ENVIRONMENTAL CONDITIONS

A. Apply Sheet Membrane Waterproofing system only in dry weather when air and surface temperatures are above -4ºC (25ºF).

B. Apply Bituthene 3000 only in dry weather when air and surface temperatures are above 5ºC (40ºF). Use Bituthene Low Temperature Membrane between -4ºC (25ºF) and 5ºC (40ºF).

C. Apply Surface Conditioner and other accessory products in dry weather above -4ºC (25ºF).

D. Conditions Suitable for Primers Application:
1. Apply solvent primers in dry weather above -4ºC (25ºF).
2. Apply uncured concrete primer in dry weather above 5°C (40ºF).
3. Apply Bituthene water-based primer in dry weather above 10ºC (50ºF).
4. Do not apply products to frozen concrete.

3.04 CONDITIONING

A. Dilute surface conditioner according to label instructions. Spray diluted Surface Conditioner uniformly to substrate at a rate of 12 to 15 sq. m/L (500 to 600 sq. ft. per gallon). Use appropriate sprayer and nozzle.

B. Allow surface conditioner to dry completely and thoroughly prior to membrane application. The surface conditioner is considered dry when the substrate returns to its original color (minimum 1 hour). To test for dryness, rub small conditioned area by hand. Wet conditioner will ball up under the fingertips. Let dry until conditioner cannot be rubbed off. If conditioned areas are not covered that day, recondition the area if there is significant dust or dirt contamination.

3.05 PRIMING

A. Apply one of the primers manufactured by the Sheet Membrane Waterproofing System maker and selected by the system manufacturer as being the best choice based on job conditions.

B. Apply Bituthene primers by lamb’s wool roller at a coverage rate of 6 to 8 sq. m/L (250 to 350 sq. ft. per gallon). Allow primer to dry 1 hour or until tack-free.

C. Apply Bituthene water based primer by spray or roller at a coverage rate of 12 to 15 sq. m/L (500 to 600 sq. ft. per gallon). Allow primer to dry 1 hour or until concrete returns to original color.

D. Dry time may be longer in cold temperatures. Reprime areas if contaminated by dust. If the work area is dusty, apply membrane as soon as the primer is dry. Surfaces treated with Deck Prep do not require conditioning or priming. Metal does not require priming but must be clean, dry, and free of loose paint, rust, or other contaminants.

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3.06 CORNER DETAILS

A. Use the corner treatment recommended by the System manufacturer based on the location of the corner. Comply with recommendations of system manufacturer's field representative.

B. At Wall to Footing Inside Corners:
   1. Apply membrane to within 1-inch (25 mm) of base of wall. Treat the inside corner by installing a 3/4-inch (19 mm) fillet of Liquid Membrane, extend Liquid Membrane at least 2-1/2-inch (64 mm) onto footing, and 2-1/2-inch (64 mm) onto wall membrane.
   2. Treat the inside corner by installing a 3/4-inch (19 mm) fillet of Liquid Membrane. Apply 12-inch (305 mm) wide strip of membrane centered over fillet. Apply wall membrane over inside corner and extend 6-inch (150 mm) onto footing. Apply 1-inch (25 mm) wide troweling of mastic or Liquid Membrane over all terminations and seams within 12-inch (300 mm) or corner.

C. At footings where the elevation of the floor slab is 6-inch (152 mm) or more above the footing, treat the inside corner either by the above methods or terminate the membrane at the base of the wall. Seal the termination with Mastic or Liquid Membrane.

D. Outside corners, apply 12-inch (305 mm) membrane strip centered on corner. Cover the treated corner with a full sheet of membrane to ensure 2-ply coverage. Or, lap Sheet Membrane from two adjacent surfaces at least 12 inches at an outside corner so there is 2-ply coverage at corner and extending 6 inches on each side of corner. Apply Edge Guard Tape over all membrane joint laps.

E. Joints: Properly seal all joints with waterstop, joint filler and sealant as required. Sheet Membrane is not intended to function as the primary joint seal. Prestrip all slab and wall cracks over 1/16-inch (1.5 mm) wide and all construction and control joints with 12-inch (300 mm) wide membrane.

3.07 PROTRUSIONS AND PENETRATIONS

A. Protrusion of Items Cast In Concrete:
   1. Apply Sheet Membrane to within 1-inch (25 mm) of the base of the protrusion. Apply Liquid Membrane 90 mils thick (3/32-inch or 2.3 mm) around protrusion. Liquid Membrane should extend over the membrane a minimum of 2-1/2-inch (64 mm) and at least 6 inches out onto the protruding item.
   2. Apply a layer of Sheet Membrane or edge seal tape lapping the Liquid Membrane at least 6 inches on each side. Seal all edges of Sheet Membrane with Liquid Membrane.

B. Penetrations:
   1. Apply membrane to the wall or slab surface and extend at least 6 inches inside the hole in the wall or slab.
   2. Insert a sealant backer rod and install a two-part polyurethane sealant to fill the annular space between the penetrating item and the Sheet Membrane that has been extended inside the hole in the wall or slab. Apply the sealant filler to a thickness equal to 2/3 of the widest part of the annular space.
   3. Apply two layers of Sheet Membrane fitted around the hole or opening in the wall or slab and extending out onto the Sheet Membrane applied to the face of the wall or slab. Extend the first layer of Sheet Membrane 6 inches out

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onto the penetrating item and 6 inches onto the membrane on the face of the wall or slab. Extend the second layer of Sheet Membrane 6 inches beyond the edges of the first layer. Seal the edges of all layers of Sheet Membrane with Liquid Membrane.

3.08 VERTICAL SURFACES

A. Apply membrane in lengths up to 8 feet (2.4 m). Overlap all seams at least 2-1/2-inch (64 mm). On higher walls apply membrane in two or more sections with the upper overlapping the lower by at least 2-1/2-inch (64 mm). Roll all membrane with a hand roller.

B. Seal all laps within 12-inch (305 mm) of all corners with a troweling of Liquid Membrane. Apply a troweled bead of Liquid Membrane to all vertical and horizontal joints and terminations at the end of each workday.

C. Patch tears and inadequately lapped seams with Sheet Membrane. Slit fishmouths and repair with a Sheet Membrane patch extending 6 inches (152 mm) in all directions from the slit and seal edges of the patch with Liquid Membrane. Inspect the membrane thoroughly and make any required repairs before covering.

3.09 PROTECTION OF MEMBRANE

A. Protect Sheet Membrane to avoid damage from other trades, construction materials, or backfill.

B. On vertical applications, use Drainage Composite. Adhere drainage composite to membrane with adhesive and/or two-sided tape per manufacturer’s recommendations.

3.10 BACKFILL

A. Use extreme care during backfill operation to avoid damage to waterproofing system. Follow generally accepted practice for backfill and compaction. Add and compact backfill in 6-inch (152 mm) to 12-inch (305 mm) lifts.

3.11 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials, which would be exposed, in the completed work.

B. Protect completed membrane waterproofing form subsequent construction activities as recommended by manufacturer.

END OF SECTION

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SECTION 07140

FLUID-APPLIED WATERPROOFING MEMBRANE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Fluid applied potable water membrane waterproofing or liner for canals, ponds, reservoirs, and tanks as specified and indicated on the Drawings. Membrane is a two-component asphalt modified urethane, applied as a liquid which rapidly cures to form a seamless, abrasion, corrosion, and chemical resistant waterproofing membrane or liner for applications requiring classification in accordance with ANSI/NSF 61.

B. Alternates/Alternatives: Submit proposed equivalents in accordance with Section 01300.

1.02 REFERENCES

A. American Society for Testing and Materials Standard Specifications:
1. ASTM D257: D-C Resistance or Conductance of Insulating Materials.
2. ASTM D412: Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.
3. ASTM D751: Coated Fabrics.
4. ASTM D832: Rubber Conditioning for Low-Temperature Testing.
5. ASTM D4258: Surface Cleaning Concrete for Coating.
6. ASTM D4259: Abrading Concrete.
7. ASTM D4263: Indicating Moisture in Concrete by the Plastic Sheet Method.
8. ASTM D4285: Indicating Oil or Water in Compressed Air.
9. ASTM E96: Water Vapor Transmission of Materials.

B. American Concrete Institute:
1. Making a Condition Survey of Concrete in Service (ACI 201.1R).

C. ANSI/NSF 61 - Drinking Water System Components - Health Effects.

D. ICRI 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays.

1.03 SYSTEM DESCRIPTION

A. Design Requirements

B. Performance Requirements

1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

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B. Product Data: Submit manufacturer's product data, including surface preparation, application, curing, and material safety data sheets.

C. Samples: Submit 3 inch x 1inch samples of the following for approval.
   1. Cured membrane, 60 mils thick.
   2. Cured patching material.
   3. Reinforcing fabric and joint cover sheet
   4. Protection board and/or protection mat.
   5. Prefabricated drainage mat.
   6. Geotextiles.

D. Quality Assurance/Control Submittals
   1. Material safety data sheet.
   2. Certificates for product and installation warranty.
   3. Submit certification that membrane has been classified by an ANSI certified laboratory to ANSI/NSF 61 in tanks, pipes, and joints.
   4. Submit for applicator's supervisor a certificate indicating completion of manufacturer's contractor training program.
   5. Submit maintenance manual containing instructions for the Owner on how to properly maintain the membrane properties of the potable water tank waterproofing or liners.

1.05 QUALITY ASSURANCE

A. Qualifications: The subcontractor or applicator of the membrane shall be trained and approved by the membrane manufacturer. Employ a supervisor during all phases of the work who has successfully completed manufacturer's contractor training program. Employ persons trained for the application of potable water tank membranes for waterproofing or liners.

B. Pre-Installation Meetings: A pre-installation conference shall be held prior to application of membrane to assure proper substrate and installation conditions, to include Contractor, Owner’s representative, Engineer, subcontractor/applicator and inspectors, if any. Review environmental requirements, materials, protection of adjacent work, surface preparation, application, curing, disinfection, field quality control, cleaning, and coordination with other work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Deliver materials to site in original unbroken packages bearing manufacturers label showing brand, weight, volume, and batch number.

B. Storage and Protection: Store materials at site in strict compliance with manufacturers instructions. Store materials indoors in an area well ventilated and protected from damage. Keep a copy of the applicable material safety data sheets with each material. Do not allow materials to freeze in containers.

1.07 PROJECT/SITE CONDITIONS

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A. Protect adjacent areas not to be waterproofed. Where necessary, apply masking to prevent staining of surfaces to remain exposed wherever membrane abuts to other finish surfaces.

B. Do not apply in wet weather or when rain is imminent. Do not apply when the surface may become wet within 4 hours after application. Perform work only when existing and forecasted weather conditions are within manufacturers recommendations. Apply when surface is minimum of 50 degrees F (10 degrees C) and minimum of 5 degrees F (3 degrees C) above dew point. Consult manufacturer for cold weather application instructions.

C. Do not apply to porous substrates when substrate or ambient temperatures are rising. Do not apply to porous substrates when substrate is in direct sunlight. Do not apply over substrates that are frozen or contain frost.

D. Minimum clearance of 24 inches is required for spray application of product. For areas with less than 24 inch clearance, the product shall be applied by hand.

E. All pipes and conduits under or passing through the waterproofing or liner shall be positively secured in their proper position and protected prior to material application.

F. Protect reinforcing steel from material installation.

1.08 WARRANTY

A. Provide a manufacturer's and installers warranty that the membrane will be free of defects. The manufacturer will replace at no charge any product not meeting the specifications or permitting leakage through the membrane. Warrant that the product will not become brittle or crack and will provide a water barrier. Warranty shall be for a period of 5 years from the substantial completion of the project. If breach of the warranty is established the manufacturer and installer shall re-supply sufficient materials and re-install sufficient materials to replace the non-conforming product.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Pre-Approved Manufacturers:
   1. C.I.M. Industries, Inc., 23 Elm Street, Peterborough, New Hampshire 03458. Phone (603) 924-9481. Fax (603) 924-9482.
   2. LBI Technologies, Inc., 3873 East Eagle Drive, Anaheim, California 92807. Phone (714) 575-9200. Fax (714) 575-9229.
   3. or equal.

2.02 MATERIALS

A. Fluid applied potable water liquid membrane designed for spray, squeegee, roller, or trowel application:
   1. CIM 1061 Commercial Industrial Membrane: Two-component, high solids, elastomeric asphalt extended, urethane industrial membrane.

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2. Liquid Boot: Single course, high build, polymer modified asphaltic emulsion.
3. or equal.

B. Physical Properties:
1. Potable Water Service: ANSI/NSF 61, maximum use level 171 cm^2/L.
2. Volatile Organic Compounds (VOC): 0.75 pounds per gallon (90 g/L).
3. Mullen Burst Strength: ASTM D751, 50 mils: Minimum 150 psi.
4. Tensile Strength: ASTM D 412, 100-mil sheet: Minimum 1,000 psi.
5. Extension to Break: ASTM D 412, Minimum 300 percent.
6. Membrane Weight: 60 mils wet film thickness: 31 pounds/100 square feet.
7. Membrane Performance, Weathering: ASTM D 822, 5,000 hours.
8. Permeability to Water Vapor: ASTM E 96, Method E, 100 degrees F (38 degrees C), 100-mil sheet: 0.03 perms.
9. Electrical Resistivity, Volume: ASTM D 257, 50 percent relative humidity, 23 degrees C, 2-inch disc, 100-mil thickness: 1.9 x 10E14 ohm-cm.

C. Primer: Two-component, high solids, epoxy primer. Use as a prime coat on dry, porous and non-porous surfaces, such as concrete. Prevents flash rust on blasted steel. CIM 61 Epoxy Primer, or equal.

D. Bonding Agent: Organo-silane compound dispersed in isopropyl alcohol. Use as a solvent wash on non-porous surfaces, such as steel. CIM Bonding Agent, or equal.

E. Patching Material: Tough, liquid applied, chemical and corrosion resistant urethane elastomer, chemically thickened to allow trowel applications with minimum sag. Use as a crack filler and for application to vertical surfaces and cold joints. CIM 1000 Trowel Grade Commercial Industrial Membrane, or equal.

F. Reinforcing Fabric and Joint Cover Sheet: Stitch bonded polyester. Compatible with membrane materials. Weight 3 ounces per square yard (100g/m^2). CIM Scrim, or equal.

G. Protection Board:
1. Vertical surfaces: 3/8-inch thick expanded polystyrene protection board; 6 oz/yd^2 geotextile; or other protection as favorably reviewed.
2. Horizontal surfaces: 1/8-inch thick asphaltic impregnated, felt and fiberglass protection mat; 30 pound roofing cap sheet; 6 oz/yd^2 geotextile; two inches of clean sand; or other protection as favorably reviewed.

H. Prefabricated Drainage Mat: A formed plastic sheet, one side smooth with concave dimples, the other side bonded to a geotextile.

I. Geotextile: Non-woven polypropylene fabric, 4 oz/yd^2. At least one side shall be heat-rolled. The heat-rolled side shall be used as the application surface.

PART 3 - EXECUTION

3.01 EXAMINATION

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A. Site Verification of Conditions: The applicator shall inspect substrate and adjacent areas where materials will be applied. The applicator shall notify the Engineer of conditions that would adversely affect the application or subsequent utilization of the materials. The applicator shall not proceed with application until unsatisfactory conditions are corrected by the Contractor.

3.02 PREPARATION

A. Protection: Protect adjacent work and surrounding areas from contact with fluid-applied membrane materials.

B. Surface Preparation for New Concrete Tanks:
1. Prepare surfaces in accordance with manufacturer's instructions.
2. Provide clean, dry, and structurally sound concrete surfaces.
3. Provide broom finish or float finish to Class B tolerance.
4. Cure concrete to a minimum of 28 days. Wet cure concrete for 14 days. Do not apply curing compounds.

C. Abrasive Blasting:
1. Prepare concrete surfaces to receive membrane by abrasive blasting.
2. Remove dirt, soil, grease, oil, paint, coatings, form release agents, curing compounds, laitance, loose material, unsound concrete, and other foreign materials that would inhibit performance of membrane in accordance with ASTM D 4258 and by abrasive blasting.
3. Obtain a firm, sound concrete surface in which bug holes are fully opened. Remove sharp concrete edges and projections. Perform abrasive blasting in accordance with ASTM D 4259. Receive approval by Engineer of blasting media. Maintain air supply for abrasive blasting free of oil and water in accordance with ASTM D 4285.

D. Repair of Concrete Surfaces:
1. Repair concrete surface to be free of holes. Fully open bug holes before repair. Repair defects in the concrete surface, such as bug holes, air pockets, and honeycomb by filling and smoothing off with patching material, epoxy patching compound, or grout. Abrasive blast repaired surfaces. Repair surface profiles greater than 1/4 inch with patching material, to a profile less than 1/8 inch.
2. Repair cracks in concrete surface with materials suitable for type and width of crack, compatible with substrate and membrane, and approved by the Engineer.

E. Condition of Concrete Surfaces:
1. Do not apply primer or membrane to concrete surface unless two or more of the following moisture tests confirms moisture levels of 5 percent or less for properly prepared surface:
   a. Plastic Sheet Method ASTM D4263
   b. Relative Humidity Test
   c. Calcium Chloride Test
   d. Gel Bridge Test
   f. Radio Frequency Test

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F. Application of Primer:
1. Apply primer to concrete surface at 5 mils dry thickness.
2. Allow primer to cure in accordance with manufacturer's instructions before top coating with the liquid membrane.
3. All penetrations shall be prepared in accordance with the manufacturer's instructions.
4. Provide a ¾-inch minimum cant strip of trowel grade material at all horizontal to vertical transitions and other inside corners of 90° or less.

3.03 APPLICATION

A. Application of Liquid Membrane:
1. Apply membrane in accordance with manufacturer's instructions.
2. Keep material containers tightly closed until ready for use.
3. Keep equipment, air supplies, and application surfaces absolutely dry.
4. Mix and apply when liquid membrane is above 60 degrees F (15 degrees C).
5. Do not use adulterants, thinners, or cutback solutions.
6. Blend and mix 2-component materials in accordance with manufacturer's instructions. Do not hand mix components.
7. Maintain air supply for material spray application free of oil and water in accordance with ASTM D 4285.
8. Apply liquid membrane directly to a clean and dry surface or to scrim.
9. Apply 6 to 12 inch wide strip of joint cover sheet over cracks over 1/8 inch wide, non-working joints, and edges. Center joint cover sheet over all joints and adhere by first applying a tack coat of liquid membrane.
10. Apply sufficient liquid membrane to achieve 60 mils dry film thickness for potable water immersion service.
11. Prepare for joint lines should rain or other conditions require work stoppage or extended delay. Install joint lines clean and straight. Install overlap 6 inches minimum to ensure an impervious joint. Severely abrade with wire brush or sandpaper and apply bonding agent to all areas to be recoated when more than 4 hours curing time has taken place.

B. Recoating:
1. Recoat liquid membrane system within 4 hours to obtain maximum interlayer adhesion to build specified thickness.
2. Immersion Service: Complete recoating within 4 hours, except at joint lines.
3. Non-Immersion Service: Severely abrade with wire brush or surface grinder, apply bonding agent, and recoat, if membrane has cured more than 4 hours.

C. Colored or Reflected Surface Finish: Apply 1 of the following.
1. Pigmented topcoat.

D. Curing:
1. Cure membrane in accordance with manufacturer's instructions.
2. Do not allow uncured membrane to come into contact with potable water.
3. Allow sufficient time for solvents to evaporate from the cured membrane before placing into potable water service. Allow minimum solvent release time of 2 weeks at 60 degrees F (15 degrees C) for a 60-mil membrane.

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Other temperatures or thicknesses may require different solvent release times.

4. Receive approval of cured membrane by Engineer before disinfection.

E. Disinfection
   1. Wash, rinse, and disinfect the membrane in accordance with manufacturer's instructions before placing into potable water service.
   2. Dispose of cleaning and disinfecting solutions in accordance with local regulations.
   3. Receive approval of cleaned and disinfected membrane by Engineer before placing into potable water service.
   4. Disinfect potable water tanks in accordance with Section 11003.

3.04 FIELD QUALITY CONTROL

A. Inspection: Provide inspection services by an independent inspection firm throughout all phases of surface preparation, application, curing, and disinfection of membrane.

3.05 CLEANING

A. Remove and dispose of all temporary materials used to protect adjacent work and surrounding areas.

B. Immediately remove and clean membrane materials from surfaces not intended to receive the materials.

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SECTION 08307

ACCESS HATCHES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Reservoir roof access hatches.
   2. Valve and drain vault access hatches.
   3. Sidewalk access hatches.

1.02 REFERENCES

A. California Building Standards Commission
   1. 2019 California Building Code (California Code of Regulations, Title 24)

B. Trade and Technical Association Standards:
   1. “Aluminum Design Manual 2015” published by The Aluminum Association.
   2. "AWS D1.2, Structural Welding Code – Aluminum” published by American Welding Society (AWS).
   3. “Structural Aluminum” published by National Association of Architectural Metal Manufacturers (NAAMM).

1.03 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Product Data: Fully describe all items proposed for use. Include sufficient data to show that products conform to specification requirements as indicated herein and in Related Sections.

C. Shop Drawings: Show dimensions, attachments, inserts and relationship of work to adjoining construction.

D. Warranty.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Applicable State of California Occupational Safety and Health (OSHA) Regulations.
   2. California Building Code, 2019 edition.

PART 2 - PRODUCTS

2.01 ACCESS HATCHES

A. Minimum clear opening dimensions of each hatch shall be as shown on the Drawings. Provide single leaf or double leaf hatches as indicated in the Access Hatch Schedule.
   1. Single Leaf: Bilco "J-AL" series; equivalent by L.W. Products Co.; equivalent by EJ; equivalent by Babcock-Davis; equivalent by U.S.F. Fabrication; or equal.

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2. Double Leaf: Bilco "JD-AL" series; equivalent by L.W. Products Co.; equivalent by EJ; equivalent by Babcock-Davis; equivalent by U.S.F. Fabrication; or equal.

B. Live load: Provide hatches to withstand the loads indicated in the Access Hatch Schedule.

C. Door Leaves: ¼-inch thick aluminum, diamond pattern, reinforced as required to withstand the specified loads.

D. Frame: Minimum ¼-inch thick aluminum channel with anchor flange around perimeter for embedment into concrete. Provide channel to collect rain water and provide 1-1/2-inch drainage coupling for connection to drain lines. Contractor shall provide and route drain lines. Drain lines shall be freely draining by gravity.

E. Doors: Door shall be equipped with heavy forged Type 316 stainless steel hinges with ¼-inch Type 316 stainless steel hinge pins, compression spring operators enclosed in telescopic tubes. Doors shall open to minimum 90 degrees and shall include an automatic hold-open arm with a positive automatic latch that will secure the door in the open position until the release handle is activated. Provide stainless steel hold-open pin through holes in hold-open arms to ensure against accidental hatch closure. Attach pin to hatch with a short stainless steel chain to prevent loss. Submit details of latch for review. Door hinges shall be recessed or flush.

F. Lock: Provide a hinged covered recess with a door to frame padlock hasp and a removable recessed or drop-down flush lifting handle(s).

G. Lift-Assist Mechanism: Provide stainless steel compression spring(s) or pneumatic spring(s) enclosed in sealed telescoping tube(s).

H. Safety Chain: For double leaf doors, provide a stainless steel safety chain between doors at the opposite end from the latch to form a barrier when the doors are locked in the open position.

I. Safety Grate: Where indicated in the Access Hatch Schedule, provide a secondary fall protection safety grate located beneath the solid hatch cover, which lifts independently from the cover and is equipped with a latch to hold it in the open position. Provide corrosion resistant hardware. Equip with lift assistance and automatic hold open hardware. Rated for 300 psf live load. Operates independently of the access cover reinforcing. Grating panel(s) shall be fiberglass, molded in one piece, with load bearing bars in both directions to allow for use without continuous side support. Panel shall be designed to support a 300 psf live load and be high visibility safety yellow in color. Torsion rod lift assistance shall be provided for ease of operation and a hold open arm shall be included to automatically lock the panel in the fully open 90 degree position. A release handle shall be provided to close the grating panel and there shall be a provision to lock the panel to prevent unauthorized access. Hold open arm shall be aluminum with a stainless steel release handle. All other hardware, including mounting brackets, hinges, torsion rod, padlock loop, and fasteners, shall be Type 316 stainless steel. Manufacturer shall provide a twenty-five year warranty against defects in material and work. The grate shall comply with OSHA Standard 1910.28 for fall protection.

J. All non-aluminum metals and hardware: Type 316 stainless steel.

K. Finish: Mill finish aluminum. All surfaces of aluminum in contact with concrete shall be coated for isolation in accordance with Section 05500.

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L. Weather-Tightness: All hatches shall be rated “weather tight” unless noted otherwise in the Access Hatch Schedule. Provide an EPDM or neoprene rubber rim gasket mechanically fastened to the perimeter of the frame to prevent infiltration of rainwater. Include gaskets and o-rings for accessory penetrations as applicable.

M. Warning Sign:
   1. Provide a sign or decal permanently attached to the underside of hatch doors reading: "Warning: Permit Confined Space Entry."
   2. Provide a sign or decal permanently attached to the underside of hatch doors reading: "Danger: Make Sure Hold-Open Latch is Positively Engaged Before Using. Insert Pin in Holes in Hold-Open Arms to Hold Door Open."

2.02 ACCESS HATCH SCHEDULE

Hatch Location	No. of Leaves	Live Load	Safety Grate	Special Requirements
4’-0” x 4’-0” Roof Hatch (Quantity = 2)	Single	300 pounds per square foot	Yes	1. Weather tight 2. Provide warning signs
8’-0” x 8’-0” Valve Vault	Double	300 pounds per square foot	Yes	1. Weather tight 2. Provide warning signs 3. Safety chain
4’-0” x 8’-0” Drain Vault	Double	300 pounds per square foot	Yes	1. Weather tight 2. Provide warning signs

PART 3 - EXECUTION

3.01 INSTALLATION

A. Deliver hatches to job site in time for installation in the concrete pour.

B. Coat all aluminum surfaces, which will be in contact with concrete, in accordance with Section 05500.

C. Make connection of drainage coupling to plumbing drain line prior to the concrete pour.

D. Install in conformance with the manufacturer’s installation instructions. Set frame level and true to plane at all four corners, and flush with adjacent finished surfaces. Doors, when closed, shall be flush with frames and flush with each other.

E. Install specified warning sign(s).

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SECTION 11001

GENERAL EQUIPMENT AND MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: The general requirements for all of the Equipment and Mechanical work in the scope of the Project, included in Divisions 11, 12, 13, 14, and 15 and elsewhere wherever specifically mentioned in these Specifications.

B. Direct the attention of all subcontractors and suppliers of equipment and related appurtenances for the work to the applicable provisions in the Contract Documents wherever they may occur.

1.02 REFERENCES

A. American Gear Manufacturers Association (AGMA).

B. American Institute of Steel Construction (AISC).

C. Hydraulic Institute.

D. National Electrical Manufacturers Association (NEMA).

E. Occupational Safety and Health Act (OSHA).

F. California Code of Regulations, Title 8 Industrial Relations (CAL/OSHA).

1.03 STANDARDS FOR THE WORK

A. Complete Systems: Provide pipe, fittings, wiring, and supports to produce complete, operable systems with all elements properly interconnected. If a specific dimensioned location is not shown for interconnections or smaller system elements, select appropriate locations and show them on Shop Drawing submittals for review.

B. Provide equipment and material new and without imperfections. Erect in a neat and workmanlike manner; aligned, leveled, cleaned and adjusted for satisfactory operation; installed in accordance with the recommendations of the manufacturers and the best standard practices for this type of work so that connecting and disconnecting of piping and accessories can be readily made and so that all parts are easily accessible for inspection, operation, maintenance, and repair. Locate oil and lubrication fittings clear of and away from guards, base, and equipment and within reach from the operating floor. Coordinate location of all motor connections in order to properly orient encased electrical conduits. In order to meet these requirements with equipment as furnished, minor deviation from the Drawings may be made as favorably reviewed by the Engineer.

C. The recommendations and instructions of the manufacturers of products used in the work are hereby made part of these Specifications, except as they may be superseded by other requirements of these Specifications.

1.04 SUBMITTALS

A. Shop Drawings: Show sizes and arrangement of equipment, foundations, and anchor bolts required; performance characteristics; fan curves and pump curves;

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control diagrams; wiring diagrams; motor data sheets; methods of assembly; pipe hanging details; ductwork layouts; and connections to other work. Date and sign drawings as certified for use in construction of this project. The arrangement of mechanical equipment and appurtenant piping shown on the Drawings may be varied as necessary to fit the favorably reviewed certified manufacturer's installation drawings. However, manufacturers' drawings shall not deviate in substance from the Contract Drawings and Specifications as to location, size, type, and design of equipment. The following minimum requirements shall accompany all equipment submissions:

1. Overall dimensions.
2. Mounting arrangement and dimensions.
3. Description of materials.
4. Connection sizes and orientation.
5. Capacity and location of lifting eyes.
6. Motor arrangement showing location of electrical connections.
7. Rating data - Mechanical and Electrical as applicable.
8. Detail electrical wiring diagrams, showing component designation and rating.
9. Motor data as specified in Section 11303, Paragraph 2.03.I.
10. List of special tools and/or spare parts to be furnished, if any.

B. Each piece of equipment, for which certified witnessed or non-witnessed performance tests are required, shall be accompanied by a completed form containing at least the following information:

1. Owner's name and location of project.
2. Contractor's name and subcontractor if applicable.
3. Name of item being submitted.
4. Specification reference by section, paragraph and page.
5. Data on item (manufacturer, general descriptive data, dimensions, size of connections, speeds, performance curves, serial number). A specific list of the test results plus a list, which shows the values that differ from Specifications.
6. Motor data, type, voltage, frequency, phase, full load amperes, starting method, frame size, enclosure insulation type (NEMA Code letter), dimensions, service factor, serial number.
7. Date and signature of person certifying the performance.

C. Operations and Maintenance Manuals: Prepare and submit manuals covering installation, operation and maintenance of all equipment and machinery specified in Divisions 11, 12, 13, 14, and 15.

D. Manufacturers' Affidavits: Where called for in the Specifications, each equipment manufacturer, or their authorized representative, shall submit an affidavit conforming to the requirements of Section 01650.

1.05 RESPONSIBILITY AND CARE OF EQUIPMENT

A. The Contractor shall be responsible for the equipment included in this Contract until it has been finally inspected, tested, and accepted in accordance with the requirements of these Specifications.

B. The Contractor shall make his own provisions for properly storing and protecting all material and equipment against theft, injury, or damage from any and all causes. Damaged material and equipment shall not be used in the work.

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PART 2 - PRODUCTS

A. DESIGN

B. General: Design all equipment for the service intended, of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and during continuous or intermittent operation. Adequately stay, brace and anchor, and install equipment in a neat and workmanlike manner. Give consideration to appearance and safety, as well as utility, in the design of details. Use cathodically compatible materials of construction.

C. Seismic: Refer to Section 01190 of the Specifications for the seismic design criteria.

D. Controls: Unless noted otherwise, the design of the electric control of any equipment system and/or equipment package shall be the responsibility of the manufacturer of the equipment system and/or equipment package. The elementary control diagrams as shown on the Electrical Drawings and the diagrams shown on the Instrumentation Drawings are illustrative of control and monitoring requirements pertaining to various equipment of this project. The manufacturers shall design their own functional electric control devices and circuitry, in consultation with the specific elementary control diagrams and other project specifications, to meet the equipment control requirements. All such systems and package controls shall be furnished by the equipment manufacturer, except that controls shown in motor control centers and process controllers, remote control devices, and their interconnecting wiring shall be provided under Divisions 16 and 17. Provide heating, ventilating, and air conditioning controls, both 24-volt and line voltage type, by a HVAC controls specialist.

2.02 MATERIALS AND STANDARD SPECIFICATIONS

A. Materials: Design, fabricate, and assemble equipment and systems with new materials and in accordance with acceptable modern engineering and shop practices. Manufacture individual parts to standard sizes and gauges so repair parts can be installed in the field.

B. Uniformity: Unless otherwise specified, equipment or material of the same type or classification used for the same purpose shall be the product of the same manufacturer and shall be the same model.

2.03 LUBRICATION

A. Provide lubricants of types recommended by equipment manufacturers, in quantities sufficient for consumption prior to completion, testing and final acceptance.

2.04 STRUCTURAL METAL FRAMING

A. Details of fabrication shall be in accordance with Section 05100 OR 05500.

B. Weld submerged steel surfaces which butt or bear against each other, to seal the surfaces against the penetration of the liquid. Weld all gaps between adjacent submerged steel surfaces less than 1/32-inch wide to seal the surfaces. Weld size shall be not less than the thickness of the thinnest member of the lapped or joined assembly.

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2.05 EQUIPMENT BASES AND BEDPLATES

A. Mount equipment assemblies on a single heavy cast iron or welded steel bedplate unless otherwise shown or specified. Provide bases and bedplates with machined support pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Round or chamfer and grind smooth all corners. Continuously weld seams and contact edges between steel plates and shapes, and grind welds smooth. Do not support machinery or piping on bedplates other than that which is factory installed. Provide jacking screws in equipment bases and bedplates to aid in leveling prior to grouting. Mount all equipment bases and baseplates on reinforced concrete pads at least 3 inches high.

2.06 ANCHORS

A. Each equipment manufacturer shall furnish an anchor bolt pattern and the required anchor bolts, nuts, and washers of adequate design for securing bases and bedplates to concrete bases. Provide anchor bolts of length to allow for 1 1/2 inch of grout under baseplates and adequate anchorage into structural concrete unless otherwise shown or specified.

B. Provide anchor and assembly bolts and nuts of ample size and strength for the purpose intended. All bolts shall be standard machine bolts, with cold pressed hexagon nuts. Provide suitable degauling compounds for bronze and stainless steel threaded components. Any space wholly or partially underground, or having a wall or ceiling forming part of a water channel, is classified as a moist location. Unless otherwise specified or noted on the Drawings, provide materials as follows:
   1. Bolts and nuts in submerged locations or submerged and embedded in concrete or buried in earth: Type 304 stainless steel.
   2. Bolts and nuts for supports or equipment in dry or moist locations: Galvanized steel (hot-dipped), with oversize nuts.
   3. Use other bolting materials where specifically called for in the Specifications or on the Drawings.

C. Anchor all motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive. Do not provide expansion type anchors for motor-driven equipment.

D. Anchor all non-motor-driven equipment with cast-in-place anchor bolts or drilled-in anchors set with epoxy adhesive except that, where specifically allowed by note on the Drawings, expansion type anchors may be used.

E. Refer to Section 05090 for technical specification requirements for cast-in-place and post-installed anchors.

2.07 SAFETY GUARDS

A. Cover belt or chain drives, fan blades, couplings, nip points, exposed shafts, and other moving or rotating parts on all sides with safety guards conforming to all federal, state, and local codes and regulations pertaining; conform to the most restrictive requirement. Design guards for easy installation and removal, complete with necessary supports, accessories, and fasteners, all hot-dip galvanized. Design guards in outdoor locations to prevent entrance of rain and dripping water. Provide tachometer test opening in line with ends of shafts. Typically, guards shall be expanded metal on a structural steel frame except that outdoor guards may be

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of solid material. Provide hinged doors with latch for service and lubrication access.

B. Cover all pipes, manifolds, heaters, and other surfaces which have a surface temperature sufficient to burn human tissue with a thermal insulating material or otherwise guard against contact.

C. Guards to comply with OSHA and local requirements OR CAL/OSHA 3940 through 3944.

2.08 LIFTING EYES

A. Supply all equipment weighing over 100 pounds with lifting eyes. Parts of equipment assemblies which are normally serviced separately, such as motors, to have lifting eyes of their own.

2.09 DRIVES

A. General: Provide all drive units with an AGMA rating and service factor suitable for 24 hours per day operation under the operating load.

B. Electric Motors: Conform to the requirements of Section 11303, Paragraph 2.03.I.

C. V-Belt Drives: Equip each V-belt drive with suitable tension adjustment. Provide drives having a service factor of at least 1.6 with arc length correction at maximum torque using nameplate rating of driving motor.

2.10 NAMEPLATES

A. Manufacturer's Nameplate: Furnish each piece of equipment and its driver with a corrosion-resistant metal nameplate fastened to the item in a readily readable position. This nameplate to contain the manufacturer's name, equipment rating, capacity, size, model, serial number, and speed. All information written or printed to be in English.

B. Direction of Rotation: Furnish each piece of rotating equipment with a direction of rotation arrow.

C. Functional Identification: Label each piece of equipment using a plastic laminate label with the functional name and number of the equipment.
   1. Fasten labels to the equipment, its base, or other acceptable location:
      a. Letters: At least 1/2-inch high with the border trim on all sides not less than 1/4 inch.
      b. Color: Green background with white letters.
      c. Fasteners: Brass or stainless steel screwed into inserts, anchor shields, or tapped holes in equipment or base.

2.11 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, provide suitable insulation between adjacent surfaces so as to eliminate direct contact and any resultant electrolysis. Connections of dissimilar piping materials shall utilize dielectric unions, flanges, couplings, or bushings.

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2.12 SPECIAL TOOLS

A. For each type of equipment to be furnished, provide a complete set of all special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation, and maintenance of such equipment.

2.13 FINISHES

A. Conform to applicable requirements of Section 09960.

B. Factory Painting: On pumps, motors, drives, starters, control panels, and other similar self-contained or enclosed components, apply a factory protective paint system unless otherwise noted. Paint or otherwise protect surfaces that are inaccessible after assembly by a method which provides protection for the life of the equipment.

C. Shop Priming: Except where field sandblasting is required, apply one or more shop coats of metal primer on surfaces to be finish painted at the site, of sufficient thickness to protect surfaces until finished. Primer shall be compatible with finish coat.

D. Rust Preventive: Coat machined, polished, other ferrous surfaces, and non-ferrous surfaces which are not to be painted with rust preventive compound.

2.14 NOISE AND VIBRATION

A. Mechanical and electrical equipment, as installed in this project, shall not create sound levels that are in excess of that permitted by CAL/OSHA for 8 hours per day worker exposure unless otherwise noted for the specific piece of equipment involved. If the required sound level cannot be achieved by bare equipment in its designated environment, provide sound attenuating enclosures. Sound attenuating enclosures shall have necessary ventilation to prevent equipment overheating and shall be constructed for easy removal to permit maintenance. Devices necessary for day-to-day operation shall pierce the enclosure or otherwise be accessible without need to remove the enclosure.

B. Equipment which when operating has obvious excessive vibrations shall be repaired or replaced as directed by the Engineer. Baseline vibration measurements shall be made where specified.

2.15 FACTORY TESTS

A. Perform factory tests for each piece of equipment where specifically called for in the section specifying that equipment. Note that factory tests are inherent in many reference standards. The requirement for a factory test in a referenced standard is hereby made a part of these Specifications. Conduct factory tests at the same speeds and other conditions at which the equipment will operate in the field, except as noted.

B. Where specifically noted, performance tests may be witnessed by the Engineer or his representative. Inform the Engineer in sufficient time to allow arrangements to be made for witness of such tests. When non-witnessed tests are performed, supply certified results.

C. Perform factory testing of pumps in accordance with the requirements and standards of the Hydraulic Institute.

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D. Tests of other equipment shall conform to the requirements set forth in these Specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect each item of equipment for damage, defects, completeness, and correct operation before installing.

3.02 PREPARATION

A. Prior to installing equipment, ensure that the areas are clean. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service equipment in accordance with the approved Instruction Manuals and specific recommendations of the equipment manufacturer.

3.03 INSTALLATION

A. Structural Fabrications: Conform to the AISC Code and Specification referenced in Article "Structural Steel Fabrications," and conform to Section 05100 OR 05500.

B. Equipment: Conform to approved Operations and Maintenance Manuals. Employ skilled craftsmen experienced in installation of the types of equipment specified. Use specialized tools and equipment, such as precision machinist levels, dial indicators, gauges, and micrometers, as applicable. Produce acceptable installations free of vibration or other defects. Align and pin to common bedplate equipment and drivers connected by flexible couplings.

C. Anchor Bolts: Deliver bolts with templates or setting drawings and verify that bolts are correctly located before structural concrete is placed.

D. Base and Bedplate Grouting: Do not place grout until initial fitting and alignment of connected piping is completed. Level and align equipment on the concrete foundations, then entirely fill the space under base or bedplates with grout. Bevel exposed grout at 45 degree angle, except round exposed grout at horizontal surfaces for drainage. Trowel or point exposed grout to a smooth, dense finish and damp cure with burlap for 3 days. When grout is fully hardened, remove jacking screws and tighten nuts on anchor bolts. Check the installation for alignment and level, and perform approved corrective work as required to conform to the tolerances given in the applicable Instruction Manual.

1. Make an allowance of at least 1-1/2 inches for grout under the equipment bases, whether or not shown on the Drawings. Use steel shims to level and adjust the bases. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise approved, all grout shall be a favorably reviewed non-shrink, non-metallic grout.
2. Grout: Dimensionally stable, inorganic, premixed and resistant to acids, alkalies, and salt water, and unaffected by water and oil. It shall have high strength even when used as a pourable mixture, and shall bond well with steel and cured concrete or be compatible with a suitable bonding agent which shall then be used to effect the bond. Use in strict accordance with the manufacturer's recommendations. Provide Five Star Grout as manufactured by U.S. Grout Corporation, Bonsal Construction Grout as manufactured by

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Bonsal Company, or equal. Submit for favorable review by the Engineer prior to use.

3. Where practicable, place the grout through the grout holes in the equipment base and work outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

E. Architectural Metals: Handrails, guardrails, stairs, and other architectural metals furnished as a part of equipment shall conform to the requirements of Division 5.

3.04 EQUIPMENT STARTUP AND ADJUSTMENT

A. Arrange for an authorized factory-trained representative of the company or companies supplying the various items of equipment to check the installation and adjust and test the equipment. Said representative shall be experienced and knowledgeable of the equipment being tested. Furthermore, the representative shall assist and instruct the operating staff in adjusting and operating the equipment during the initial plant operation period.

1. Provide initial lubrication for all equipment.
2. Test and demonstrate to the Engineer that all equipment operates properly and specified performance has been attained. For pumps, include measurement of suction and discharge pressure at the pump and measurement of pumping rate by volumetric means or through a suitably calibrated meter for two points on the performance curve. For adjustable-speed pumps, conduct tests at a minimum of two speeds. Furnish any test equipment or measuring devices required which are not part of the permanent installation.
3. In addition, demonstrate that the entire facility is in full operating condition prior to the acceptance of the work. Should any equipment or part thereof fail to operate as intended, immediately remove and replace it, all at the Contractor's expense. Pay for all tests involved in this Section.
4. Pressure test equipment and connections thereto as required by these Specifications.

3.05 PERFORMANCE TESTS

A. Upon completion of the work, and after all systems are set and balanced, conduct performance tests in accordance with Division 1 and other applicable sections of these Specifications. Submit test conditions, test data and results to the Engineer for review.

3.06 SOUND LEVEL TESTING

A. Measure the sound level developed by all mechanical and electrical equipment provided. Perform testing as required by the technical specifications OR in all rooms and spaces containing such equipment during the final operation test program with all equipment operating. Use OSHA approved instrument and record the highest sound level developed when measured according to OSHA standards in each room and space. Deliver a copy of records to the Engineer.

3.07 TOOLS, LOOSE PARTS, AND LUBRICANTS

A. Tools and Loose Parts Supplied: Provide an inventory of tools and loose parts required to be supplied under the project. Turn over inventory and parts to the Owner. The Owner's written acknowledgment of receipt is required for project

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completion. Loose parts are defined as items such as special tools, keys, safety equipment, and portable equipment. Refer to Section 01700 and relevant technical sections of these Specifications for additional instructions.

B. Recommended Spare Parts: Furnish a complete list of recommended spare parts and supplies for each equipment furnished with current prices and a source of supply.

C. Provide a list of all recommended lubricants not listed in the Operations and Maintenance Manuals.

END OF SECTION

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SECTION 11003

DISINFECTION AND VOC TESTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Clean, flush and disinfect all surfaces with which the process water may come in contact in the following equipment, structures, tanks, pipelines, and accessories, including:
      a. Treatment equipment and pumping structures
      b. Water storage facilities:
      c. Large pipelines:
      d. Small pipelines:
         1) Hot and cold domestic water piping.
         2) Fire sprinkler system.
         3) Irrigation
   2. Dispose of disinfection solution.
   3. Test for volatile organic compounds (VOCs).

1.02 REFERENCES

A. American Water Works Association (AWWA):
   1. C651 AWWA Standard for Disinfecting Water Mains
   2. C652 AWWA Standard for Disinfection of Water Storage Facilities
   3. C655 AWWA Field Dechlorination
   4. C670 AWWA Online Chlorine Analyzer Operation and Maintenance

B. Standard Methods for Examination of Water and Wastewater
   1. 9221 - Multiple Tube Fermentation Technique
   2. 9222 - Membrane Filter Technique
   3. 9223 - Chromogenic Substrate Coliform Test

C. National Sanitation Foundation (NSF)/American National Standards Institute (ANSI)
   1. NSF/ANSI Standard 60: Drinking Water Treatment Chemicals - Health Effects
   2. NSF/ANSI Standard 61: Drinking Water System Components - Health Effects

1.03 SCHEDULING

A. Schedule and coordinate the work with the Owner and Engineer. Once disinfection has been satisfactorily accomplished, no further entry to the interior of the facilities will be allowed unless entry must be made to perform repairs, in which case repeat disinfection on a localized basis at no additional cost to the Owner. The Contractor shall be responsible for maintaining security of the disinfected facilities.

B. Disinfect equipment, tanks and pipelines following successful pressure testing.

C. Conduct test for VOC, after successfully completing disinfection and prior to putting tank/clearwell in service.

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1.04 SUBMITTALS

A. Submit in accordance with Section 01300.

B. Submit a Disinfection Plan in the Product Information category including the procedures, methods, materials and schedules proposed for disinfecting the required surfaces, and method of disposal of chlorinated water.

C. Submit VOC test report.

1.05 QUALITY ASSURANCE

A. Laboratory testing related to disinfection will be performed by and paid for by the Owner.

B. Laboratory testing related to disinfection shall be performed by a third party, coordinated with and paid for by the Contractor.

C. Laboratory testing for VOCs shall be arranged for and paid for by the Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Chlorine: See the respective AWWA Standards and paragraph 3.02 below for forms of chlorine that may be used for disinfecting operations.

PART 3 - EXECUTION

3.01 PREPARATION

A. Provide all necessary appurtenances required for the disinfection procedures including taps, temporary piping, connections and shutoff valves. Submit data on appurtenances which will be permanently installed for review by the Engineer.

B. The Contractor is advised that precautions taken to keep surfaces clean during construction and avoiding the entry of deleterious substances on the work during construction will facilitate achieving the disinfection requirements of this project.

C. Prior to disinfecting, thoroughly clean accessible surfaces of dust, dirt, foreign matter and deleterious substances. Remove any oil by contact with absorbents. Use water sprays, steam cleaning, vacuum cleaning, swabbing, hand brushing or a combination of methods and rinsing to effect the cleaning, but do not use any method that will be detrimental to the finish surfaces. Flush inaccessible surfaces clean.

3.02 APPLICATION

A. After completing all construction activities, including painting and application of elastomeric membranes and after allowing a minimum of ten days for the paint and/or elastomeric membranes to cure, disinfect the required surfaces with chlorine solutions in accordance with the following procedures. Following disinfection and flushing, the Owner will take water samples for chlorine residual and bacteriological analysis of the water. If the specified chlorine residual and bacteriological requirements are not satisfied, repeat disinfection procedure until

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the requirements are met. The Contractor shall pay for the additional sampling and testing at no additional cost to the Owner, until disinfection requirements are met.

B. Water Storage Facilities:
   1. Standard: AWWA C652 as amended herein.
   2. Forms of Chlorine: Use sodium hypochlorite or calcium hypochlorite.
   3. Method: 2 (Brush or Spray).
      a. A solution of at least 200 ppm of available chlorine shall be applied directly to the surfaces of the facilities that will be in contact with process water when the facility is full to the overflow elevation.
      b. After the surfaces have been thoroughly coated and in contact with the strong chlorine solution for 30 minutes, treated water shall be admitted into the structure and the available chlorine in the water when the structure is filled with water shall be at least 10 ppm.
   4. Testing and Verification: After chlorination and before placing the water storage facility in service, water sample(s) will be collected from the full facility and tested for the presence of coliforms and the chlorine residual will be measured.
      a. The facility may be placed into service if the test for coliform is negative and the chlorine residuals are at acceptable distribution system levels.
      b. If any of the samples show the presence of total coliform bacteria, one or more of the following procedures shall be followed before placing the facility in service:
         1) Repeat samples shall be collected and tested until two consecutive samples are negative.
         2) Repeat disinfection process and resample.

C. Small Pipelines:
   1. Preparation: Provide the system with a 1-inch minimum service cock or valve or other means to inject chlorine solution at a point within 2 or 3 feet of its junction with the supply source. When system is complete, thoroughly flush it by fully opening every outlet until clear water flows from all of them.
   2. Disinfecting Agent: Sodium hypochlorite or calcium hypochlorite in sufficient quantities to produce chlorine concentration of at least 50 parts per million in the system.
   3. Disinfecting Procedure:
      a. Connect a hand-operated pump, or other means of injecting the disinfecting agent, to one-inch minimum service cock or valve or other injection device. Pump must provide a pressure greater than that of supply of system.
      b. With system completely full of water and supply valve open, proceed to adjust every outlet of system so that a trickle of water flows from each.
      c. Inject disinfectant slowly and continuously at an even rate, not in slugs, until a test at each outlet shows a free chlorine residual concentration of at least 50 parts per million.
      d. Close all outlets and valves, including valve connecting to supply line and one-inch minimum service cock on solution injection connection. Maintain condition for 24 hours. After 24 hours, test for residual chlorine at each outlet. The free residual chlorine concentration indicated should be not less than 10 ppm. If the indicated free chlorine concentration is less than 10 ppm, repeat disinfection procedure until an approved result is obtained.

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e. When the above procedure has been completed to the satisfaction of the Engineer, flush out entire system with fresh water until tests at all outlets show a residual of not more than 0.5 ppm.

3.03 FIELD QUALITY CONTROL

A. Chlorine Residual Testing: AWWA C651, Appendix A, DPD Drop Dilution Method, except where otherwise specified. Testing shall be performed by the Contractor.

B. Bacteriological Analyses of Water: After the completion of disinfecting procedure, including the final flushing as described in AWWA C651 and heretofore, the Owner/Contractor's Laboratory will obtain water samples from this system for bacteriological analyses.

C. Requirements for satisfactory disinfection of process equipment, tanks, pipelines and associated elements are:
   1. Bacteriological analyses indicate that water samples are negative for coliform organisms; and
   2. Heterotrophic plate count (standard plate count) is less than 100 colony forming units per milliliter.
   3. If bacteriological analyses do not satisfy the above requirements, then repeat disinfection procedure until these requirements are met.

D. Testing for Volatile Organic Compounds:
   1. After the tank/clearwell has been disinfected and after the elastomeric membrane waterproofing has cured in the washwater recovery basins, fill the tank/clearwell and the washwater recovery basins to maximum design levels, then allow to soak for at least five days before samples of the water from each tank/clearwell or washwater recovery basin are collected and analyzed for volatile organic compounds. Analysis shall conform to EPA Method 524.2.
   2. If any test fails, repeat the test procedure in five days time from the initial test at no additional cost to the **Owner**. If the repeat test also fails, dispose of the contaminated water in accordance with Section 01140. Refill the tank/clearwell or washwater recovery basin with water and retest as described above. The cost of the retest and the water to fill the tank/clearwell or washwater recovery basin shall be at the Contractor's expense. If any test fails a second time, the final acceptance of the tank/clearwell and its baffles and/or the washwater recovery basin and its elastomeric membrane waterproofing shall be subject to a negotiation between the Contractor and the **Owner**.

3.04 DISPOSAL OF DISINFECTION SOLUTION

A. Dechlorinate and dispose of disinfection solution in the sanitary sewer. Take care to assure that chlorinated water is not spilled into drains.

3.05 PROTECTION OF DISINFECTED STRUCTURES

A. If required to re-enter a disinfected structure, the work shall be conducted using techniques and work methods as necessary to maintain the disinfected status. This shall include use of disinfected foot coverings, tools, and the like. In the event the Contractor contaminates the facilities, additional flushing and disinfection of the affected system shall be performed at no additional cost to the Owner.

END OF SECTION

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SECTION 11303

SUBMERSIBLE WASTEWATER PUMPS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish complete, tested and operating, one submersible wastewater pumps and one sump pump, as shown on the Drawings and as specified herein.

1.02 REFERENCES

A. Hydraulic Institute Standard 14.6 – Rotodynamic Pumps for Hydraulic Performance Acceptance Tests.

1.03 SUBMITTALS

A. Shop Drawings: The Contractor shall submit shop drawings for favorable review of the pumps and accessories. Include sufficient data to show that equipment conforms to Specification requirements as indicated herein and in Related Sections. Submit per Section 01300 in a single complete initial package under the Product Review category. Include the following:
   1. Pump and motor product and performance data, including a pump performance curve for each application and indicate minimum continuous stable flow (MCSF). Indicate impeller trim.
   2. Typical wet well installation drawings indicating dimensions and minimum clearances.

B. Manuals: The Contractor shall furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

C. Affidavits: The Contractor shall furnish affidavits from the manufacturer stating that the pumps have been properly installed and tested and each is ready for full time operation.

D. Performance Testing: Certified non-witnessed factory performance tests in accordance with Hydraulics Institute Standard 14.6 are required for each pump shall be not less than Grade 1U unless noted elsewhere in this specification. Obtain favorable review from the Engineer prior to shipment of the pumps.

1.04 QUALITY ASSURANCE

A. All equipment furnished under this Section shall: 1) be of a manufacturer who has been regularly engaged in the design and manufacture of the equipment for at least 5 years; and 2) be demonstrated to the satisfaction of the Engineer that the quality is equal to equipment made by those manufacturers specifically named herein.

PART 2 - PRODUCTS

2.01 COLLECTOR MANHOLE SUBMERSIBLE PUMP

A. General: Pump No. 1 for the Collector Manhole shall be heavy-duty, submersible, non-clog, centrifugal, quick disconnect type wastewater pumps. The pumps shall

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be capable of operating in the range of capacity specified on a continuous basis with no detrimental effects to the pump or motor.

B. Pump Schedule: The pump operating characteristics shall be as follows:

Parameter	Pump No. 1 (Existing Collector Manhole)
Primary Point at Full Speed (gpm @ TDH)	250 @ 23.54 ft
Maximum Capacity at Full Speed (gpm @ TDH)	380 @ 22 ft
Minimum Capacity at Full Speed (gpm @ TDH)	210 @ 30 ft
Minimum Shutoff Head	39 feet ± 0.5 ft
Pump Drive Type	Constant Speed
Nominal Operating Speed	1740 rpm
Motor Horsepower	3.75 HP
Required minimum efficiency at Primary Point	53.1%
Minimum Solids sphere passage	3 inches
Minimum Size Discharge (inches)	3 Flanged
Discharge pressure gauge range (see Section 15050)	0 to 30 psig
Manufacturer and Model No.	Sulzer/ABS XFP 80C CB1 or equal

2.02 VALVE VAULT SUMP PUMPS

A. General: Pump No. 2 for the Valve Vault shall be heavy-duty, submersible, non-clog, centrifugal, sump pumps. The pumps shall be capable of operating in the range of capacity specified on a continuous basis with no detrimental effects to the pump or motor.

B. Pump Schedule: The pump operating characteristics shall be as follows:

Parameter	Pump No. 2 (New Valve Vault)
Primary Point at Full Speed (gpm @ TDH)	150 @ 11.1 ft
Maximum Capacity at Full Speed (gpm @ TDH)	180 @ 6.68 ft
Minimum Capacity at Full Speed (gpm @ TDH)	60 @ 23.7 ft
Minimum Shutoff Head	30 feet ± 0.5 ft
Maximum Synchronous Speed	1750 rpm
Pump Drive Type	Constant Speed
Motor Horsepower	1.5 HP
Required minimum efficiency at Primary Point	32%

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Parameter	Pump No. 2 (New Valve Vault)
Minimum Solids sphere passage	2 inches
Minimum Size Discharge (inches)	3 FNPT
Discharge pressure gauge range (see Section 15050)	0 to 30 psig
Manufacturer and Model No.	Crane-Barnes 3SE10*4L, ABS/Sulzer, or equal

2.03 PUMP CONSTRUCTION:

A. General:

1. Pump No. 1 shall be designed to permit sump-top removal of pumping units from the wet well for inspection or service without disconnecting or disturbing the existing discharge piping. The pump connection shall be metal to metal. The design shall permit the pumps when lowered into place to be automatically connected to the discharge piping by positively locking the volute in position to prevent any axial or lateral movement. There shall be no need for personnel to enter the wet well when pump inspection or service is required.
2. Pump No. 2 shall be equipment with a 3” FNPT connection with discharge piping. Inspection or service of pump shall be made by disconnection of 3” sleeve coupling located on the discharge piping. Removal of pump from the Valve Vault shall be done from the top of the Vault using a retrieval cable.
3. Pump assembly, including motor, pump, and cable accessories must be rated for unclassified submerged environment.

B. Pump Castings: Castings shall be of cast-iron or semi-steel of uniform quality and free from blowholes, porosity, hard spots, shrinkage defects, cracks and other injurious defects. The casings shall be designed to permit replacement of wearing parts. Joints shall be properly sealed with O-rings and shall not leak under a test pressure equal to 50% greater than the pump discharge pressure or the total dynamic head, whichever is greater. Passageways shall permit smooth flow and shall be free from sharp turns and projections.

C. Impellers: Impellers shall be of cast-iron, OR cast-steel, OR an alloy suitable for the service required. The impellers shall be smooth and free flowing and shall have sufficient clearance to permit objects in the sewage that enter the pump to pass into the discharge pipe. Each impeller shall be accurately fitted and keyed, splined, or threaded on the shaft, and locked in such a manner that lateral movement will be prevented and reverse rotation will not cause the impeller to loosen. The impeller to volute clearance shall be adjustable by the means of a single trim screw.

D. Balance: All rotating parts of the equipment shall be in such balance, mechanically and hydraulically, as to operate throughout the required range without excessive end thrust, vibration, or noise.

E. Shafts: Shafts shall be stainless steel, shall be of sufficient size and strength to perform the work required, and shall be adequately provided with alignment bearings.

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F. Bearings: Bearings subject to submersion shall have a minimum L-10 life of 50,000 hours.

G. Mechanical Seals: Each pump shall be equipped with tandem independently-mounted silicon-carbide seals. The cavity between the seals shall be filled with lubricating oil.

H. Wear rings: Provide replaceable wear rings or liners in accordance with the pump manufacturer's standard. Wear rings shall be of the same material as the impeller.

I. Electrical Motors: The Premium Efficiency Motor shall be capable of operating completely submerged, partially submerged or unsubmerged. at 60 Hertz, 230 Volt, Single-Phase, oil filled, inverter duty rated for constant-speed applications. Motor shall be capable of continuous operation over the entire range of operating liquid levels shown on the Drawings and in the Specifications.
   1. Insulation: The pump motors shall be designed for continuous duty over the entire range of operating liquid levels shown on the Drawings and in the Specifications. The stator and stator leads shall be moisture-resistant, triple varnished and insulated according to Class F, capable of withstanding a temperature rise of up to 155 degrees C. The allowable temperature rise of the motor at full load condition shall not exceed 80 degrees C.
   2. Stator: The motor stator shall be mounted in an oil-filled, watertight casing and shall not be fixed in place by externally-mounted screws which may cause leakage in the motor.
   3. Motor Rating: Motors shall have service factors of 1.10 or greater horsepower and shall be non-overloading throughout the entire pump curve.
   4. Junction Box: The motor shall have a junction box capable of being sealed completely from the stator casing to prevent leakage through the junction box into the stator housing should a motor cable be damaged or have some other means to prevent leakage into the junction box under any condition.
   5. Cable Entry: The cable entry water seal design shall be such that it precludes specific torque requirements to ensure a watertight and submersible seal. It shall permit no entry of water into any high voltage area even if the cable is severed below the water level.
   6. Cooling System: Each pump shall be provided with an adequately designed integrated oil cooling system to enhance heat transfer and allow the motor to operate at full rated power continuously without the need for derating or reduced duty cycle. Wastewater jackets are not required for motors that are designed to operate continuously at full load with ambient cooling.
   7. Motor Protection: Integral thermal sensors in the motors, one for each phase, shall be provided to monitor stator temperatures. These sensors shall be used in conjunction with and supplemented by external motor over-current protection located at the control panel.

J. Pump and motor protection:
   a. Provide the following devices for each pump:
      1) Moisture detection probe between the mechanical seals.
      2) Thermal sensors embedded in the motor windings.
   b. Relays for the protection devices shall be provided by the pump manufacturer or shall be guaranteed by the Contractor to be compatible with each pump in accordance with the pump manufacturer requirements. Install in the pump starter enclosure.

K. Shop Coating: Pump, motor, and accessories shall be factory applied and finish coated in accordance with the manufacturer's standard.

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L. Controls: Pumps shall be equipped with integral float switches for controlling pump start and stop. A separate high level float switch for the sump shall be furnished as part of, and as specified under, Division 17.
   1. Pump No. 1 shall be integrated with the existing control panel. See Instrumentation and Controls drawings.
   2. Pump No. 2 shall be supplied with a vendor-supplied control panel (VCP) and shall house all required controls, circuit breakers, motor starters, and contacts. The VCP shall have a HAND/OFF/AUTO hand switch to permit local operation of the pump, and indicator lights for RUN status and FAIL status. The VCP shall have dry contacts to provide remote monitoring via OWNER's PLC of all status signals as shown on the Contract Documents, which shall include at a minimum RUN status and FAIL status.

2.04 ACCESSORIES

A. Piping, Fittings, and Appurtenances: Each pump shall be furnished with a stainless steel chain of sufficient strength to raise and lower pump. All components and fasteners shall be Type 316 stainless steel. Guide cable system of stainless steel will be acceptable in lieu of pipe rails.
   1. Each pump shall be provided with 18 inches of lifting chain connected to the pump. Lifting cable shall be connected to the end of the lifting chain. The lifting cable shall be of sufficient length to extract the pump from the installation. Both the lifting chain and lifting cable shall be Type 316 stainless steel. Ends of the lifting chain and one end of the lifting cable shall be provided with shackles for connecting. The other end of the lifting cable shall have a loop for hooking on the cable holder. The loop shall fit through the large eye of the Grip-Eye.
   2. Provide a Type 316 stainless steel cable holder.
   3. Furnish each submersible pump with a stainless steel Grip-Eye for use with a mechanical lifting device. Grip eye shall be appropriately sized for weight of pump to be lifted and size of lifting chain.
   4. The Collector Manhole Pump No. 1 shall utilize the existing quick-disconnect discharge elbow, pipe rails, guide rail brackets, and rail-guided lifting assembly.

B. Pressure Gauges: Provide discharge pressure gauges for each pump with features and accessories in accordance with Section 15050. Gauge range is indicated in the Pump Schedule.

C. Miscellaneous Materials:
   1. Bolts, nuts, anchors, washers, and all other types of supports necessary for the installation of the pumps, drive units, and all other accessories within the wet well shall be furnished and shall be of Type 316 stainless steel.
   2. Elastomers: Nitrile (Buna-N).
   3. Miscellaneous metal items permanently installed within the wet well: Type 316 stainless steel. Type 304 stainless steel or galvanized steel is not acceptable.
   4. Protective coatings: Discharge piping and other items within the wet well requiring protective coatings per Section 09960 shall be coated in accordance with the requirements for "submerged service."

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PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment shall be installed in strict conformance with the manufacturer's installation instructions.

3.02 FIELD SERVICE

A. The manufacturer of the pumps shall supply a competent field service engineer to thoroughly check and inspect the pumps after installation, place the pumps in operation and make necessary adjustments, and instruct owner's personnel in proper operating and maintenance procedures before and after installation. Provide a minimum of 1 man-days of field service.

3.03 FIELD PAINTING

A. Pumps and appurtenances shall be touched up as required, per Section 09960.

3.04 FIELD TESTING

A. Each pump shall be field tested to verify that they are operating properly and are able to pump the design flow rate. Field testing shall be observed by the Engineer. For further requirements on performance tests, refer to Section 11001.

END OF SECTION

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SECTION 15050

PIPING, VALVES, AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Provide all piping, including fittings, valves, supports, and accessories as shown on the Drawings, described in the Specifications and as required to completely interconnect all equipment with piping for complete and operable systems, including equipment drains.

1.02 REFERENCES

A. Air-Conditioning and Refrigeration Institute (ARI)

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

C. ASTM International (ASTM)

D. American Society of Mechanical Engineers (ASME)

E. American National Standards Institute (ANSI)

F. American Water Works Association (AWWA)

G. American Welding Society (AWS)

H. Cast Iron Soil Pipe Institute (CISPI)

I. U.S. Department of Transportation (DOT)

J. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)

K. National Fire Protection Association (NFPA)

1.03 SUBMITTALS

A. Shop Drawings:
   1. Verify by excavation, inspection and measurement all installation conditions, including existing utilities and structures, for all pipe before preparation of Shop Drawings. Submit field measurements and photos with Shop Drawings were exposed conditions are significantly different than indicated on the Drawings.
   2. Layouts and Schematics: Submit detailed installation drawings of all piping. Schematics may be submitted for piping 4 inches and smaller. The Drawings and schematics shall include: pipe support locations and types, fittings, valves, other appurtenances. (Product Review)
   3. Submit data to show that the following items conform to the Specification requirements:
      a. Pipe, fittings and accessories (Product Review).
      b. Pipe couplings and flexible pipe pieces (Product Review).
      c. Valves and Accessories (Product Review).
   4. Pipe, fittings and joint fabrication details for welded steel pipe (T.M 2P and T.W 1P) (Product Review).

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5. Submit reinforcement calculations for welded steel pipe to demonstrate compliance with AWWA M11.
6. Submit procedures for welding field joints of welded steel pipe (T.M 2P and T.W 1P) and welder qualifications (Product Review).
7. Submit samples of gaskets and other materials where required by the detailed specifications.
8. Submit certified test reports as required herein and by the referenced standard specifications (Product Information).
9. All items utilized on systems supplying or producing drinking water including, but not limited to, pipe and valve linings, solvent cements, welding materials, gaskets and gasket lubricants, and additives in concrete or cement mortar shall comply with the Safe Drinking Water Act and NSF requirements for use in water systems in accordance with Section 64591 of the California Water Works Standards. Submit proof of NSF certification for each item.
10. Samples: Solder and flux for copper pipe.
11. Gaskets for Type PVC-3 pipe.
12. Testing data for welded joints. Welds.
13. Submit leak and pressure testing plan in accordance with the requirements in 3.09.
14. Submit shop drawings for leak and pressure testing apparatus including, but not limited to, temporary bulkheads necessary for testing of new pipelines.

B. Manuals: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for the following items:
1. Valves 4 inches and larger and all actuated valves.
2. Air Valves.
3. Pneumatic/motorized actuators, including positioners and I/P converters. Include the actuator manuals for the valves requiring them.
4. Strainers, motorized or automatic washing.
5. Filters.
6. Pressure regulators.
7. Rotameters.

C. Affidavits: Furnish affidavits from the manufacturers for the following equipment:
1. Valves, manually operated.
2. All motorized or calibrated equipment.

D. Field test reports as required in Part 3.

1.04 QUALITY ASSURANCE

A. Materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years. Demonstrate to the satisfaction of the Engineer that the quality is equal to the materials and equipment made by the manufacturers specifically named herein, if an alternate manufacturer is proposed.

B. Factory Quality Control: The Contractor shall test all products as noted herein and by the reference specifications.

C. Field Quality Control:
1. The Owner will:
a. Inspect field welds and test the welds if it is deemed necessary.
b. Perform bacteriological analysis for pipelines to be disinfected.

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2. The Contractor shall:
    a. Perform leakage tests.
    b. Be responsible for the costs of additional inspection and retesting by the Owner resulting from noncompliance.

1.05 APPURTENANCES

A. Furnish and install all necessary guides, inserts, anchors and assembly bolts, washers and nuts, hangers, supports, gaskets, couplings, and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the piping; devices included in or on the piping equipment; and piping accessories.

PART 2 - PRODUCTS

2.01 GENERAL

A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.

B. Construct vents of materials specified for the pipe system for which they serve.

C. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping.

D. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage tests as specified hereinafter.

E. Cutoff Flanges: Provide at all pipe or sleeve penetrations where cast into wall for pipes 4 inches and greater in nominal diameter, and at all penetrations of 3-inch and smaller nominal diameter pipe in wet or potentially wet locations as indicated on the Drawings. Cutoff flange outside diameter shall be at least a standard connection flange's outside diameter except that for pipe 30-inch-diameter and larger, nominal size, cutoff flange outside diameter may be 6 inches greater than outside pipe diameter. Cutoff flange shall be at least ¼ inch thick and shall be continuously welded (or cast) onto the pipe.

2.02 GENERAL MATERIAL REQUIREMENTS

A. Gaskets: Except where specified otherwise, gaskets shall be SBR rubber.

B. Bolts: Unless specified otherwise herein, flange bolts and nuts, coupling bolts and nuts, and other hardware shall be as follows:
    1. Exposed: Electroplated zinc or cadmium steel.
    2. Submerged: Type 304 stainless steel, minimum tensile strength: 60,000 psi.
    3. Concrete Encased: Steel.
    4. Buried: Type 304 stainless steel, minimum tensile strength: 60,000 psi.
    5. Apply an anti-galling compound to the threads of stainless steel bolts.

C. Flexible Sealant: Flexible sealant for pipe joints, where shown on the Drawings, shall be a two-component polysulfide, non-sag; Sikaflex 2C, Dualthane, or equal.

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D. Fusion Epoxy Coating: AWWA C213; except application shall be by fluid bed only unless the greatest dimension of the article to be coated exceeds 10 feet, in which case electrostatic spray or flocking application may be used.

E. All materials in contact with potable water shall comply with the Safe Drinking Water Act and NSF requirements for use in water systems.

2.03 PIPING MATERIALS

A. Pipe and Fitting Designation: Piping materials are identified by a "Type" designation in these Specifications. The "Type" designation identifies not only the pipe itself but the associated fittings and appurtenances and the installation and test procedures described for that "Type." The designation of a particular type shall indicate a complete installation including fittings, joints, cleaning and testing. The pipe and fitting materials for each type designation shall be as specified herein and summarized in the Pipe Type Schedule.

B. Pipe Schedule: Piping systems and their corresponding piping and valve systems are listed on the Drawings.

C. Pipe Type Schedule: Pipe material, joints, and fittings shall be as summarized below. A detailed specification of each pipe type follows. (The detailed specification supersedes the schedule in case of any conflicts.)

Pipe Type	Pipe Description	Field Joints	Fittings
~~ABSD~~	~~ABS, Drain Waste Vent~~	~~Solvent Weld~~	~~ABS~~
~~ABSP~~	~~ABS, Pressure~~	~~Solvent Weld~~	~~ABS~~
~~ABSS~~	~~ABS, Sewer~~	~~Solvent Weld~~	~~ABS~~
~~ALP~~	~~Aluminum Pipe~~	~~Flange, Thread or Weld~~	~~Aluminum~~
~~ALT~~	~~Aluminum Tube~~	~~Compression~~	~~--~~
~~BS40~~	~~Black Steel, Schedule 40~~	~~Weld~~	~~Steel~~
~~BS80~~	~~Black Steel, Schedule 80~~	~~Weld~~	~~Steel~~
~~CISP~~	~~Cast Iron Soil Pipe~~	~~B&S or Mech. Coupling~~	~~CI~~
~~CMP~~	~~Corrugated Metal Pipe~~	~~Band~~	~~--~~
~~CMPP~~	~~Perforated Corrugated Metal Pipe~~	~~Band~~	~~--~~
~~CPVC~~	~~CPVC~~	~~Solvent Weld~~	~~CPVC~~
~~CUP~~	~~Copper~~	~~Solder or Flare~~	~~Wrought Copper or Bronze~~
~~CURT~~	~~Copper Refrigerant Tubing~~	~~Braze~~	~~--~~
~~CUT~~	~~Copper Tube~~	~~Compression or Solder~~	~~Wrought Copper~~
~~DIPB~~	~~Ductile Iron Bell & Spigot Pipe~~	~~B&S~~	~~DI~~
DIPF	Ductile Iron Flanged Pipe	Flange or Mech. Groove Coupling	DI
~~FRPP~~	~~Fiberglass Reinforced Plastic Pipe~~	~~Adhesive Bond~~	~~Fiberglass~~
~~GSP~~	~~Galvanized Steel Pipe, Schedule 40~~	~~Thread~~	~~Galvanized Malleable Iron or Cast Iron~~
~~HDPE~~	~~High Density Polyethylene, Water~~	~~Heat Weld~~	~~Polyethylene~~
~~PEGP~~	~~Polyethylene, Gas~~	~~Fusion~~	~~Polyethylene~~

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Pipe Type	Pipe Description	Field Joints	Fittings
~~PET~~	~~Polyethylene Tube~~	~~Compression~~	~~Barbed or Comp.~~
~~PPP~~	~~Polypropylene Pipe~~	~~Hot Weld or Mechanical~~	~~Polypropylene~~
~~PVC-1~~	~~PVC, Schedule 40, 80~~	~~Threaded or Solvent Weld~~	~~PVC, Schedule 40, 80~~
~~PVC-2~~	~~PVC, Pressure Rated~~	~~Solvent Weld~~	~~PVC~~
PVC-3C900 PVC	PVC, Pressure Rated	B&S	PVC
~~PVC-4~~	~~PVC, Pressure~~	~~B&S~~	~~CI or DI~~
~~PVC-5~~	~~PVC, Sewer~~	~~B&S~~	~~PVC~~
PVC-6	PVC, Drain, Waste and Vent	B&S	PVC
~~PVC-7~~	~~Yelomine~~	~~Spline~~	~~?~~
PVC-8	PVC, Perforated	Solvent Weld or B&S	PVC
~~PVC-9~~	~~PVC, Corrugated, Sewer~~		~~--~~
~~PVCT~~	~~PVC Tube~~	~~Compression~~	~~PVC Barbed~~
~~PVDF~~	~~PVDF~~	~~Butt Fusion Flanged or Threaded~~	~~PVDF~~
~~RCCP~~	~~Prestressed Reinforced Concrete Cylinder Pipe~~	~~B&S~~	~~WS~~
~~RCPP~~	~~Reinforced Concrete Pressure Pipe~~	~~B&S (Bell and Spigot)~~	~~WS~~
~~RCSD~~	~~Reinforced Concrete Storm Drain and Sewer Pipe~~	~~B&S~~	~~--~~
~~SCISP~~	~~Silicon Cast Iron Soil Pipe~~	~~B&S~~	~~Silicon CI~~
~~SSP~~	~~Stainless Steel Pipe~~	~~Flanged or Weld~~	~~Stainless Steel~~
~~SST~~	~~Stainless Steel Tube~~	~~Compression or Weld~~	~~Stainless Steel~~
~~VCP~~	~~Vitrified Clay Pipe~~	~~B&S~~	~~VC~~
~~VCPP~~	~~Perforated Vitrified Clay Pipe~~	~~B&S~~	~~VC~~
~~PCCP~~	~~Pretensioned Concrete Cylinder Pipe~~	~~Weld or Flanged~~	~~WS~~
WSP	Welded Steel Pipe	Weld (flanged or coupling where shown)	WS

D. DIPF Pipe:

1. Pipe: Flanged or grooved end ductile iron.
   a. Flanged Pipe: AWWA C115 including Appendix A, minimum thickness Class 53.
   b. Grooved End Pipe: AWWA C151 with grooves in accordance with AWWA C606, Table 3, for rigid joints. Provide minimum thickness classes in accordance with AWWA C606.
2. Joints: Where flanges are shown on the Drawings, provide mechanical rigid grooved couplings up to 24 inch or flanges, at the Contractor's option, except where grooved couplings are required in the Drawings. (See paragraph 1.09A.1 for special requirements for pipe supports with grooved

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couplings.) Provide flanges where required to connect to valves, equipment or certain pipe supports.

3. Flanges: Ductile iron, plain faced, AWWA C115. Submit certification that flanges comply with AWWA C115. Provide insulating flanges with two cathodic test stations for buried ductile iron to steel connections.
4. Mechanical Grooved Couplings: AWWA C606, minimum pressure rating of 150 psi.
5. Fittings:
    a. Flanged: Ductile iron, AWWA C110 or AWWA C153.
    b. Grooved End: Ductile iron, AWWA C110 for materials, dimensions and pressure ratings. Grooves shall be in accordance with AWWA C606, Table 3, for rigid joints.
    c. Buried bolts and nuts for flanged and grooved end joints shall be Type 304 stainless steel.
6. Lining: Standard thickness cement mortar lining for pipe and fittings, AWWA C104, except where noted otherwise in the Drawings or in the Pipe Schedule. Cement mortar lining shall be seal coated.
    a. Ceramic Epoxy Lining for pipe and fittings where required in the Drawings or Piping Schedule: See ductile iron push-on joint pipe.
    b. Glass lining for pipe and fittings where required in the Drawings or Piping Schedule: See ductile iron push-on joint Pipe.
    c. Fusion epoxy lining and coating, where required in the Drawings or Piping Schedule, shall be applied in accordance with paragraph 2.02D.
7. Coating: Buried pipe shall receive asphalt coating per AWWA C115. Exposed or submerged pipe requiring protective coating per Section 09960shall be shipped bare or shall be factory primed compatible with selected field paint system.
8. Protection for buried pipe: Polyethylene encasement, black, AWWA C105. Single-wrap pipe, double-wrap flanged fittings, mechanical joints, or other appurtenances with significantly different outside diameters from the pipe. Tape to seal seams and over laps at least 2 inches wide.
9. Bonding: Bond ductile iron to provide electrical continuity, except that insulating flanges without bonding shall be provided where shown on the Drawings.
10. Gaskets:
    a. Flanged: Full face, 1/8 inch-thick NBR (Nitril or Buna N), AWWA C115, Appendix A.
    b. Mechanical Grooved Coupling: NBR (Nitril or Buna N), AWWA C606.
11. Flange Bolts: AWWA C115, Appendix A unless stainless steel is required in paragraph 2.02.
12. Pipe Taps:
    a. Direct threaded taps are not acceptable. Pipe branch line connections shall be made using service saddles, by using reducing flanges on tees, or by tapping blind flanges on tees.
    b. Service Saddles:
        1) Materials: Ductile iron saddle with electro-galvanized straps and hardware for aboveground and bronze or 304 stainless steel for buried, and nitrile or neoprene gaskets.

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2) Type: For ductile iron pipe 4 inches and less, single strap saddles may be used. For pipe greater than 4 inches, double strap saddles shall be used.
3) Manufacturers: Smith-Blair; equivalent by Mueller; or equal.

13. Field Closure Connections for Restrained Joints: Pipe cut in the field where necessary and when favorably reviewed by the Engineer shall be connected by one of the following methods:
    a. Series 3800 Mega-Coupling by EBAA Iron, Inc.; or equal.
    b. Mechanical Joint Sleeve with two Series 1100 Megalug Restraints by EBAA Iron, Inc.; or equal.

E. PVC-6 Pipe:
1. Pipe and Fittings: Polyvinyl chloride drain, waste and vent, ASTM D2665. Fitting patterns, ASTM D3311.
2. Joints: Solvent weld.
3. Cement: Solvent cement, ASTM D2564, as recommended by the manufacturer.

F. PVC-8 Pipe:

1. Pipe and Fittings: Plastic underdrain pipe, ASTM F758, Type PS 46 (SDR 35).
2. Joints: Gasketed bell and spigot, or solvent weld.

G. WSP Pipe:
1. Pipe: Cement mortar lined steel cylinder pipe, AWWA C200 except as modified herein. Pipe shall be cement mortar coated where buried, and if required elsewhere by the Drawings or Specifications. Steel shall be ASTM A36.
    a. Dimensions: Nominal inside diameter shall be the minimum net inside clear lined diameter.
    b. Steel Cylinder Thickness: The pipe manufacturer shall design steel cylinder for pipe and fittings for the cover shown on the Drawings, in accordance with AWWA M-11. The minimum cylinder thickness for pipe with welded joints shall be 12 gauge. Design criteria areas follow:
        1) Superimposed external load: AASHTO H20
        2) Internal pressure including surge allowance: 250 psi
        3) Internal negative pressure: 15 psi
        4) Maximum allowable stress: 50 % of minimum yield point OR 16,500 psi, whichever is less.
        5) Maximum deflection permitted: 2%
        6) For tapered sections, minimum cylinder and mortar lining thicknesses shall conform to the requirements for the larger pipe diameter.
    c. Minimum steel cylinder thickness and lining thickness for in-plant piping:

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Nominal Size (Inches)	Steel Cylinder Minimum Wall Thickness (inches)	Minimum Lining Thickness (inches)
~~6 - 8~~	~~0.135~~	~~3/8~~
~~10 - 16~~	~~0.188~~	~~1/2~~
18 - 48	0.250	3/4
~~54 - 60~~	~~0.312~~	~~3/4~~

2. Joints: Use welded joints, except flanged or connected with couplings where shown on the Drawings.
    a. Welded joints shall be butt strap, split butt strap, or lap joint. Butt straps and lap joint details shall be submitted to the Engineer for favorable review. The joint shall be designed to withstand all loads associated with installation and operating conditions. Rolled lap joints are not acceptable. The radius of the bell bends shall be greater than 15 times the cylinder wall thickness. Joint configuration and welding shall conform to the requirements of AWWA M 11 and AWWA C206 except where modified herein. The size of fillet welds shall be equal to the thickness of the smaller plate being joined. Butt welds shall be full penetration.
    b. For pipe less than 24 inch-diameter, the procedure described in AWWA C205 utilizing a burlap-covered ball shall be used for applying cement mortar lining to the insides of the joints.
    c. Cement mortar lining shall be patched after joint testing and may be hand applied. Conform to AWWA C205, Appendix A.
3. Fittings: Fittings shall be made of hydrostatically tested cylinders of the same material and minimum thickness as the pipe, except that elbows shall have greater thickness if necessary to compensate for stress concentrations. They shall be as detailed on the Drawings or, if not detailed on the Drawings, shall be designed by the pipe manufacturer by the method stated in the AWWA Pipe Manual M11 as modified herein, subject to the favorable review of the Engineer. Unless otherwise noted or detailed on the Drawings, fitting dimensions shall conform to AWWA C208. Adding pipe to the fittings does not change the requirement that the fittings conform to AWWA C208 dimensionally, nor does it reclassify the pipe portion as part of the fitting. Use 250 psi for the design pressure P.
    a. Provide reinforcement for fittings (outlets, tees and wyes, etc.) in the form of collars, wrappers or crotch plates, in accordance with the current revision of AWWA M11. Coat buried fitting reinforcement with cement mortar.
    b. Crotch plates shall be designed in accordance with AWWA M11, using a minimum plate thickness of 1 inch.
    c. Elbow dimensions (unless otherwise noted or detailed on the Drawings):
        1) Minimum number of pieces for mitered elbows:
            a) 68° to 90°: Five pieces
            b) 46° to 67°: Four pieces
            c) 23° to 45°: Three pieces
            d) Up to 22½°: Two pieces.

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2) Radius, R, to pipe centerline:
   a) 1.25 pipe diameters for in-plant piping
   b) 2.5 pipe diameters for transmission lines.
3) Wrought steel elbows complying with ANSI B16.9 and ASTM A234 may be substituted for mitered elbows as long as they meet, as a minimum, the radius, wall thickness and internal diameter requirements of this Specification.

d. Nozzles 3 inches and less shall be Schedule 40 weld fittings. Wheeling Pipe-O-Lets; Allied Branchlets; or equal. They may be unreinforced.

e. Flares: Flare diameter shall be equal to the flange O.D. for the same size pipe. Fabricate flares from two sections of truncated cones, one angled 22½ degrees from pipe axis, the other 45 degrees. Grind all interior welds and edges perfectly smooth before lining.

4. Lining: Cement mortar, ¾ inch thick AWWA C205 except as modified herein. Cement shall be Type II. On pipe 27-inch diameter and larger, the lining shall be reinforced using a plain 2- by 4-inch, 13- by 13-gauge welded wire mesh welded to the inside of the pipe, fitting, or steel plate special. If the cement mortar lining is applied by the centrifugal process, the reinforcement may be omitted. Wire reinforcement shall conform to ASTM A185. Paint interior edges and other unlined surfaces in accordance with Section 09960.

5. Coating:
   a. Cement mortar coating: ¾ inch thick over the reinforcement, AWWA C205. Cement shall be Type II containing 15% to 20% pozzalan. Reinforcement shall be in accordance with AWWA C205.
   b. Non-cement mortar coating: Pipe without cement mortar coating shall be painted in accordance with Section 09960. Shop prime with products compatible with final coats. Hold back coatings of concrete encased portions of pipes from a point 2 inches within face of concrete encasement.
   c. On buried piping where the cement mortar coating is held back for flexible couplings or other similar connections, edges shall be ground smooth and the exposed pipe shall be painted in accordance with Section 09960, Protective Coatings, and shall overlap the cement lining and mortar coating. Stripe coat edges between finish coats.

6. Flanges and Bolts:
   a. Steel ring flanges conforming to AWWA C207, Class B, with bolt holes drilled in conformance with ANSI B16.1, 125-pound class except as needed to match equipment or other pipeline items. Bolts shall be sized in accordance with ANSI B16.1. Welding shall conform to AWWA C207. The inside diameter of all flanges shall be no more than 3/16 inch greater than the outside diameter of the steel cylinder. Flanges shall be welded to the cylinder without warping and with flange face perpendicular to the longitudinal axis of the cylinder.
   b. Where ductile pipe joins with steel cylinder pipe, the steel flange is to be modified to be compatible, in pressure rating and configuration, with the ductile iron pipe. Provide insulating flanges with two cathodic test stations for buried ductile iron to steel connections.
   c. Exposed metal on the flanges shall be coated in accordance with Section 09960. In addition, buried flanges, couplings and other mechanical connections shall be double-wrapped with polyethylene

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encasement, AWWA C105 and extended to overlap the cement mortar coating with edges of the encasement taped with PVC tape.

7. Gaskets: SBR rubber (Nitril or Buna N), 1/8 inch thick.
8. Interior Bracing: Each section of pipe 24-inch and larger shall have adequate interior bracing to prevent the pipe from being deformed during handling, transportation, storage, and installation. Bracing shall not be removed until construction operations are complete.
9. Factory Testing: Perform hydrostatic pressure tests of pipe and tests of specials in accordance with Section 5.2 of AWWA C200. Test methods are subject to the favorable review of the Engineer and the tests will be witnessed by the Engineer.
10. Marking: Cylinders and completed pipe and fittings shall be marked in accordance with AWWA C200-97, Section 6.1. The manufacturer shall maintain records that identify the cylinder used for all completed pipe and fittings. All test results and other documentation required to be furnished to the Engineer shall identify the cylinders and completed pipe and fittings by use of this marking system.
11. Interior Moisture Control: Maintain interior moisture and provide plastic sheet end caps during storage and transportation.
12. Protective Coating: Exposed steel at joints, flanges, and other locations shall be coated in accordance with Section 09960.

2.04 PIPE COUPLINGS AND FLEXIBLE PIPE PIECES

A. General: For typical pipe joints refer to pipe material specifications. Other joint devices shall be furnished where called for on the Drawings and as specified below.

B. Flexible Couplings and Flange Coupling Adaptors:
   1. Sleeve: Cast iron or fabricated steel.
   2. Followers: Cast iron, ductile iron, or steel.
   3. Sleeve Bolts: ASTM A325, Type 3; malleable iron; or equivalent, except for buried and submerged, which shall be Type 304 stainless steel and Type 316 stainless steel, respectively.
   4. Coating: Fusion epoxy line and coat sleeve and followers.
   5. Pressure Rating: The test pressure of the applicable service or 50 psi, whichever is greater.
   6. Performance: Longitudinal movement and angular deflection capabilities shall meet AWWA C219.
   7. Flanged Coupling Adaptor Flanges: Match mating flanges. If required by connecting valve or other device, provide flanges with inside diameter equal to nominal pipe diameter.
   8. Buried Flexible Coupling Sleeve: Long barrel; Smith-Blair 442, Dresser Style 40; or equal.
   9. Manufacturers:
      a. Flexible Couplings:
         1) Connecting Pipe with Identical Outside Diameters: Smith-Blair 411 or 441; Dresser Style 38 or 138; or equal.
         2) Connecting Pipe with Slightly Different Outside Diameters: Smith-Blair 413 or R441; Dresser Style 62; or equal.
      b. Flange Coupling Adaptors: Smith-Blair 912 or 913; Dresser Style 128 W; or equal.

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10. Gaskets: SBR rubber or oil and grease resistant (Nitril or Buna-N).
11. Joint Restraint: Provide joint harnesses (tie rod lug or attachment plate assemblies) designed for the test pressure or 50 psi, whichever is greater, across all flexible couplings and flange coupling adaptors, except where specifically indicated otherwise on the Drawings. For steel pipe, the joint harness shall conform to the requirements of Chapter 13 of AWWA M-11, Table 13-4 - Tie Bolt Schedule for Harnessed Joints. Anchor studs may be used on flange coupling adapters for pipe up to 12 inches in diameter.
12. Protection for Buried Couplings and Adaptors:
    a. Double-wrap with polyethylene encasement, AWWA C105 and tape the edges of the encasement with PVC tape.

C. Flexible Connectors:
1. Up to 12-inch-Diameter:
    a. Type: Built-up, single arch (unless otherwise shown on Drawings) rubber expansion joints with full rubber flanges and retainer rings.
    b. Materials: Neoprene cover over nitrile tube, reinforced with nylon or polyester body and galvanized steel retainer rings, except those used on ozone gas piping systems which shall have Hypalon cover over Hypalon tube, and Type 316 stainless steel retainer rings.
    c. Pressure Rating: 190 psi.
    d. Manufacturers:
        1) Standard: Proco Series 230; Holz Type 200; Garlock Style 200HP; or equal.
        2) Concentric Reducers: Proco RC Series; Holz 200TC.
        3) Eccentric Reducers: Proco RE Series; Holz 200TE.
        4) For connections to plastic piping systems provide connectors with additional flexibility as recommended by the manufacturer. Proco Series 261R; Holz Type 320EZ; or equal.
2. Larger than 12-inch-Diameter:
    a. Type: Built-up, single arch (unless otherwise shown on Drawings)
    b. Materials: Neoprene cover over nitrile tube, reinforced with nylon or polyester body and galvanized steel retainer rings. Protect cover with Hypalon paint where exposed outdoors.
    c. Pressure Rating: 80 psi.
    d. Manufacturers:
        1) Standard: Proco Series 230; Holz Type 200, or equal.
        2) Concentric Reducers: Proco RC Series; Holz 200TC.
        3) Eccentric Reducers: Proco RE Series; Holz 200 TE.
        4) For connections to plastic piping systems provide connectors with additional flexibility as recommended by the manufacturer. Proco Series 261R; Holz Type 320EZ; or equal.
3. Restraint: Provide galvanized steel control rod-compression sleeve assemblies for all flexible spools, except where pipelines cross structural expansion joints or where specifically omitted by note in the Drawings. Number and size of control rods shall be as required for the test pressure of the pipe system or 50 psi, whichever is greater.
4. Provide full-size intermediate metal pipe flanges where rubber spool connects with wafer style valves, lug style valves, or other pipeline items that do not have full-face metal flanges.

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2.05 VALVES AND ACCESSORIES

A. Valve and Accessory System Designation: Most valves and accessories to be furnished and installed are identified by a valve and accessory system designated by a letter symbol in the Pipe Schedule.

B. General Requirements for Valves:
   1. All valves of each type shall be the product of one manufacturer.
   2. All exposed valves shall be furnished with operators, handwheels, levers, or other suitable type wrench including handles as specified herein or as shown on the Drawings. Valves 4-inch and larger located more than 7 feet above the floor level shall be furnished with chain operators. Chains shall be galvanized and shall extend to within 3 feet of the floor. Provide hook so that chain may be stored clear of walkways. All buried valves shall be provided with 2-inch-square operating nut and valve boxes.
   3. All threaded stem valves shall open by turning the valve stem counter-clockwise.
   4. All exposed valves and valve operators shall have a non-bleeding shop coat, unless otherwise specified.
   5. Pneumatic Valve Actuators: Conform to AWWA C504 and AWWA C540 as modified herein. Cylinder bodies, heads, and ends fabricated from plastic, fiberglass, or other non-metallic materials will not be acceptable.

C. General Requirements for Accessories: Pressure Gauges: Provide shutoff valves for all pressure gauges. Conform to additional requirements in this Section below.

D. Valve and Accessory Systems:
   1. Valve and Accessory System A: Applicable Service Condition: Clean Water and air.
      a. Gate Valves: see Section 15111
      b. Butterfly Valves: see Section 15113

PART 3 - EXECUTION

3.01 PIPING INSTALLATION

A. General Handling and Placing:
   1. Exercise great care to prevent injury to or scoring of the pipe lining and coating, as applicable, during handling, transportation or storage. Handle fusion epoxy coated pipe and ceramic epoxy lined pipe in accordance with AWWA C213. Do not store pipe on rough ground and do not roll the pipe on the coating. Any damaged pipe sections, specials, or fittings shall be repaired or replaced at the expense of the Contractor as satisfactory to the Engineer.
   2. Carefully inspect each pipe, fitting, valve and accessory before installation to insure there is no defective workmanship or obstructions. Inspect the interior and exterior protective coatings and patch all damaged areas in the field or replace to the satisfaction of the Engineer.
   3. Place or erect all piping to accurate line and grade and backfill, support, hang, or brace against movement as specified or shown on the Drawings, or as required for proper installation. Remove all dirt and foreign matter from the pipe interior prior to installation and thoroughly clean all joints before joining.

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4. Use reducing fittings where any change in pipe size occurs. Do not use bushings unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.
5. Cast all metallic pipes and sleeves 6-inch and larger into new concrete walls without blockout. Pipes 5 inches and smaller may be cast in place or installed in a smooth core drilled hole using a link type seal at the Contractor's option. Maintain at least ½-inch clearance between reinforcing steel and metal pipe in penetrations.

B. General Buried Piping Installation:
1. Trenching, bedding, and backfill for buried piping shall be as shown on the Drawings and as specified in Section 02300.
2. Where pipe grade elevations are shown on the Drawings, install the pipe with straight grades between the indicated elevations.
3. Where no pipe grade elevations are shown on the Drawings, install buried piping with at least 3 feet of cover to finished grade. Where piping crosses under buried electrical ducts, provide at least 4 feet 6 inches of cover. Provide 12 inches minimum separation between the buried pipes and ducts.
4. Provide each pipe with a firm, uniform bearing for its full length in the trench except at field joints. Do not lay pipe in water or when trench conditions or weather are unsuitable for such work.
5. Protect buried piping against thrust by use of restrained pipe joints and/or thrust blocks. All exposed free pipe ends shall be securely braced. Cap or plug pipe ends that are left for future connections as shown on the Drawings and in a manner favorably reviewed by the Engineer.
6. Where piping leaves a structure or concrete encasement, provide a joint capable of angular deflection within 12 inches of the structure for pipes 12-inch and smaller or as shown on the Drawings for larger pipe sizes. Conform to details on the Drawings where such details are shown.
7. Snake buried PVC pressure pipe from side to side in the trench in long sweeps.
8. Concrete Encasements: All piping and conduits installed under slabs or footings on earth or crushed rock shall be encased in concrete not less than 6-inch thickness on all sides and extending up to the bottom of the slab or footing, unless otherwise specifically noted on the Drawings. Encasement shall extend to within 6 inches of the first pipe joint beyond the slab or footing. Provide concrete encasement whether or not the encasement is shown on the Drawings. Provide encasement under slabs on earth or crushed rock even if the structure is supported on piles, caissons, or footings. Provide continuous concrete cradles where shown.
9. Coat bolts on buried flanges or other buried appurtenances in accordance with Paint System 8 in Section 09960. Wrap the appurtenance with polyethylene encasement and tape the encasement tightly closed to the pipe.

C. General Exposed Piping Installation:
1. Unless shown otherwise, install piping parallel to building lines, plumb and level.
2. Install piping without springing or forcing the pipe in a manner that would set up stresses in the pipe, valves, or connected equipment.
3. Set all pipe flanges level, plumb, and aligned. All flanged fittings shall be true and perpendicular to the axis of the pipe. All bolt holes in flanges shall straddle vertical centerline of pipes.

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4. Flexibility and Expansion: Provide flexible couplings, flexible hose, or flexible spools for all piping connections to motor driven equipment and where otherwise shown. The Contractor may install additional flexible couplings at favorably reviewed locations to facilitate piping installation, provided that he submits complete details describing location, pipe supports, and hydraulic thrust protection. Anchor piping subject to expansion or contraction in a manner permitting strains to be evenly distributed. Sleeves for branches through walls from adjacent mains shall be of sufficient size to allow for free side motion of covered pipe in sleeves.
5. Install unions or flexible connections where shown on the Drawings, and at all non-motor-driven equipment to facilitate removal of the equipment.
6. Provide valves wherever equipment drain connections are furnished and carry the discharge pipe to the nearest floor drain, drain trench or sump. Where no receptacle for drain exists, install drain piping to 1-inch above the floor. Drain piping and valve materials shall conform to the requirements of the system served.
7. Where piping conveying liquids passes over motor control centers, electrical panels and other electrical devices, install a protective drainage tray below the piping.

D. Water Main Installation:
1. The Contractor is advised that precautions taken to keep the pipeline clean during construction will facilitate achieving the disinfection requirements of this project with a minimum of effort and expense. Compliance with these suggested minimum procedures will not relieve the Contractor of the disinfection requirements.
2. Prior to installation, thoroughly clean the interior of each length of pipe and each fitting or valve and inspect to ensure that no foreign material remains. Cover both ends with plastic and do not uncover them until just prior to completing the joint.
3. Whenever pipe laying is discontinued for short periods, or whenever work is stopped at the end of the day, close the open ends of the pipe with water-tight plugs or bulkheads.
4. Provide adequate trench pumping to ensure against groundwater contacting the inside of the pipeline at any tie. Do to lower any pipe or fitting into a trench where groundwater is present and may enter the pipe. When necessary, pump the water from trenches and keep the trench dry until the joist have been completed and the open ends of the pipe have been closed with a water-tight plug. Do not remove the plug until the trench has again been pumped dry.
5. Keep new pipe sections clean and dry.
6. When making the connection between a new pipeline and an existing pipeline, or when repairing a damaged pipe, take the following extra precautions:
    a. Clean the exterior of the existing pipeline of all dirt and debris, and spray or swab with a standard 5.25% or stronger chlorine solution (as specified) in the immediate vicinity of the work. Clean equipment and materials, including new pipe and fittings, to be used in making these connections of all dirt and debris and disinfect them. Allow at least 30 minutes contact time before the chlorine solution is diluted or rinsed off. Provide sufficient trench pumps to prevent flooding of the trench.

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b. When an old line is opened either by accident or by design, the excavation may be wet or badly contaminated from groundwater. Apply liberal quantities of standard chlorine solution tablets to the open trench areas to lessen the danger from such pollution. Tablets are recommended because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation. Scatter liberally around and locate the tablets so that flow entering the work site will contact the disinfecting agent. Trenching application should be done very carefully to avoid contact by skin and clothing with chlorine solution. Minimally, safety dictates wearing safety goggles and rain gear.

c. When excavating a leaking or broken pipeline, “valve-off” the system gradually to less than water-tightness. This is to prevent causing areas of zero pressure which would allow entry of foreign material. A flow should be maintained which is slightly less than trench pump capability. Once the break is exposed and cleaned to disallow site contamination, the valving can then be made water-tight.

E. Pipe Welding:

1. General: Unless specified otherwise, shop and field welding of pipe shall conform to ANSI B31.1 as amended by this paragraph.
2. All field and shop welding shall be done by the electric arc process unless otherwise specified. All field welding shall be done in passes not thicker than ¼-inch. Size and type of electrodes, and current and voltages used, shall be subject to the favorable review of the Engineer. Give particular attention to the alignment of edges to be joined, so that complete fusion and penetration will be effected throughout the bottom of the weld. Welds shall contain no valleys or undercuts in the center or edges of the weld. Thoroughly clean each pass, except the final one, of dirt, slag, and flux before the succeeding bead is applied.
3. Clean completed field welds of pipe joints of dirt, slag and flux, and then visually inspect. Completely chip out all defects in welds discovered during field inspection in a manner that will permit proper and complete repair by welding subject to the favorable review of the Engineer. Under no circumstances will caulking of defective welds be permitted.
4. All welding shall be done by experienced, skilled operators familiar with the methods and materials to be used. Hand welding will be done only by welders qualified under the standard qualification procedure of Section IX of the ASME Boiler and Pressure Vessel Code. The Contractor shall conduct tests of his welders, when required by the Engineer, in accordance with that code and in the presence of the Engineer. An independent testing laboratory, favorably reviewed by the Engineer, shall supervise the testing and determine the quality of the test work. Weld specimens in the same positions as those in which the welder is to qualify his work. The Engineer may require test specimens at any time. Any welder whose work is found unsatisfactory shall not remain employed on this Contract, regardless of the quality of his earlier work. Each hand weld specimen shall be plainly marked with the welder's identifying symbol. The Contractor shall furnish all materials required and pay all costs for qualifying welders.
5. Field welds shall follow as closely as possible to the laying operation. All field welds shall be complete before lining or coating of the joints in steel pipe is

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begun. Where pipe is fusion epoxy lined and/or coated, follow AWWA C-213 procedures for field welded joints.

6. A single, continuous, watertight, full fillet weld shall be the minimum required at all field joints. Double welded joints are required on all piping specifically noted to be double welded.
7. See also installation specifics for welding of pipe.

F. Installation Specifics:
   1. WSP Pipe*:*
      a. Installation of pipe shall be in accordance with AWWA C604.
      b. The maximum trench width at the top of the pipe shall be the pipe outside diameter plus 3 feet.
      c. Field welding of joints shall be in accordance with AWWA C206. Acceptance of field welds will be based on visual inspection and non-destructive testing by the Engineer while the welds are being made and after they are completed. Hand or power wire brush each weld thoroughly after completion to facilitate the inspection. Correct defects not complying with AWS Code D1.1 Sections 6.9 and 6.10. Determine the cause of defects and take corrective measures to prevent a reoccurrence.
      d. Following satisfactory testing of the weld, the interior of all joints shall be cement mortar lined. Pipe 24 inches and less shall be finished using the ball and burlap procedure described in AWWA C205, paragraph 4.7.2.2.2. The exterior of the joints of buried pipe shall be cement mortar coated in accordance with Appendix A of AWWA C205. Prior to coating the exterior, tack weld one layer of wire mesh to the pipe.
      e. Steel edges not encased in concrete or cement mortar shall receive a protective coating of 16 mils of high solids epoxy per Section 09960.

3.02 COUPLING INSTALLATION

A. Flexible Couplings and Flange Coupling Adaptors: Prior to installation, thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket. Wipe gaskets clean before they are installed. If necessary, flexible couplings and flanged coupling adapter gaskets may be lubricated with soapy water or manufacturer's standard lubricant before installation on the pipe ends. Install in accordance with the manufacturer's recommendations. Tighten bolts progressively, drawing up bolt on opposite sides a little at a time until all bolts have a uniform tightness. Workers tightening bolts shall be equipped with torque-limiting wrenches or other favorably reviewed type. Anchor studs on restrained flanged coupling adaptors shall be installed so as to lock into holes drilled through the pipe wall in accordance with manufacturer’s recommendation.

3.03 INSTALLATION OF VALVES AND ACCESSORIES

A. Wrap buried valve bodies as specified for flexible couplings and flanged coupling adapters.

B. Use reducing fittings where any change in pipe size occurs between valves or accessories and the attached pipeline. Bushings shall not be used, unless specifically noted on the Drawings. Use eccentric reducing fittings wherever necessary to provide free drainage of lines.

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C. Install valves and accessories such that all parts are easily accessible for maintenance and operation. Provide valve boxes for buried valves.

D. Where valve handwheels are shown on the Drawings, valve orientation shall be as shown. Where valve handwheels are not shown, orient valves to permit easy access to the handwheels or handles and to avoid interferences.

E. Install pressure gauges and thermometers in a position to permit reading them from a point approximately 5 feet above floor level, except that pump pressure gauges shall be installed close to the pump elevation.

F. Rigidly support pressure switches and connect them to piping and equipment using a suitable flexible linkage that will not permit transmission of vibrations from the piping or equipment to the pressure switches.

G. Provide a union adjacent to each screwed end valve and accessory with additional unions as necessary to facilitate removal.

H. Provide a shutoff valve below each pressure gauge, protective device or air valve unless otherwise specified.

I. Connections between ferrous and non-ferrous piping, valves, accessories or pipe supports shall be made using a dielectric coupling, union, or flange.

J. Where valves or other pipeline items require metal full-face connecting flanges, provide intermediate flanges if the connecting flange is not adequate.

K. All insulated piping passing through walls or slabs shall be sleeved and insulation shall run continuously through the sleeves and shall allow for 1/8-inch annular clearance between outside of insulation and sleeve wall.

L. Provide a suitable chrome plated escutcheon on pipes passing through walls, floors, ceilings and partitions in finished areas.

M. Install link-type seals in cast-in-place metal sleeves or in smooth core drilled holes. Grout both sides flush with non-shrink grout unless otherwise shown on the Drawings.

N. Install thermometer wells in piping tees in vertical position. Fill with oil. Where wells are in lines 2 inches and smaller, increase line size so that velocity at well section is not increased.

O. Provide test plugs on all closed water systems and condenser water systems located in inlet and outlet of coils, heat exchangers, cooling towers, and where indicated on Drawings. Locate test plugs where they will be easily accessible, have adequate clearance for insertion and removal of gage needles and thermometer stems, and position to allow unobstructed viewing of gages and thermometers.

3.04 PIPE AND VALVE IDENTIFICATION

A. General: Identify all exposed piping in this project by painting, banding, system name labels, and direction arrows. The color and banding shall be as selected by the Engineer. Identify all buried and exposed valves with tags as specified below.

B. Exposed Pipe Identification: Before painting, banding and labeling, pipes shall be identified by the Contractor with temporary wired-on cardboard tags showing the proposed marking for review by the Engineer.

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C. Piping: Paint all exposed pipes with the appropriate paint system as specified in Section 09960 and provide pipe markers per the schedule specified in Section 10400.

D. Valves: Provide each buried valve with a valve tag identifying the pipeline contents, and either its valve number, or the area or item served by the valve for valves without a valve number. Contents shall be as designated in the Piping Schedule.

E. Provide access panel markers for valves and control devices concealed behind access panels and above suspended ceilings. Locate markers on access doors and on ceiling T-bars.
   1. Markers for Ceiling T-bar Installation: Blue, pressure-sensitive, self-adhesive, at least 3 mils thick, 3/8-inch diameter.
   2. Markers for Access Doors: 1/16-inch thick, engraved plastic-laminate, with abbreviated terms and numbers corresponding to the concealed item. Provide 1/8-inch center attachment hole.

3.05 FIELD QUALITY CONTROL

A. The Owner will:
   1. Inspect field welds and test the welds if it is deemed necessary.
   2. Perform bacteriological analysis for pipeline to be disinfected.

B. Factory Quality Control: The Contractor shall test all products as required herein and by the reference specifications.

C. The Contractor shall:
   1. Perform leakage tests.
   2. Be responsible for the costs of additional inspection and retesting by the Owner resulting from non-compliance.

3.06 CLEANING

A. Prior to testing, thoroughly clean the inside of each completed piping system of all dirt, loose scale, sand and other foreign material. Cleaning shall be by sweeping, flushing with water or blowing with compressed air, as appropriate for the size and type of pipe. Flushing shall achieve a velocity of at least 3 feet per second. The Contractor shall install temporary strainers, temporarily disconnect equipment, or take other appropriate measures to protect equipment while cleaning piping. Cleaning shall be completed after any pipeline repairs.

3.07 FIELD TESTING

A. General: Perform leakage tests on all pipe installed in this project. Furnish all equipment, material, personnel and supplies to perform the tests and make all taps and other necessary temporary connections. The test pressure, allowable leakage and test medium shall be as specified and as shown in the following Schedule/Paragraphs. Test pressure shall be measured at the highest point on the line, except that pressure at lowest point shall not exceed pipe manufacturer's rated test pressure, unless specifically noted otherwise. Leakage tests shall be performed on all piping at a time agreed upon and in the presence of the Engineer. All visible leaks shall be repaired, regardless of the test results. The Contractor may purchase water for construction, cleaning, testing, and disinfection of the pipelines from the City at a fire hydrants designated by the City. At any connection

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to the City water system, the Contractor shall provide an air-gap or reduced pressure backflow valve system to prevent backflow into the water source.

B. Buried Piping: The leakage test for buried piping shall be made after all pipes are installed and backfilled. However, the Contractor may conduct preliminary tests prior to backfill. If the Contractor elects to conduct preliminary tests, provide any necessary temporary thrust restraint.

C. Exposed Piping: All supports, anchors and blocks shall be installed prior to the leakage test. No temporary supports or blocking shall be installed for final test.

D. Encased Piping: The leakage test for encased piping shall be made after all pipe is installed and encased, and before any structures are constructed above it. However, the Contractor may conduct preliminary tests prior to encasement. If the Contractor elects to conduct preliminary tests, provide any necessary temporary thrust restraint.

E. Accessories: It shall be the responsibility of the Contractor to block off or remove equipment, valves, gauges, etc., which are not designed to withstand the full test pressure.

F. Testing Apparatus: Provide pipe taps, nozzles and connections as necessary in piping to permit testing including valves to isolate the new system, addition of test media, and draining lines and disposal of water, as is necessary. These openings shall be plugged in a manner favorably reviewed by the Engineer after use. Provide all required temporary bulkheads.

G. Pneumatic Testing: Piping tested by air or another gas shall show no reduction of pressure during the test period after corrections have been made for changes in temperature in conformance with the following relationship:

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

Where T_1 and T_2 are the absolute temperatures of the gas in the pipe and P1 and P2 are the absolute pressures. The subscript "1" denotes the starting conditions and the subscript "2" denotes the final conditions.

H. Precautions for Pneumatic Testing: Where air or another gas is called for as the test medium, the Contractor shall take special precautions to protect personnel. During the initial pressurization of a pipeline to the specified test pressure, personnel shall be protected by suitable barricades or shall remove themselves to locations where portions of the concrete structure itself are between them and the pipeline under test.

I. Correction of Defects: If leakage exceeds the allowable, the installation shall be repaired or replaced and leakage tests shall be repeated as necessary until conformance to the leakage test requirements specified herein have been fulfilled. All visible leaks shall be repaired even if the pipeline passes the allowable leakage test.

J. Reports: The Contractor shall keep records of each piping test, including:
   1. Description and identification of piping tested.
   2. Test pressure.
   3. Date of test.

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4. Witnessing by Contractor and Engineer.
5. Test evaluation.
6. Remarks, to include such items as:
    a. Leaks (type, location).
    b. Repairs made on leaks.
7. Test reports shall be submitted to the Engineer.

K. Testing Specifics: Piping shall be tested as indicated in the Pipe Schedule shown on the Drawings. Unless specified otherwise, test each system for 4 hours.

3.08 DISINFECTION OF POTABLE WATER SYSTEMS

A. See Specification 02516.

END OF SECTION

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SECTION 15111

GATE VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Gate valve, bronze trimmed.
   2. Resilient seated gate valve (AWWA C509/C515).

1.02 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

C. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service

D. AWWA C515 – Reduced-Wall, Resilient Seated Gate Valves for Water Supply Service

E. AWWA C 550 - Standard for Protective Interior Coatings for Valves and Hydrants.

1.03 SUBMITTALS

A. Submit manufacturer’s product data for valves, actuators, and accessories. Indicate maximum torque required to open valve, torque output of actuator, and number of turns to open valve.

B. Submit samples of gaskets and other materials where required by the detailed specifications.

C. Submit certified test reports as required herein and by the referenced standard specifications (Product Information).

D. All items utilized on systems supplying or producing drinking water including, but not limited to, pipe and valve linings, solvent cements, welding materials, gaskets and gasket lubricants, and additives in concrete or cement mortar shall comply with the Safe Drinking Water Act and NSF requirements for use in water systems in accordance with Section 64591 of the California Water Works Standards. Submit proof of NSF certification for each item.

E. Manuals: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for valves 4 inches and larger and all actuated valves.

F. Affidavits: Furnish affidavits from the manufacturers for the following:
   1. Submit manufacturer's affidavit for proposed valves and actuators certifying compliance with specifications
   2. Submit manufacturer's affidavit that resilient seated valves were manufactured in the United States and conform to applicable requirements of AWWA C 509/C515.

1.04 QUALITY ASSURANCE

A. Materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials

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and equipment for a period of at least 5 years. Demonstrate to the satisfaction of the Engineer the quality is equal to the materials and equipment made by the manufacturers specifically named herein, if an alternate manufacturer is proposed.

B. Factory Quality Control: The Contractor shall test all products as noted herein and by the reference specifications.

1.05 APPURTENANCES

A. Furnish and install all necessary guides, inserts, anchors and assembly bolts, washers and nuts, hangers, supports, gaskets, couplings and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the valve.

PART 2 - PRODUCTS

2.01 GATE VALVES, RESILIENT SEAT

A. Size: 3 through 16-inch
   1. General: Comply with AWWA C509 or C515 except where otherwise specified herein. Valve shall be epoxy lined and coated. Valve shall be NSF 61 certified.
   2. Rating: 250 psi.
   3. Type: Rising stem, OS&Y, handwheel operated for exposed service, non-rising stem with operating nut for buried service.
   4. Connections: Flanged or mechanical joint as indicated on the Drawings.
   5. Finish:
      a. Exposed Exterior: Shop prime compatible with field applied finish coats. Refer to Section 09960.
      b. Buried Exterior: Shop coat with high-solids epoxy, 6 mils minimum OR shop coat in accordance with Specification 09960 System 7, 16 mils minimum.
      c. Interior: Shop line with two-component, high solids epoxy, AWWA C550.
   6. Manufacturers: U.S. Pipe Metroseal; Clow; or equal.

2.02 ACTUATORS

A. Manual Actuators:
   1. Type: Manual, except where specified otherwise, or shown otherwise on the Drawings. Provide valve position indicators on all actuators.
   2. Manual Actuators:
      a. Above-ground: Handwheel, provide chainwheel for installations over 6 feet.
      b. Buried: Designed for buried service, watertight up to 10 psi. Provide 2-inch-square standard AWWA operating nut, with extension stem to reach the ground surface as shown on the Drawings, and with a ground level position indicator.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install gate valves in accordance with manufacturers recommendations.

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B. Install resilient seat gate valves in accordance with AWWA C509.

3.02 PROTECTIVE COATINGS

A. Provide coating for all valves in accordance with Section 09960.

3.03 TESTING

A. Operationally test all valves to demonstrate operation without binding. Cycle valve three times minimum.

B. Perform a leakage test for each valve. Test may occur in conjunction with pipeline test. Test in accordance with Section 15050

END OF SECTION

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SECTION 15113

BUTTERFLY VALVES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. AWWA C 504 butterfly valves, 150 psi.
   2. AWWA C 504 Class 250B butterfly valves, 250 psi
   3. Aeration service butterfly valves.

1.02 REFERENCES

A. ASME B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

C. AWWA C 504 - Standard for Rubber-Seated Butterfly Valves.

D. AWWA C 550 - Standard for Protective Interior Coatings for Valves and Hydrants.

1.03 SUBMITTALS

A. Submit manufacturer’s product data for valves, actuators, and accessories. Indicate maximum torque required to open valve, torque output of actuator, and number of turns to open valve.

B. Submit samples of gaskets and other materials where required by the detailed specifications.

C. Submit certified test reports as required herein and by the referenced standard specifications (Product Information).

D. All items utilized on systems supplying or producing drinking water including, but not limited to, pipe and valve linings, solvent cements, welding materials, gaskets and gasket lubricants, and additives in concrete or cement mortar shall comply with the Safe Drinking Water Act and NSF requirements for use in water systems in accordance with Section 64591 of the California Water Works Standards. Submit proof of NSF certification for each item.

E. Manuals: Furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for valves 4 inches and larger and all actuated valves.

F. Affidavits: Furnish affidavits from the manufacturers for the following:
   1. Submit manufacturer's affidavit for proposed valves and actuators certifying compliance with specifications
   2. Submit manufacturer's affidavit that butterfly valves were manufactured in the United States and conform to applicable requirements of AWWA C 504 and that they have been satisfactorily tested in the United States in accordance with AWWA C 504 using test pressure of 150 psi in both directions. Submit Proof-of-Design and hydrostatic testing procedure in accordance with AWWA C 504.

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1.04 QUALITY ASSURANCE

A. Materials and equipment furnished under this Section shall be of manufacturers who have been regularly engaged in the design and manufacture of the materials and equipment for a period of at least 5 years. Demonstrate to the satisfaction of the Engineer the quality is equal to the materials and equipment made by the manufacturers specifically named herein, if an alternate manufacturer is proposed.

B. Factory Quality Control: The Contractor shall test all products as noted herein and by the reference specifications.

1.05 APPURTENANCES

A. Furnish and install all necessary guides, inserts, anchors and assembly bolts, washers and nuts, hangers, supports, gaskets, couplings and flanges; all other appurtenant items shown on the Drawings, specified or required for the proper installation and operation of the valve.

PART 2 - PRODUCTS

2.01 AWWA BUTTERFLY VALVES

A. Standard: AWWA C504, except as modified herein.

B. Type:
   1. 3-inch through 12-inch: Wafer body, except short body flanged (ANSI #125) or mechanical joint where shown on the Drawings, or where buried.
   2. 14-inch through 72-inch: Short body flanged (ANSI #125) or mechanical joint where shown on the Drawings.
   3. Geared operator, resilient seated, 90˚ seating.

C. Pressure Class:
   1. 3-inch through 12-inch: 150 psi.
   2. 14-inch through 72-inch: 150 psi, unless shown otherwise on the Drawings.
   3. Valves shall be leak-tight at rated pressure in either direction.

D. Materials:
   1. Body: Cast Iron; ASTM A126, Class B, or ASTM A48, Class 40.
   2. Disk: Cast or ductile iron with Ni-Chrome or Type 316 stainless steel edge.
   3. Valve Shaft: Type 304 or Type 316 stainless steel.
   4. Seats: Buna-N.

E. Construction:
   1. Seats: Applied to body. Cartridge type seats with retaining rings are not acceptable.
   2. Disk to Shaft Connection: Stainless steel taper pins or torque plug.
   3. Valve Diameter Limitation: Internal diameter of valve at the throat shall be no less than the nominal diameter of the valve less 1-½ inches.
   4. Bearings shall be self-lubricating and corrosion-resistant.

F. Finish:
   1. Exposed Exterior: Shop prime compatible with field applied finish coats. Refer to Section 09960.
   2. Buried Exterior: Shop coat with high-solids epoxy, 6 mils minimum OR shop coat in accordance with Specification 09960 System 7, 16 mils minimum.
   3. Interior: Shop line with two-component, high solids epoxy, AWWA C550.

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G. Testing: Test in accordance with AWWA C504, except that leakage test shall be in both directions. Submit certified test results for valves 24 inches and larger.

H. Manufacturer:

Size Range	Type	First Name	Second Name or Equal
3-inch -12-inch	Wafer	Pratt, MKII	-
3-inch – 20-inch	Flanged	Pratt, 2FII	DeZurik, BAW
24-inch - 72-inch	Flanged	Pratt, XR-70	DeZurik, BAW
Buried 6-inch – 48-inch	Flanged	Pratt Groundhog	DeZurik, BAW

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install butterfly valves in accordance with manufacturers recommendations.

B. Install butterfly valves in accordance with AWWA C504, Appendix A, Sections A.2 through A.5, inclusive.

3.02 PROTECTIVE COATINGS

A. Provide coating for all valves in accordance with Section 09960

3.03 TESTING

A. Operationally test all valves to demonstrate operation without binding. Cycle valve three times minimum.

B. Perform a leakage test for each valve. test may occur in conjunction with pipeline test. Test in accordance with Section 15050

END OF SECTION

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SECTION 16010

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Work Included:

1. Provide all required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment, and satisfactorily complete all electrical work shown on the Drawings, included in these Specifications, or required for a complete and fully operating facility. In addition, provide wiring for the equipment that will be provided under other Divisions of these Specifications.
2. Provide conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions. Coordinate with the supplier of electrical equipment specified under other Divisions.
3. Provide all conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions, including process instrumentation primary elements, transmitters, local indicators and control panels. This also includes lightning and surge protection equipment wiring at process instrumentation transmitters if required. Contractor shall install vendor furnished cables specified under other Divisions.
4. Provide a complete raceway system for the specialty cable systems. Install the specialty cable systems in accordance with the system manufacturer's installation instructions. Review of the raceway layout, prior to installation, with the system supplier and cable manufacturer to ensure raceway compatibility with the system and materials being furnished. Where redundant cables are furnished, install them in separate raceways.
5. Provide raceway and power wiring for all heating, ventilation and air conditioning equipment furnished under other related Divisions. Refer to HVAC drawings and related specifications for power requirements.
6. Auxiliary Devices: Provide conduit and wire for power and control for all auxiliary devices such as solenoid valves, pressure switches, and instruments that are included as part of a manufacturer's packaged system (i.e., all systems specified in Divisions 11 through 15. Contractor shall be responsible for conduit and wire to these auxiliary devices even if not specifically shown on the Drawings or specified herein.
7. Provide concrete, excavation, backfill and steel reinforcement required for encasement, installation or construction of the WORK of the various Sections of Division 16 as a part of the WORK under the respective Sections, including duct banks, manholes, handholes, equipment housekeeping pads and light pole bases.

B. Work Specified in Other Divisions:

1. Section 01190: Seismic Requirements
2. Section 11001: General Equipment and Mechanical Requirements – equipment supports and foundations
3. Section 11002: Electric Motor Drives - providing electric motors
4. Division 17: Providing instruments and other process control equipment.

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C. Work to be Done by Utilities:
   1. Providing and connecting power company meters and instrument transformers.
   2. Providing telephone company instruments, relays, terminals, and cables.

D. Safety: Conduct operations in accordance with NFPA 70E, Standard for Electrical Safety Requirements for Employee Workspaces.

1.02 CODE COMPLIANCE AND REFERENCE STANDARDS

A. Electric equipment, materials and installation shall comply with the National Electrical Code (NEC) and with the latest edition of the following codes and standards:
   1. National Electrical Safety Code (NESC)
   2. Occupational Safety and Health Administration (OSHA)
   3. National Fire Protection Association (NFPA)
   4. National Electrical Manufacturers Association (NEMA)
   5. American National Standards Institute (ANSI)
   6. Insulated Cable Engineers Association (ICEA)
   7. Instrument Society of America (ISA)
   8. Underwriters Laboratories (UL)
   9. Factory Mutual (FM)
   10. Institute of Electrical and Electronics Engineers
   11. American Society of Testing Materials (ASTM)
   12. California Electrical Code (CEC)
   13. Local Telephone Company requirements
   14. Local Utility Company requirements

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

C. All materials and equipment for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without a UL label affixed.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Owner/Engineer.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times.

1.03 SUBMITTALS

A. Shop Drawings shall be custom prepared for this project and submitted as listed in each of the Electrical Specification Sections. Shop drawings shall include the following:
   1. Complete materials list stating manufacturer, brand name and catalog number of each item or class of material.

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2. Shop drawings for grounding work not specifically indicated on the drawings but required under the NEC.
3. Front, side and rear elevations along with top views with required dimensional data.
4. Location of conduit entrances and access plates.
5. Catalog cuts defining component data.
6. Connection diagrams, terminal numbers, internal wiring diagrams, conductor size and cable numbers.
7. Method of anchoring, seismic requirements and weight.
8. Types of materials and finish.
9. Nameplates.
10. Temperature limitations, as applicable.
11. Voltage requirements, phase and current, as applicable.
12. Front and rear access requirements.
13. Test reports.

B. O&M Manuals and other documentation, shall be submitted in accordance with these contract documents. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc. to instruct operating and maintenance personnel unfamiliar with such equipment. All manuals and other documentation shall be submitted as listed in each of the Electrical Specification Sections and include the following:
1. A comprehensive index.
2. A complete "As-built" set of approved shop drawings.
3. A complete list of the equipment supplied, including serial numbers, ranges and pertinent data.
4. A table listing of the "as left" settings for all timing relays and alarm and trip set points.
5. System schematic drawings "As-Built", illustrating all components, piping and electrical connections of the system supplied under this Section.
6. Detailed service, maintenance and operation instructions for each item supplied.
7. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.
8. The operating instructions shall also incorporate a functional description of the entire system, with references to the systems schematic drawings and instructions.
9. Complete parts list with stock numbers, including spare parts.

C. Record Drawings shall be promptly furnished when the equipment installation is complete. Payment may be withheld until Record Drawings have been furnished and approved.

D. At the time of delivery of the equipment, the Contractor shall have an approved shop drawing in his possession for the Owner's Inspector and/or Owner's Engineer for verification.

E. As-Built Drawings: As the work progresses, legibly record all field changes on a set of Project Contract Drawings, hereinafter called "As-Built Drawings". The As-Built Drawings and specifications shall be kept up to date throughout the project. As-Built Drawings shall accurately show the installed condition of the following items at a minimum:
1. One-line Diagram(s).

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2. Raceways and pullboxes.
3. Conductor sizes and conduit fills.
4. Panelboard Schedule(s).
5. Control Wiring Diagram(s).
6. Luminaire Schedule(s)
7. Luminaire, receptacle and switch outlet locations.
8. Underground raceway and duct bank routing including manhole/handhole locations.

1.04 TESTS

A. The Contractor shall be responsible for factory and field tests indicated in Division 16, as required by the Engineer and as required by other authorities having jurisdiction.

B. Furnish necessary testing equipment

C. Pay the costs of the tests, including replacement parts and labor due to damage resulting from damaged equipment or from testing and correction of a faulty installation.

D. Reporting
   1. Where test reporting is indicated, submit proof-of-design test reports for mass-produced equipment with the Shop Drawings.
   2. Submit factory performance test reports for custom-manufactured equipment for approval prior to shipment.
   3. Submit field test reports for review prior to Substantial Completion.

E. Remove and replace equipment or material that fails a test, or, if the Engineer approves, repair and retest for compliance.

F. Connections to equipment or materials with a factory warranty shall be as recommended by the manufacturer and shall be performed in a manner that does not void the warranty.

1.05 PERMITS AND INSPECTIONS

A. Obtain permits and pay all fees required for permits inspections.

B. Pay inspection, connection and turn-on service charges required by the utility company.

C. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. Provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory.

D. Inspection of the equipment at the factory by the Engineer will be made after the manufacturer has performed satisfactory checks, adjustments, tests and operations.

E. Favorable review of the equipment at the factory only allows the manufacturer to ship the equipment to the project site. The Contractor shall be responsible for the proper installation and satisfactory startup operation of the equipment to the satisfaction of the manufacturer and the Engineer.

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1.06 DEMOLITION AND RELATED WORK

A. General
   1. Perform electrical demolition work as indicated.
   2. The Contractor is cautioned that demolition work may also be indicated on non-electrical Drawings.
   3. Coordinate with all trades regarding electrical de-energization, disconnection and removal, and the overall sequence of construction.

B. Electrical Requirements for Removed Equipment
   1. Remove dedicated wiring and exposed conduits back to the source.
   2. Where control wiring to be demolished shares a conduit with other wiring to remain, the control wiring shall be abandoned in place. Where power wiring to be demolished shares a conduit with other wiring to remain, the power wiring shall be removed.
   3. Remove power wiring from the power source to the first pullbox or manhole remote from the panel and abandon in place the remaining wiring.
   4. Abandon in place wiring routed through encased conduits and cut encased conduits flush to the floor and grout flush with the floor.
   5. Remove remote mounted starters, disconnect switches, circuit breakers, sensors and transmitters

C. Where new lighting and receptacles are installed in existing structures, remove old lighting, receptacles, switches, wiring and conduits.

D. Junction Boxes
   1. Wiring and conduits indicated to be extended shall be terminated in a new junction box with terminal strips.
   2. Provide a junction box with a NEMA rating in accordance with the area in which it is located and sized as required by the NEC.
   3. Properly identify wires and terminals before disconnection.

E. Removed materials and equipment not indicated to be returned to the Owner shall, upon removal, become the Contractors property and shall be disposed of off-site.

F. Remove and relocate material and equipment indicated to be relocated or reused, and reinstall with care in order to prevent damage.

G. Place materials indicated to be returned to the Owner in boxes, with the contents clearly marked, and store at a location determined by the Engineer.

H. Identification
   1. Where switchgear, motor control centers, switchboards or panelboards are indicated to have components, assemblies or circuits removed and/or reconnected, provide the affected equipment compartments with new engraved nameplates matching the existing. Modify panelboard schedule(s) to indicate revised circuits.
   2. Pencil or magic marker markings directly on equipment will not be acceptable.

1.07 COORDINATION

A. Coordinate the electrical work with the other trades, code authorities, utilities, and the Owner.

B. Where connections must be made to existing installations, properly schedule all the required work with the Owner, including the power shutdown periods.

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Schedule and carry out shutdowns so as to cause the least disruption to operation of the plant and privately owned facilities.

C. Submit a written sequencing request indicating the sequence and duration of activities to be performed during the plant shutdown.

D. Switching, safety tagging and other project related tasks required for shutdown or to isolate existing equipment, shall be performed by the Owner.

E. In no case shall the Contractor begin any work in, on or adjacent to existing equipment without written authorization from the Engineer.

F. Modifications
   1. Perform modifications or alterations to existing electrical facilities as required to successfully install and integrate the proposed electrical equipment as indicated.
   2. Perform modifications to existing equipment, panels and cabinets in a professional manner. Repair coatings of existing equipment to match existing
   3. The costs for modifications to existing electrical facilities that are required for a complete and operable system shall be included as part of the Work.

G. Existing Utilities
   1. Exercise extreme caution when digging trenches to not damage existing underground utilities.
   2. The cost of repairs of damages caused during construction shall be included as a part of the Work.

H. Field Verifications
   1. Visit the site before submitting a Bid to become better acquainted with the Work of this Contract.
   2. The lack of knowledge will not be accepted as justification for extra compensation to perform the Work.
   3. The Contractor shall be responsible for identifying available existing circuit breakers in lighting panel for the intended use as required.
   4. The Contractor shall be responsible for field verifying the available space in switchgear, switchboards and/or motor control centers to integrate new overcurrent protective devices meeting the requirements of these Specifications.
   5. The cost for the above field verifications shall be included as part of the Work.

I. Installation of Temporary Power
   1. To facilitate the continuous operation of existing equipment, provide temporary equipment as indicated.
   2. Submit installation and connection details for favorable review and acceptance by the Engineer.
   3. Costs associated with these temporary installations shall be included as part of the Work.
   4. Temporary wiring and equipment shall remain the property of the Contractor unless indicated otherwise.

1.08 ELECTRICAL AND TELEPHONE SERVICES

A. Contact the serving utility and verify compliance with requirements before construction.

B. Coordinate schedules and payments for Work by utilities.

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C. Where conduits and conductors in the Work are indicated to be larger, heavier schedule, or have greater protective coating than utility requirements, provide the larger size, heavier schedule or greater protection.

D. Provide electrical service as indicated and as required by the serving utility.

E. Verify and provide service conduits, fittings, transformer pad, grounding devices and service wires not provided by the serving utility.

F. Verify with the utility the exact location of each service point and type of service, and pay charges levied by the serving utilities as part of the Work.

G. Telephone Service
   1. Provide telephone service from the utility connection to the telephone backboard or other Owner directed telephone panel.
   2. Provide telephone cable from the Telemetry Panel to the utility connection point with at least 2 pairs.
   3. Terminate every pair of wires in the telephone panel.
   4. Connect at least one voice quality pair, provide with service and switch on with a dial tone prior to startup.

1.09 LOCATIONS

A. General: Use equipment, materials and wiring methods suitable for the types of locations in which they are located, as defined in Paragraph B. herein.

B. Definitions of Types of Locations:
   1. Dry Locations: All those indoor areas which do not fall within the definitions below for Wet, Damp, Hazardous, or Corrosive Locations and which are not otherwise designated on the Drawings.
   2. Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Drawings.
   3. Damp Locations: All spaces wholly or partially underground, or having a wall or ceiling forming part of a channel or tank, unless otherwise designated on the Drawings.

C. Unless otherwise specified herein or shown on the Drawings, electrical enclosures and associated installations shall have the following ratings:
   1. NEMA 1 gasketed or 12 for dry, non-process indoor above grade locations
   2. NEMA 3R for outdoor installations identified not to be hazardous or corrosive.
   3. NEMA 4X enclosures of Type 304 or 316 stainless steel in corrosive areas except in chlorine and HFS areas where non-metallic enclosures shall be provided.
   4. NEMA 6 or 6P enclosures for submersible, indoor or outdoor use. Enclosures for temporary submersion shall be rated NEMA 6 and prolonged submersion shall be rated 6P at limited depth.

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PART 2 - PRODUCTS

2.01 GENERAL

A. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are favorably reviewed by the Engineer prior to installation.

B. It is the intent of these Specifications and Drawings to secure high quality in all materials and equipment in order to facilitate operation and maintenance of the facility. All equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses, which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed, braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details.

C. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light-duty, fragile and competitive grade devices of doubtful durability shall not be used.

D. Where a NEMA enclosure type is indicated, use that type of enclosure despite the fact that certain modifications such as cutouts for control devices may negate the NEMA rating.

E. Temperature Ratings of Equipment 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.

2.02 MOUNTING HARDWARE

A. Miscellaneous Hardware
   1. Provide nuts, bolts and washers constructed of stainless steel.
   2. Provide threaded rods for trapeze supports constructed from continuous threaded galvanized steel, 3/8-inch diameter minimum.
   3. Struts
      a. Construct struts for mounting of conduits and equipment of stainless steel.
      b. Where contact with concrete or dissimilar metals may cause galvanic corrosion, use suitable non-metallic insulators in order to prevent such corrosion.
      c. Strut manufacturer shall be Unistrut, B-Line or approved equal.
   4. Provide plastic protective end caps for all exposed strut ends. End caps shall be manufactured by Unistrut P2860-33 or approved equal.
   5. Provide stainless steel expansion anchors for attaching equipment to concrete walls, floors and ceilings. Expansion anchors shall be manufactured by Power Fasteners, Inc and be the "Power-Bolt" or "Power-Stud" series or approved equal.

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2.03 NAMEPLATES

A. For each piece of electrical equipment, provide a manufacturer's nameplate showing his name, location, the pertinent ratings and the model designation.

B. Identify each piece of equipment and related controls with a rigid laminated engraved phenolic nameplate. Engrave nameplates with the inscriptions indicated on the Drawings and, if not so indicated, with the equipment name. Securely fasten nameplates in place using fasteners constructed of brass, cadmium plated steel or stainless steel and screwed into inserts or tapped holes as required. Where no inscription is indicated on the Drawings, furnish nameplates with an appropriate inscription furnished by the Engineer upon prior request by the Contractor.

C. Provide engraved characters of the block style, with no characters smaller than 1/8 inch top to bottom.

D. Each control device, including pushbuttons, control switches, and indicating lights, shall have an integral legend plate or nameplate indicating the device function. These shall be inscribed as indicated on the Drawings or as favorably reviewed by the Engineer.

2.04 PAINTING

A. Equipment: Refer to each electrical equipment section of these Specifications for painting requirements of equipment enclosures. Repair any final paint finish, which has been damaged or is otherwise unsatisfactory, to the satisfaction of the Engineer.

B. Wiring System: Paint all exposed conduits, boxes and fittings to match the color of the surface to which they are affixed. Paint finishes shall include proper surface preparation, prime coat and a final finish coat, and shall conform to Section 09960.

PART 3 - EXECUTION

3.01 REQUIREMENTS

A. All electrical installations shall conform to the codes and standards outlined in this Section.

3.02 WORKMANSHIP

A. Assign a qualified representative who shall supervise the electrical construction work from beginning to completion and final acceptance.

B. Perform all labor using qualified craftsmen, who have had experience on similar projects. Provide first-class workmanship for all installations.

C. Ensure that all equipment and materials fit properly in their installations.

D. Perform any required work to correct improperly fit installations at no additional expense to the Owner.

E. Provide materials and incidental required for a complete and operable system, even if not required explicitly by the Contract Documents.

F. Typical incidentals are terminal lugs not furnished with vendor-supplied equipment, compression connectors for cables, splices, junction and terminal boxes, and

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control wiring required by vendor-furnished equipment to connect with other equipment indicated in the Contract Documents.

3.03 EXCAVATION AND BACKFILL

A. Provide the excavations for electrical equipment foundations and trenches for conduits as shown on the Drawings.

B. Exercise caution during all excavation work and avoid damage to existing underground pipes. Exercise extreme caution when working near existing electrical conduits and facilities. Field verify the location of all electrical facilities before proceeding with any nearby work.

C. Refer to Division 2, Earthwork, of these Specifications for all excavation and backfilling work.

3.04 CONCRETE

A. Where shown on the Drawings or specified, provide the required concrete installations for conduit encasement and equipment foundations.

B. Refer to Division 3, Concrete, of these Specifications for all concrete work.

3.05 CONDUCTOR IDENTIFICATION

A. Identify all wires and cables in conformance with the requirements of Sections 16120, and 16124. This requirement applies to all equipment provided under this contract, regardless of Division, as well as to all conductors provided or worked on during this contract.

3.06 CUTTING, DRILLING, AND WELDING

A. Provide any cutting, drilling, and welding that is required for the electrical construction work.

B. Structural members shall not be cut or drilled, except when favorably reviewed by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry.

C. Provide the required welding for equipment supports. Conduits and fittings shall not be welded to structural steel.

D. Perform patch work with the same materials as the surrounding area and finish to match, as specified in Division 3 of these Specifications.

3.07 METAL PANELS

A. Mount all metal panels which are mounted on or abutting concrete walls in damp locations or any outside walls 1/4 inch from the wall, and paint the back sides of the panels with a high build epoxy primer. Film thickness shall be 10 mils minimum.

3.08 FIELD TESTS

A. Perform tests in accordance with applicable procedures as described in NETA Acceptance Testing Specifications.

B. Give 2-week notice to the Owner/Engineer prior to any test to permit witnessing the test.

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C. Provide the services of a recognized independent testing laboratory and pay all costs of performing the inspections and tests as specified herein.

D. The testing laboratory shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections. It is the intent of these tests to ensure that all electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with the Contract Documents and manufacturer's instructions. The tests and inspections shall determine the suitability for energization.

E. The testing laboratory shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907. Membership in the International Electrical Testing Association (NETA) constitutes proof of meeting such criteria. The testing laboratory shall submit proof of these qualifications to the Engineer for review. Testing laboratory shall be Electrical Testing and Controls, Electro-Test, Power Systems, or approved equal.

F. The testing laboratory shall have a calibration program, which maintains all applicable test instrumentation within, rated accuracy. The accuracy shall be traceable to the National Bureau of Standards in an unbroken chain. Instruments shall be calibrated in accordance with the following frequency schedule:
   1. Field instruments: 6 months maximum
   2. Laboratory instruments: 12 months
   3. Leased specialty equipment: 12 months
   Date calibration labels shall be visible on all test equipment.

G. Where testing pursuant to NETA requirements is required in these specifications, submit a test report which includes the following:
   1. Name of project, name of person performing test, and date of test
   2. Description of equipment tested
   3. Description of test
   4. List of test equipment used and calibration date
   5. Test results
   6. Conclusions and recommendations
   7. Appendix, including appropriate test forms
   The test report shall be bound and its contents certified. Submit the completed report directly to the Engineer no later than thirty (30) days after completion of the test unless directed otherwise. Number of reports to be submitted for review shall be the same as the number required for shop drawing submittals.

H. Safety practices shall include, but are not limited to, the following requirements:
   1. Occupational Safety and Health Act of 1970, OSHA.
   2. Accident Prevention Manual for Industrial Operations, Seventh Edition, National Safety Council, Chapter 4.
   3. Applicable state and local safety operating procedures.

I. All field tests shall be performed with apparatus de-energized except where otherwise specifically required by Section 7 of the latest Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems published by NETA. The testing laboratory shall have a designated safety representative who shall be present on the project and supervise operations with respect to safety. In all cases, work shall not proceed until the safety representative has determined that it is safe to do so. The testing laboratory shall have available sufficient protective barriers and warning signs to conduct specified test safely.

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J. Electrical equipment and materials furnished and installed by the Contractor, and the testing equipment listed below shall be tested in accordance with the "Inspection and Test Procedures" and "System Function Tests" (Section 7) of the latest Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems published by NETA. Tests shall not include any tests listed as optional in the aforementioned NETA Specifications unless specifically noted in respective equipment specifications for this project.

K. Retesting will be required for all unsatisfactory tests after the equipment or system has been repaired. Retest all related equipment and systems if required by the Engineer. Repair and retest equipment and systems, which have been satisfactorily tested but later, fail, until satisfactory performance is obtained.

L. Putting Equipment and Cables into Service: Submittal and favorable review of the specified factory and field tests shall occur before the Contractor is permitted to place the respective equipment or cable into service.

M. Miscellaneous Tests
   1. Insulation Resistance, Continuity, Rotation: Perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment including all motors 1/2 horsepower and larger prior and in addition to tests performed by the testing laboratory specified herein. Supply a suitable and stable source of test power to the test laboratory at each test site. The testing laboratory shall specify requirements. Notify the testing laboratory when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling. All testing shall be performed in the presence of the Engineer. The testing laboratory shall be responsible for implementing all final settings and adjustments on protective devices and tap changes. Any system material or workmanship that is found defective on the basis of acceptance tests shall be reported directly to the Engineer. The testing laboratory shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.
   2. Motor Current: Measure and record current in each phase for each new motor. Include measurement of the motor terminal voltages and motor currents when the motor is being operated at normal operating loads. For motors that are part of variable frequency drive systems, use true-RMS-reading instruments in making the measurements.
   3. Operational Tests: Operationally test all circuits to demonstrate that the circuits and equipment have been properly installed, adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, including alarm conditions, and demonstrate satisfactory interfacing with the data acquisition and alarm systems.

3.09 EQUIPMENT PROTECTION

A. Exercise care at all times after installation of equipment, motor control centers, etc., to keep out foreign matter, dust, dirt, debris, or moisture. Use protective sheet-metal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

3.10 CLEANING EQUIPMENT

A. Before final acceptance, thoroughly clean the electrical Work of cement, plaster and other materials.

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B. Clean out and vacuum all construction debris from the bottom of all equipment.

C. Provide and touch-up to original condition any factory painting that has been marred or scratched during shipment or installation, using paint furnished by the equipment manufacturer.

D. Remove temporary tags, markers, stickers and the like.

E. Remove all oil and grease spots with a non-flammable cleaning solvent by carefully wiping and scraping cracks and corners.

F. Dispose of cleaning debris and refuse off-site.

END OF SECTION

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SECTION 16110

ELECTRICAL RACEWAY SYSTEMS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the drawings and as specified herein.

B. Raceways and conductors that are listed on the conduit and cable schedules are generally not shown on the Drawings, except where they are required to pass through a restricted or designated space and the Contractor would benefit from additional information. Conduit block diagrams indicate exposed conduits as solid lines and shall be run near the ceilings or along walls of the areas through which they pass and shall be routed to avoid interferences with HVAC ducts, cranes and hoists, lighting fixtures, doors and hatches, etc. Conduit block diagrams indicate concealed or buried conduits as dashed lines and shall be run in underground duct banks, center of concrete floor slabs, in partitions, or above hung ceilings as required.

C. In the event that individual equipment loads provided are larger than indicated in the Contract Documents, revise raceways, conductors, starters, overload elements, and branch circuit protectors as necessary in order to control and protect the increased connected load in conformance to NEC requirements as part of the WORK.

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI) Publications:
1. C80.1 Specification for Zinc Coated Rigid Steel Conduit
2. C80.5 Specifications for Rigid Aluminum Conduit

B. Federal Specifications (FS):
1. FS W C 1094 W C 1094A Conduit and Conduit Fittings, Plastic, Rigid
2. FS WW C 540 WW C 540A Conduit, Metal, Rigid, (Electrical, Aluminum)
3. WW C 540C Conduit, Metal, Rigid & Coupling, Elbow & Nipple, Electrical Conduit, Aluminum
4. FS WW C 566 WW C 566C Flexible Metal Conduit

C. National Electrical Manufacturers Association (NEMA) Publications:
1. RN 1 Polyvinyl Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
2. TC2 Electrical Polyvinyl Chloride (PVC) Conduit
3. TC 6 PVC and ABS Plastic Utilities Duct for Underground Installation
4. TC14 Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

D. Underwriters Laboratories (UL) Standards:
1. 6 Rigid Metal Electrical Conduit
2. 6A Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless Steel
3. 360 Liquid-Tight Flexible Metal Conduit
4. 651 Electrical Rigid Nonmetallic Conduit and Fittings
5. 651A Type EB and A Rigid PVC Conduit and HDPE Conduit

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6. 2515 Aboveground Reinforced Thermosetting Resin Conduit

1.03 SUBMITTALS

A. Submit complete catalog cuts of raceways, fittings, boxes, supports, and mounting hardware, marked where applicable to show proposed materials and finishes.

B. Prepare as-built drawings of encased concealed and exposed raceways, ducts, raceways, junction boxes, pull boxes, and electrical and instrumentation equipment.

1.04 LOCATIONS

A. Refer to Section 16010 for definitions of types of locations.

PART 2 - PRODUCTS

2.01 GENERAL

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

B. Provide exposed conduit of 3/4-inch minimum trade size and encased conduit of 1-inch minimum trade size.

C. The use of short sections of 1/2-inch flexible conduit for final termination of field control devices and instrumentation is permitted. They may not be longer than 36 inches in length, and may only transition to the smaller size junction boxes or condulets at the field device.

2.02 CONDUIT, RACEWAYS

A. Galvanized Rigid Steel Conduit (GRS) shall be manufactured from mild steel, hot-dip galvanized inside and out, conforming to ANSI C80.1 and UL 6. Couplings shall be threaded type. Manufacturers shall be Allied Tube and Conduit, Wheatland Tube or approved equal.

B. Rigid Aluminum Conduit: Conduit shall be manufactured from 6063 alloy, temper T-1 and conform to FS WW C 540 OR ANSI C80.5 and UL-6A. Manufacturers shall be Allied Tube and Conduit, American Conduit OR approved equal.

C. PVC coated rigid steel conduit (PGRS) shall meet the requirements of GRS above. A PVC coating shall be bonded to the outer surface with a thickness not less than 40 mils. The inside surfaces and threads of the conduit shall be provided with a 2-mil urethane coating. PGRS shall be manufactured in accordance with UL-6, ANSO C80.1 and NEMA RN1. Manufacturers shall be Robroy Industries Perma-Cote or Plasti-Bond series, Thomas & Betts Ocal Blue or approved equal.

D. Liquidtight Flexible Conduit shall be constructed of a flexible galvanized metal core with a sunlight-resistant thermoplastic outer jacket. Conduit shall be manufactured• in accordance with UL 360. Flexible conduit in hazardous areas shall be rated for the Class, Division and Group in which its installed. Manufacturers shall be Anaconda Sealtite, Electriflex Liquatite or approved equal.

E. Rigid Nonmetallic Conduit: Rigid nonmetallic conduit shall be PVC Schedule 40 (PVC 40) or PVC Schedule 80 (PVC 80) and sunlight resistant. Conduit shall be approved for underground use and for use with 90°C wires, and shall conform to

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NEMA TC-2 and UL 651. Manufacturers shall be Carlon, Cantex or approved equal.

F. Fiberglass conduit shall be manufactured using the single circuit filament winding process. The resin shall be epoxy-based, with no fillers. All additives for increasing flame spread and lowering smoke density shall be halogen free. Conduit shall be manufactured in accordance with NEMA TC 14. Manufacturers shall be Champion Fiberglass, United Fiberglass or approved equal.

2.03 CONDUIT SUPPORTS

A. Supports for individual conduits shall be Type 316 stainless steel one-hole type with conduit back spacer.

B. Supports for multiple conduits and all associated hardware shall be Type 316 stainless steel Unistrut or Superstrut channels, or equal.

2.04 FITTINGS

A. General
   1. For use with metallic conduit, provide cast and malleable iron fittings of the threaded type with 5 full threads.
   2. Fittings
      a. Provide fittings with neoprene gaskets and non-magnetic stainless steel screws.
      b. Attach covers by means of holes tapped into the body of the fittings.
      c. Covers for fittings attached by means of clips or clamps will not be accepted.
   3. Terminations
      a. In outdoor areas, terminate conduit in rain-tight hubs as manufactured by Myers, O.Z. Gedney, Appleton or approved equal.
      b. In other than outdoor areas, provide sealed locknuts and bushings.

B. Fittings for use with rigid steel shall be hot dipped galvanized steel or galvanized cast ferrous metal; access fittings shall have gasketed cast covers and be Crouse-Hinds Condulets, Appleton Unilets, or equal. Provide threaded-type couplings and connectors; set-screw type and compression-type are not acceptable.

C. Fittings for use with aluminum shall be cast aluminum with less than 0.40 percent copper content, and suitable for use with aluminum conduit. Manufactures shall be O.Z. Gedney, Appleton, Crouse-Hinds or approved equal.

D. Fittings for use with PVC-coated GRS conduit shall be PVC-coated that are the products of the same manufacturer as the conduit. Both male and female threads and internal surfaces shall contain a 2-mil urethane coating.

E. Fittings for use with rigid nonmetallic conduit shall be PVC and have solvent-weld-type conduit connections. Boxes shall be manufactured of PVC or fiberglass reinforced polyester (FRP). Manufactures shall be Carlon, Crouse-Hinds, Hoffman or approved equal. If such are not available, then the Specification for PVC coated galvanized rigid steel fittings shall apply.

F. Fittings for flexible conduit shall be Appleton Type ST, O.Z. Gedney Series 4Q, or approved equal.

G. Fittings for use with fiberglass conduit shall be fiberglass and as recommended by the conduit manufacturer.

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H. Combination expansion-deflection fittings with internal grounding shall be installed where conduit movement is expected in more than one dimension, and where conduits transition out of structures in locations where differential settlement may occur. Combination expansion/deflection fittings shall be manufactured by Crouse-Hinds Type XJGD or approved equal.

I. Expansion fittings with internal grounding shall be installed wherever exposed raceway cross building expansion joints. Expansion fittings shall be Crouse Hinds Type XLGSA or approved equal.

J. Union couplings for conduits shall be the Erickson type and shall be Appleton Type EC, O.Z. Gedney 3-piece Series 4, or approved equal. Threadless couplings shall not be used.

K. Bushings:
   1. Bushings shall be the insulated type.
   2. Bushings for rigid steel conduit shall be hot dip galvanized insulated grounding type, O.Z. Gedney Type HBLG, Appleton Type GIB, or approved equal.

2.05 BOXES

A. Boxes specified herein are for use with raceway systems only. Boxes used for housing electrical and instrumentation equipment shall be as described elsewhere in these Specifications.

B. NEMA 4X Areas: NEMA 4X terminal boxes, junction boxes, pull boxes, etc. shall be Type 304 or 316 stainless steel. Boxes shall be suitable for wall mounting or have feet where self-standing. Boxes shall have continuously welded seams and welds shall be ground smooth. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. All boxes shall have hinged gasketed doors with quarter turn latches or 3-point latch (single operator) system on enclosures larger than 36 inches wide or 32 inches tall. Terminal boxes shall be furnished with terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20A, 600V. Boxes shall be Concept Series as manufactured by Hoffman Engineering Co. or approved equal.

2.06 WIREWAYS AND AUXILIARY GUTTERS

A. General: Wireways shall consist of a prefabricated channel-shaped trough with hinged or removable covers, associated fittings, and supports. Straight sections shall not be longer than 5 feet. Separate power, control, signal and communications cables by grounded metallic dividers in wireways or run in separate wireways. Cross-sectional dimensions shall be as indicated on the Drawings. Fittings shall consist of elbows, tees, crosses, and closing plates as required.

B. Interior Locations: All components shall be constructed from sheet steel not less than 14 gauge and coated with a corrosion-resistant gray paint. Covers shall be held closed with hinges and clamps.

C. Exterior Locations: Wireway and associated fittings shall be NEMA rated for the area in which it is to be installed. Wireways shall be supplied with gasketed closing end plates and gasketed hinged covers.

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D. Ground the steel and aluminum wireway bodies. Provide steel dividers with steel wireways or aluminum dividers with aluminum wireways, and ground by means of an individual grounding conductor.

E. Terminate conduits in all wet and damp locations with rain-tight hubs as manufactured by O.Z. Gedney, Myers or approved equal.

2.07 CONDUIT SEALANTS

A. Moisture Barrier Types: Sealant shall be a non-toxic, non-shrink, non-hardening, putty type hand applied material providing an effective barrier under submerged conditions.

B. Fire Retardant Types: Fire stop material shall be a reusable, non-toxic, asbestos-free, expanding, putty type material with a 3 hour rating in accordance with UL 1479. Provide products indicated by the manufacturer to be suitable for the type and size of penetration.

PART 3 - EXECUTION

3.01 CONDUIT, RACEWAY AND FITTING INSTALLATION

A. No wire shall be pulled until the raceway system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the raceway system has been completed in every detail.

B. From pull point to pull point, the sum of the angles of all of the bends and offsets shall not exceed 270 degrees.

C. Coat threads with a conductive lubricant before assembly.

D. Provide joints that are tight, thoroughly grounded, secure and free of obstructions by use of a mandrel. Adequately ream the conduit in order to prevent damage to the wires and cables inside. Use strap wrenches and vises to install the conduit in order to prevent wrench marks on the conduit. Any conduit with wrench marks shall be replaced.

E. The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction. Duxseal, or 3M seal spray shall be used in all applications. Plugging with tape is prohibited, even for short periods of time.

F. For power, control and signal circuits, provide conduit per Conduit Use Tables below, unless specifically indicated otherwise on the Drawings:
   1. Exception: For raceways leaving a building above grade and then going below grade, provide PVC-coated GRS from a point 3 feet above grade to a point 5 feet from the building wall.

G. Unless boxes have cast, threaded hubs, provide insulated type metallic grounding bushings for metallic conduits at all boxes. Bond together all conduits to provide continuity of the equipment grounding system. Size bonding conductor per NEC.

H. Provide flexible conduit in lengths of not more than 36 inches at connections to motors, valves and any equipment subject to vibration or relative movement. All flexible conduits, regardless of length or manufacturer rating, shall have a dedicated ground bonding conductor pulled through, whether it is included in the conduit fill schedules or not.

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I. Conduits embedded in concrete floors on grade shall be installed between grids of reinforcing steel, or shall be encased below the floors, provided the concrete is thickened in a manner satisfactory to the Engineer. Installation of conduit below the bottom of this slab is not acceptable; embedding or encasing is required.

J. Damage to PVC coating of coated conduits or fittings shall be repaired with factory-approved PVC patching material to the original factory condition.

K. Install fiberglass conduit in accordance with the manufacturer's instructions. Connections between sections of conduit may be either glued or threaded, at the Contractor's option.

L. Underground Raceways: Slope all underground raceways to provide drainage; for example, slope conduit from equipment located inside a building to the handhole located outside the building. For additional requirements see Section 16402.

M. Conduit Supports: Properly support all conduits as required by the NEC. Run all conduits exposed except where the Drawings indicate that they are to be embedded in the floor slab, walls, or ceiling, or to be installed underground.
   1. Exposed Conduits:
      a. Support exposed conduits within 1 foot of any outlet and at intervals not exceeding NEC requirements; wherever possible, group conduits together and support on common supports. Support exposed conduits fastened to the surface of the concrete structure by one-hole clamps, or with channels. Use conduit spacers with one-hole clamps. Coordinate conduit locations with piping, equipment, fixtures, and with structural and architectural elements. Conduits attached to walls or columns shall be as unobtrusive as possible and shall avoid windows. Run all exposed conduits parallel to building lines. No diagonal runs will be accepted. Bends in parallel runs shall be concentric and shall be run straight and true.
      b. Group together exposed conduits in horizontal runs located away from walls and support on trapeze hangers. Arrange such conduits uniformly and neatly. Trapeze hangers shall consist of channels of adequate size, suspended by means of minimum 3/8” diameter rods or other suitable means from the ceiling or from pipe hangers. Install such runs so as not to interfere with the operation of valves or any other equipment, and keep at least 6 inches clear of any pipe which may operate at more than 100°F. Treat cut surfaces or damaged ends with corrosion-resistant coatings such as "Devcon Z", prepared by Subox Coatings; "Galvanox Type I", prepared by Pedley-Knowles; or approved equal. Application shall follow manufacturer's recommendation.

N. Conduit Identification: In each handhole, pullbox, cabinet, motor control center or other equipment enclosure, identify each conduit using the conduit number shown on the Drawings by means of a stamped brass tag affixed with stainless steel wire; where affixing a tag is not feasible, identify conduits by affixing a brass tag with epoxy or other approved method of stenciling to the wall or structure adjacent to the conduit terminus.

O. Conduit Seals:
   1. Moisture Seals: Provide in accordance with NEC Paragraph 300.5(g).
   2. Gas Seals: Provide in accordance with NEC Paragraph 501.5.

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P. Aluminum conduit shall not be installed underground or encased in concrete. If necessary to run through concrete, install in a non-metallic conduit sleeve or use PVC coated conduit.

Q. Rigid PVC conduit shall be stored on a flat surface and shielded from the sun.

CONDUIT USE TABLE 1

	Inside Buildings				
	Exposed	**Concealed**			
Circuit Type	Standard	Above Suspended Ceilings	In Stud Walls	Embedded In Concrete	Slab On Grade
Power & 120 Vac Control	GRS or Aluminum	PVC-80 or GRS	GRS	PVC-40 or PVC-80	PVC-40 or PVC-80
Signal	GRS or Aluminum	GRS	GRS	GRS	GRS

CONDUIT USE TABLE 2

	Outside Buildings			**Transition**
Circuit Type	Exposed	Buried In Soil	Duct Bank Encased In Concrete	Within 5 Feet of Building
Power & 120 Vac Control	PVC Coated GRS, Aluminum or Fiberglass	PVC Coated GRS	PVC-40	PVC Coated GRS
Signal	PVC Coated GRS, Aluminum or Fiberglass	PVC Coated GRS	GRS	PVC Coated GRS

* Provide ground wire sized per NEC requirements for all circuits.

Notes:
1. Generally, the Conduit Use Tables apply.
2. Signal circuits are those subject to RF interference or induced current. MSPs, TSPs, telephone cable, coaxial cable, and manufacturer's cables specially designed for low level signals are all presumed to be part of signal circuits.
3. Provide fiberglass conduit where indicated on the Drawings.

3.02 WIREWAY INSTALLATION

A. Straight sections and fittings shall be solidly bolted together to be mechanically rigid and electrically continuous. Dead ends shall be closed. Unused conduit openings shall be plugged.

B. Wireways shall be supported every 5 feet.

C. Wireways and auxiliary gutters shall not contain wiring or control devices and shall not extend over 30 feet in length.

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SECTION 16120

LOW VOLTAGE WIRE AND CABLE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish labor, materials, equipment and incidentals necessary to install wire and cable specified under this Section. Electrical work shall be in accordance with Specification 16010 – General Electrical Requirements.

B. Work shall include building wire, cable, wiring connections and terminations and modular wiring systems.

1.02 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):
   1. B3-74 Specification for Soft or Annealed Copper Wire
   2. B8-77 Specification for Concentric Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   3. B173-71 Specification for Rope Lay Stranded Copper Conductors Having Concentric Stranded Members

B. Insulated Cable Engineers Association (ICEA):
   1. S-66-524 Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable

C. International Electrical Testing Association (NETA);
   1. ATS Acceptance Testing Specifications

D. National Electrical Manufacturers Association
   1. WC-3 Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
   2. WC-5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

E. Underwriters Laboratories (UL) Standards:
   1. 62 Flexible Cords and Fixture Wire
   2. 510 Insulating Tape
   3. 1063 Stranded Conductors for Machine Tool Wire

1.03 SUBMITTALS

A. Submit the following material or equipment data:
   1. Each type of cable and wire t be used.
   2. Cable and wire splices
   3. Wire markers

1.04 DELIVERY, STORAGE AND HANDLING

A. The Contractor shall protect all cable and wire from being damaged at all times.

B. Cable ends shall be protected from water entry in accordance with the manufacturer’s recommended procedures. Cable ends shall not be left open in manholes or other locations subject to submergence. If the cable ends become

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submerged prior to splicing or termination, the cables shall be replaced in their entirety.

C. Cables shall be pulled into raceways in accordance with the manufacturer's requirements. Under no circumstances shall cable pulling tensions exceed the manufacturer's written instructions.

D. Pulling tensions on raceway cables shall be within the limits recommended by the cable manufacturer. Wire pulling lubricant, where needed, shall be UL approved.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. General: Conductors, include grounding conductors, shall be stranded copper. Aluminum conductor and/or solid conductor wire and cable will not be permitted. Insulation shall bear the UL label, the manufacturer's trademark, and identify the type, voltage, and conductor size. 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 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. Wiring shall have wire markers at each end.

B. Power and Control Conductors, 600 Volts and Below:
   1. Solid copper wires shall be 600 volt Type XHHW, sizes #12 and #10 AWG for use with lighting and receptacle circuits only.
   2. Stranded copper wire for power circuits shall be 600 volt Type XHHW or RHW, Class B stranding, sizes #12 AWG and larger.
   3. Stranded copper wire for control circuits shall be 600 volt Type XHHW or RHW, Class B stranding, size #14 AWG.
   4. Control wires inside panels and cabinets shall be machine tool grade type MTW, UL approved, rated for 90 degrees C at dry locations.
   5. Fixture wire shall be 600 volt, silicone rubber insulated, 200°C, UL Type SF 2, with stranded copper conductors.
   6. Cords shall be 600 volt, 2 conductor plus ground, Type SO, hard service, of adequate length and with grounding type plug attached, rated in amperes as shown on the Drawings.
   7. Conductors for feeders as defined in Article 100 of the NEC shall be sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combinations of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.
   8. Conductors for branch circuits as defined in Article 100 of the NEC shall be sized to prevent voltage drop exceeding 3 percent at the farthest connected load or combinations of such loads and where the maximum total voltage drop on both feeders and branch circuits to the farthest connected load does not exceed 5 percent.

2.02 SPLICES AND TERMINATIONS OF CONDUCTORS

A. Splices:
   1. Wire and Cable Splicing Materials and Applications:

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a. For Lighting Systems and Power Outlets: Wire nuts shall be twist-on type insulated connectors utilizing an outer insulating cover and a means for connecting and holding the conductors firmly. They shall be UL listed and suitable for connecting two to four solid copper conductors of #14 or #12 AWG size or two or three #10 AWG solid copper conductors.
b. All Equipment: Crimp type connectors shall be insulated type with nylon jacket, suitable for the size and material of the wires and the number of wires to be spliced and for use with either solid or stranded conductors. They shall be UL listed.
c. Division 16 Equipment and Power Conductors: Bolted pressure connectors shall be suitable for the size and material of the conductors to be spliced. They shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor.
d. All Equipment: Epoxy splice kits shall include epoxy resin, hardener, and mold, and shall be suitable for use in wet locations and hazardous locations.

B. Terminations:
1. Low Voltage Terminations:
a. Crimp type terminals shall be UL listed, self-insulating sleeve type, with ring or rectangular type tongue, suitable for the size and material of the wire to be terminated, and for use with either solid or stranded conductors.
b. Terminal lugs shall be UL listed and of the split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor. Tongues shall have NEMA standard drilling.
c. Crimp with manufacturer recommended ratchet-type tool with calibrated dies. Hand crimping tools are not acceptable.

C. Tape used for splices and terminations shall be compatible with the insulation and jacket of the cable and shall be of plastic material. Tape shall conform with UL 510. Varnished cambric, rubber and thermoplastic tape shall be used for all split-bolt terminations.

D. Wire markers shall be heat shrink type (Raychem; T&B; or equal). Wire identification numbers shall be permanently imprinted on the markers. In locations which are not practical for heat shrink type labels, such as conduit bodies and small pull boxes, machine-printed, adhesive backed wire markers shall be used. Markers shall be custom-printed with the full identification string. Individual character markers and clip-on wire markers are not acceptable.

PART 3 - EXECUTION

3.01 CONDUCTOR INSTALLATION

A. The Contractor shall provide, terminate and test all power, control, and instrumentation conductors.

B. The Contractor shall, as a minimum, provide the number of control wires listed in the conduit schedule or on the Contract Drawings. Excess wires shall be treated as spares for future use.

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C. Conductors shall not be pulled into any raceway until raceway has been cleared of moisture and debris.

D. Wire in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be neatly fanned out to terminals.

E. Provide the following types and sizes of conductors for the uses indicated for 600 volts or less:
   1. Solid Copper, Sizes #12 and #10 AWG: As shown on the Drawings for circuits for receptacles, switches and light fixtures with screw-type terminals.
   2. Stranded Copper, Size #14 AWG and Larger, Individual Conductors or CC: As shown on the Drawings for the control of motors or other equipment. Size #14 shall not be used for power supplies to any equipment.
   3. Stranded Copper, Sizes #12 AWG and Larger: As shown on the drawings for motors and other power circuits.
   4. Stranded Copper, #6 AWG and Larger.
   5. Fixture Wire: For connections to all fixtures in which the temperature may exceed the rating of branch circuit conductors.

F. Color Coding: All wire shall be coded with specific colors infused in the conductor insulation at the time of manufacture. If a conductor is specified in a gauge not available with integrally colored insulation, it shall be marked by the Contractor at the time of installation using colored electrical coding tape or an approved marking paint. Where tape or paint is used as the conductor identification system, it shall clearly distinguish the conductor over its entire exposed length in all junction boxes, manholes, conduit bodies, or other accessible intermediate locations, and at every termination. All wiring shall conform to the following wiring color code:

SYSTEM	CONDUCTOR	COLOR
120/240 Volt AC, 1-Phase, 3 Wire	Neutral Line 1 Line 2	White Black Red
All Systems	Earth, System, or Equipment Ground	Green Insulation, Green w/ Yellow Tracer, or Bare Conductor
120 Volt AC Control Power Circuits (In field or in Control Cabinets)	Neutral Line 1 Line 2	White Black Red
120 Volt AC UPS-derived Control Power (secondary side)	Neutral Line	White w/ Red Tracer Red w/ White Tracer
24 VAC Control Power Circuits (In field or in Cabinets)	Neutral Line	White or Grey, with Yellow Tracer Brown
12 or 24 Volt DC Control Wiring (PLC Discrete I/O, etc.)	DC Negative DC Positive DC Switched (DI/DO)	Yellow Orange Blue
120 Volt AC Control Wiring inside or outside cabinets to/from PLC Discrete I/O	Common or Neutral 120 VAC discrete inputs 120 VAC relay or discrete outputs	White or Grey, w/ Blue Tracer Blue Red

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SYSTEM	CONDUCTOR	COLOR
Instrumentation Twisted-shielded Cabling (PLC Analog I/O @ 4-20mA, or 1-5 Volt DC, etc.) Process Signals to/from Transmitters, Analyzers, etc.	Negative Polarity Positive Polarity (1st Conductor) Positive Polarity (2nd Conductor) Shield Drain Wire	Black White (or clear) Red Bare Conductor, or covered w/ heat-shrink tubing of a unique color
Instrumentation wiring in cabinets (PLC Analog I/O from field terminations of shielded cables).	PLC Analog Input Connections PLC Analog Output Connections	Grey Brown

G. Exercise care in pulling wires and cables into conduit or wireways so as to avoid kinking, putting undue stress on the cables or otherwise abrading them. No grease will be permitted in pulling cables. Only soapstone, talc, or UL listed pulling compound will be permitted. The raceway construction shall be complete and protected from the weather before cable is pulled into it. Swab conduits before installing cables and exercise care in pulling, to avoid damage to conductors.

H. Wrap all cables in manholes with fireproofing tape. Extend tape 1-inch into ducts.

I. Cable bending radius shall be per applicable code. Install feeder cables in one continuous length unless splices are favorably reviewed.

J. Provide an equipment grounding conductor, whether or not it is shown on the Drawings, in any flexible conduit or any raceway in which all or any portion of a run consists of non-metallic duct or conduit. For flexible conduit, an external bonding jumper is an acceptable alternative.

K. In panels, bundle incoming wire and cables, No. 6 AWG and smaller, lace at intervals not greater than 6 inches, neatly spread into trees and connect to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Perform lacing with plastic cable ties or linen lacing twine. Where plastic panel wiring duct is provided for cable runs, lacing is not necessary when the cable is properly installed in the duct.

L. For cables crossing hinges, utilize extra flexible stranded wire, make up into groups not exceeding 12, and arrange so that they will be protected from chafing and excess flexing when the hinged member is moved.

3.02 CONDUCTOR SPLICES AND TERMINATIONS

A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Engineer. Splices, when permitted, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions. Splice or terminate wire and cable as follows:

1. Watertight Splices: Splices in concrete pullboxes, for any type of cable or wire, shall be watertight and rated for continuous submergence. Make splices in low voltage cables using epoxy resin splicing kits rated for application up to 600 volts.

B. Terminations:

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1. Terminate stranded #14 wire using crimp type terminals where not terminated in a box lug type terminal. Terminals must be coordinated with type of terminal board where provided.
2. Excess control wire shall be long enough to terminate at any terminal block in the enclosure, be properly taped, be identified with origin and be neatly coiled.

3.03 CONDUCTOR IDENTIFICATION

A. Except for interior lighting and receptacle circuits, identify each wire or cable at each termination and in each pullbox, junction box, handhole, and manhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule or as favorably reviewed by the Engineer.

B. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

3.04 FIELD TESTS

A. Refer to Specification 16950 – Electrical Tests for all cable testing requirements.

END OF SECTION

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SECTION 16124

SIGNAL CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Related Work Described Elsewhere:
   1. Division 17: Instrumentation and Controls

1.02 REFERENCE STANDARDS

A. American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA):
   1. 568-C.2 Balanced Twisted-Pair Telecommunications Cabling and Components Standards

B. American Society for Testing and Materials (ASTM):
   1. B8-11 Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronic Engineers (IEEE):
   1. 1143 Shielding Practice for Low Voltage Cables, Guide on

D. Insulated Cable Engineers Association (ICEA)
   1. S-73-532 Standard for Control, Thermocouple, Extension, and Instrumentation Cable

E. National Fire Protection Association (NFPA):
   1. 262 Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

F. Underwriters Laboratories Incorporated (UL):
   1. 13 Standard for Power-Limited Circuit Cables
   2. 83 Thermoplastic-Insulated Wires and Cables
   3. 444 Communications Cables
   4. 1666 Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION CABLE

A. Provide UL listed, twisted pair instrumentation Tray Cable (TC) conforming to ICEA S-73-532, and suitable for transmission of 4-20mA analog, low voltage signals.

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B. The cable shall be two-conductor (2/C), three-conductor (3/C), four-conductor (4/C), or more as indicated on the Drawings.

C. Each conductor in the cable shall be #16 AWG 7x24 stranded bare copper, or as indicated on the Drawings.

D. Conductor insulation: Polyvinyl Chloride/Nylon

E. Shield: Aluminum Foil, 100 percent coverage

F. Drain wire: #18 AWG, stranded, tinned copper

G. Jacket material: Polyvinyl Chloride, minimum thickness 0.047 inches.

H. Insulation shall be rated at 600 volts.

I. Temperature rating: UL dry, 90 degrees C; UL web, 75 degrees C

J. Instrumentation cable installed in underground conduits shall be rated as suitable for the application.

K. Instrumentation cable shall be Belden 3090A, 3091A, or approved equal.

2.02 TELEPHONE CABLE

A. Station cable:
1. Provide UL listed, Category 3 unshielded twisted pair (UTP) cable conforming to ANSI/TIA-568-C.2 and suitable for use indoors with telephone systems.
2. Conductors: 4 pairs of #24 AWG solid, bare copper
3. Conductor insulation: Polyvinyl Chloride
4. Outer jacket material: Polyvinyl Chloride
5. Insulation shall be 300 volt class.
6. Operating temperature range: -20 to +60 degrees C
7. Terminations/Connectors: Cables shall terminate in crimp connectors or at punch down blocks at both ends.
8. Cable shall be plenum-rated for flammability in accordance with NFPA 262, and suitable for use as riser cable.
9. Telephone station cable shall be Belden 1245A2 or approved equal. Ethernet cable for office/admin use may be used for this application.

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A. Signal cable shall be installed by personnel who have a minimum of 3 years' experience in terminating and splicing shielded twisted pair cables and coaxial cables.

B. Adequate care shall be exercised by the installers to prevent cable damage or sheath distortion. Bending radius shall not be less than 10 times the cable outside diameter.

C. Raceways shall be swabbed before installation of cable to remove moisture and debris.

D. Cables shall be continuous from initiation to termination without splices except where specifically indicated.

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E. Cable shielding shall be grounded at one end only of the cable. Bonding shall be to a single ground point only. Bonding from cable to cable in multiple run installations shall not be permitted.

F. Heat shrinkable sleeving shall be installed on all cables to insulate shielding at the ungrounded cable terminations.

G. Signal cable shall not be run in the same raceway with power and control wiring except where specifically indicated.

H. Where installed in control consoles containing power circuits, cables shall be routed a minimum of 2 inches distant. Color coding shall be strictly observed throughout the installation.

I. Cable in panels, cabinets, and wireways shall be neatly grouped using nylon tie straps, and shall be fanned out to terminals.

J. Manufacturer's cable pulling tension shall not be exceeded.

K. Pulling lubricant shall be UL approved.

3.02 CONDUCTOR SPLICES AND TERMINATIONS

A. Splices: Install all conductors without splices unless necessary for installation, as determined by the Engineer. Splices, where approved, and terminations shall be in accordance with the splice or termination kit manufacturer's instructions.

B. Terminations:
   1. Crimp-type terminals shall be UL listed, self-insulating, sleeve type with ring or rectangular tongue, suitable for size and material of the wire to be terminated and for use with either stranded or solid wire. Spade type lugs are acceptable with telephone cable systems only.
   2. Crimp with manufacturer's recommended ratchet-type tool with calibrated dyes. Hand crimping tools are not acceptable.
   3. Coaxial cable and connectors shall be terminated in accordance with the manufacturer's instructions.

3.03 CONDUCTOR IDENTIFICATION

A. Identify each wire or cable at each termination, in each pullbox, and in each handhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule or as favorably reviewed by the Engineer. Conductor numbering shall be coordinated with the Interconnection Diagrams specified in Division 17.

B. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

3.04 FIELD TESTS

A. Perform testing in accordance with Section 16950 – Electrical Tests.

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END OF SECTION

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SECTION 16402

UNDERGROUND ELECTRICAL WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

1.02 APPLICABLE STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Federal Specifications (Fed. Spec.):
      a. RR-F-621C Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole
      b. RR-G-661D Grating, Metal, Bar Type (Floor, except for Naval Vessels)
   2. American Concrete Institute (ACI) Publication:
      a. 318 Building Code Requirements for Reinforced Concrete
   3. American Society of Testing and Materials (ASTM) Publications:
      a. A36 Structural Steel
      b. A153 Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
      c. A615 Deformed and Plain Billet - Steel Bars for Concrete Reinforcement
      d. C33 Concrete Aggregates
      e. C139 Concrete Masonry Units for Construction of Catch Basins and Manholes, Specification for
      f. C150 Portland Cement
      g. C478 Precast Reinforced Concrete Manhole Sections, Specification for
      h. C857 Recommended Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
      i. C858 Standard Specification for Underground Precast Concrete Utility Structures
   4. American Association of State Highway and Transportation Officials (AASHTO) Publication:
      a. HB-13 Standard Specifications for Highway Bridges
   5. American National Standard Institute (ANSI) Publication:
      a. C2 National Electrical Safety Code
   6. National Fire Protection Association (NFPA) Publication:
      a. 70 National Electrical Code (NEC)
   8. State of California Public Utilities Commission (Cal. PUC) Publication:
      a. G.O.128 Construction of Underground Electric Supply and Communication System, Rule for

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

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PART 2 - PRODUCTS

2.01 GENERAL

A. Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated.

B. Conduit: Provide per Section 16110.

C. Wire and Cable: Provide per Section 16120, and Section 16124.

PART 3 - EXECUTION

3.01 TRENCHING, BACKFILL, AND COMPACTION

A. See Section 02221.

3.02 WIRE AND CABLE INSTALLATION

A. See Section 16120, Section 16124.

3.03 UNDERGROUND RACEWAYS WITH CONCRETE ENCASEMENT

A. All underground raceways shall be encased in concrete unless otherwise specifically shown otherwise on the Drawings.
   1. Concrete encasement shall be minimum of 3 inches around outer walls of raceways and minimum of 2 inches between raceways. Conduits shall be PVC Type EB.
   2. Concrete shall be portland cement type with 4 sacks cement per cubic yard of concrete, maximum coarse aggregate size of 3/8-inches and shall have minimum strength of 2,000 psi after 28 days. Amount of water shall not exceed slump required for placement.
   3. Underground raceways shall slope toward manholes, pullboxes, etc., at minimum rate of 3 inches per 100 feet unless indicated otherwise on Drawings. Raceway entrances in manholes, handholes, etc., shall be by means of bell ends and shall be sealed against entry of silt, debris, rodents, etc., into raceways.
   4. Top of concrete encasement shall be minimum of 24 inches below grade.
   5. Minimum radius of all horizontal bends in underground duct banks shall be 25 feet. Bends shall be formed of factory made sweeps or continuous assembly of bend segments or curved segments, except that polyvinyl chloride conduits may be field formed. Minimum radius of all vertical bends in underground raceways shall be ten times nominal size of conduit. Vertical bends shall be made of rigid steel or permanently coated aluminum conduit.
   6. Underground raceways within roadways shall be run parallel or perpendicular to road centerline.
   7. Pull wires left in underground raceways shall be 1/8-inch nylon rope or 3/16-inch polypropylene.
   8. Terminate conduits in end-bells where duct lines enter manholes and handholes. Provide structural support for concrete encased duct banks at the point where they terminate. Separators shall be of precast concrete, high impact polystyrene, steel, or any combination of these. Stagger the joints of the conduits by rows and layers so as to provide a duct line having the maximum strength. During construction, protect partially completed duct lines from the entrance of debris such as mud, sand and dirt by means of

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suitable conduit plugs. As each section of a duct line is completed, draw a brush through having the diameter of the duct, and having stiff bristles until the conduit is clear of all particles of earth, sand, and gravel; then immediately install conduit plugs.

B. Connections to Existing Ducts: Where connections to existing duct lines are indicated, excavate the lines to the maximum depth necessary. Cut off the lines and remove loose concrete from the conduits before new concrete encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct line, to take the shear at the joint of the duct lines. Remove existing cables that constitute interference with the work. Abandon in place those used ducts and cables that do not interfere with the work.

C. Removal of Ducts: Where duct lines are removed from existing manholes, close the openings to waterproof the manhole. Chip out the wall opening to provide a key for the new section of wall.

D. See Section 16110 for additional requirements.

END OF SECTION

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SECTION 16450

ELECTRICAL GROUNDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work Included: Furnish all labor, material, equipment, tools and services necessary for the installation, connection and testing of all grounding as specified herein and as shown on the Drawings.

1.02 REFERENCE STANDARD

A. American Society for Testing and Materials (ASTM) Publication:
   1. B228 Copper Clad Steel Conductors Specification
   2. D178 Specifications for Rubber Insulating Matting

B. National Fire Protection Association (NFPA):
   1. 70 National Electrical Code (NEC)

C. Underwriters Laboratories (UL) Standards:
   1. 467 UL Standard for Safety Grounding and Bonding Equipment

D. International Electrical Testing Association (NETA) Publication:
   1. ATS Acceptance Testing Specifications for Electrical Equipment for Power Systems

E. Institute of Electrical and Electronics Engineers:
   1. 142 Grounding of Industrial and Commercial Power Systems (Green Book)

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.

PART 2 - PRODUCTS

2.01 GENERAL

A. The grounding systems shall consist of the ground rods, grounding conductors, ground bus, ground fittings and clamps, and bonding conductors to water piping, structural steel and UFER grounding as shown on the Drawings. One system shown provides service and separately derived system grounds. A second system is an electronic ground system to provide for the discharge of static electricity.

2.02 SYSTEM COMPONENTS

A. Ground Rods: Ground rods shall be cone pointed copper clad Grade 40 HS steel rods conforming to UL 467. The welded copper encased steel rod shall have a conductivity of not less than 27% of pure copper. Rods shall be not less than 3/4-

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inch in diameter and 10 feet long, unless otherwise indicated. Rods longer than 10 feet shall be made up of 10-foot units joined together with threaded couplings. The manufacturer's trademark shall be stamped near the top.

B. Ground Conductors: Buried conductors shall be medium-hard drawn bare copper; other conductors shall be soft drawn copper. Sizes over No. 6 AWG shall be stranded. Coat all ground connections except the exothermic welds with electrical joint compound, non-petroleum type, UL listed for copper and aluminum applications.

C. Ground Connections: Connection to ground rods and buried connections shall be by exothermic weld. Lugs for attachment of cables to steel enclosures shall be of the binding post type with a 1/2-13NC stud. Each post shall accommodate cables from #4 AWG to #4/0 AWG.

D. Ground Rod Boxes: Boxes shall be a 9-inch-diameter precast concrete unit with hot-dip galvanized traffic covers. Units shall be 12-inches deep. Covers shall be embossed with the wording "Ground Rod."

E. Ground Bus: Ground bus shall be a high conductivity copper alloy strap measuring 1/4-inch thick copper conforming to ASTM B187-C11000 and of minimum 4” x12” length or as shown on the Drawings. Bus shall be predrilled and tapped to accept 8-32 brass machine screws on 1-inch centers. Bar shall be equipped with fiberglass-reinforced molded polyester UL-compliant standoff insulators rated for 600V. Ground bus shall be mounted with 1/8” thick stainless steel brackets and 3/8” stainless steel bolts.

F. Ground Plates: Ground plates shall be of the irreversible compression type suitable for embedment in cast concrete. Ground plates shall be made of high-strength, high-conductivity cast copper alloy body with a pure wrought copper compression element. Grounding plate shall be 4 hole and suitable for termination with size #2-250kcmil copper conductors. Ground Plates shall be Hubbell/Burndy Type YGF or approved equal.

G. Exothermic Welds: Exothermic welded connections shall be Erico CADWELD, Hubbell BURNDYWeld, or approved equal.

H. Insulating Tape: Insulating tape for copper conductors passing through concrete slabs shall be UL Listed, premium grade, 10-mil thick, pressure-sensitive vinyl insulating tape. Tape shall have elastic backing with strong adhesive strength. Tape shall be 3M/Scotch Vinyl Insulation Tape 22, or approved equal.

I. Ground Enhancement Material (GEM): GEM must be permanent and maintenance free (no recharging with salts or chemicals which may be corrosive), maintain its earth resistance with time and not depend on water to maintain its conductivity. GEM in its set form shall have a resistivity of not more than 20 ohm-cm. GEM shall be suitable for installation in dry form or slurry form, set up firmly and not dissolve or decompose or otherwise pollute the soil or local water table. GEM shall be manufactured by Erico Products or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ground all equipment for which a ground connection is required per NEC whether or not the ground connection is specifically shown on the Drawings.

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B. Provide a ground wire in every conduit carrying a circuit of over 50 volts to ground.

C. Sizes shall be as indicated on the Conduit/Cable Schedule and in accordance with NEC Article 250.

D. Provide a grounding-type bushing for secondary feeder conduits that originate from the secondary section of each MCC section, switchboard, or panelboard.

E. Individually bond the raceway to the ground bus in the secondary section.

F. Provide a separate grounding conductor in each individual raceway for parallel feeders. Connect the parallel ground conductors together at each end of the parallel run, as required by the NEC.

G. Interconnect the secondary switchgear MCC or panelboard neutral bus to the ground bus in the secondary switchgear compartment only at the service entrance point. For wye connected, 3 phase, separately derived systems with 3 wire distribution, connect the transformer neutral to the grounding electrode system at the transformer. Connections shall be in accordance with the NEC.

H. Provide a ground ring with minimum burial depth of 36 inches or as indicated on the Drawings, whichever is greater.

I. Embed a grounding conductor in every duct bank as indicated. The ground conductor shall be terminated at the ground grid at each end of the duct bank. Where no ground grid is installed, terminate at a suitable grounding electrode conductor near the end of the duct bank in accordance with the NEC.

J. Provide a ground rod box for each ground rod so as to permit ready access for the connection and/or removal of any pressure connectors to facilitate testing.

K. Install ground enhancement material around each ground rod per GEM manufacturer's installation instructions. GEM shall extend 6 inches in all directions around the ground rod surface. GEM shall extend from 8 inches below top of ground rod to bottom of ground rod.

L. Bond metallic water piping at its entrance into each building. Ground separately derived electrical system neutrals to the metallic water piping in addition to the system driven ground, per NEC requirements.

M. Make embedded or buried ground connections, taps and splices with exothermic welds. Do not conceal or cover ground connections until the Engineer or an authorized representative has established that every grounding connection conforms to the requirements of the Contract Documents and has given the Contractor written confirmation.

N. Effectively bond structural steel for buildings to the grounding system using exothermic welds.

O. Where bare copper ground conductor is installed through a new concrete slab, wrap the conductor with insulating tape before pouring concrete. Apply tape in half-lapped layers with sufficient tension to produce a uniform wind, with no tension on the last wrap to prevent flagging.

P. Provide a separate grounding conductor for each motor and connect at motor box. Provide a supplemental ground connection for motor shaft grounding rings, where applicable.

Q. Shielded instrumentation cable shall have its shield grounded at one end only unless the approved Shop Drawings indicate that the shield will be grounded at

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both ends. The grounding point shall be at the control panel or at the receiving end of the signal carried by the cable. The termination of the shield drain wire shall be on its own terminal screw. Jumper together the terminal screws, using manufactured terminal block jumpers or a No. 14 green insulated conductor. Connect the ground bus via a green No. 12 conductor to the main ground bus for the panel.

3.02 TESTING

A. Testing shall be in accordance with Specification 16950 – Electrical Tests.

B. Furnish to the Engineer a test report with recorded data of each ground rod location.

END OF SECTION

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SECTION 16950

ELECTRICAL TESTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the work necessary to test, commission, and demonstrate that the electrical system satisfies the requirements of these Specifications and functions as required by the Contract Documents. The work of this Section is applicable to both pre and post energization testing required by the Manufacturer to facilitate sign-off on their respective equipment as well as pre and post energization testing performed by an independent third party entity independent of manufacturers, suppliers and installers of electrical equipment, installations and systems.

B. The Work shall include furnishing the labor, equipment, and power required to support the testing indicated in other Divisions of these Specifications. Electrical testing indicated herein and functional testing of power and controls not tested under Division 17 – Instrumentation, shall be completed before commencement of the Initial Operation Period as defined in Section 01650, for each phase of construction as indicated on the Drawings. This scope may require the Contractor to activate circuits, shutdown circuits, run equipment, make electrical measurements, replace blown fuses, and install temporary jumpers, etc.

C. Carry out tests indicated herein for individual items of materials and equipment in other Sections. 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.

D. Factory Acceptance Testing and other off-site test requirements are included in other Sections.

E. Corrections and Replacements
   1. Before final acceptance, each part of the work shall be thoroughly tested, and each test shall be documented and submitted in accordance with the Contract Documents.
   2. Any materials or equipment failing any test shall be corrected or replaced as required to pass the test at no additional cost to the Owner.
   3. Any materials or equipment failing any test shall be re-tested after correction or replacement to verify compliance.
   4. Any failures shall again be corrected or replaced, and then re-tested.
   5. The correction/replacement/re-testing cycle shall continue until the item passes the required test(s).

1.02 REFERENCE STANDARDS

A. Electric equipment, materials, installation, and testing shall comply with the National Electrical Code (NEC), and shall also conform to the following codes and standards:
   1. American National Standards Institute (ANSI)
   2. InterNational Electrical Testing Association (NETA)
   3. Institute of Electrical and Electronics Engineers (IEEE)

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4. Occupational Health and Safety Administration (OSHA)
5. ASTM International Standard E329
6. IEEE 400, Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems
7. IEEE 576, Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
8. Telecommunications Industry Association (TIA) 568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standards.

1.03 SUBMITTALS

A. Submit complete system test procedures for review. Test procedures shall include but not be limited to:
   1. Detailed procedures, both pre and post energization testing requirements of the Manufacturer and independent third-party entity, in sufficient detail to verify conformance with these Specifications.
   2. Incorporation of the Test Record Sheets included at the end of this Section.
   3. Detailed comprehensive testing schedule including:
      a. Electrical testing of each major area.
      b. Each major piece of electrical distribution equipment.
      c. Each major electrical subsystem.
      d. Duration of each test.
      e. Milestone test completion date.
      f. Date of test results submittals following completion of the tests.
      g. Names and qualifications of the individual(s) responsible for performing the testing, including a copy of current NETA Technician cards.
      h. Proof of NETA accreditation for the testing agency.

B. Following completion of the test submit the completed test results to the Engineer for review. The results shall include a dedicated section with the "as-left" settings of all devices, relays, circuit breakers, etc.

C. Test results shall be submitted in one submittal.

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.

1.04 QUALITY ASSURANCE

A. Testing Firm Qualifications:
   1. Corporately and financially independent organization functioning as an unbiased testing authority.
   2. Professionally independent of manufacturers, suppliers, and installers of electrical equipment and systems being tested.
   3. Employer of engineers and technicians regularly engaged in testing and inspecting of electrical equipment, installations, and systems.
   4. Supervising engineer accredited as Certified Electrical Test Technologist by NICET or NETA and having a minimum of 5 years testing experience on similar projects.
   5. Technicians certified by NICET or NETA.
   6. Registered Professional Engineer to provide comprehensive project report outlining services performed, results of such services, recommendations, actions taken, and opinions.

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7. In compliance with OSHA CFR 29, Part 1910.7 criteria for accreditation of testing laboratories or a full member company of NETA.

B. Test equipment shall have an operating accuracy equal to or greater than requirements established by NETA ATS.

C. Test instrument calibration shall be in accordance with NETA ATS.

1.05 FIELD TESTS

A. All testing shall be performed in the presence of the Owner.

B. Any system material or workmanship that is found to be defective on the basis of acceptance tests shall be reported directly to the Owner.

PART 2 - PRODUCTS

2.01 PRE-ENERGIZATION AND OPERATING TESTS

A. The complete electrical system for each phase of construction shall be performance tested when first installed on-site. Each protective, switching, and control circuit shall be adjusted and tested by actual operation using current injection or equivalent methods as necessary to ensure that each and every such circuit operates correctly to the satisfaction of the Owner.
   1. Control and Signal Circuits. Each control or signal circuit shall be observed to perform its proper control function or produce a correct signal output.
   2. Acceptance Tests. Complete acceptance tests shall be performed, after the station installation is completed, on all assemblies, equipment, conductors, and control and protective systems, as applicable, to verify the integrity of all the systems.

B. Test Report. A test report covering the results of the tests required in the Pre-Energization and Operating Tests shall be delivered to the Engineer prior to energization. Acceptance Testing shall be in accordance with NETA ATS, *Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems*, published by the InterNational Electrical Testing Association. Tests shall be provided by both the manufacturer representative and independent third-party NETA accredited testing agency where required.

2.02 FIELD TESTS BY MANUFACTURER'S OR SUPPLIERS

A. All field tests shall be performed by the Manufacturers or Suppliers.

2.03 TEST REQUIREMENTS

A. The following test requirements supplement test and acceptance criteria that may be stated elsewhere.
   1. Activate ground fault tripping by operating test features provided with ground current protective systems and by injecting a known and reasonable current in the ground current sensor circuit. In general, ground fault tripping should occur at a ground current equivalent to 20 percent of phase current. Current injection is not required of circuit 400 amperes or less.

B. Low Voltage Cables-600 volts Maximum
   1. Visual and Mechanical Inspection
      a. Compare cable data with Drawings and Specifications.

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b. Inspect exposed sections of cables for physical damage and correct connection in accordance with single-line diagram.
c. Inspect bolted electrical connections for high resistance using one of the following methods:
    1) Use of low-resistance ohmmeter
    2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
d. Inspect compression-applied connectors for correct cable match and indentation.
e. Inspect for correct identification and arrangements.
f. Inspect cable jacket insulation and condition.

2. Electrical Tests
    a. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. Test duration shall be 1 minute.
        1) Motor feeders tested with motors disconnected and controller open.
        2) Motor control circuits tested and verified for proper operation with control stations and overcurrent devices connected.
        3) Panelboard feeders tested with feeder breaker open and panelboard connected. If a lighting transformer is associated with the panelboard, it shall be connected and the test made for both primary and secondary sides.
        4) Conductors of main lighting feeders, including lighting panel with branch circuits open.
        5) Prior to performing insulation resistance tests on cables, verify that they are not connected to a solid state device.
        6) Equipment which may be damaged during this test shall be disconnected.
        7) The Engineer shall be consulted if minimum insulation values cannot be obtained.
    b. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable.
    c. Perform continuity test to ensure correct cable connection.
    d. Perform the following industry-standard operational and performance tests on each Category 6 Ethernet cable as detailed in ANSI/EIA-568-C:
        1) Wire map (pass/fail)
        2) Propagation delay (pass/fail)
        3) Delay skew (pass/fail)
        4) Cable length
        5) Insertion loss (attenuation)
        6) Return loss (pass/fail)
        7) Near-end crosstalk (NEXT) (pass/fail)
        8) Power sum near-end crosstalk (PSNEXT) (pass/fail)
        9) Equal level far-end crosstalk (ELFEXT)
        10) Power sum equal level far-end crosstalk (PSELFEXT).

3. Test Values - Visual and Mechanical
    a. Compare bolted connection resistance to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.

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b. Bolt-torque levels shall be in accordance with NETA ATS Table 100.12 unless otherwise specified by the manufacturer.

4. Test Values - Electrical
   a. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
   b. Insulation-resistance values shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.1. Values of insulation resistance less than this table or manufacturer's recommendations shall be investigated.
   c. Cable shall exhibit continuity.
   d. Deviations in resistance between parallel conductors shall be investigated.
   e. Compare Category 6 Ethernet test values against TIA 568-C for determination of pass/fail status.

C. Molded and Insulated Case Circuit Breakers
1. Visual and Mechanical Inspection
   a. Compare equipment nameplate data with drawings and specifications.
   b. Inspect physical and mechanical condition.
   c. Inspect anchorage and alignment.
   d. Verify the unit is clean.
   e. Operate the circuit breaker to insure smooth operation.
   f. Inspect bolted electrical connections for high resistance using one or more of the following methods:
      1) Use of a low-resistance ohmmeter.
      2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data or NETA ATS Table 100.12
   g. Inspect operating mechanism, contacts, and arc chutes in unsealed units.
   h. Perform adjustments for final protective device settings in accordance with the coordination study.
2. Electrical Tests
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
   b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to ground with the circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer’s published data. In the absence of manufacturer’s published data, use NETA ATS Table 100.1.
   c. Perform a contact/pole-resistance test.
   d. Determine long-time pickup and delay by primary current injection.
   e. Determine short-time pickup and delay by primary current injection.
   f. Determine ground-fault pickup and time delay by primary current injection.
   g. Determine instantaneous pickup by primary current injection.
   h. Test functions of the trip unit by means of secondary injection.
   i. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer’s published data.
   j. Verify correct operation of auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free,

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anti-pump function, and trip unit battery condition. Reset all trip logs and indicators

k. Verify operation of charging mechanism.

3. Test Values – Visual and Mechanical
   a. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
   b. Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
   c. Settings shall comply with coordination study recommendations.
4. Test Values – Electrical
   a. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
   b. Insulation-resistance values shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.1. Values of insulation resistance less than this table or manufacturer's recommendations should be investigated.
   c. Microohm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's published data is not available, investigate values that deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.
   d. Insulation-resistance values of control wiring shall not be less than two megohms.
   e. Long-time pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors. If manufacturer's curves are not available, trip times shall not exceed the value shown in NETA ATS Table 100.7.
   f. Short-time pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current tolerance band.
   g. Ground fault pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current tolerance band.
   h. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances. In the absence of manufacturer's published data, refer to NETA ATS Table 100.8.
   i. Pickup values and trip characteristics shall be within manufacturer's published tolerances.
   j. Minimum pickup voltage of the shunt trip and close coils shall conform to the manufacturer's published data. In the absence of the manufacturer's published data, refer to NETA ATS Table 100.20.
   k. Breaker open, close, trip, trip-free, anti-pump, and auxiliary features shall function as designed.
   l. The charging mechanism shall operate in accordance with manufacturer's published data.

D. Grounding System
   1. Visual and Mechanical Inspection

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a. Verify ground system is in compliance with drawings, specifications, and NFPA 70 National Electrical Code Article 250.
b. Inspect physical and mechanical condition.
c. Inspect bolted electrical connections for high resistance using one or more of the following methods:
1) Use of low-resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
d. Inspect anchorage.

2. Electrical Tests
a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
b. Perform fall-of-potential or alternative test in accordance with ANSI/IEEE 81 on the main grounding electrode or system.
c. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and derived neutral points.

3. Test Values – Visual and Mechanical
a. Grounding system electrical and mechanical connections shall be free of corrosion.
b. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
c. Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

4. Test Values – Electrical
a. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
b. The resistance between the main grounding electrode and ground shall be no greater than five ohms for large commercial or industrial systems and one ohm or less for generating or transmission station grounds unless otherwise specified by the owner. (Reference ANSI/IEEE Standard 142)
c. Investigate point-to-point resistance values that exceed 0.5 ohm.

E. Test ground fault interrupter (GFI) receptacles and circuit breakers for proper operation by methods sanctioned by the receptacle manufacturer.

F. A functional test and check of electrical components is required prior to performing subsystem testing and commissioning. Compartments and equipment shall be cleaned as required by other provisions of these Specifications before commencement of functional testing. Functional testing shall comprise:
1. Visual and physical check of cables, circuit breakers, transformers, and connections associated with each item of new and modified equipment.

G. Subsystem testing for each phase of construction shall occur after the proper operation of alarm and status contacts has been demonstrated or otherwise accepted by the Owner and after process control devices have been adjusted as accurately as possible. Alarm conditions shall be simulated for each alarm point, and alarm indicators shall be checked for proper operation. It is intended that the

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Contractor will adjust limit switches and level switches to their operating points prior to testing and will set pressure switches, flow switches, and timing relays as dictated by operating results.

H. Subsystems shall be defined as individual and groups of pumps, conveyor systems, chemical feeders, air conditioning units, ventilation fans, air compressors, etc.

I. After initial settings have been completed, each subsystem shall be operated in the manual mode and it shall be demonstrated that operation is in compliance with the Contract Documents. Once the manual mode of operation has been proven, automatic operation shall be demonstrated to verify such items as proper start and stop sequence of pumps, proper operation of valves, proper speed control, etc.

J. Voltage Field Test:
   1. Check and record voltage at point of termination of SCE supply system after the installation is essentially complete and has been made operational.
   2. Check and record voltage amplitude and balance between phases for loaded and unloaded conditions.
   3. Unbalance Corrections:
      a. Notify the Owner if balance (as defined by NEMA) exceeds 1%, or if voltage varies throughout the day and from loaded to unloaded condition more than plus or minus 4% of nominal.
   4. Voltage Balance Report:
      a. Submit Voltage Balance Report for each switchboard, distribution panel-board, load center, motor control center, and transformer.

K. Equipment Line Current Tests:
   1. Check and record line current in each phase for each major piece of electrically-operated equipment.
   2. Make a line current check after SCE has made final adjustments to supply voltage magnitude or balance.
   3. If any phase current for any piece of equipment is above rated nameplate current, prepare a supplement to the Equipment Line Current Report that identifies any causes of problems and corrective action that was taken.
   4. Submit Equipment Line Current Report for each point of connection to motors, transformers, branch circuit distribution connections, and incoming utility service connection.

2.04 TEST REPORTS

A. The test report shall include the following:
   1. Summary of project.
   2. Description of equipment tested.
   3. Description of test.
   4. Test data.
   5. Analysis and recommendations.

B. Test data records shall include the following minimum requirements:
   1. Identification of the testing organization.
   2. Equipment identification.
   3. Humidity, temperature, and other atmospheric conditions that may affect the results of the tests/calibrations.
   4. Date of inspections, tests, maintenance, and/or calibrations.
   5. Identification of the testing technician.

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6. Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
7. Indication of expected results when calibrations are to be performed.
8. Indication of "as-found" and "as-left" results.
9. Sufficient spaces to allow all results and comments to be indicated.

C. The Contractor shall submit the complete report to the Engineer for review.

PART 3 - EXECUTION

3.01 FIELD TESTS

A. The Contractor shall provide ten Working Days' notice to the Owner prior to any field testing to permit witnessing of the testing.

TEST RECORD SHEETS

The test record sheets listed below shall be used to record testing of electrical equipment and of the electrical installation as required by these specifications. Sample copies of each sheet are attached.

Sheet No.	Title
1	Insulation Resistance (Power, Control Wire, and Cable) Test Record
2	Insulation Resistance (Instrument Wire and Cable) Test Record
3	Ground Electrode Testing Test Record
4	Bonding Resistance Readings (Nonelectrical Equipment/Structures) Test Record
5	Bonding Resistance Readings (Electrical Equipment) Test Record
6	Insulation Resistance (Equipment) Test Record

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INSULATION RESISTANCE
(POWER, CONTROL WIRE, AND CABLE)
TEST RECORD

TEST EQUIPMENT: _____ TEST VOLTAGE: _____

TEST EQUIPMENT: _____ TEST VOLTAGE: _____

AMBIENT TEMPERATURE: _____ ºC _____ ºF DATE: _____

NOTES: 1. Perform Insulation Resistance Test (megger) between each conductor and all other conductors and metallic sheath for cables with nonshielded conductors. Test between each conductor and shield for multiconductor cables with shielded conductors. Record lowest reading for each cable.

2. Use 1,000-V test set for cable rated 600 volts and 2,500-V test set for cable rated over 600 volts.

3. Readings will vary inversely with temperature and cable length. When the use of temperature correction factors is specified, attach a second sheet with computed values. Indicate on each sheet "measured" or "temperature corrected."

Panel No. Circuit No. Feeder No.	Wire Tagging	Cable Rated Voltage	Wire or Cable				Insulation Resistance (megohms) *	Initials
			Quantity	Size	From	To		

*Minimum acceptable values:

Cable Rated Voltage	Test Duration	Resistance for Cable Only	Cable/Wire Size or Amperage (megohms)	Resistance When Cable Connected to Equipment (ohms)

DISTRIBUTION:

CONTRACTOR/Date _____

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INSULATION RESISTANCE
(INSTRUMENT WIRE AND CABLE)
TEST RECORD

TEST EQUIPMENT: _____ TEST VOLTAGE: _____

TEST EQUIPMENT: _____ TEST VOLTAGE: _____

AMBIENT TEMPERATURE: _____ ºC _____ ºF DATE: _____

NOTES: 1. Record only the lowest value.

2. MP - Multi-pair cable. SP - Single pair cable.
3. Megger with instruments disconnected.
4. Use 250 volt (or lower voltage, when specified) range on DC test set.
5. Readings will vary with temperature and cable length.

Cable Number or Instrument Number	Indicate MP or SP Type (2)	Conductor to Conduit (Single Pair Non-Shielded Cables) (megohms)	Conductor to Conductor (megohms) (1)	Shield to Conductor to Shield (megohms) (1)	Overall Shield to Shield (Multipair Cables Only) (megohms) (1)	Lead and Armor (Multipair Cables Only) (megohms)	Shield to Conduit (Single Pair Cables Only) (megohms)	Initials

DISTRIBUTION:

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GROUND ELECTRODE TESTING
TEST RECORD

TEST EQUIPMENT: _____ (Note 1) _____ (Note 2)

REFERENCE DRAWING: _____ _____

NOTES: 1. Record resistance-to-earth for each electrode with all other conductors disconnected. Resistance not to exceed 25 ohms for any single anode.

2. Check continuity from each electrode to any test bar or other electrode such that the complete ground loop is tested.

Rod Number	Resistance to Earth (ohms)	Ambient Temperature (ºC/ºF)	Weather	Taps	Initials/Date

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BONDING RESISTANCE READINGS
(NONELECTRICAL EQUIPMENT/STRUCTURES)
TEST RECORD

TEST EQUIPMENT USED: _____ WEATHER: _____

NOTES: 1. Vessels, tanks, and structural steel bonded to the main grounding system, dedicated ground rod or foundation, as indicated on drawings listed below.

2. Measure resistance from ground wiretap (or anchor bolt) to tagged equipment frame or structural steel.

EQUIPMENT TAG NO. OR STRUCTURE	DRAWING	MEASURED RESISTANCE (ohms)	INITIALS/DATE

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BONDING RESISTANCE READINGS
(ELECTRICAL EQUIPMENT)
TEST RECORD

TEST EQUIPMENT USED: _____ WEATHER: _____

NOTES: 1. Electrical equipment bonded to the main grounding system or dedicated ground rod, as indicated on drawings listed below.

2. Measure resistance from ground wiretap to tagged equipment bus bars, tagged equipment enclosures, and any other points indicated on the drawings.

EQUIPMENT TAG NO. OR STRUCTURE	DRAWING	MEASURED RESISTANCE (ohms)	INITIALS/DATE

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INSULATION RESISTANCE (EQUIPMENT)
TEST RECORD

TEST EQUIPMENT: _____ SUBSTATION: _____

AMBIENT TEMPERATURE: _____ ºC _____ ºF DATE: _____

REFERENCE DRAWING: _____ REF. SEC.: _____

NOTES: 1. Use 1,000-V test set for equipment rated 600 volts and below, 2,500/5,000-V test set for equipment rated over 600 volts.

2. For equipment with solid state control circuits, consult manufacturer's literature for maximum test voltages.

Switchgear or MCC (or other)	INSULATION RESISTANCE (megohms) *						Test Voltage (kV)	Rated Voltage (kV)	Initials/Date
	∅A to G	∅B to G	∅C to G	∅A to ∅B	∅B to ∅C	∅C to ∅A			

*Minimum acceptable values:

EQUIPMENT VOLTAGE CLASS (megohms)	RESISTANCE

TESTER'S INITIALS/DATE

_____

DISTRIBUTION:

CONTRACTOR/Date _____

END OF SECTION

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SECTION 16955

CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provisions: Applicable provisions of Section 16010 become a part of this Section as if repeated herein.

B. Work Included: Furnish and install all control devices complete, including, as applicable, enclosures, engraved escutcheons or nameplates, gaskets, lenses, lamps and mounting provisions.

1.02 REFERENCE STANDARDS

A. National Electrical Manufacturers Association (NEMA) Publications:
   1. ICS1 General Standards for Industrial Controls and Systems
   2. ICS2 Standards for Industrial Control Devices, Controllers and Assemblies
   3. ICS6 Enclosures for Industrial Controls and Systems

1.03 SUBMITTALS

A. Submit material or equipment data in accordance with the Product Review category of the General Conditions and the submittal requirements of Section 16010.

PART 2 - PRODUCTS

2.01 GENERAL

A. All control devices shall conform to applicable provisions of NEMA Standards ICS1 and ICS2.

2.02 CONTROL AND TIMER RELAYS

A. General: Relays shall be provided as necessary to perform switching functions required of control panels and other control circuits. Relays shall be of the following types (abbreviations in parentheses correspond to labels on the Drawings):
   1. Size 0 Magnetic Contactors (MS): Provide Size 0 magnetic contactors for driving Size 4 and Size 5 ac operated motor starters. Provide Size 0 contactors of the same type and manufacture as the motor starter contactors.
   2. Relays (CR):
      a. Provide machine tool relays for the following applications:
         1) All relays driving 120 Vac motor starters up to and including Size 3.
         2) All relays driving non-motor loads up to 6 amps (or 720 VA).
      b. Provide machine tool type relays with convertible contacts rated 10 amperes continuous with NEMA Rating Designation A600 for ac applications and N600 for dc applications. Coils shall be designed for

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continuous duty and shall have the voltage rating indicated on the Drawings.

c. Relays shall be the magnetically held type unless designated otherwise on the Drawings. For each relay provide one spare Form C contact over and above the number indicated on the Drawings. In addition, for latching relays, provide coil clearing contacts as necessary.

d. Manufacturer: Square D, Class 8501, Type X; General Electric CR120B; or equal.

3. General Purpose Control (GR) or (AR) Relays (plug-in):

a. Provide plug-in style 2-, 3-, or 4-pole enclosed relays with integral neon or LED indicators for the following applications:

1) Relay logic (relays driving other relays, including machine tool relays) operating at voltages up to 120 Vac.

2) Control power switching.

3) All relays driving non-motor loads up to 2 amps (240 VA) at 120 Vac.

b. Provide relay sockets rated for 10 amp, 240 Vac with screw-type barriered terminals.

c. Manufacturer: Square D, Class 8501, Type R; Allen-Bradley Bulletin 700; or equal.

4. Analog or Digital Signal Switching (SR) Relays: Provide plug-in style indicating type relays with gold plated silver contacts for switching low level currents (less than 100 mA). Provide relay sockets screw-type barriered terminals.

5. General Requirements:

a. Provide relays rated for 1 million operations at 10 amp, 120 Vac, at power factor of 0.2.

b. Where timing relays are interfaced to motor starters or adjustable speed motor controllers, provide auxiliary machine-tool relays or Size 0 magnetic contactors. Refer to previous specifications for machine-tool relays and Size 0 magnetic contactors.

c. Where timing relays or control relays require additional contacts, provide auxiliary control relays, properly sized for the application as described previously in this Section.

2.03 CONTROL PANEL ACCESSORIES

A. Relays, timers and other internally mounted equipment shall be of the types specified in other sections of these Specifications.

B. Panel face mounted equipment shall be of the types specified in other sections of these Specifications.

C. Standards: All control devices shall conform to applicable provisions of NEMA Standards ICS 1 and ICS 2.

D. Pushbuttons, Selector Switches and Pilot Lights:

1. Shall be heavy-duty oiltight units; each unit shall have an engraved escutcheon plate unless nameplates are indicated on the Drawings or are necessary because of length of identification. Pushbuttons and selector switches shall have contacts rated 10 amperes continuous, Rating Designation A600 in conformance with NEMA ICS 2.

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2. Pushbuttons used as emergency stop devices shall have a padlockable means for maintaining an open circuit. Indicating lights shall be push-to-test transformer type with lenses of the colors shown on the Drawings.

E. Multiposition control switches shall have rotary action, round knurled handle and the number of positions and stages shown on the Drawings. They shall be suitable for panel mounting. Each position shall have a positive detent. Contacts shall have a continuous current rating of 10 amperes at 300 Vac. Switches shall have integral indicator.

F. For 4-20 mAdc and 1 to 5 Vdc signal selector switches, provide oiltight selector switches with electronic duty gold contact blocks. Provide sliding contacts for reliable operation without benefit of thermal cleaning action.

G. Manufacturer: Provide Microswitch heavy-duty oiltight manual controls, with electronic duty gold contact blocks; Allen-Bradley Bulletin 800T oiltight selector switch with stackable "Logic-Reed" contact blocks; or equal.

H. Colors and Descriptions:

1. Indicating Lamps: Unless otherwise noted on the Drawings, the following color code and inscriptions shall be followed for the lenses of all indicating lights.

Indicating Lamp Inscription	Color
ON/START	Red
OFF/STOP	Green
CLOSED	Green
LOW	Amber
FAIL	Red
HIGH	Amber
OPEN	Red
POWER ON	White
RESET	Red
AUTO	Blue

2. Lettering shall be black on white and amber lenses. Lettering shall be white on red and green lenses.
3. Pushbuttons: Follow color coding for indicating lamp above.
4. All unused or noninscribed buttons shall be black. Lettering shall be black on white and yellow buttons. Lettering shall be white on black, red and green buttons.

J. Nameplates: Unless specified otherwise in the Drawings, nameplates shall be black lamacoid with minimum 3/16-inch-high white letters for major area titles, 5/32-inch for component titles, and 1/8-inch for subtitles, and shall be fastened with a permanent but dissolvable adhesive or by screws.

2.04 CONTROL STATIONS

A. Provide control stations complying with NEMA ICS 6 for manual control functions as follows and as shown on the Drawings: start-stop pushbutton, hand-off-auto,

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forward-reverse-jog-stop, etc. Control stations shall include selector switches, pushbuttons, and indicators as specified in this Section.

B. Enclosures shall NEMA 3R.

C. Nameplates: Provide an engraved plastic nameplate for each control station and escutcheons or nameplates for devices mounted thereon.

D. Provide pushbuttons, selector switches, indicators, etc., as shown on the Drawings and as required. Provide control devices with NEMA ratings matching that of the control station.

E. Manufacturer: Provide Allen-Bradley; Westinghouse; Crouse-Hinds; or equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Identify all control devices with engraved plastic nameplates or escutcheons, as applicable. Install control devices as recommended by the manufacturer.

3.02 PROBES AND HOLDER

A. Adjust potentiometer to suit conductivity of water.

END OF SECTION

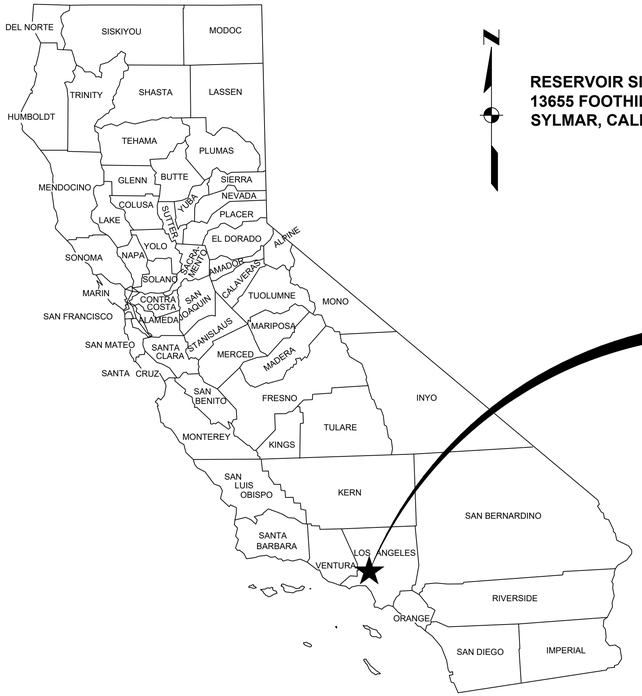
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CITY OF SAN FERNANDO

SAN FERNANDO, CA

UPPER RESERVOIR REPLACEMENT

JOB NO. 7613, P-733
APRIL 2021



VICINITY MAP

N.T.S.

RESERVOIR SITE
13655 FOOTHILL BLVD
SYLMAR, CALIFORNIA



SITE A
INTERSECTION OF
DRONFIELD AND HUBBARD

LOCATION MAP

1" = 500'

SHEET	DESCRIPTION
GENERAL	
G-1	COVER SHEET, VICINITY MAP, LOCATION MAP, AND SHEET INDEX
G-2	GENERAL LEGEND, ABBREVIATIONS, AND GENERAL NOTES
G-3	GENERAL & CIVIL SYMBOLS
DEMOLITION	
D-1	DEMOLITION SECTION
CIVIL	
C-1	CIVIL ABBREVIATIONS AND LEGEND
C-2	CIVIL SITE AND PAVING PLAN
C-3	CIVIL GRADING AND DRAINAGE PLAN
C-4	CIVIL YARD PIPING PLAN
C-5	CIVIL PIPE PROFILES
C-6	CIVIL DETAILS I
C-7	CIVIL DETAILS II
C-8	CIVIL DETAILS III
C-9	CIVIL DETAILS IV
C-10	CIVIL DETAILS V
C-11	CIVIL DETAILS VI
STRUCTURAL	
S-1	STRUCTURAL GENERAL NOTES AND ABBREVIATIONS
S-2	STRUCTURAL SPECIAL INSPECTION
S-3	STRUCTURAL STANDARD DETAILS I
S-4	STRUCTURAL STANDARD DETAILS II
S-5	STRUCTURAL STANDARD DETAILS III
S-6	STRUCTURAL RESERVOIR UNDERDRAIN PLAN AND DETAILS
S-7	STRUCTURAL RESERVOIR FOUNDATION PLAN AND COLUMN DETAIL
S-8	STRUCTURAL RESERVOIR ROOF PLAN AND PIPE PENETRATION AND MANWAY HATCH DETAILS
S-9	STRUCTURAL RESERVOIR SECTION I
S-10	STRUCTURAL RESERVOIR SECTION II
S-11	STRUCTURAL TYPICAL RESERVOIR REINFORCING AND HATCH AND VENT DETAILS
S-12	STRUCTURAL RESERVOIR ROOF REINFORCING PLAN
S-13	STRUCTURAL OUTLET SUMP PLAN, SECTIONS AND DETAILS
S-14	STRUCTURAL RESERVOIR STAIRS PLAN, SECTIONS AND DETAILS
S-15	STRUCTURAL CATWALK PLAN, SECTIONS AND DETAILS
S-16	STRUCTURAL OVERFLOW STRUCTURE PLAN, SECTIONS AND DETAILS
ELECTRICAL	
E-1	ELECTRICAL ABBREVIATIONS AND GENERAL NOTES
E-2	ELECTRICAL DETAILS
E-3	ELECTRICAL ONE LINE DIAGRAM
E-4	ELECTRICAL DEMO SITE PLAN
E-5	ELECTRICAL SITE PLAN
E-6	ELECTRICAL LIGHTING PLAN
E-7	ELECTRICAL CONDUIT BLOCK DIAGRAM
E-8	ELECTRICAL CONDUIT AND WIRE SCHEDULE
INSTRUMENTATION & CONTROLS	
I-1	I&C PROCESS LEGEND
I-2	I&C INSTRUMENTATION LEGEND
I-3	P&ID
I-4	INSTRUMENTATION DETAILS
LANDSCAPING	
LC-1	CONSTRUCTION PLAN
LC-2	CONSTRUCTION DETAILS
LI-1	IRRIGATION PLAN AND NOTES
LI-2	IRRIGATION MATERIALS LEGEND AND NOTES
LI-3	IRRIGATION DETAILS
LI-4	IRRIGATION DETAILS
LI-5	IRRIGATION CALCULATIONS AND DETAILS
LI-6	IRRIGATION CALCULATIONS AND DETAILS
LP-1	PLANTING PLAN, PLANT LIST, NOTES, AND DETAILS

USE OF DOCUMENTS

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NO.	REVISION	DATE	BY

SCALES

0 — 1"

0 — 25mm

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REGISTERED PROFESSIONAL ENGINEER — PETER DANIEL THOMAS — No. C70931 — Exp. 6/30/21 — CIVIL — STATE OF CALIFORNIA

DESIGNED	WM
DRAWN	PT
CHECKED	WM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON consulting inc.

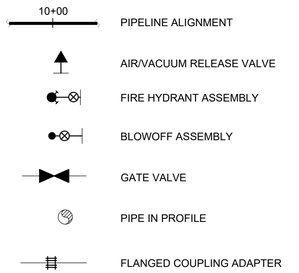
COVER SHEET, VICINITY MAP, LOCATION MAP AND SHEET INDEX

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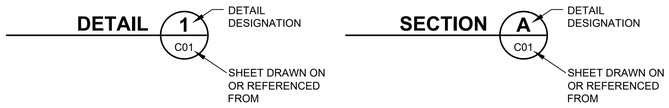
FILE NAME	1944519.00-G-1.dwg
JOB NO.	1944519.00
DATE	APRIL 2020
SHEET	G-1
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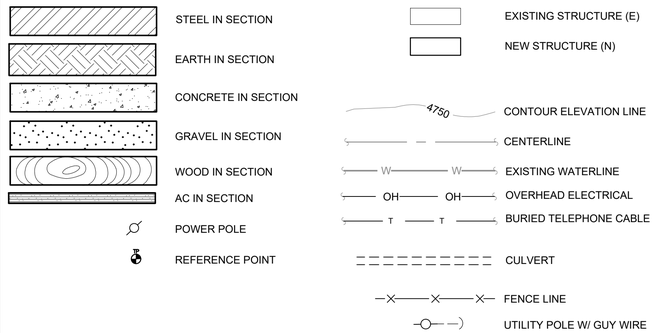
PIPING SYMBOLS



REFERENCE SYMBOLS



GENERAL LEGEND



ABBREVIATIONS

ABAND	ABANDONED
AB, A.B.	AGGREGATE BASE, ANCHOR BOLT
AC, A.C.	ASPHALT CONCRETE
ACP	ASBESTOS CEMENT PIPE
ADDIT.	ADDITIONAL
ADJ.	ADJUSTABLE
AGG	AGGREGATE
ALUM	ALUMINUM
APPRO.	APPROXIMATELY
ARCH	ARCHITECTURAL
ASPH	ASPHALT
AVG	AVERAGE
ARV	AIR RELEASE VALVE
ASSY	ASSEMBLY
AVRV	AIR/VACUUM RELIEF VALVE
BF	BLIND FLANGE
BFV	BUTTERFLY VALVE
BLDG	BUILDING
BM	BEAM, BENCH MARK
BO	BLOWOFF
BOC	BACK OF CURB
BOT, BOTT	BOTTOM
BV	BALL VALVE
C	CURVE
CALTRANS	(CALIFORNIA DEPARTMENT OF TRANSPORTATION)
CATV	CABLE TV
CATVR	CABLE TV RISER
CC, C/C	CENTER TO CENTER
CI	CAST IRON
CL, ℄	CENTERLINE
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CLR	CLEAR(ANCE)
CO	CLEANOUT
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINU(ED), (OUS)
CP	CONTROL POINT, CATHODIC PROTECTION
CPLG	COUPLING
CTS	CATHODIC TEST STATION
D	DRAIN
DEFL	DEFLECTION
DEPT	DEPARTMENT
DI	DUCTILE IRON, DROP INLET
DIA, Ø	DIAMETER
DIM	DIMENSION
DIP	DUCTILE IRON PIPE
DISCH	DISCHARGE
DL	DEADLOAD
DN	DOWN
DWG(S)	DRAWING(S)
E	ELECTRICAL, EAST
EA	EACH
EF	EACH FACE
EL., ELEV	ELEVATION
ELL	ELBOW
ELEC(T)	ELECTRIC(AL)
EMG	EMERGENCY
EPB	ELECTRICAL PULL BOX
EQ	EQUAL
EQUIP	EQUIPMENT
ETS	ELECTROLYSIS TEST STATION
EXH	EXHAUST
EXIST, (E)	EXISTING
EXP	EXPANSION
EW	EACH WAY
(F)	FUTURE
FAC	FACTORY
FC	FLEXIBLE COUPLING
FCA	FLANGE COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FE	FIRE EXTINGUISHER
FF	FINISH FLOOR
FH	FIRE HYDRANT
FIN	FINISH(ED)
FL	FLOW LINE
FLR	FLOOR
FLG	FLANGE
FLEX	FLEXIBLE
FRP	FIBERGLASS REINFORCED PLASTIC
FT	FOOT
FTG	FOOTING
G	GAS
GA	GAUGE
GALV	GALVANIZED
GB	GRADE BREAK
GI	GALVANIZED IRON
GPD	GALLONS PER DAY
GPM	GALLONS PER MINUTE
GS	GALVANIZED STEEL
GV	GATE VALVE
GYP (BD), GWB	GYPSUM (BOARD), GYPSUM WALLBOARD
H, HT	HEIGHT
HB	HOSE BIB
HDPE	HIGH DENSITY POLYETHYLENE
HM	HOLLOW METAL
HORIZ.	HORIZONTAL
H.P.	HIGH POINT, HINGE POINT
HP	HORSEPOWER
HR	HOUR
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IN	INCHES
INSUL	INSULATION
INV	INVERT
IPS	IRON PIPE SIZE
JB	JUNCTION BOX
JT	JOINT
L	LENGTH, LINE
LAB	LABORATORY
LG	LONG
LL	LIVE LOAD
LOG	LIP OF GUTTER
LR	LONG RADIUS
LT	LEFT TURN
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MECH	MECHANICAL
MET	METAL
MFR, MNFR	MANUFACTURER
MJ	MECHANICAL JOINT
MG	MILLION GALLON
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MNTD	MOUNTED
MPH	MILES PER HOUR
N	NORTH
(N)	NEW
N.F.C.	NOT FOR CONSTRUCTION
N/A	NOT APPLICABLE
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NIC	NOT IN CONTRACT
NO.	NUMBER
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OF	OVERFLOW
OG	ORIGINAL GROUND
OPNG(S)	OPENING(S)
P	PNEUMATIC, PIPE
PACP	PERFORATED ASBESTOS CEMENT PIPE
PCCP	PRETENSIONED CONCRETE CYLINDER PIPE
PC	POINT OF CURVE (BEGIN CURVE)
PG	PRESSURE GAUGE
PI	POINT OF INTERSECTION
PL	PLATE
P/L	PROPERTY LINE
PRES(S)	PRESSURE
PRV	PRESSURE RELEASE VALVE, PRESSURE REDUCING VALVE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENT (END CURVE)
PVC	POLYVINYL CHLORIDE
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
RCCP	REINFORCED CONCRETE CYLINDER PIPE
REINF	REINFORCE(D), (MENT)
REQ'D	REQUIRED
RESIL	RESILIENT
RESV	RESERVOIR
RM	ROOM
RT	RIGHT TURN
R/W	RIGHT OF WAY
S	SEWER, SOUTH
SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SECT	SECTION
SF	SQUARE FOOT
SHT	SHEET
SMUD	SACRAMENTO MUNICIPAL UTILITIES DISTRICT
SPEC	SPECIFICATION(S)
SQ	SQUARE
SS	STAINLESS STEEL, SANITARY SEWER
STA	STATION
STD	STANDARD
ST(L)	STEEL
STR(UCT)	STRUCTUR(E), (AL)
SV	SOLENOID VALVE
SYS	SYSTEM
T	TELEPHONE
T/	TOP
TBM	TEMPORARY BENCHMARK
T&B	TOP AND BOTTOM
T/C, TOC, TC	TOP OF CONCRETE
TDH	TOTAL DYNAMIC HEAD
TEMP	TEMPERATURE
TH	THICKNESS
TOP	TOP OF PAVEMENT
TP	TEST PIT
TUD	TUOLUMNE UTILITIES DISTRICT
T/S, TOS	TOP OF STEEL
TYP	TYPICAL
T-_-P	TYPE_____PIPE
T-_-S	TYPE_____SUPPORT
UD	UNDERDRAIN
V, VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VTR	VENT TO ROOF
W	WATER, WELDED, WEST
WB	WATER BAR
W/	WITH
WC	WATER CLOSET
WCO	WALL CLEANOUT
WH	WATER HEATER
WMH	WATER MANHOLE
W/O	WITHOUT
WTP	WATER TREATMENT PLANT
WTR	WATER
WV	WATER VALVE
WS	WATER SURFACE
WWF	WELDED WIRE FABRIC
#	POUND, NUMBER
&	AND
@	AT

GENERAL NOTES

1. THIS PROJECT IS WITHIN CITY OF LOS ANGELES RIGHT OF WAY. CONTRACTOR SHALL CONFORM TO CITY OF LOS ANGELES ENCROACHMENT PERMIT AND REQUIREMENTS.
2. THE KNOWN EXISTING BURIED UTILITIES AND PIPELINES ARE SHOWN ON THE DRAWINGS IN THEIR APPROXIMATE LOCATION. THERE IS NO GUARANTEE THAT ALL EXISTING PIPELINES AND OBSTRUCTIONS ARE SHOWN OR THAT LOCATIONS INDICATED ARE ACCURATE. THE CONTRACTOR SHALL "POTHOLE" TO DETERMINE THE ACTUAL LOCATION AND ELEVATION OF ALL EXISTING UTILITIES CROSSING NEW PIPELINES.
3. UNLESS OTHERWISE NOTED, ALL PIPE SHALL HAVE A MINIMUM COVER OF 3'-6". VERTICAL SEPARATION BETWEEN THE NEW PIPELINE AND THE EXISTING UTILITIES SHALL BE A MINIMUM OF 12-INCHES.
4. EXACT LOCATION AND DEPTH OF EXISTING PIPELINE IS NOT KNOWN. CONTRACTOR IS REQUIRED TO LOCATE AND EXPOSE EXISTING PIPING PRIOR TO ORDERING MATERIAL.
5. THE CONTRACTOR IS RESPONSIBLE FOR ASSURING THAT ALL PIPELINES, VALVES AND FITTINGS ARE ADEQUATELY RESTRAINED AGAINST JOINT SEPARATION. PROVIDE RESTRAINED JOINTS OR THRUST BLOCKS FOR ALL HORIZONTAL BENDS, WYES, AND BLIND FLANGES. PROVIDE RESTRAINED JOINTS FOR ALL VERTICAL BENDS.
6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORING ALL ITEMS DISTURBED DURING CONSTRUCTION BACK TO THEIR ORIGINAL OR BETTER CONDITION.
7. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING AS-BUILT PIPELINE PLANS AND PROFILES AFTER COMPLETION OF THE PROJECT. THE ENGINEER WILL PROVIDE EXISTING DESIGN DRAWING FILES IN AUTOCAD FOR CONTRACTOR TO GENERATE AS-BUILT PIPELINE PLANS AND PROFILES.
8. THE EXISTING AC PIPE SECTIONS (AT EXISTING PIPE CONNECTION) SHALL BE CAREFULLY CUT AND REMOVED BY THE CONTRACTOR.

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SCALES

0 1"

0 25mm

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REGISTERED PROFESSIONAL ENGINEER — PETER DANIEL SYKOWSKI — No. 070491 Exp. 6/30/21 — CIVIL — STATE OF CALIFORNIA

DESIGNED	WM
DRAWN	PT
CHECKED	WM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

GENERAL LEGEND, ABBREVIATIONS, AND GENERAL NOTES

FILE NAME	1944519.00-G-2.dwg
JOB NO.	1944519.00
DATE	APRIL 2020
SHEET	G-2
OF	##

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CIVIL / GENERAL SYMBOLS

	LINE TYPE
PROPOSED OUTLINE (HEAVY)	CONTINUOUS
EXISTING (LIGHT)	CONTINUOUS
PROPOSED HIDDEN OR UG (HEAVY)	HIDDEN
FUTURE (MEDIUM)	HIDDEN
EXISTING HIDDEN OR UG (LIGHT)	HIDDEN
CUTTING PLANE (SECTION)	PHANTOM (PLINE)
BREAK LINE (SHORT)	
BREAK LINE (LONG)	
SANITARY SEWER (EXISTING)	SS
STORM DRAIN (EXISTING)	SD
WATER LINE (EXISTING)	W
GAS PIPELINE (EXISTING)	G
UNDERGROUND TELEPHONE LINE (EXISTING)	T
ELECTRICAL CONDUIT (EXISTING)	E
CABLE TV (EXISTING)	CTV
FIBER OPTIC (EXISTING)	FO
AERIAL UTILITY (EXISTING)	AU
CROSSING UTILITIES (EXISTING)	
FENCE (NEW)	x
FENCE (EXISTING)	x
SEDIMENT FENCE	
PROPERTY LINE/RIGHT-OF-WAY	
CONTRACTORS WORK AREA LIMITS	WA
CENTERLINE	
CULVERT WITH END SECTIONS	
HANDRAIL OR GUARDRAIL	
WATER SURFACE	
GRADE CHANGE LINE	
RIDGE LINE	
FLOW LINE	
GRADED SLOPE	TOP / TOE
DITCH OR SWALE	
CONTOUR MAJOR (NEW)	110
CONTOUR MINOR (NEW)	108
CONTOUR MAJOR (EXIST)	110
CONTOUR MINOR (EXIST)	

PROPOSED MANHOLE (NEW)	
MANHOLE (EXISTING)	
BENCH MARK	BM
MONITORING WELL (NEW)	MW
MONITORING WELL (EXISTING)	MW
ROTARY BORING, IDENTIFICATION NUMBER	B-2
TEST PIT, IDENTIFICATION NUMBER	TP-3
HISTORIC BORING, IDENTIFICATION NUMBER	WW-B9
SPOT ELEVATION	10.35
ELECTROLYSIS TEST STATION	ETS
WATER METER	WM
FIRE DEPT CONNECTION	
FIRE HYDRANT	
UTILITY BOX (AS LABELED)	
POWER POLE	
STREET LIGHT	
STREET LIGHT AND TRAFFIC SIGNAL	
YARD LIGHT	
TRAFFIC SIGNAL	
TELEPHONE RISER	T RISER
GUY ANCHOR	
CATCH BASIN	CB
DROP INLET	DI
CLEAN OUT	CO
VALVE	
UTILITY STATION	TYPE X
DRIVEWAY	
HANDICAP ACCESS RAMP	
CURVE NO	14
SURVEY PANEL	
ELEVATION MARK (REFERENCE)	
ELEVATION MARK (DESIGN)	
FLAG NOTE	1

STRUCTURE OR PIPE (NEW)
STRUCTURE OR PIPE (EXISTING)
DEMOLITION
AC DEMOLITION IN PLAN
CONCRETE IN SECTION
STEEL IN SECTION
WOOD IN SECTION
GRATING IN PLAN
CHECKERED PLATE IN PLAN
GRAVELED AREA IN PLAN OR SECTION
RIP RAP (RIVER ROCK)
SAND
BRICK OR CONCRETE BLOCK IN SECTION
GRADE (UNDISTURBED EARTH)
STRUCTURAL FILL
ASPHALT CONCRETE (IN PLAN)
ASPHALT CONCRETE (IN SECTION)

NOTES:

1. THIS IS A GENERALIZED LEGEND SHEET. THIS CONTRACT MAY NOT USE ALL INFORMATION SHOWN.

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NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

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REGISTERED PROFESSIONAL ENGINEER — PETER DANIEL STYMNESS — No. 070491 — Exp. 6/30/21 — CIVIL — STATE OF CALIFORNIA

DESIGNED	WM
DRAWN	PT
CHECKED	WM

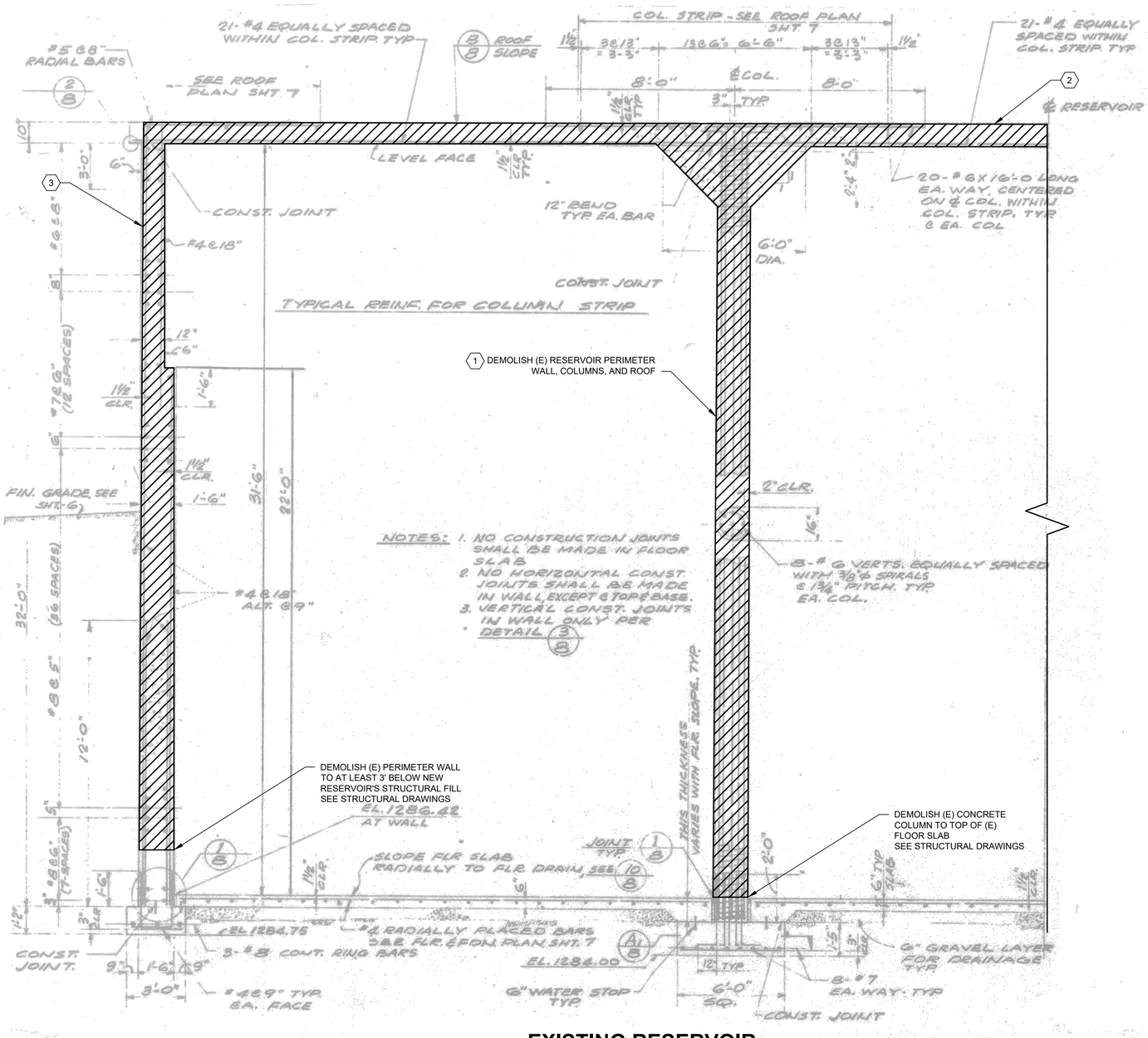
CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting Inc.

GENERAL & CIVIL SYMBOLS

FILE NAME	1944519.00-G-3.dwg
JOB NO.	1944519.00
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EXISTING RESERVOIR

DEMOLITION NOTES

1. TOTAL OF 4 COLUMNS WITHIN EXISTING RESERVOIR
2. APPROX ROOF AREA OF 245 SQ FT
3. APPROX WALL LENGTH OF 237 FT
4. SEE SHT C-2 FOR EXISTING RESERVOIR LOCATION

USE OF DOCUMENTS

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NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER BILL H. MOSER No. C28129 CIVIL STATE OF CALIFORNIA

DESIGNED	WM
DRAWN	PT
CHECKED	WM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

DEMOLITION SECTION

FILE NAME	1944519.00-D-1.dwg
JOB NO.	1944519.00
DATE	APRIL 2020
SHEET	D-1 OF ##

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CIVIL GENERAL NOTES

GENERAL

1. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.
2. THE CONTRACTOR SHALL PROPERLY DISPOSE OF ALL DEBRIS FROM DEMOLITION AT CONTRACTORS EXPENSE.
3. ALL BUILDING COORDINATES ARE TO OUTSIDE CORNER OF COLUMN OR BUILDING.
4. THE CONTRACTOR SHALL DISPOSE OF ALL NON-ORGANIC WASTES SUCH AS OLD GUNITE, PIPING, ROCK RUBBLE ETC. AT AN APPROVED LANDFILL OR, OTHER SUITABLE DISPOSAL SITES AT THE CONTRACTOR'S EXPENSE.
5. CONTRACTOR SHALL RESTORE ALL SURVEY MONUMENTS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION.

UTILITIES

1. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL LOCATE ALL EXISTING UTILITIES IN AND AROUND THE AREAS OF NEW CONSTRUCTION. THE CONTRACTOR SHALL POTHOLE FOR EXISTING UTILITIES PRIOR TO SUBMITTAL OF SHOP DRAWINGS, FOR POINTS OF CONNECTIONS.
2. THE CONTRACTOR SHALL PROTECT ALL REMAINING EXISTING UTILITIES.
3. LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM AVAILABLE RECORDS. THE CONTRACTOR SHALL VERIFY ALL LOCATIONS AND ELEVATIONS AND SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT UTILITY LINES WHETHER SHOWN OR NOT SHOWN.
4. PRIOR TO ANY CONNECTION TO AN EXISTING UTILITY, THE CONTRACTOR SHALL COORDINATE WITH THE UTILITY OWNER.
5. PRIOR TO ANY EXCAVATION IN THE VICINITY OF ANY EXISTING UNDERGROUND FACILITIES, INCLUDING ALL WATER, SEWER, STORM DRAIN, GAS, PETROLEUM PRODUCTS, OR OTHER PIPELINES; ALL BURIED ELECTRIC POWER, COMMUNICATIONS, OR TELEVISION CABLES; ALL TRAFFIC SIGNAL AND STREET LIGHTING FACILITIES; AND ALL ROADWAY, STATE HIGHWAY, AND RAILROAD RIGHTS-OF-WAY, THE CONTRACTOR SHALL NOTIFY THE RESPECTIVE AUTHORITIES REPRESENTING THE OWNERS OR AGENCIES RESPONSIBLE FOR SUCH FACILITIES NOT LESS THAN 3 DAYS NOR MORE THAN 7 DAYS PRIOR TO EXCAVATION SO THAT A REPRESENTATIVE OF SAID OWNERS OR AGENCIES CAN BE PRESENT DURING SUCH WORK IF THEY SO DESIRE. IN THE CASE OF THE UNDERGROUND UTILITY SERVICE ALERT CENTER, THIS NOTICE WILL GIVE THEM TIME TO MARK THE LOCATION OF THE UTILITIES. THE CONTRACTOR SHALL ALSO NOTIFY THE REGIONAL OR LOCAL UNDERGROUND SERVICE ALERT COMPANY AT LEAST 3 DAYS, BUT NO MORE THAN 7 DAYS, PRIOR TO SUCH EXCAVATION.

PIPING

1. THE CONTRACTOR SHALL COMPLY WITH THE STATE DEPARTMENT OF HEALTH SERVICES CRITERIA FOR THE SEPARATION OF WATER MAINS AND SANITARY SEWERS.
2. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 36 INCHES OF COVER ON ALL PIPELINES UNLESS OTHERWISE SHOWN OR DIRECTED.
3. STRAIGHT SLOPES SHALL BE MAINTAINED BETWEEN INVERT ELEVATIONS SHOWN OR SPECIFIED.
4. THE CONTRACTOR SHALL ADJUST ALL VALVE BOXES, PULL BOXES, AND MANHOLES TO FINISHED GRADE UNLESS OTHERWISE SHOWN OR SPECIFIED. MANHOLES IN OPEN FIELDS SHALL BE SET ONE FOOT ABOVE GRADE. APPROXIMATE RIM ELEVATIONS ARE SHOWN ON DRAWINGS.
5. ALL PIPE TRENCHING AND BACKFILL SHALL BE IN ACCORDANCE WITH DETAIL C-602 FOR RIGID PIPE AND C-601 FOR FLEXIBLE PIPE. THE PIPING SHOWN ON THESE PLANS SHALL BE RESTRAINED JOINT DESIGN AT ALL SLEEVE TYPE COUPLINGS.
6. THE CONTRACTOR SHALL PROVIDE TWO FLEXIBLE SLEEVE TYPE COUPLINGS WITH RESTRAINED JOINTS FOR EACH PIPE PENETRATING A STRUCTURE. THE COUPLINGS AND FLEXIBLE JOINTS SHALL BE 3-FEET AND 8-FEET AWAY FROM THE STRUCTURE. ALL PIPING SHALL BE RESTRAINED JOINT DESIGN UNLESS INDICATED OTHERWISE. COUPLINGS AND RESTRAINED JOINTS SHALL BE PROVIDED WHETHER SHOWN ON THE DRAWINGS OR NOT. STEEL PIPE RESTRAINED HARNESS SETS SHALL BE PROVIDED IN ACCORDANCE WITH AWWA M-11. ALL OTHER PIPES, COUPLINGS AND RESTRAINED JOINTS HALL BE APPROVED BY THE ENGINEER. ALL RESTRAINED JOINTS SHALL BE IN ACCORDANCE WITH THE PIPE MANUFACTURERS' RECOMMENDATIONS.

EROSION CONTROL

1. THE CONTRACTOR SHALL SUBMIT AN EROSION CONTROL PLAN FOR WORK DURING THE CONSTRUCTION, SIGNED AND STAMPED BY A REGISTERED CIVIL ENGINEER PRIOR TO THE START OF CONSTRUCTION.
   a. ALL SLOPES SHALL BE PROTECTED FROM EROSION DURING ROUGH GRADING OPERATIONS AND THEREAFTER, UNTIL INSTALLATION OF FINAL GROUNDCOVER (SEE LANDSCAPE PLANS FOR FINAL GROUNDCOVER).
   b. ALL SLOPE PROTECTION SWALES SHALL BE CONSTRUCTED AT THE SAME TIME AS BANKS ARE GRADED.
   c. THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTATION AND MAINTENANCE OF EROSION CONTROL MEASURES CONTAINED WITHIN THE CONTRACT SPECIFICATIONS OR AS REQUIRED BY THE CITY, DISTRICT, OR OTHER REGULATORY AUTHORITY. THE CONTRACTOR SHALL ALSO PROVIDE ANY ADDITIONAL EROSION CONTROL MEASURES (E.G. HYDROSEEDING, MULCHING OF STRAW, SAND BAGGING, DIVERSION DITCHES, ETC.) DICTATED BY FIELD CONDITIONS TO PREVENT EROSION OR THE INTRODUCTION OF DIRT, MUD, OR DEBRIS INTO EXISTING PUBLIC STREETS, WATERWAYS, OR ONTO ADJACENT PROPERTIES DURING ANY PHASE OF CONSTRUCTION OPERATIONS.

CIVIL GENERAL NOTES - CONTINUED

SURVEY AND CONTROL

BENCHMARK L.A. CITY NO. 03-00843 NAVD88
SPIKE EASTERLY CURB HUBBARD ST 2FT SOUTHERLY OF BEGINNING OF CURB RETURN SOUTHERLY OF FOOTHILL BLVD
ELEV = 1296.015 (2000)

GEOTECHNICAL SYMBOLS

- SOIL BORING LOCATION
- TEST PIT LOCATION
- MONITORING WELL

DRAINAGE SYMBOLS

- RIPRAP
- HAY BALE
- SILT FENCE

CORROSION CONTROL SYMBOLS

- ETS — ELECTROLYSIS TEST STATION
- T — CATHODIC TEST STATION
- CTS — CORROSION TEST STATION
- CATS — CASING TEST STATION
- IJTS — INSULATING JOINT TEST STATION
- FPTS — FOREIGN PIPELINE TEST STATION
- CSTS — CURRENT SPAN TEST STATION

GENERAL CIVIL SYMBOLS

- NEW
- EXISTING
- FUTURE
- EXISTING TO BE REMOVED OR DEMOLISHED
- CENTERLINE
- EARTH (IN SECTION)
- COMPACTED EARTH (IN SECTION)
- S=0.0123 — SLOPE ON PAVED SURFACE
- 3:1 — BERM SLOPE (HORZ TO VERT)

TOPOGRAPHY AND MAPPING SYMBOLS

- MAJOR CONTOURS
- MINOR CONTOURS
- TOP OF SLOPE
- TOE OF SLOPE
- P/L — PROPERTY LINE
- R/W — RIGHT-OF-WAY LINE
- GRADE BREAK
- R — RIDGE LINE
- ESMT — EASEMENT LINE
- ESMT — TEMPORARY EASEMENT LINE
- TRAIL OR DIRT ROAD
- FLOW LINE
- FLOOD HAZARD AREA
- EDGE OF WETLANDS
- RAILROAD
- GUARDRAIL (PERMANENT)
- GUARDRAIL (REMOVABLE)
- VEGETATION
- WELL

PIPING AND UTILITIES

UTILTIES (SINGLE LINE) SEE PIPE SCHEDULE FOR ADDITIONAL PIPING INFO

- G — UTILITIES (SIZE WHERE NOTED)
- G — UNDERGROUND

G	NATURAL GAS LINE
HPG	HIGH PRESSURE GAS LINE
LPG	LIQUID PETROLEUM GAS LINE
W	WATER
PW	POTABLE WATER
FIRE	FIRE SUPPLY WATER LINE
REW	RECLAIMED WATER
UW	UTILITY / NON-POTABLE WATER
IRRG	IRRIGATION LINE
SDR	STORM DRAIN
SS	SANITARY SEWER
STM	STEAM LINE
TEL	TELEPHONE
COMM	COMMUNICATIONS LINE
FOC	FIBER OPTIC CABLE
CATV	CABLE TV
E	POWER
UNID	UNIDENTIFIED
ABND	ABANDONED UTILITY

- BUMPED HEAD
- POWER POLE
- BURIED ACCESS MANHOLE (IN PLAN) LOCATE ON SIDE SHOWN
- BURIED ACCESS MANHOLE (IN PROFILE)
- AV/AR VALVE (IN PLAN)
- AV/AR VALVE (IN PROFILE)
- A/R VALVE (IN PLAN) LOCATE ON SIDE SHOWN
- BLOWOFF (IN PLAN) LOCATE ON SIDE SHOWN
- BLOWOFF (IN PROFILE)
- FH — FIRE HYDRANT (IN PLAN)
- FH — FIRE HYDRANT (IN PROFILE)
- MH — MANHOLE (IN PLAN)
- MH — MANHOLE (IN PROFILE)
- CLEANOUT TO GRADE (IN PLAN)
- CO — CLEANOUT TO GRADE OR PRESSURE CLEANOUT TO GRADE (IN PROFILE)

BURIED VALVES IN VALVE BOX

- GATE VALVE
- BUTTERFLY VALVE
- PLUG VALVE
- CHECK VALVE

ROAD AND PAVING SYMBOLS

- ASPHALT CEMENT (IN PLAN)
- ASPHALT CEMENT (IN SECTION)
- CONCRETE PAVING
- GRAVEL PAVING
- CONCRETE CURB
- CONCRETE CURB
- DROP INLET CATCH BASIN
- DRIVEWAY/ACCESS RAMP

CONTROL SYMBOLS

- BENCH MARK
- SITE COORDINATES (SEE TABLE ON DRAWINGS)
- N XXXXXX E XXXXXX — SITE COORDINATES
- HORIZONTAL CONTROL POINT
- VERTICAL CONTROL POINT
- HORZ AND VERT CONTROL POINT
- XXX.XX — FINISHED ELEVATION
- XXX.XX — EXISTING ELEVATION
- Δ — DELTA

STRUCTURES

- SITE OR RETAINING WALL
- x x x — FENCE (CHAINLINK)
- FENCE (WOOD)
- STRUCTURE
- STRUCTURE (BELOW GRADE)
- CATCH BASIN

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SCALES
0 — 1"
0 — 25mm
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REGISTERED PROFESSIONAL ENGINEER — BILL R. MOSER — No. C28129 — CIVIL — STATE OF CALIFORNIA

DESIGNED WM
DRAWN PT
CHECKED WM

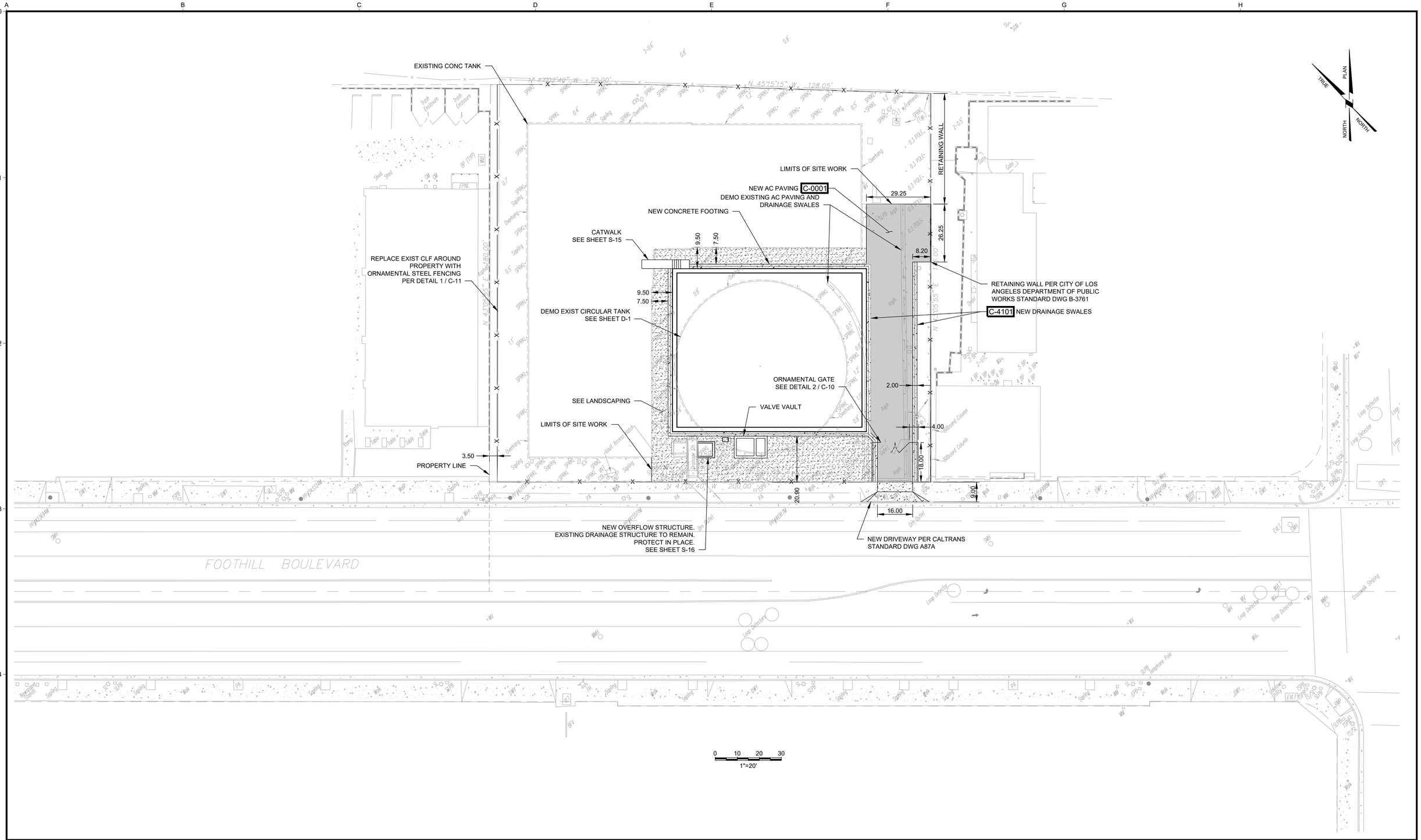
CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting Inc.

CIVIL
ABBREVIATIONS AND LEGEND

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JOB NO. 1944519.00
DATE APRIL 2020
SHEET C-1 OF ##

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CHECKED	WM

CITY OF SAN FERNANDO
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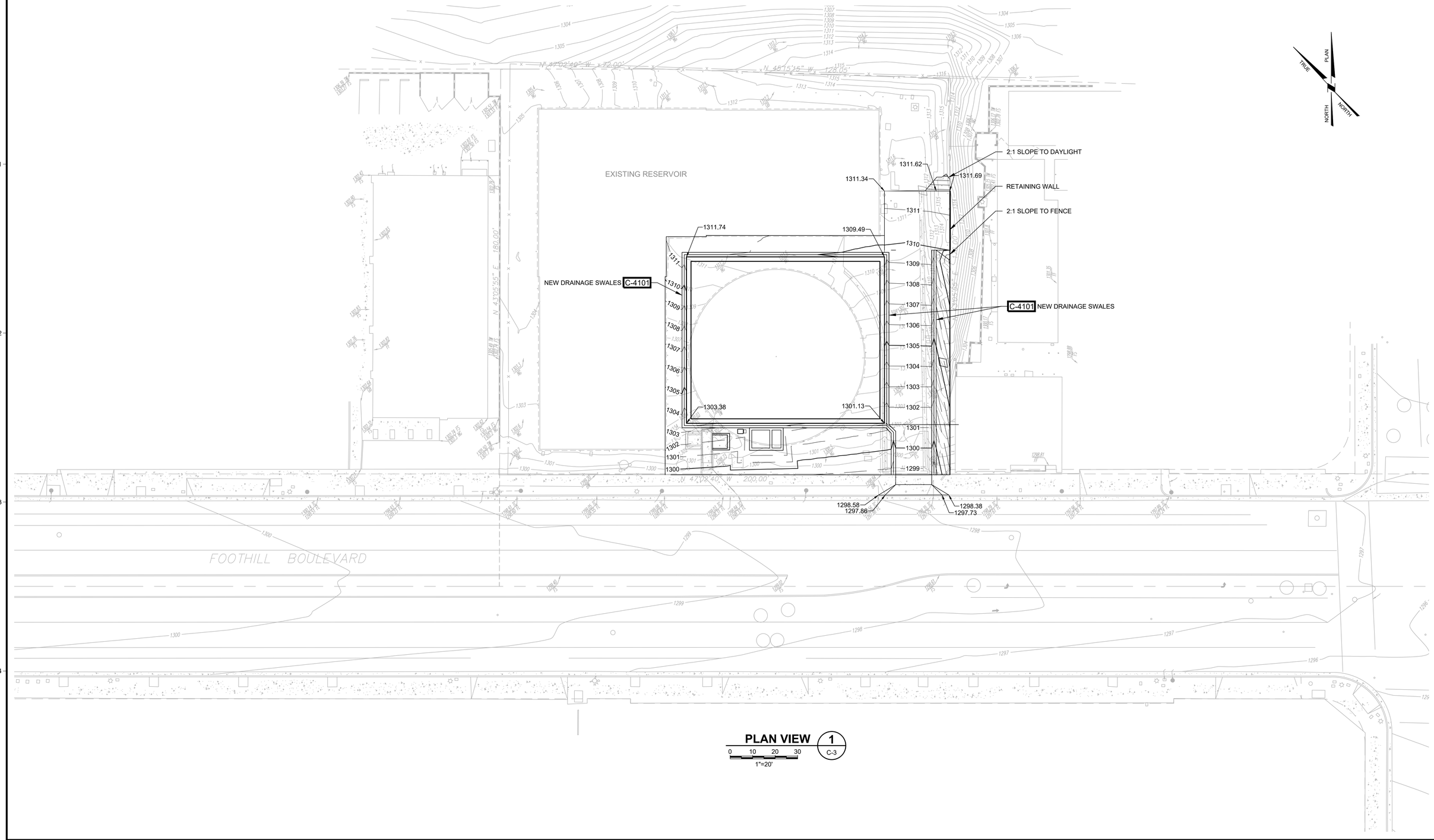
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CIVIL
SITE AND PAVING PLAN

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PLAN VIEW 1 (C-3)

0 10 20 30

1"=20'

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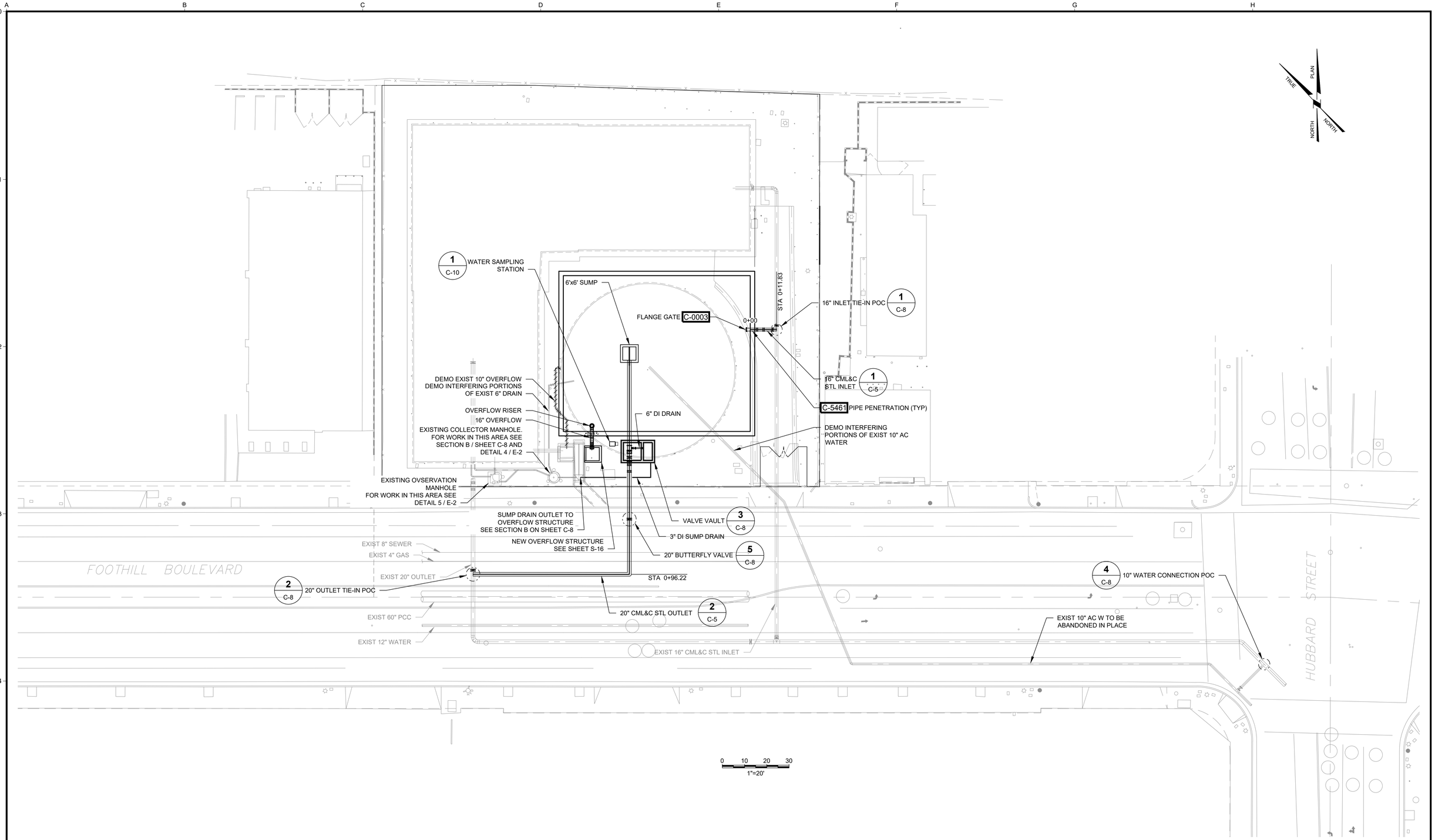
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CIVIL
GRADING AND DRAINAGE PLAN

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0 25mm

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BILL H. MOSER
No. C28129
CIVIL
STATE OF CALIFORNIA

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CHECKED	WM

CITY OF SAN FERNANDO
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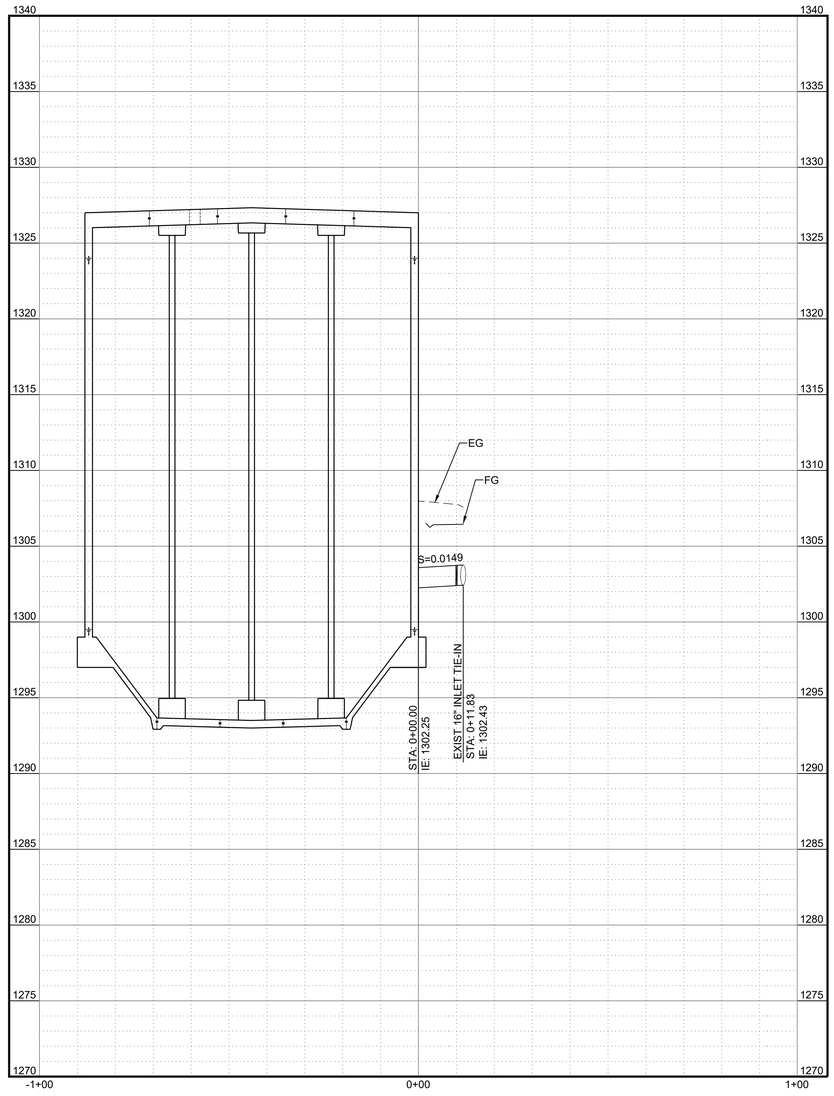
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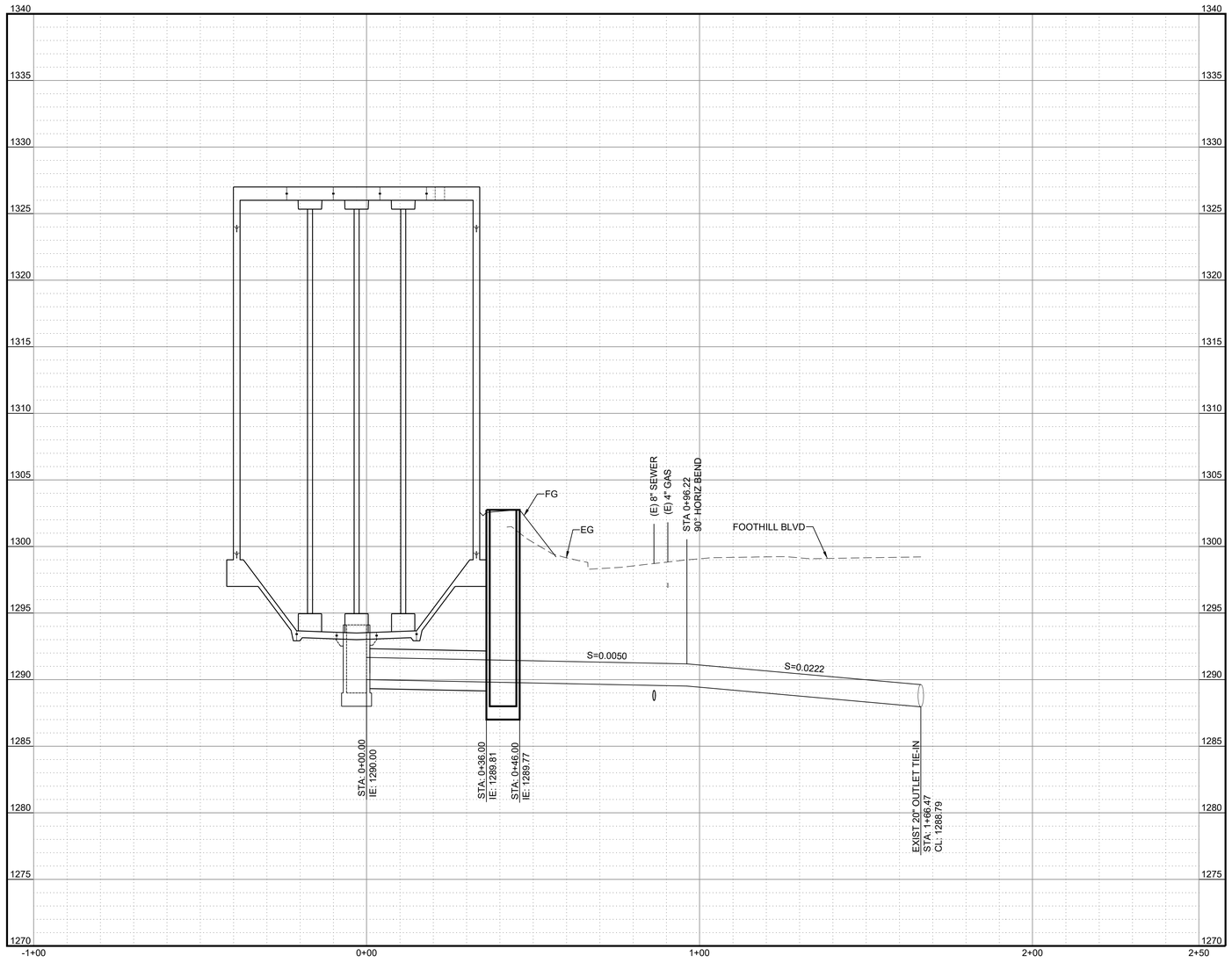
CIVIL
YARD PIPING PLAN

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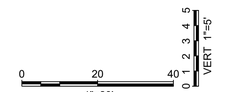
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16" CML&C STL INLET 1 C-4



20" CML&C STL OUTLET 2 C-4



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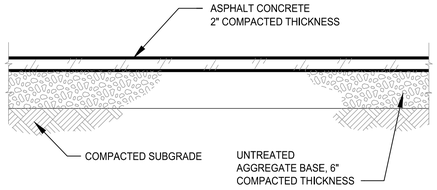
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CIVIL
PIPE PROFILES

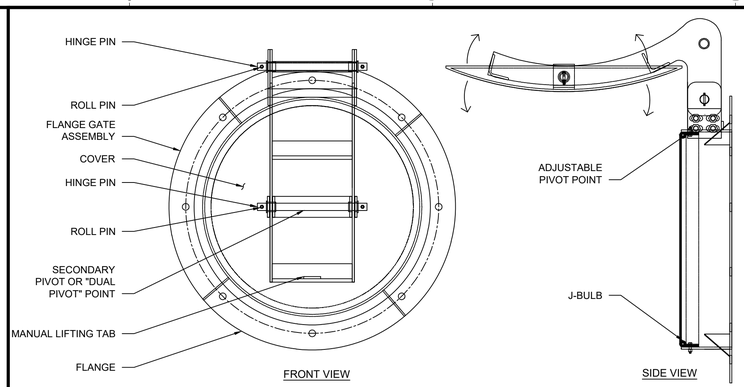
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ASPHALT CONCRETE PAVING DETAIL C-0001

SCALE: NTS
REV 00



FLANGE GATE C-0003

SCALE: NTS
REV 00

A. FLEXIBLE PIPE REFERS TO ALL STEEL, DUCTILE-IRON, AND PLASTIC PIPES.

B. TYPICAL TRENCH SECTIONS (I, II AND III) ARE TO BE USED ONLY WHERE STABLE, COMPACT SOIL CONDITIONS EXIST. IF BOULDERS OR LARGE OBSTRUCTIONS ARE ENCOUNTERED, TRENCH SECTIONS MAY BE DEEPER OR WIDER THAN SHOWN. THE ENGINEER SHALL BE ADVISED SHOULD THIS OCCUR.

C. THE NEED FOR PROTECTIVE SYSTEMS AND EXCAVATION SLOPES SHALL BE DETERMINED CONSIDERING APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS, AND GEOTECHNICAL CONSULTANTS' RECOMMENDATIONS.

D. PROTECTIVE SYSTEMS SHALL BE DESIGNED AND BUILT IN ACCORDANCE WITH THE APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS.

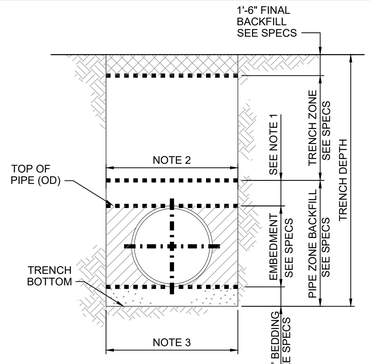
E. SUPPORTING DOCUMENTATION SHALL BE SUBMITTED TO THE ENGINEER REGARDING PIPE DESIGN AND COMPLIANCE WITH APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS.

F. UNSUPPORTED VERTICAL AND/OR SLOPING TRENCH WALL SLOPES SHALL NOT BE STEEPER THAN ALLOWED BY APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS, UNLESS SUPPORTING DOCUMENTATION IS SUBMITTED, ACCORDING TO AFOREMENTIONED SAFETY STANDARDS.

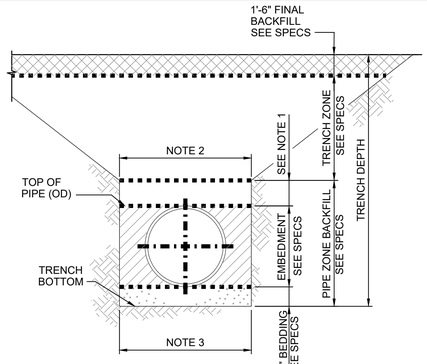
G. TRENCH SECTIONS OTHER THAN THE TYPICAL SECTIONS SHOWN MAY BE UTILIZED PROVIDED THEY COMPLY WITH APPLICABLE LOCAL, STATE AND FEDERAL (OSHA) SAFETY STANDARDS AND REGULATIONS. DOCUMENTATION SUPPORTING THIS COMPLIANCE AND PIPE DESIGN CALCULATIONS SHALL BE SUBMITTED TO THE ENGINEER.

H. IF OVER-EXCAVATION DUE TO POOR FOUNDATION MATERIAL IS ORDERED BY THE ENGINEER, THE BACKFILL MATERIAL SHALL BE ACCORDING TO THE EARTHWORK SECTION OF THE SPECIFICATIONS ARTICLE ENTITLED, "FILL AND BACKFILL MATERIAL REQUIREMENTS."

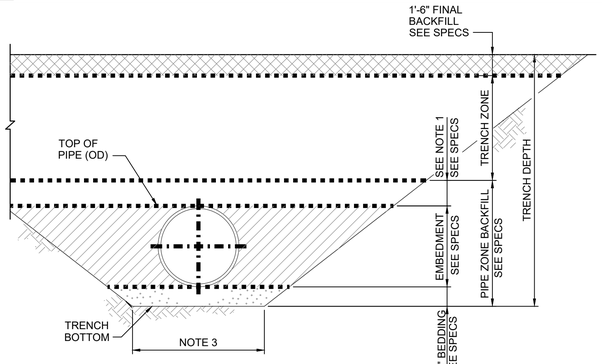
I. IF DURING CONSTRUCTION, THE WATER TABLE IS DISCOVERED TO BE ABOVE THE TRENCH BOTTOM, THE ENGINEER SHALL BE NOTIFIED, AND APPROPRIATE DEWATERING SHALL BE IMPLEMENTED TO LOWER THE WATER LEVEL BELOW THE TRENCH BOTTOM. THE BACKFILL MATERIAL SHALL BE ACCORDING TO THE EARTHWORK SECTIONS OF THE SPECIFICATIONS, OR AS ORDERED BY THE ENGINEER.



TRENCH SECTION - TYPE I



TRENCH SECTION - TYPE II



TRENCH SECTION - TYPE III

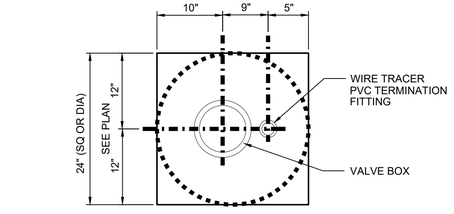
NOTES:

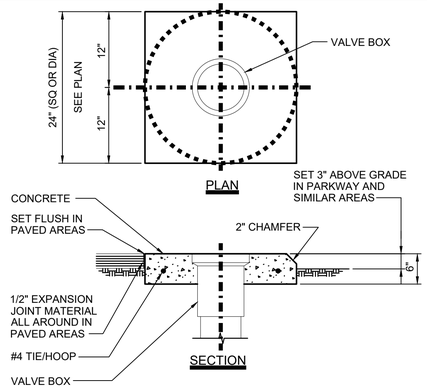
1. 6" MIN FOR PIPE DIAMETER < 24"
   12" MIN FOR PIPE DIAMETER > 24"
2. MAX TRENCH WIDTH @ TOP OF PIPE:
   OD + 36" FOR, 18" & LARGER PIPE OD
   OD + 24" FOR LESS THAN 18"
3. MIN TRENCH BOTTOM WIDTH =
   OD + 24" FOR MECHANICAL COMPACTION

TRENCH SECTION C-5021

FLEXIBLE PIPE

SCALE: NTS
REV 00

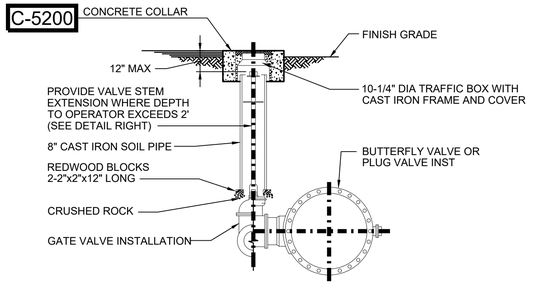




VALVE BOX COLLAR C-5200

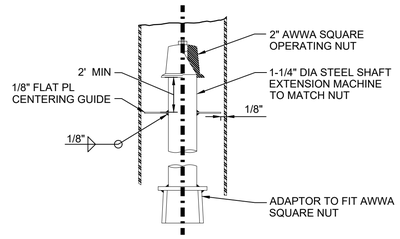
SCALE: NTS
REV 00

C-5200



NOTES:

1. PROVIDE PROTECTIVE COATING TO EXTERIOR SURFACE OF VALVE BODY IN ACCORDANCE WITH SPECS.
2. FOR LUBRICATED PLUG VALVE, EXTEND LUBRICATION LINE TO GRADE PER MANUFACTURES INSTRUCTIONS.



BURIED VALVE INSTALLATION C-5251

SCALE: NTS
REV 00

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NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

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REGISTERED PROFESSIONAL ENGINEER BILL H. MOSER No. C28129 CIVIL STATE OF CALIFORNIA

DESIGNED	WM
DRAWN	PT
CHECKED	WM

CITY OF SAN FERNANDO
SAN FERNANDO, CA

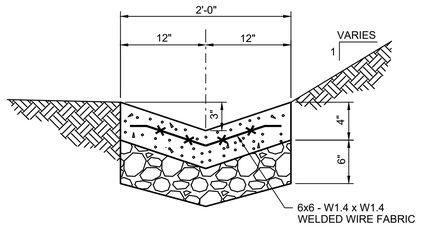
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CIVIL
DETAILS I

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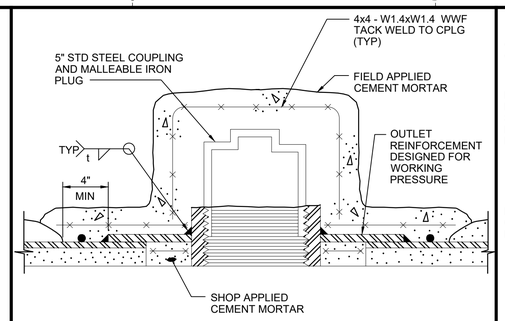


NOTES:

1. EXPANSION JOINTS OF ONE-HALF INCH BITUMINOUS MATERIAL SHALL BE PLACED AT 50-FEET SPACING AND WHERE SWALE BUTTS OTHER CONCRETE STRUCTURES.

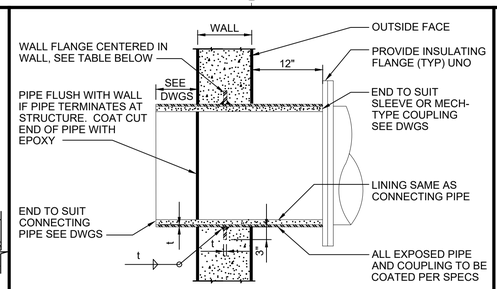
DRAINAGE SWALE — C-4101

CONCRETE LINED, SECTION — SCALE: NTS — REV 00



HANDHOLE FOR BAR WRAPPED PIPE — C-5131

WSP, CML&C, REQUIRED FOR <24" DIAMETER — SCALE: NTS — REV 00

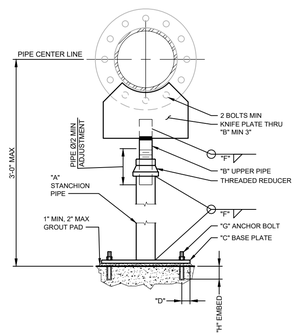


WALL FLANGE PLATE THICKNESS

PIPE SIZE	STEEL PLATE
30" & UNDER	1/4"
31" TO 60"	5/16"
61" & OVER	3/8"

STEEL PIPE THROUGH OR TERMINATING AT WALL — C-5461

SCALE: NTS — REV 00



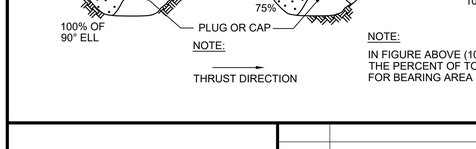
ADJUSTABLE PIPE SUPPORT							
PIPE SIZE	"A" (STANCHION PIPE)	"B" (NECK PIPE)	"C" (BASE PLATE)	"D" (EDGE DISTANCE)	"F" (WELD SIZE)	"G" (Ø ANCHOR/BOLT SIZE)	"H" MIN EMBEDMENT DEPTH
6"	3" XS	2 1/2"	14" SQ X 1/2" THK	2"	1/4"	3/4"	5"
8"	3" XS	2 1/2"	14" SQ X 1/2" THK	2"	1/4"	3/4"	5"
10"	3" XS	2 1/2"	14" SQ X 3/4" THK	1 1/2"	3/8"	7/8"	10"
12"	3" XS	2 1/2"	14" SQ X 3/4" THK	1 1/2"	3/8"	7/8"	10"
14"	3 1/2" XS	3"	20" SQ X 3/4" THK	1 1/4"	3/8"	7/8"	10"
16"	3 1/2" XS	3"	20" SQ X 3/4" THK	1 1/4"	3/8"	7/8"	10"
18"	5" STD	4"	26" SQ X 3/4" THK	1 7/8"	1/2"	1 1/4"	10"
20"	5" STD	4"	26" SQ X 3/4" THK	1 7/8"	1/2"	1 1/4"	10"
24"	5" STD	4"	26" SQ X 3/4" THK	1 7/8"	1/2"	1 1/4"	10"

NOTES:

1. IF ADJUSTMENT IS NOT REQ'D, DELETE NECK PIPE AND REDUCER AND WELD STANCHION DIRECTLY TO BOTTOM PIPE STRAP.
2. DO NOT CUT OR WELD AFTER GALVANIZING.
3. PIPE SUPPORT MAY BE ORIENTATED IN ANY DIRECTION.
4. ANCHOR BOLTS SHALL BE GALVANIZED GR 55 THREADED ROD W/ HILTI HIT-HY200 EPOXY ADHESIVE.
5. BASE PLATE SHALL HAVE CORNERS AND EDGES ROUNDED W/ 1/8" RADIUS.

ADJUSTABLE STANCHION SUPPORT — M-5201

FLANGE ATTACHMENT — SCALE: NTS — REV 00

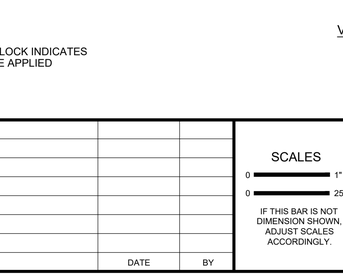


NOTES:

1. DIMENSION "A" CORRESPONDS TO THE COMPLETED JOINT OVERLAP AFTER WELDING. DIMENSION "A" SHALL BE THE GREATER OF 3" OR 5 t, MINIMUM.
2. FOR STANDARD JOINTS, THE MINIMUM DIMENSION "B" SHALL BE AS REQUIRED TO PROVIDE THE MINIMUM OVERLAP DIMENSION "A" AND MAINTAIN THE INDICATED HOLDBACK FOR THE WELD.
3. FOR SPECIAL TEMPERATURE CONTROL JOINTS, THE MINIMUM DIMENSION "B" SHALL BE INCREASED BY AT LEAST 3 INCHES. AT THE TIME OF INSTALLATION AND PRIOR TO WELDING, THE SPIGOT SHALL BE INSERTED INTO THE LENGTHENED BELL TO PROVIDE "A" +3 INCHES MINIMUM OVERLAP. SEE SPECIFICATIONS FOR SPECIAL TEMPERATURE CONTROL JOINT WELDING REQUIREMENTS.
4. FILLET WELDS FOR BELL AND SPIGOT LAP JOINTS SHOWN. FILLET WELDS ON OTHER JOINTS ARE SIMILAR.
5. CONTRACTOR MAY PUT TAP ON SPIGOT ID AT HIS DISCRETION.
6. THE JOINTS SHALL BE FABRICATED AND INSTALLED TO BE WITHIN THE TOLERANCES INDICATED. THE TOLERANCE REQUIREMENTS SHALL APPLY TO BOTH WELDS AND TO BOTH STRAIGHT AND DEFLECTED JOINTS.

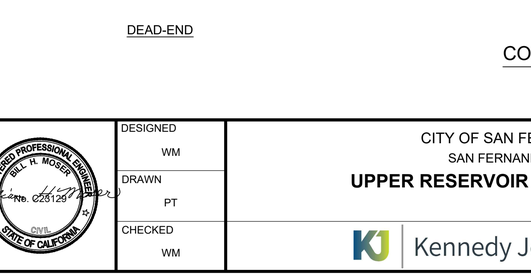
LAP JOINT WELD — C-5501

WSP — SCALE: NTS — REV 00



BUTT STRAP SPLICE — C-5502

WSP — SCALE: NTS — REV 00



NOTES:

1. CONTRACTOR SHALL CONDUCT AN AIR/SOAP SOLUTION LEAK TEST AT 40 PSI AIR PRESSURE IN ADDITION TO DYE PENETRANT OR MAGNETIC PARTICLE TESTING PERFORMED BY THE CONSTRUCTION MANAGER. IF LEAKS ARE DETECTED, REPAIR AND RETEST THE WELDS UNTIL THERE ARE NO DEFECTS. PLUG HOLES WITH A THREADED OR WELDED PLUG AT COMPLETION OF TEST AND COAT AS SHOWN. TAP HOLES MAY BE ON INSIDE OR OUTSIDE OF JOINT.
2. SHOP APPLIED CEMENT MORTAR LINING SHOWN. OMIT INSIDE JOINT MORTAR REPAIR FOR FIELD APPLIED CEMENT MORTAR LINING.
3. FOR FIELD WELDING OF INDIVIDUAL BUTT STRAP PIECES TO EACH OTHER, SEE DETAIL C-5502.
4. UNLESS OTHERWISE INDICATED, BUTT STRAP WIDTH SHALL CONFORM TO THE LIMITATIONS SHOWN FOR PIPE END SEPARATION AND OVERLAP REQUIREMENTS.

BUTT STRAP JOINT — C-5508

WSP, CML&C — SCALE: NTS — REV 00

THRUST PER PSI OF WATER PRESSURE AT VARIOUS FITTINGS				
PIPE SIZE	DEAD END OR TEE	90° ELBOW	45° ELBOW	22 1/2° ELBOW
4	19	27	15	7
6	39	55	30	15
8	67	94	51	26
10	109	154	84	43
12	155	218	119	61
14	210	296	161	82
16	275	383	209	106
18	351	494	269	137
20	434	611	333	169
24	623	878	478	244

EXAMPLE:

8-INCH 90° ELBOW, PRESSURE=200 PSF
FROM TABLE: THRUST = 94 X 200 = 18,800 lb
ASSUME BEARING STRENGTH OF SOIL = 2000 PSF

18,800 / 2000 =9.4 SQ FT= BEARING AREA REQUIRED FOR THRUST BLOCK

SIDE THRUST PER 100 PSI PRESSURE PER DEGREE OF DEFLECTION			
PIPE SIZE	SIDE THRUST-lb	PIPE SIZE	SIDE THRUST-lb
4	35	14	377
6	72	16	486
8	122	18	665
10	197	20	790
12	278	24	1150

MULTIPLY THRUST BY DEGREE OF DEFLECTION TO OBTAIN TOTAL THRUST

NOTES:

1. IN USING THE ABOVE TABLES, USE THE MAXIMUM INTERNAL PRESSURE ANTICIPATED (i.e. HYDROSTATIC TEST PRESSURE) POSSIBLE SURGE PRESSURE DUE TO PUMP SHUT-OFF, ETC.
2. SEE SOILS REPORT FOR BEARING STRENGTH OF SOIL IN THE ABSENCE OF A SOILS REPORT AN AVERAGE SOIL (SPADABLE MEDIUM CLAY) CAN BE ASSUMED TO HAVE A BEARING STRENGTH OF 2000 PSF
3. USE LIGHTWEIGHT CONCRETE FOR HILL THRUST BLOCK.
4. CONCRETE FOR THRUST BLOCKS TO BE 2000 PSI.

CONCRETE THRUST BLOCKS — C-5401

SCALE: NTS — REV 00

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SCALES

0 1"
0 25mm

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REGISTERED PROFESSIONAL ENGINEER — BILL H. MOSER — No. C28129 — CIVIL — STATE OF CALIFORNIA

DESIGNED	WM
DRAWN	PT
CHECKED	WM

CITY OF SAN FERNANDO
SAN FERNANDO, CA

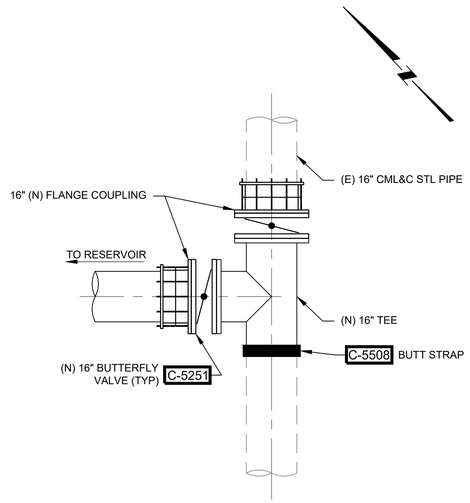
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CIVIL
DETAILS II

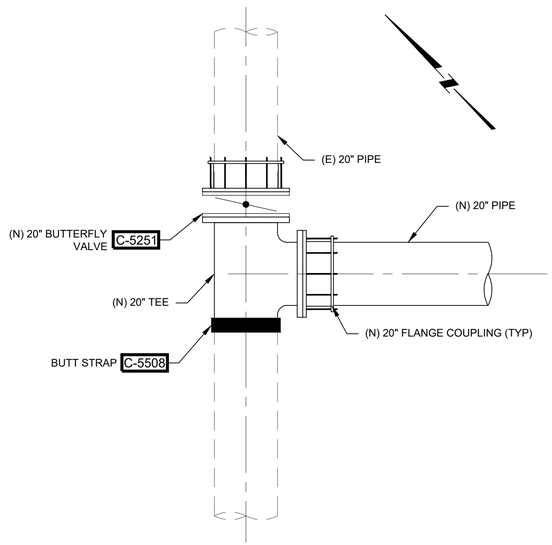
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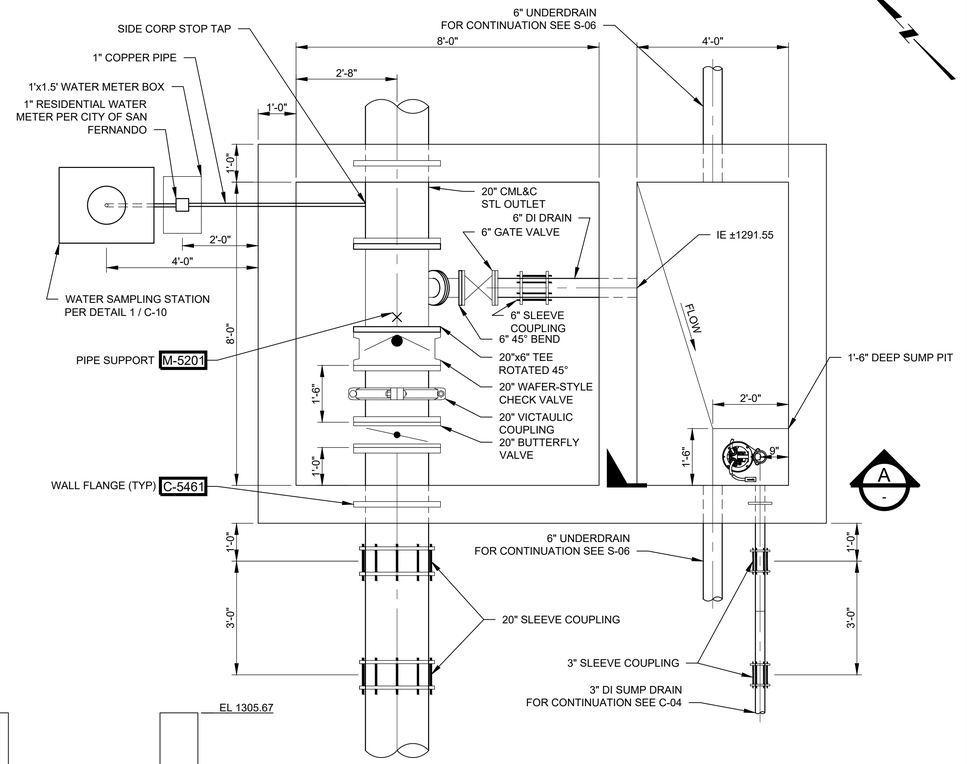
16" INLET CONNECTION 1 C-4

0 1 2 3
1/2"=1'-0"



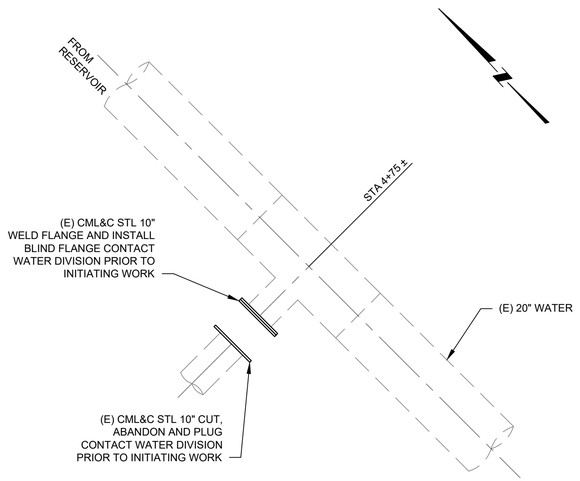
20" OUTLET CONNECTION 2 C-4

0 1 2 3
1/2"=1'-0"



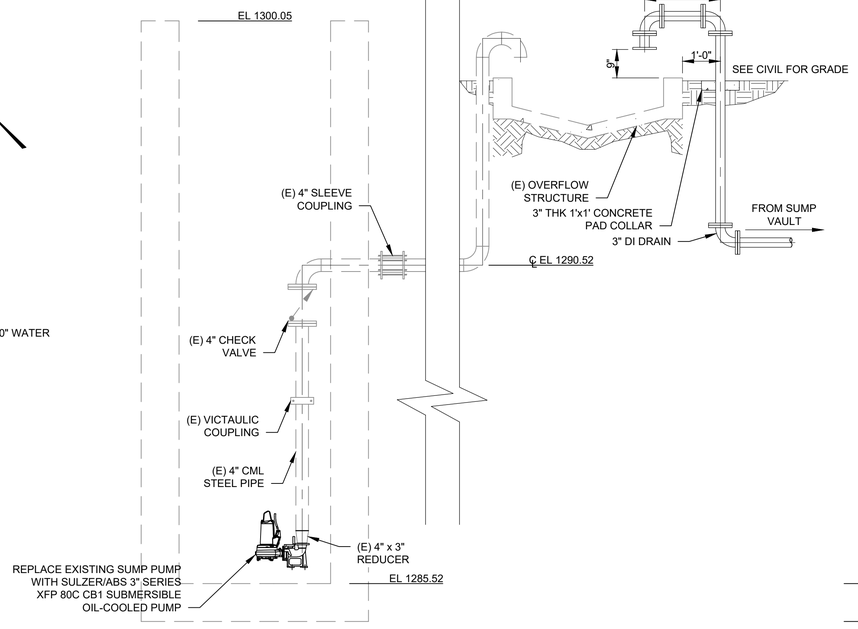
VALVE VAULT 3 C-4

0 1 2 3
1/2"=1'-0"



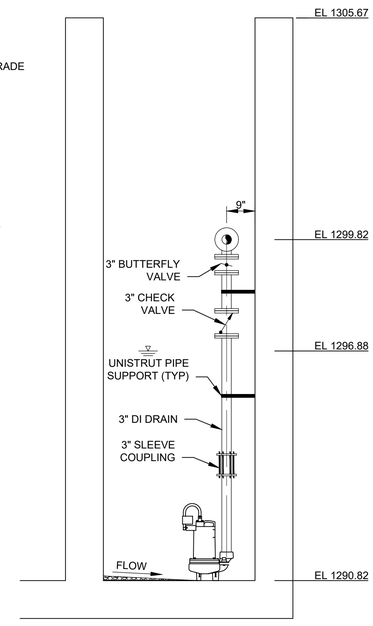
10" WATER CONNECTION 4 C-4

0 1 2 3
1/2"=1'-0"



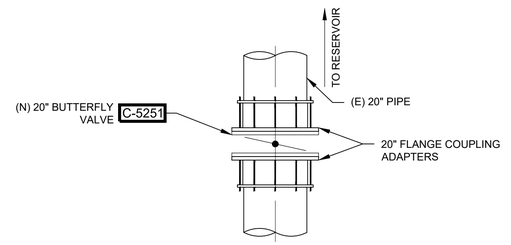
EXIST COLLECTOR MH AND OVERFLOW STRUCTURE B C-4

NTS



SUMP PUMP A -

NTS



20" OUTLET CONNECTION 5 C-4

0 1 2 3
1/2"=1'-0"

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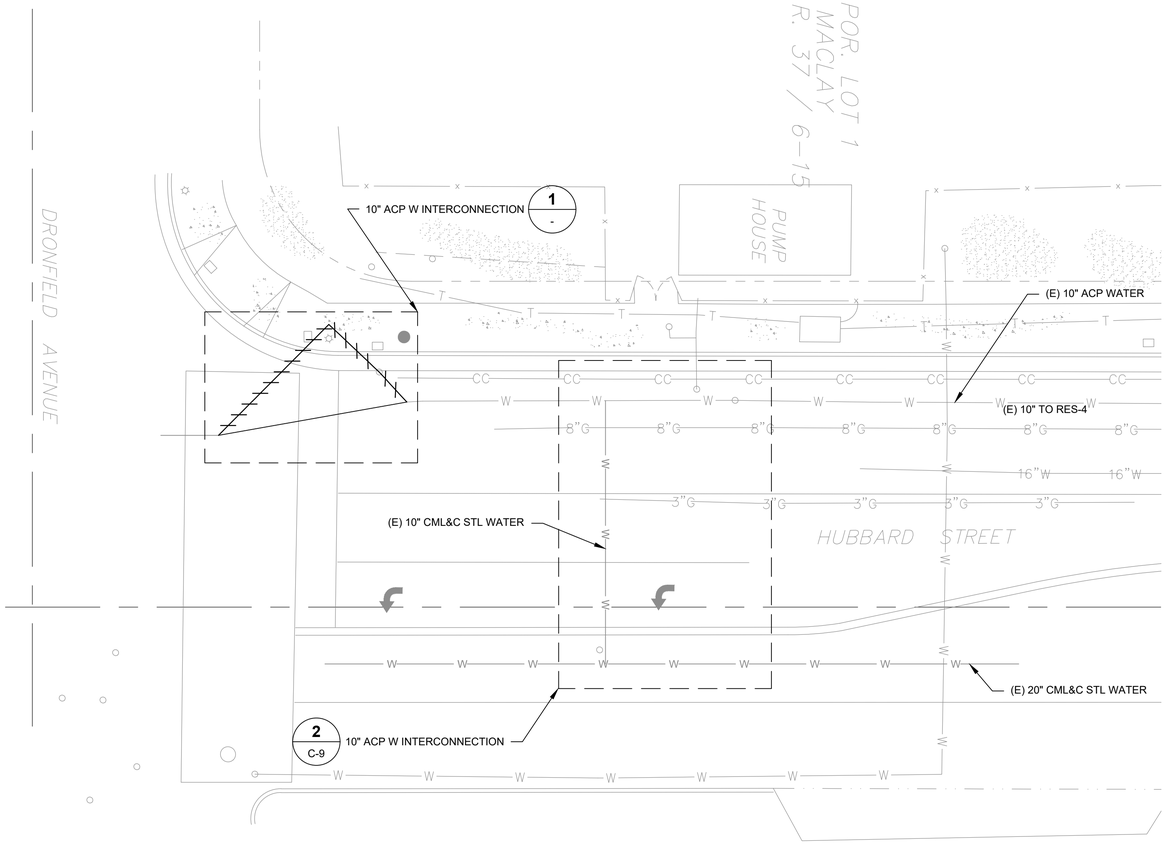
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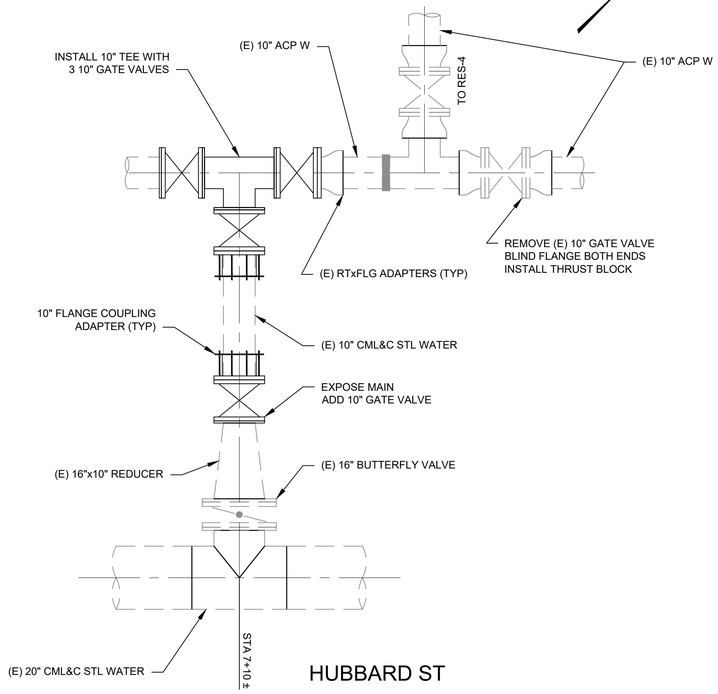
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SITE A PLAN

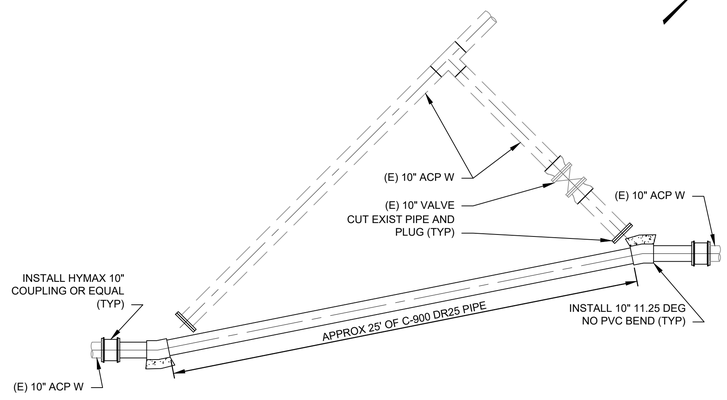
0 10 20

1"=10'



10" WATER CONNECTION 2

NOT TO SCALE



10" WATER CONNECTION 1

0 3 6

1/4"=1'-0"

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STATE OF CALIFORNIA

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CHECKED	WM

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SAN FERNANDO, CA

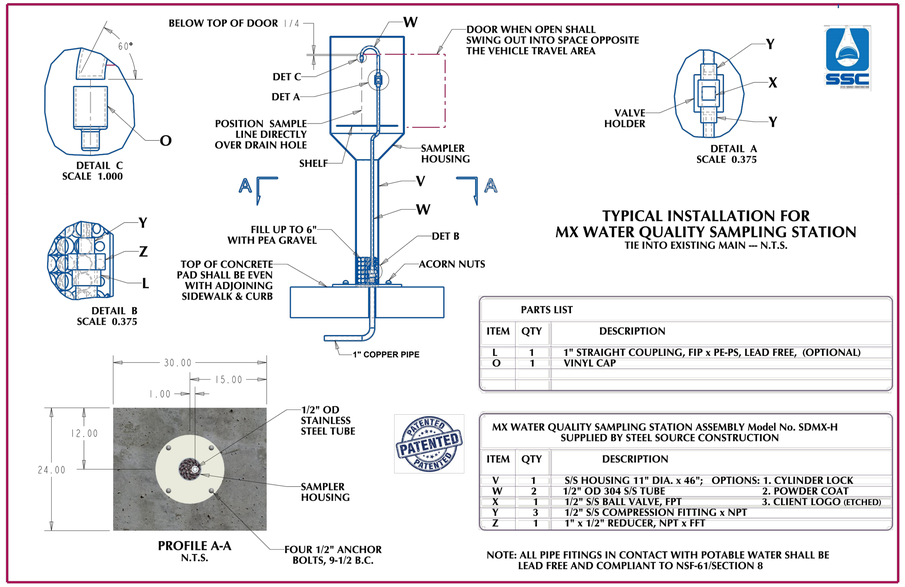
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TYPICAL INSTALLATION FOR MX WATER QUALITY SAMPLING STATION

TIE INTO EXISTING MAIN — N.T.S.

PARTS LIST

ITEM	QTY	DESCRIPTION
L	1	1" STRAIGHT COUPLING, FIP x PE-PS, LEAD FREE, (OPTIONAL)
O	1	VINYL CAP

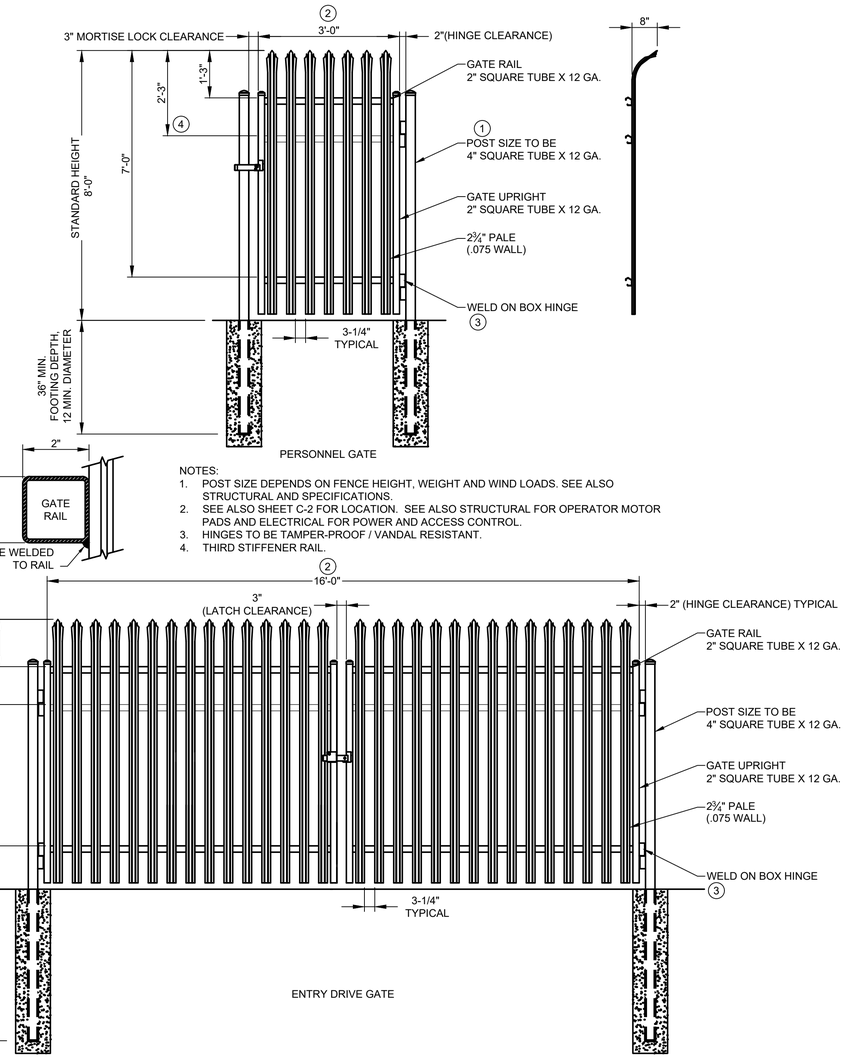
MX WATER QUALITY SAMPLING STATION ASSEMBLY Model No. SDMX-H
SUPPLIED BY STEEL SOURCE CONSTRUCTION

ITEM	QTY	DESCRIPTION
V	1	S/S HOUSING 11" DIA. x 46"; OPTIONS: 1. CYLINDER LOCK
W	2	1/2" OD 304 S/S TUBE 2. POWDER COAT
X	1	1/2" S/S BALL VALVE, FPT 3. CLIENT LOGO (ETCHED)
Y	3	1/2" S/S COMPRESSION FITTING x NPT
Z	1	1" x 1/2" REDUCER, NPT x FFT

NOTE: ALL PIPE FITINGS IN CONTACT WITH POTABLE WATER SHALL BE LEAD FREE AND COMPLIANT TO NSF-61/SECTION 8

WATER SAMPLING STATION 1

NOT TO SCALE C-8



ORNAMENTAL STEEL GATE 2

NOT TO SCALE C-2

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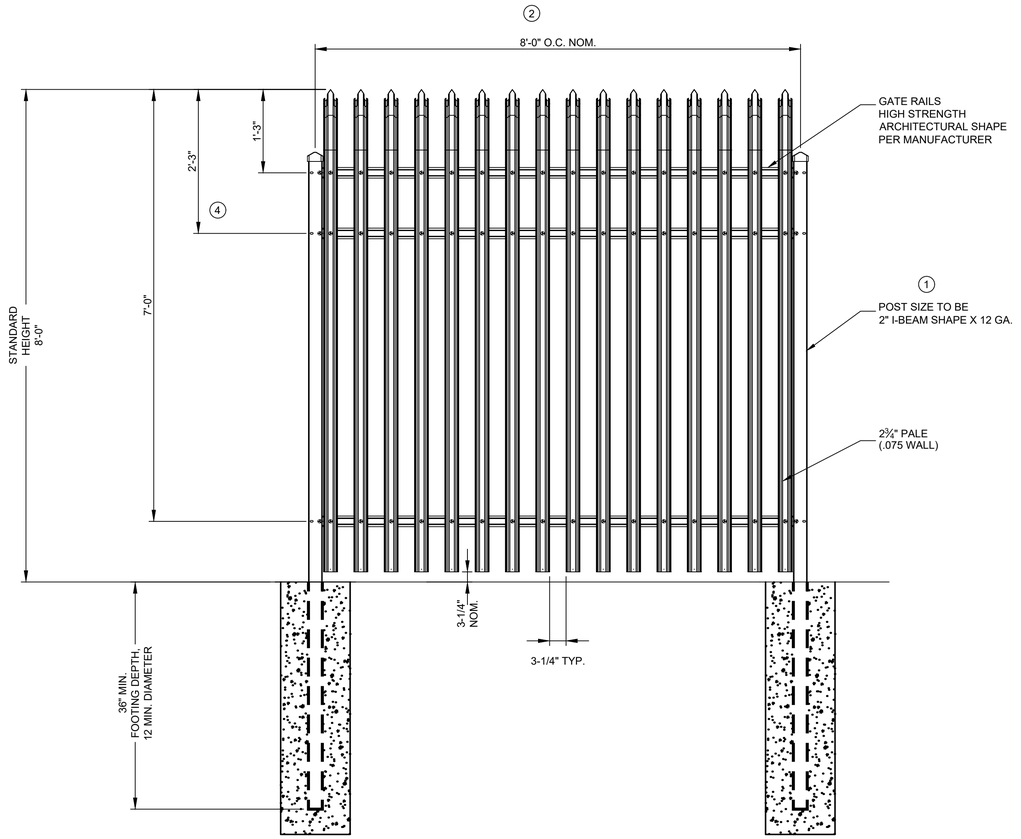
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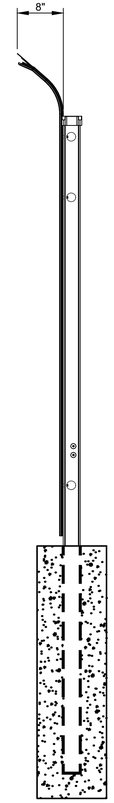
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DETAILS V

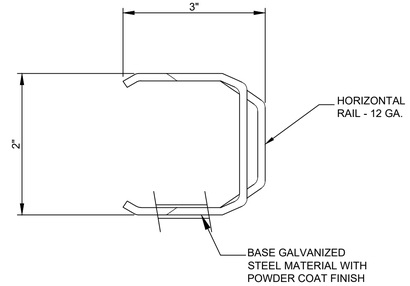
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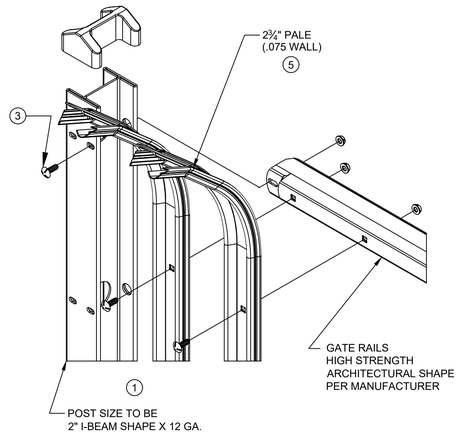


TYPICAL FENCE PANEL



TYPICAL PANEL SECTION





NOTES:
1. POST SIZE DEPENDS ON FENCE HEIGHT, WEIGHT AND WIND LOADS. SEE ALSO STRUCTURAL AND SPECIFICATIONS.
2. SEE ALSO SHEET C-2 FOR LOCATION. SEE ALSO STRUCTURAL FOR OPERATOR MOTOR PADS AND ELECTRICAL FOR POWER AND ACCESS CONTROL.
3. FASTENERS TO BE TAMPER-PROOF / VANDAL RESISTANT, TYPICAL.
4. THIRD STIFFENER RAIL.
5. BOLT HOLES TO BE RECESSED TO PREVENT CHISELING OF BOLT HEADS.

ORNAMENTAL STEEL FENCE

1 / C-2

NOT TO SCALE

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REGISTERED PROFESSIONAL ENGINEER
BILL H. MOSER
No. C28129
CIVIL
STATE OF CALIFORNIA

DESIGNED	WM
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CITY OF SAN FERNANDO
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FILE NAME	1944519.00-C-11.dwg
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SHEET	C-11 ##

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GENERAL STRUCTURAL NOTES

GENERAL

1. DESIGN AND CONSTRUCTION SHALL CONFORM TO THE 2019 CALIFORNIA BUILDING CODE (CBC), AND THE REFERENCED BUILDING CODE STANDARDS.
2. THESE NOTES AS WELL AS THE TYPICAL DETAILS APPLY TO ALL PARTS OF THE PROJECT, UNLESS NOTED OTHERWISE.
3. SHOP DRAWINGS FOR THIS CONTRACT SHALL BE COORDINATED WITH FAVORABLY REVIEWED EQUIPMENT MANUFACTURER'S DRAWINGS.
4. DIMENSIONS NOTED WITH AN ASTERISK, " * ", ARE TO BE COORDINATED WITH FAVORABLY REVIEWED SUBMITTAL BY THE EQUIPMENT MANUFACTURER.
5. DETAILS CALLED OUT WITH S-XXXX SHALL REFER TO THE STANDARD DETAIL FOR WHICH THEY ARE SO NAMED.

PERMITS AND INSPECTIONS

1. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS AND COORDINATING ALL INSPECTIONS REQUIRED BY THE SPECIAL INSPECTOR AND AS DESCRIBED IN THE CONTRACT DOCUMENTS.
2. THE CONTRACTOR SHALL NOTIFY THE SPECIAL INSPECTOR AT LEAST FIVE (5) WORKING DAYS PRIOR TO EACH SPECIAL INSPECTION AND TESTING REQUIRED. THE CONTRACTOR SHALL PROVIDE ACCESS TO THE WORK REQUIRED FOR SPECIAL INSPECTIONS AND TESTING.
3. THE CONTRACTOR SHALL DESIGN, DETAIL, FABRICATE, INSTALL, AND MAINTAIN SHORING, SHEETING, BRACING AND SLOPING AS NECESSARY TO MAINTAIN SAFE EXCAVATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING FULL COMPLIANCE WITH 29 CFR PART 1926 OSHA SUBPART P EXCAVATIONS AND TRENCHES REQUIREMENTS. ALL EARTHWORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH APPLICABLE LAW, INCLUDING LOCAL ORDINANCES, CALOSHA, CALIFORNIA CIVIL CODE AND CALIFORNIA DEPARTMENT OF INDUSTRIAL SAFETY REQUIREMENTS, AND APPLICABLE OSHA REQUIREMENTS. SEE EARTHWORK NOTES ON SHEET S-9.

SPECIAL INSPECTIONS AND STRUCTURAL OBSERVATIONS

1. THE CONTRACTOR SHALL NOTIFY THE ENGINEER 48-HOURS BEFORE PLACEMENT OF REINFORCING STEEL AND CONCRETE SO THAT THE SUBGRADE OF EXCAVATIONS MAY BE INSPECTED BY THE GEOTECHNICAL ENGINEER.
2. THE GEOTECHNICAL ENGINEER SHALL VERIFY BACKFILL MATERIAL AND BACKFILLING PROCEDURES AND PROVIDE SOIL COMPACTION TESTS.
3. STRUCTURAL OBSERVATION SHALL BE PROVIDED BY THE DESIGN ENGINEER(S) OF RECORD OR THEIR AUTHORIZED REPRESENTATIVES IN ACCORDANCE WITH CBC 2019, SECTION 1710. STRUCTURAL OBSERVATION SHALL CONSIST OF SITE VISITS AT INTERVALS APPROPRIATE TO THE STAGE OF CONSTRUCTION TO OBSERVE CONSTRUCTION IN PROGRESS AND REVIEW OF TESTING AND INSPECTION REPORTS FOR GENERAL COMPLIANCE WITH THE CONSTRUCTION DOCUMENTS RELATING TO THE STRUCTURAL WORK AND THE NONSTRUCTURAL COMPONENTS AND EQUIPMENT ANCHORAGE.
4. SPECIAL INSPECTION IN ACCORDANCE WITH CBC 2019, SECTION 1704, SHALL BE REQUIRED AS INDICATED IN THE SPECIAL INSPECTION AND TESTING SCHEDULE ON SHEET S-2.

SOIL AND FOUNDATIONS

1. GEOTECHNICAL INVESTIGATIONS FOR DESIGN PURPOSES FOR THIS PROJECT WERE MADE FOR THE CITY OF SAN FERNANDO BY CONVERSE CONSULTANTS IN A REPORT DATED 29 SEPTEMBER 2020.
2. IN ACCORDANCE WITH THE CBC CHAPTER 18, THE SOILS AT THE UPPER RESERVOIR SITE IN SYLMAR, CA ARE GENERALLY CLASSIFIED AS FILL OVERLYING SAND TO SILTY SAND WITH SOME GRAVEL AND CLAY OVERLYING SAND TO SILTY SAND WITH SOME COBBLES.
3. THE DESIGN BEARING CAPACITY OF THE SOILS IS 3,500 PSF FOR FOOTINGS. BEARING CAPACITY OF SOILS ARE FOR DEAD AND LIVE LOADS FOR FOUNDATIONS. BEARING VALUES MAY BE INCREASED BY ONE-THIRD WHEN TRANSIENT LOADS SUCH AS WIND OR SEISMIC LOADS ARE INCLUDED.
4. SOILS SHALL BE EXCAVATED TO THE ELEVATIONS INDICATED ON THE DRAWINGS FOR FOUNDATIONS. THE SUBGRADE SHALL BE PREPARED AS INDICATED ON THE DRAWINGS AND SPECIFICATIONS AND APPROVED BY THE GEOTECHNICAL ENGINEER. EXCAVATED MATERIAL SHALL BE REPLACED WITH STRUCTURAL FILL AS SHOWN ON THE DRAWINGS. FOUNDATIONS SHALL BE CONSTRUCTED AGAINST UNDISTURBED NATIVE COMPETENT MATERIAL OR COMPACTED STRUCTURAL FILL. SEE EARTHWORK NOTES ON SHEET S-9.

LOADING CRITERIA

1. MINIMUM LOADING REQUIREMENTS PER CHAPTER 16 OF THE CALIFORNIA BUILDING CODE INCLUDING LATEST REVISION.
2. DEAD LOAD: AS CALCULATED
3. LIVE LOADS:

CATWALKS FOR MAINTENANCE ACCESS	40 PSF UNIFORM, 300 LBS POINT
ELEVATED SLABS & WALKWAYS	100 PSF UNIFORM
FIXED LADDERS	300 LBS POINT
FIXED STAIRWAYS & EXIT-WAYS	100 PSF UNIFORM, 300 LBS POINT PER TREAD
HANDRAILS, GUARDRAILS AND GRAB BARS	50 PLF AT TOP RAIL, 200 LBS POINT
ROOF (REDUCTION FOR UNIFORM LOAD)	50 PSF UNIFORM, 2,000 LBS POINT
GRATING, CHECKERED PLATE, ACCESS HATCHES	EQUAL TO FLOOR LIVE LOAD
SIDEWALKS & VEHICULAR DRIVEWAYS	250 PSF UNIFORM, 8,000 LBS POINT AASHTO
UNRESTRICTED VEHICULAR ACCESS	AASHTO HL-93
CONCRETE VAULTS AND COVERS	AASHTO HL-93

4. WIND LOAD:

BASIC WIND SPEED, V_{ULT}	105 MPH (ASCE 7-16 FIGURES 26.5-1A,B,C)
NOMINAL WIND SPEED, V_{ASD}	81 MPH (CBC EQN 16-33)
EXPOSURE	IV, UON ON STRUTURAL PLANS (ASCE 7-16 CBC TABLE 1604.5)

5. SNOW LOAD:

IMPORTANCE FACTOR, I_s	1.20
BASIC GROUND SNOW LOAD, Pg	0 PSF

6. SEISMIC LOAD:

RISK CATEGORY	IV
SEISMIC IMPORTANCE FACTOR, I_E	1.50
SEISMIC IMPORTANCE FACTOR, I_P	1.50
MAPPED RESPONSE PARAMETER, S_S	2.649
MAPPED RESPONSE PARAMETER, S_1	0.870
SITE CLASS	C
DESIGN RESPONSE PARAMETER, S_{DS}	1.695
DESIGN RESPONSE PARAMETER, S_{D1}	0.836
SEISMIC DESIGN CATEGORY	F
RESPONSE MODIFICATION FACTOR, Ri	2.5
RESPONSE MODIFICATION FACTOR, Rc	1
LONG PERIOD TRANSITION PERIOD, T_L	8

REINFORCING STEEL

1. REINFORCING BARS SHALL BE ASTM A615, GRADE 60.
2. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
3. ARRANGEMENT AND DETAILING OF REINFORCING STEEL, INCLUDING BAR SUPPORTS AND SPACERS, SHALL BE IN ACCORDANCE WITH THE LATEST ACI 315 DETAILING MANUAL.
4. REINFORCING SHALL LAP IN ACCORDANCE WITH THE CONCRETE REINFORCEMENT SPLICE TABLE, UNLESS OTHERWISE SHOWN. WHEN BARS OF DIFFERENT SIZE LAP TO EACH OTHER, SPLICE LENGTH FOR THE SMALLER BAR CAN BE USED. DOWELS SHALL HAVE THE SAME SIZE AND SPACING AS THAT OF THE REINFORCING STEEL THEY ARE SPLICED AND SHALL HAVE A MINIMUM LAP AS NOTED ABOVE. BAR SPLICES SHALL BE STAGGERED.
5. HOOK REINFORCING BARS INTERRUPTED BY OPENINGS.
6. NO WELDING OF REINFORCING BARS SHALL BE PERMITTED, UNLESS APPROVAL IN WRITING IS OBTAINED FROM THE ENGINEER PRIOR TO CONSTRUCTION.
7. DIMENSIONS TO REINFORCING ARE TO BAR CENTERLINES, UNLESS NOTED OTHERWISE BAR COVER IS CLEAR DISTANCE BETWEEN THE BAR AND THE CONCRETE SURFACE. UNLESS NOTED OR SHOWN OTHERWISE BAR COVER FOR REINFORCING STEEL SHALL BE AS FOLLOWS:

FOOTINGS AND BASE SLABS:	
FORMED SURFACES AND BOTTOMS ON CONCRETE WORK MAT	2-INCH
TOP SURFACES EXPOSED TO EARTH, WATER, OR WEATHER	2-INCH
BOTTOMS AND SIDES IN CONTACT WITH EARTH	3-INCH
SUSPENDED SLABS:	
FORMED SURFACES EXPOSED TO EARTH, WATER, OR WEATHER	2-INCH
TOP AND BOTTOM BARS DRY CONDITION	1-INCH
BEAMS AND COLUMNS:	
DRY CONDITIONS:	
STIRRUPS, SPIRALS, AND TIES	1 1/2-INCH
PRINCIPAL REINFORCEMENT	2-INCH
EXPOSED TO EARTH, WATER, OR WEATHER:	
STIRRUPS, SPIRALS, AND TIES	2-INCH
PRINCIPAL REINFORCEMENT	2 1/2-INCH
WALLS:	
LESS THAN 12-INCHES THICK	1 1/2-INCH
12 INCHES OR OVER IN THICKNESS	2 1/2-INCH

CONCRETE

1. CEMENT SHALL BE ASTM C150 TYPE II FOR ALL STRUCTURES. CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH (PSI) AS NOTED IN THE TABLE BELOW AND AS FURTHER DEFINED IN THE SPECIFICATIONS:

CONCRETE STRENGTH (PSI)		
TYPE	STRENGTH	LOCATION
B	4,500	RESERVOIR ROOF, WALLS, COLUMNS AND DROP PANELS, FLOOR, FOOTINGS, AND FOUNDATIONS
E	2,500	MISCELLANEOUS STRUCTURES AND SITEWORK
G	125 (MAX)	CLSM/CDF - SEE SPECIFICATION SECTION 02065

2. CONCRETE CONSTRUCTION SHALL CONFORM TO ACI 301-16, ACI 318-14, AND ACI 350-06, INCLUDING BAR BENDS AND HOOKS, UNLESS DETAILED OTHERWISE.
3. SUBMIT CONCRETE AND MASONRY LIFT DRAWINGS SHOWING THE LOCATION OF CONSTRUCTION JOINTS, WATERSTOPS AND OTHER TYPES OF JOINTS OTHER THAN SPECIFIED OR SHOWN ON THE DRAWINGS FOR FAVORABLE REVIEW BY THE ENGINEER BEFORE START OF WORK ON FORMS, REINFORCING STEEL OR PLACING CONCRETE. ANY ADDITIONAL VERTICAL OR HORIZONTAL CONSTRUCTION JOINTS SHALL HAVE A STANDARD KEYWAY AND SHALL BE FAVORABLY REVIEWED BY THE ENGINEER. REFER TO SPECIFICATIONS AND TYPICAL DETAILS FOR ADDITIONAL INFORMATION. CONSTRUCTION JOINTS SHALL BE ROUGHENED TO 1/4-INCH AMPLITUDE.
4. OPENINGS, PIPE SLEEVES, CONDUITS, INSERTS AND OTHER EMBEDDED ITEMS SHALL BE IN PLACE BEFORE CONCRETE IS PLACED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE ARCHITECTURAL, CIVIL, MECHANICAL, ELECTRICAL, LANDSCAPING, HVAC, PLUMBING, INSTRUMENTATION AND OTHER PLANS FOR ITEMS REQUIRING SLEEVES AND EMBEDMENTS IN CONCRETE WHICH ARE NOT INDICATED OR SHOWN ON STRUCTURAL DRAWINGS. NO PIPES OR SLEEVES SHALL PASS THROUGH STRUCTURAL MEMBERS (UNLESS SHOWN ON STRUCTURAL DRAWINGS). COORDINATE WITH EQUIPMENT MANUFACTURERS DRAWINGS FOR ANCHORING DEVICES.
5. UNLESS OTHERWISE NOTED, ALL EXPOSED EDGES AND CORNERS SHALL BE CHAMFERED 3/4-INCH. INTERIOR FLOOR SLABS AND EXTERIOR SIDEWALKS SHALL HAVE TOOLED 3/8-INCH RADIUS CONSTRUCTION JOINT.
6. EACH FACE CONCRETE SHALL BE REINFORCED A MINIMUM OF NO. 5 BARS AT 12-INCHES EACH WAY.
7. CONCRETE ENCASE ALL PIPES AND CONDUITS UNDER CONCRETE SLABS AND FOOTINGS

STRUCTURAL ALUMINUM

1. UNLESS NOTED OTHERWISE, STRUCTURAL ALUMINUM SHALL BE GRADE 6061-T6.
2. THE FABRICATOR AND INSTALLER MUST BE A STATE LICENSED CONTRACTOR REGULARLY ENGAGED IN CUSTOM FABRICATION AND INSTALLATION OF WELDED AND BOLTED STRUCTURAL ALUMINUM.
3. WELD ELECTRODES SHALL CONFORM TO AWS A5.3 OR A5.10. WELDING SHALL BE PERFORMED BY CERTIFIED WELDERS. WELDING SHALL USE ONLY APPROVED ELECTRODES. WELDING SHALL CONFORM TO THE PROVISIONS OF THE LATEST STRUCTURAL WELDING CODE (AWS D1.2).
4. CONNECTIONS SHALL USE AISI TYPE 304, STAINLESS STEEL BOLTS UNLESS NOTED OTHERWISE. PROVIDE WASHERS AT ALL BOLTED CONNECTIONS.
5. ALL ALUMINUM IN CONTACT WITH CONCRETE, PLASTER OR OTHER METALS SHALL RECEIVE AN ISOLATION COATING IN ACCORDANCE WITH THE SPECIFICATIONS.

STRUCTURAL STEEL

1. ALL STEEL CONSTRUCTION SHALL CONFORM TO THE STANDARDS AND SPECIFICATIONS OF THE 15TH EDITION OF THE AISC STEEL CONSTRUCTION MANUAL.
2. UNLESS OTHERWISE NOTED, STRUCTURAL STEEL SHAPES SHALL CONFORM TO THE FOLLOWING:

STRUCTURAL STEEL SPECIFICATION TABLE			
STEEL TYPE	SHAPE SERIES	ASTM DESIGNATION	MINIMUM YIELD STRENGTH
HIGH-STRENGTH LOW-ALLOY	Wx AND WTx	ASTM A992	Fy = 50 KSI
	PLATES CONNECTING TO Wx AND WTx SHAPES	ASTM A572	Fy = 50 KSI
CARBON STEEL	ANGLES, CHANNELS, PLATES, OTHER SHAPES	ASTM A36	Fy = 36 KSI
	STRUCTURAL PIPES	ASTM A53, GRADE B (TYPE E OR S)	Fy = 35 KSI
	ROUND HSS	ASTM A500, GRADE C	Fy = 46 KSI
	RECTANGULAR HSS	ASTM A500, GRADE C	Fy = 50 KSI

3. ALL STRUCTURAL STEEL SHALL BE FABRICATED AND ERECTED BY AN AISC CERTIFIED FABRICATOR IN CONFORMANCE WITH THE LATEST AISC SPECIFICATION PARTS 1 THRU 4 AND AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS.
4. STEEL BEAMS, JOISTS, GIRDERS, TRUSSES, AND OTHER STRUCTURAL STEEL MEMBERS SHALL NOT BE RELOCATED WITHOUT APPROVAL FROM THE ENGINEER OF RECORD.
5. CONNECTIONS AND BOLTS:
   - 5.1. STRUCTURAL BOLTS FOR STEEL FRAMING SHALL BE GALVANIZED AND CONFORM TO ASTM A325-N (TYPE 1), UON. NUTS SHALL BE LUBRICATED. FULLY TENSION HIGH STRENGTH BOLTS UNLESS CONNECTING HSS SHAPES OR OTHERWISE NOTED.
   - 5.2. STRUCTURAL BOLTS FOR STEEL FRAMING WITH SHORT-SLOTTED HOLES SHALL BE A325-SC. PROVIDE WASHERS AT ALL CONNECTIONS WITH OVERSIZED OR SHORT-SLOTTED HOLES.
   - 5.3. USE STAINLESS STEEL TYPE 316 BOLTS FOR CONNECTIONS OF STAINLESS STEEL AND ALUMINUM FRAMING.
6. WELD ELECTRODES SHALL CONFORM TO AWS A5.1 OR A5.5 E70XX ELECTRODES. WELDING SHALL BE DONE BY CERTIFIED WELDERS. WELDING SHALL USE ONLY APPROVED ELECTRODES. WELDING SHALL CONFORM TO THE PROVISIONS OF THE LATEST STRUCTURAL WELDING CODE (AWS D1.1).
7. UNLESS NOTED OTHERWISE, STRUCTURAL STEEL COMPONENTS AND CONNECTIONS SHALL BE PAINTED OR PROTECTIVE COATED IN ACCORDANCE WITH THE SPECIFICATIONS.

DEFERRED SUBMITTALS

IN ACCORDANCE WITH THE 2019 CBC, SECTION 107.3.4.1 SUBMITTAL DOCUMENTS FOR DEFERRED SUBMITTAL ITEMS SHALL BE SUBMITTED TO THE ENGINEER OF RECORD WHO SHALL REVIEW THEM AND FORWARD THEM TO THE AUTHORITY HAVING JURISDICTION WITH A NOTATION INDICATING THAT THE DEFERRED SUBMITTAL DOCUMENTS HAVE BEEN REVIEWED AND THAT THEY HAVE BEEN FOUND TO BE IN GENERAL CONFORMANCE WITH THE DESIGN. THE DEFERRED SUBMITTAL ITEMS SHALL NOT BE INSTALLED UNTIL THE DESIGN AND SUBMITTAL DOCUMENTS HAVE BEEN APPROVED BY THE BUILDING OFFICIAL OR AUTHORITY HAVING JURISDICTION.

PRIOR TO ORDERING OR FABRICATION OF ANY MATERIALS, AND PRIOR TO THE INSTALLATION OF THE INDICATED STRUCTURAL ELEMENTS, EQUIPMENT DISTRIBUTIONS SYSTEM, OR COMPONENT AND IT'S ANCHORAGE. THE CONTRACTOR SHALL SUBMIT THE REQUIRED CALCULATIONS, SUPPORTING INFORMATION, AND DRAWINGS FOR REVIEW AND ACCEPTANCE BY THE ENGINEER. ALL DEFERRED SUBMITTALS AND CALCULATIONS SHALL BE IN ACCORDANCE WITH THE 2019 CALIFORNIA BUILDING CODE, INCLUDING THE DESIGN CRITERIA AND SPECIFICATIONS WITHIN THESE CONSTRUCTION DOCUMENTS. ALL DEFERRED SUBMITTAL CALCULATIONS AND DRAWINGS SHALL BE SEALED AND SIGNED BY A REGISTERED PROFESSIONAL CIVIL ENGINEER OR STRUCTURAL ENGINEER LICENSED IN THE STATE OF CALIFORNIA. THE FOLLOWING IS A LIST OF DEFERRED SUBMITTALS THAT ARE EXPECTED TO CONTAIN STRUCTURAL CALCULATIONS OR SAFETY RELATED SYSTEM INFORMATION FOR REVIEW TO MEET THE PROJECT REQUIREMENTS:

DEFERRED SUBMITTAL ITEMS
ANCHORAGE FOR ELECTRICAL AND MECHANICAL EQUIPMENT AND ENCLOSURES
PIPE SUPPORTS AND ANCHORAGE (AS IDENTIFIED ON THE CONTRACT DOCUMENTS)

STRUCTURAL ABBREVIATIONS

&	AND	JT	JOINT
@	AT		
#	NUMBER	KIP	1,000 POUNDS
Ø	DIAMETER	KSI	KIPS PER SQUARE INCH
ℓ_d	DEVELOPMENT LENGTH		
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIAL	L,∠	ANGLE
		LB(S)	POUNDS
		LB/SF	POUND(S) PER SQUARE FOOT
AB	AGGREGATE BASE, ANCHOR BOLT	LL	LIVE LOAD
ACI	AMERICAN CONCRETE INSTITUTE	LLH	LONG LEG HORIZONTAL
		LLV	LONG LEG VERTICAL
ADDIT	ADDITIONAL	LLBB	LONG LEG BACK-TO-BACK
ADJ	ADJACENT	LONGIT	LONGITUDINAL
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION	LT	LIGHT
		LW	LIGHT WEIGHT
AISI	AMERICAN IRON AND STEEL INSTITUTE	MATL	MATERIAL
AITC	AMERICAN INSTITUTE OF TIMBER CONSTRUCTION	MAX	MAXIMUM
		MB	MACHINE BOLT
ALUM	ALUMINUM	MC	MOISTURE CONTENT
ALT	ALTERNATE	MC	MISCELLANEOUS CHANNEL
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE	MECH	MECHANICAL
		MIN	MINIMUM
APA	AMERICAN PLYWOOD ASSOCIATION	MISC	MISCELLANEOUS
		MSE	MECHANICALLY STABILIZED EARTH
APROX	APPROXIMATE		
ARCH	ARCHITECTURAL		
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	N/A	NOT APPLICABLE
		(N)	NEW
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS	NDT	NON-DESTRUCTIVE TEST(ING)
		NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
AWS	AMERICAN WELDING SOCIETY		
AWWA	AMERICAN WATER WORKS ASSOCIATION	NIC	NOT IN CONTACT
		NO.	NUMBER
		NOM	NOMINAL
B/	BOTTOM OF	NS	NEAR SIDE
BB(S)	BEARING BAR(S)	NSG	NON-SHRINK GROUT
BLKG	BLOCKING	NTS	NOT TO SCALE
BLDG	BUILDING		
BM	BEAM	OC	ON CENTERS
BM-1	BEAM MEMBER 1	OD	OUTSIDE DIAMETER
BN	BOUNDARY NAILING	OH	OPPOSITE HAND, OVERHEAD
BOT	BOTTOM	OPNG(S)	OPENING(S)
BP	BASE PLATE	OPP	OPPOSITE
BS	BOTH SIDES	OSHA	OCCUPATIONAL SAFETY AND HEALTH ASSOCIATION
BTWN	BETWEEN		
C	CHANNEL	PAF	POWDER/POWER ACTUATED FASTENER
CALC'S	CALCULATIONS		
CC,C/C	CENTER-TO-CENTER	PER	PERIODIC
CBC	CALIFORNIA BUILDING CODE	PEMB	PRE-ENGINEERED METAL BUILDING
CIP	CAST IN PLACE		
CJ	CONSTRUCTION JOINT	PL	PLATE
CJP	COMPLETE JOINT PENETRATION	PLF	POUND PER LINEAL FOOT
℄	CENTERLINE	PP	PARTIAL PENETRATION
CLSM	CONTROLLED LOW STRENGTH MATERIAL	PSF	POUND PER SQUARE FOOT
		PSI	POUND PER SQUARE INCH
CLR	CLEAR	PT(S)	POINT(S)
CNJ	CONTROL JOINT	PT	PRESSURE TREATED
COL	COLUMN		
CONC	CONCRETE	R, RAD	RADIUS
CONN	CONNECTION	RECT	RECTANGLE, RECTANGULAR
CONST	CONSTRUCTION	REINF	REINFORCING, -MENT
CONT	CONTINUOUS	REQ'D	REQUIRED
DBL	DOUBLE	SCH	SCHEDULE
DIA	DIAMETER	SF	SQUARE FOOT
DIAG	DIAGONAL	SHT	SHEET
DIM	DIMENSION	SIM	SIMILAR
DL	DEAD LOAD	SLBB	SHORT LEGS BACK-TO-BACK
DN	DOWN	SLH	SHORT LEG HORIZONTAL
DWG(S)	DRAWINGS	SLV	SHORT LEG VERTICAL
		SMS	SHEET METAL SCREW
(E)	EXISTING	SPEC(S)	SPECIFICATION(S)
EA	EACH	SQ	SQUARE
EF	EACH FACE	SS	STAINLESS STEEL
EL	ELEVATION	SSD	SATURATED SURFACE DRY
ELEC	ELECTRICAL	STAG	STAGGER
EMBED	EMBEDMENT	STD	STANDARD
EQ	EQUAL	STIFF	STIFFENER
EQUIP	EQUIPMENT	STL	STEEL
ES	EACH SIDE	STRUC	STRUCTURE
EW	EACH WAY	SUSP	SUSPENDED
EXP	EXPANSION	SYM	SYMMETRICAL
EXT	EXTERIOR		
		T/	TOP OF
(F)	FUTURE	T&B	TOP AND BOTTOM
FD	FLOOR DRAIN	TS	STRUCTURAL TUBING
FF	FINISH FLOOR	TYP	TYPICAL
FIN	FINISH		
FLR	FLOOR	UON	UNLESS OTHERWISE NOTED
FN	FIELD NAILING	UT	ULTRASONIC TESTING
FNDN	FOUNDATION		
FRP	FIBERGLASS REINFORCED PLASTIC	VERT	VERTICAL
		VIF	VERIFY IN FIELD
FS	FAR SIDE		
FT	FOOT/FEET	W/	WITH
FTG	FOOTING	W/O	WITHOUT
		W, WF	WIDE FLANGE
GALV	GALVANIZED	WCLIB	WEST COAST LUMBER INSPECTION BUREAU
GLB	GLULAM BEAM		
		WP	WORK POINT
HDG	HOT DIP GALVANIZE(D)	WSTP	WATERSTOP
HORIZ	HORIZONTAL	WT	WEIGHT, STRUCTURAL TEE WALL THICKNESS
HSS	HOLLOW STRUCTURAL SECTION		
HT	HEIGHT	WWF	WELDED WIRE FABRIC
HWL	HIGH WATER LEVEL		
		YD	YARD
IBC	INTERNATIONAL BUILDING CODE		
ICC	INTERNATIONAL CODE COUNCIL		
IN	INCH		
INT	INTERIOR		

USE OF DOCUMENTS

THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS ©.

NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER — DONALD BARRETT — No. C48483 — Exp. 12/31/22 — CIVIL — STATE OF CALIFORNIA

DESIGNED	MEJ
DRAWN	NEB
CHECKED	DLB

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting Inc.

STRUCTURAL
GENERAL NOTES AND ABBREVIATIONS

FILE NAME	1944519.00-S-1.dwg
JOB NO.	1944519.00
DATE	APRIL 2020
SHEET	S-1
OF	##

pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\San Fernando, City of CA\Projects\Upper Reservoir Replacement _ 1944519.00\10-Design\10.06-Drawings\Structural\1944519.00-S-1.dwg

SPECIAL INSPECTIONS AND TESTS - GENERAL

1. THE OWNER OR THE OWNER'S AUTHORIZED AGENT, OTHER THAN THE CONTRACTOR, SHALL EMPLOY ONE OR MORE APPROVED AGENCIES TO PROVIDE SPECIAL INSPECTIONS AND TESTS IN ACCORDANCE WITH CHAPTER 17 OF THE 2019 CALIFORNIA BUILDING CODE DURING. CONSTRUCTION ON THE TYPES OF WORK SPECIFIED AND IDENTIFY THE APPROVED AGENCIES TO THE BUILDING OFFICIAL. STRUCTURAL SPECIAL INSPECTIONS AND TESTS SHALL GOVERN THE QUALITY, WORKMANSHIP AND REQUIREMENTS FOR MATERIALS COVERED. MATERIALS OF CONSTRUCTION AND TESTS SHALL CONFORM TO THE APPLICABLE STANDARDS LISTED IN THE REFERENCED BUILDING CODE.

2. APPROVED AGENCY: AN ESTABLISHED AND RECOGNIZED AGENCY THAT IS REGULARLY ENGAGED IN CONDUCTING TESTS OR FURNISHING INSPECTION SERVICES, WHERE SUCH AGENCY HAS BEEN APPROVED BY THE BUILDING OFFICIAL. THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE AND ENGINEERS OF RECORD INVOLVED IN THE DESIGN OF THE PROJECT ARE PERMITTED TO ACT AS THE APPROVED AGENCY.

3. ACCESS FOR SPECIAL INSPECTION: THE CONSTRUCTION OR WORK FOR WHICH SPECIAL INSPECTION OR TESTING IS REQUIRED SHALL REMAIN ACCESSIBLE AND EXPOSED FOR SPECIAL INSPECTION OR TESTING PURPOSES UNTIL COMPLETION OF THE REQUIRED SPECIAL INSPECTIONS OR TESTS.

4. REPORT REQUIREMENT: APPROVED AGENCIES SHALL KEEP RECORDS OF SPECIAL INSPECTIONS AND TESTS. THE APPROVED AGENCY SHALL SUBMIT REPORTS OF SPECIAL INSPECTIONS AND TESTS TO THE BUILDING OFFICIAL AND TO THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE. REPORTS SHALL INDICATE THAT WORK INSPECTED OR TESTED WAS OR WAS NOT COMPLETED IN CONFORMANCE TO APPROVED CONSTRUCTION DOCUMENTS. DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR FOR CORRECTION. IF THEY ARE NOT CORRECTED, THE DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE BUILDING OFFICIAL AND TO THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE PRIOR TO THE COMPLETION OF THAT PHASE OF THE WORK. A FINAL REPORT DOCUMENTING REQUIRED SPECIAL INSPECTIONS AND TESTS AND CORRECTION OF ANY DISCREPANCIES NOTED IN THE INSPECTIONS OR TESTS SHALL BE SUBMITTED AT A POINT IN TIME AGREED UPON PRIOR TO THE START OF WORK BY THE OWNER OR THE OWNER'S AUTHORIZED AGENT TO THE BUILDING OFFICIAL.

5. SPECIAL INSPECTIONS OF FABRICATED ITEMS: WHERE FABRICATION OF STRUCTURAL, LOAD-BEARING OR LATERAL LOAD-RESISTING MEMBERS OR ASSEMBLIES IS BEING CONDUCTED ON THE PREMISES OF A FABRICATOR'S SHOP, SPECIAL INSPECTIONS OF THE FABRICATED ITEMS SHALL BE PERFORMED DURING FABRICATION.

6. STATEMENT OF SPECIAL INSPECTIONS: THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE SHALL PREPARE A STATEMENT OF SPECIAL INSPECTIONS.

7. MATERIAL TESTS: IN THE ABSENCE OF SUFFICIENT DATA OR DOCUMENTATION PROVIDING EVIDENCE OF CONFORMANCE TO QUALITY STANDARDS FOR MATERIALS IN CHAPTERS 19 AND 20 OF ACI 318, THE BUILDING OFFICIAL SHALL REQUIRE TESTING OF MATERIALS IN ACCORDANCE WITH THE APPROPRIATE STANDARDS AND CRITERIA FOR THE MATERIAL IN CHAPTERS 19 AND 20 OF ACI 318.

8. SEISMIC REQUIREMENTS IN THE STATEMENT OF SPECIAL INSPECTIONS: WHERE SPECIAL INSPECTIONS OR TESTS FOR SEISMIC RESISTANCE ARE REQUIRED, THE STATEMENT OF SPECIAL INSPECTIONS SHALL IDENTIFY THE DESIGNATED SEISMIC SYSTEMS AND SEISMIC FORCE-RESISTING SYSTEMS THAT ARE SUBJECT TO THE SPECIAL INSPECTIONS OR TESTS.

9. DESIGNATED SEISMIC SYSTEMS: SPECIAL INSPECTOR SHALL EXAMINE DESIGNATED SEISMIC SYSTEMS REQUIRING SEISMIC QUALIFICATION IN ACCORDANCE WITH SECTION 13.2.2 OF ASCE 7 AND VERIFY THAT THE LABEL, ANCHORAGE AND MOUNTING CONFORM TO THE CERTIFICATE OF COMPLIANCE.

10. CONTRACTOR RESPONSIBILITY: CORRECT DISCREPANCIES IDENTIFIED IN THE SPECIAL INSPECTIONS AND TESTS WHERE WORK WAS NOT COMPLETED IN CONFORMANCE TO APPROVED CONSTRUCTION DOCUMENTS.

SOIL & FOUNDATIONS

1. SPECIAL INSPECTIONS AND TESTS OF EXISTING SITE SOIL CONDITIONS, FILL PLACEMENT AND LOAD-BEARING REQUIREMENTS SHALL BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING TABLES. THE APPROVED GEOTECHNICAL REPORT AND THE CONSTRUCTION DOCUMENTS PREPARED BY THE REGISTERED DESIGN PROFESSIONALS SHALL BE USED TO DETERMINE COMPLIANCE. DURING FILL PLACEMENT, THE SPECIAL INSPECTOR SHALL VERIFY THAT PROPER MATERIALS AND PROCEDURES ARE USED IN ACCORDANCE WITH THE PROVISIONS OF THE APPROVED GEOTECHNICAL REPORT.

CONCRETE

1. SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING TABLES.
   1.1. WELDING OF REINFORCING BARS: SPECIAL INSPECTIONS OF WELDING AND QUALIFICATIONS OF SPECIAL INSPECTORS FOR REINFORCING BARS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF AWS D1.4 FOR SPECIAL INSPECTION AND OF AWS D1.4 FOR SPECIAL INSPECTOR QUALIFICATION.

HOT-ROLLED STEEL & WELDING & BOLTING

1. SPECIAL INSPECTIONS AND NONDESTRUCTIVE TESTING OF STRUCTURAL STEEL ELEMENTS IN BUILDINGS, STRUCTURES AND PORTIONS THEREOF SHALL BE IN ACCORDANCE WITH THE QUALITY ASSURANCE INSPECTION REQUIREMENTS OF AISC 360.

NON-STRUCTURAL

1. PLUMBING, MECHANICAL AND ELECTRICAL COMPONENTS: PERIODIC SPECIAL INSPECTION OF PLUMBING, MECHANICAL AND ELECTRICAL COMPONENTS SHALL BE REQUIRED FOR THE FOLLOWING:

   ANCHORAGE OF ELECTRICAL EQUIPMENT FOR EMERGENCY AND STANDBY POWER SYSTEMS IN STRUCTURES.

   ANCHORAGE OF OTHER ELECTRICAL EQUIPMENT IN STRUCTURES.

   INSTALLATION AND ANCHORAGE OF PIPING SYSTEMS DESIGNED TO CARRY HAZARDOUS MATERIALS AND THEIR ASSOCIATED MECHANICAL UNITS IN STRUCTURES.

STRUCTURAL OBSERVATIONS:

STRUCTURAL OBSERVATION IS THE VISUAL OBSERVATION OF THE STRUCTURAL SYSTEM, STRUCTURAL ELEMENTS, AND THEIR CONNECTIONS FOR GENERAL CONFORMANCE TO THE CONTRACT DOCUMENTS AT SIGNIFICANT CONSTRUCTION STAGES AND AT THE COMPLETION OF THE STRUCTURAL SYSTEMS. STRUCTURAL OBSERVATION DOES NOT INCLUDE OR WAIVE THE RESPONSIBILITY FOR INSPECTIONS REQUIRED BY CHAPTER 17 OF THE 2019 CALIFORNIA BUILDING CODE OR THE CONTRACT DOCUMENTS. ALL STRUCTURAL OBSERVATIONS SHALL BE IN ACCORDANCE WITH CHAPTER 1704.6 OF THE 2019 CALIFORNIA BUILDING CODE. THE OWNER SHALL RETAIN A REGISTERED DESIGN PROFESSIONAL (LICENSED IN CALIFORNIA) OR THE ENGINEER OF RECORD TO PERFORM ALL THE STRUCTURAL OBSERVATIONS REQUIRED.

THE CONTRACTOR OR CONSTRUCTION MANAGER SHALL NOTIFY THE ENGINEER OF RECORD AND PERSONS PERFORMING THE STRUCTURAL OBSERVATION AT LEAST (5) FIVE WORKING DAYS (FOR EACH OBSERVATION) PRIOR TO THE WORK THAT IS REQUIRED TO BE OBSERVED IS COVERED. DEFICIENCIES FOUND DURING THE STRUCTURAL OBSERVATIONS SHALL BE CORRECTED BY THE CONTRACTOR. AT A MINIMUM, STRUCTURAL OBSERVATIONS SHALL BE IN ACCORDANCE WITH THE FOLLOWING TABLE:

STRUCTURAL OBSERVATION TABLE	
CONSTRUCTION SEQUENCE	**ITEMS TO OBSERVE**
SUBGRADE AND SOIL PREPARATION	STRUCTURAL FILL AND SUBGRADE
	VERIFY THE MATERIALS BELOW THE FOUNDATION HAVE BEEN INSTALLED IN CONFORMANCE WITH THE CONTRACT DOCUMENTS
FOUNDATION	REINFORCEMENT FOR BAR SIZES, SPACING, CLEARANCES, DEPTH OF REINFORCEMENT TO TOP OF FORMS, FORMWORK. OBSERVE PRIOR TO CONCRETE PLACEMENT
	PLACEMENT OF WALL DOWELS, LAPS, ANCHOR BOLTS, STEEL EMBEDS, HOLD DOWNS
CONCRETE CONSTRUCTION	REINFORCEMENT FOR AR SIZES, SPACING, CLEARANCE, OBSERVE PRIOR TO CONCRETE PLACEMENT
	PLACEMENT OF WALL DOWELS, LAPS, ANCHOR BOLTS, HOLD DOWNS, STEEL EMBEDS
STRUCTURAL STEEL	OBSERVE WORK IN PROGRESS FOR STRUCTURAL SHAPES AND SIZES, COLUMN AND FRAMING LOCATIONS, BOLTS, AND WELDING.

CONCRETE TESTING SCHEDULE:

[X] (6) 6"Ø CYLINDERS PER 100 CUBIC YARDS*
2 @ 7 DAYS, 2 @ 28 DAYS, HOLD 2 IN RESERVE. EACH MIX PLACED, EACH DAY PLACED
[X] SLUMP TEST - PER 50 CY & AT STRENGTH SAMPLE
[X] AIR TEST - PER STRENGTH SAMPLES SCHEDULE
[X] UNIT WEIGHT TEST - PER STRENGTH SAMPLES

CONCRETE					
REQUIRED SPECIAL INSPECTIONS AND TESTS					
SPECIAL INSPECTION REQUIRED	TYPE	CONT	PERIODIC	REFERENCED STANDARD	IBC REF
YES	1. INSPECT REINFORCEMENT, INCLUDING PRE-STRESSING TENDONS, AND VERIFY PLACEMENT.	--	X	ACI 318 Ch. 20, 25.2, 25.3, 26.6.1 - 26.6.3	1908.4
YES	2. REINFORCING BAR WELDING:				
YES	a. VERIFY WELDABILITY OF REINFORCING BARS OTHER THAN ASTM A706.	--	X	AWS D1.4, ACI 318 26.6.4	--
YES	b. INSPECT SINGLE-PASS FILLET WELDS, MAXIMUM 5/16".	--	X		
YES	c. INSPECT ALL OTHER WELDS.	X	--		
YES	3. INSPECT ANCHORS CAST IN CONCRETE.	--	X	ACI 318 17.8.2	--
YES	4. INSPECT ANCHORS POST-INSTALLED IN HARDENED CONCRETE MEMBERS.				
YES	a. ADHESIVE ANCHORS INSTALLED IN HORIZONTALLY OR UPWARDLY INCLINED ORIENTATIONS TO RESIST SUSTAINED TENSION LOADS.	X	--	ACI 318 17.8.2.4	--
YES	b. MECHANICAL ANCHORS AND ADHESIVE ANCHORS NOT DEFINED IN 4.a.	--	X	ACI 318 17.8.2	
YES	5. VERIFY USE OF REQUIRED DESIGN MIX.	--	X	ACI 318 Ch. 19, 26.4.3, 26.4.4	1904.1 1904.2 1908.2 1908.3
YES	6. PRIOR TO CONCRETE PLACEMENT, FABRICATE SPECIMENS FOR STRENGTH TESTS, PERFORM SLUMP AND AIR CONTENT TESTS AND DETERMINE THE TEMPERATURE OF THE CONCRETE.	X	--	ASTM C172, ASTM C31, ACI 318 26.4, 26.12	1908.10
YES	7. INSPECT CONCRETE AND SHOTCRETE PLACEMENT FOR PROPER APPLICATION TECHNIQUES.	X	--	ACI 318 26.5	1908.6, 1908.7, 1908.8
YES	8. VERIFY MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES.	--	X	ACI 318 26.5.3 - 26.5.5	1908.9
YES	9. INSPECT PRESTRESSED CONCRETE FOR:				
YES	a. APPLICATION OF PRE-STRESSING FORCES.	X	--	ACI 318 26.10	--
YES	b. GROUTING OF BONDED PRE-STRESSING TENDONS.	X	--		
YES	10. INSPECT ERECTION OF PRECAST CONCRETE MEMBERS.	--	X	ACI 318 26.8	--
YES	11. VERIFY IN-SITU CONCRETE STRENGTH, PRIOR TO STRESSING OF TENDONS IN POST-TENSIONED CONCRETE AND PRIOR TO REMOVAL OF SHORES AND FORMS FROM BEAMS AND STRUCTURAL SLABS.	--	X	ACI 318 26.11.2	--
YES	12. INSPECT FORMWORK FOR SHAPE, LOCATION AND DIMENSIONS OF THE CONCRETE MEMBER BEING FORMED,	--	X	ACI 318 26.11.1.2(b)	--

SOILS			
REQUIRED SPECIAL INSPECTIONS AND TESTS			
SPECIAL INSPECTION REQUIRED	TYPE	CONT	PERIODIC
YES	1. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY.	--	X
YES	2. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL.	--	X
YES	3. PERFORM CLASSIFICATION AND TESTING OF COMPACTED FILL MATERIALS.	--	X
YES	4. VERIFY USE OF PROPER MATERIALS, DENSITIES AND LIFT THICKNESSES DURING PLACEMENT AND COMPACTION OF COMPACTED FILL.	X	--
YES	5. PRIOR TO PLACEMENT OF COMPACTED FILL, OBSERVE SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY.	--	X

GOVERNING CODES	
GENERAL	IBC 2018/CBC 2019
CONCRETE	ACI 318-14
STEEL	ANSI/AISC 360-16
MASONRY	TMS 402 / 602-16
WELDING	AWS D1.1-16

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER
DONALD BARRETT
No. C48483
Exp. 12/31/22
CIVIL
STATE OF CALIFORNIA

DESIGNED MEJ
DRAWN NEB
CHECKED DLB

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON consulting inc

STRUCTURAL SPECIAL INSPECTION

FILE NAME 1944519.00-S-2.dwg
JOB NO. 1944519.00
DATE APRIL 2020
SHEET S-2 OF ##

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LAP SPLICE LENGTH FOR REINFORCING BARS IN WALLS, SLABS & FTNGS (INCHES)

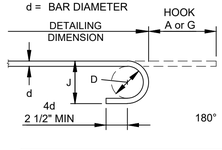
CONCRETE COMPRESSIVE STRENGTH, f'c ≥ 3,000 PSI						
BAR SIZE	COVER=1.00 IN.		COVER=1.50 IN.		COVER=2.00 IN.	
IMPERIAL [SOFT METRIC]	TOP[4]	OTHER	TOP [4]	OTHER	TOP [4]	OTHER
#3 [#10]	17	13	17	13	17	13
#4 [#13]	23	17	23	17	23	17
#5 [#16]	33	26	28	22	28	22
#6 [#19]	46	35	34	26	34	26
#7 [#22]	74	57	55	43	49	38
#8 [#25]	93	72	70	54	56	43
#9 [#29]	113	87	86	66	69	53
#10 [#32]	137	106	105	81	85	66
#11 [#36]	162	125	125	97	102	79

NOTES:
1. THE SPLICE LENGTH TABLE IS SPECIFIC TO TENSION DEVELOPMENT AND TENSION LAP SPLICE LENGTHS FOR WALLS, SLABS AND FOOTINGS DETERMINED IN ACCORDANCE WITH ACI 318-14 CHAPTER 25, ACI 350-06 CHAPTER 12, AND THE CRITERIA IN THIS DETAIL. CONTACT THE EOR FOR ANY DISCREPANCIES TO THE CRITERIA IN THIS DETAIL.
2. LAP SPLICE LENGTHS ARE CLASS B LAPS, IN INCHES, FOR GRADE 60 REINF IN NORMAL-WEIGHT CONC WITH f'c ≥ 3,000 PSI.
3. OC SPACING OF REINF SHALL BE > TWICE THE CONC COVER PLUS ONE BAR DIA.
4. TOP BARS ARE HORIZ BARS WITH > 12" OF CONC CAST BELOW BARS.
5. FOR EPOXY-COATED REINF OR LIGHTWEIGHT CONC, CONTACT THE EOR FOR LAP SPLICE LENGTHS.
6. FOR BARS OF DIFFERENT SIZES, THE LAP SPLICE LENGTHS OF THE SMALLER BAR SHALL BE USED.
7. STAGGER LAPS A DISTANCE OF ONE-HALF THE SPLICE LENGTH, UON.

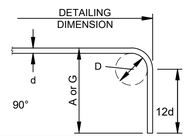
CONCRETE REBAR LAP SPLICE — S-3010
SCALE: NTS
REV 00

D = FINISHED INSIDE BEND DIAMETER (INCLUDES SPRINGBACK)

d = BAR DIAMETER



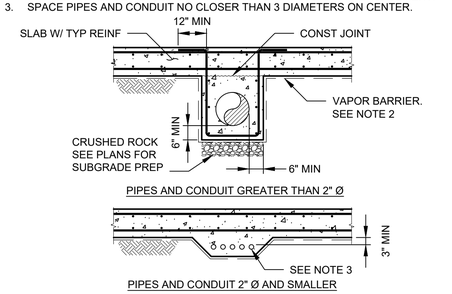
ACI 318-14 MIN BEND DIAMETER:
6d FOR #3 THROUGH #8
8d FOR #9, #10 & #11
10d FOR #14 AND #18



RECOMMENDED END HOOK DIMENSIONS				
BAR SIZE	D	180 ° HOOKS		90° HOOKS
		A or G	J	A or G
#3	0'-2 1/4"	0'-5"	0'-3"	0'-6"
#4	0'-3"	0'-6"	0'-4"	0'-8"
#5	0'-3 3/4"	0'-7"	0'-5"	0'-10"
#6	0'-4 1/2"	0'-8"	0'-6"	1'-0"
#7	0'-5 1/4"	0'-10"	0'-7"	1'-2"
#8	0'-6"	0'-11"	0'-8"	1'-4"
#9	0'-9 1/2"	1'-3"	0'-11 3/4"	1'-7"
#10	0'-10 3/4"	1'-5"	1'-1 1/4"	1'-10"
#11	1'-0"	1'-7"	1'-2 3/4"	2'-0"

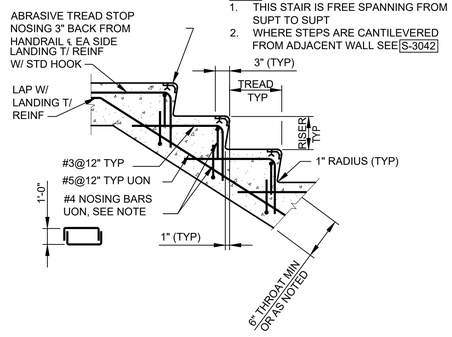
REINFORCING HOOKS — S-3020
SCALE: NTS
REV 00

NOTES:
1. ENCASEMENT REINFORCING SHALL BE #4@12" UON. PROVIDE A MINIMUM 3 INCHES CLEAR COVER.
2. WHERE VAPOR BARRIER IS SHOWN IN PLANS OR SECTIONS THE VAPOR BARRIER SHALL BE PLACED CONTINUOUSLY UNDER SLAB AND ENCASEMENT.
3. SPACE PIPES AND CONDUIT NO CLOSER THAN 3 DIAMETERS ON CENTER.



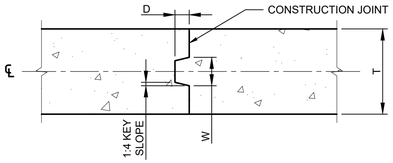
PIPE AND CONDUIT ENCASEMENT — S-3030
SCALE: 3/8" = 1'-0"
REV 00

NOTE:
1. THIS STAIR IS FREE SPANNING FROM SUPT TO SUPT
2. WHERE STEPS ARE CANTILEVERED FROM ADJACENT WALL SEE S-3042



CONCRETE STAIR — S-3040
SCALE: 3/4" = 1'-0"
REV 00

NOTES:
1. KEYS REQUIRED AT ALL CONCRETE CONSTRUCTION JOINTS (UON).
2. CLEAN AND LIGHTLY ROUGHEN FORMED SURFACE WITH WATER OR LIGHT ABRASIVE BLAST PRIOR TO PLACEMENT OF NEW CONCRETE.
3. SEE PLANS FOR REINFORCING NOT SHOWN.



THICKNESS OF SLAB OR WALL "T"	NOMINAL KEY SIZE D x W (SAWN LUMBER)
9" AND UNDER	2x3
10" TO 12"	2x4
13" TO 18"	2x6
19" TO 24"	2x8
MORE THAN 24"	2x12

CONSTRUCTION JOINT — S-3110
KEYWAY
SCALE: 3/4" = 1'-0"
REV 00

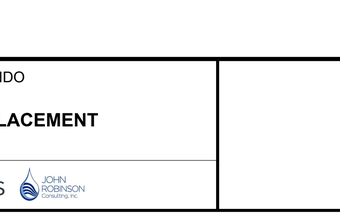
PVC WATERSTOP — S-3111
SCALE: NTS
REV 00

WATERSTOP FABRICATED JOINTS — S-3112
SCALE: NTS
REV 00

NOTES:
1. LOCATE WATERSTOP WITH WIRE TIES OR LONGIT KEY BLOCKING BETWEEN TWO CURTAINS OF REINFORCING.
2. AT INTERSECTIONS OF CONST JOINTS, CONNECT WATERSTOP WITH FACTORY MITERED ELLS AND TEES TO FORM CONTINUOUS WATER BARRIER.
3. REFER TO SPECS FOR INSTALLATION & DETAILED PRODUCT REQ'S.
4. EXTEND BAR HOOKED ENDS TO BOTTOM OF SLAB.

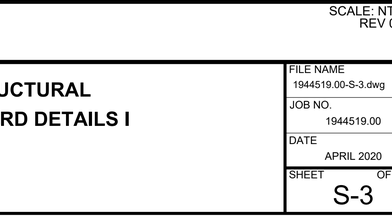
WALL-TO-SLAB JOINT — S-3122
WITH WATERSTOP
SCALE: 1" = 1'-0"
REV 00

NOTES:
1. ALL FLOOR AND WALL JOINTS OF HYDRAULIC STRUCTURES SHALL HAVE A SEALANT GROOVE.
2. WHERE FACE OF JOINT IS TO BE COATED W/ BOND BREAKER, AVOID COATING SEALANT GROOVE.



TYPICAL SEALANT GROOVE — S-3130
SCALE: NTS
REV 00

NOTES:
1. PRIOR TO FILLING, ALL STRUCTURES TO CONTAIN WATER SHALL HAVE ALL CRACKS REPAIRED AS SHOWN IN THIS DETAIL.



CRACK REPAIR — S-3131
SCALE: NTS
REV 00

WALL CONSTRUCTION JOINT — S-3132
SCALE: NTS
REV 00

ROOF SUSPENDED SLAB CONSTRUCTION JOINT — S-3142
SCALE: NTS
REV 00

FLOOR SLAB CONSTRUCTION JOINT — S-3151
SCALE: NTS
REV 00

PLAN

SECTION

REINFORCEMENT IN FLOOR SLAB VALLEY AT CORNERS — S-3151
SCALE: NTS
REV 00

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER — DONALD BARRETT — No. C48483 Exp. 12/31/22 — CIVIL — STATE OF CALIFORNIA

DESIGNED	MEJ
DRAWN	NEB
CHECKED	DLB

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

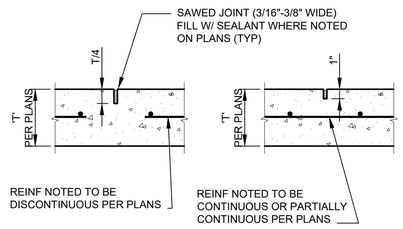
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STRUCTURAL
STANDARD DETAILS I

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JOB NO.	1944519.00
DATE	APRIL 2020
SHEET	S-3 ##

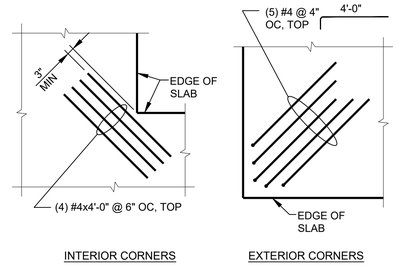
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NOTES:
1. JOINT FORMED WITH TOOL OR INSERT STRIP MAY BE SUBSTITUTED FOR SAWED TYPE WITH PRIOR ACCEPTANCE BY THE ENGINEER.
2. SAWED JOINT MUST BE CONSTRUCTED WITHIN 12 HOURS OF CONCRETE PLACEMENT.
3. THIS DETAIL DOES NOT APPLY TO SUSPENDED SLABS OR LIQUID CONTAINING BASINS UNLESS SPECIFICALLY NOTED.



CONTROL JOINT — S-3170

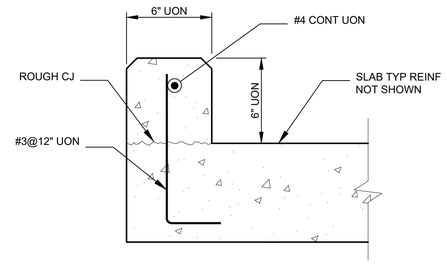
SCALE: 1-1/2" = 1'-0"
REV 00



ADDITIONAL REINF AT SLAB CORNERS — S-3180

SCALE: 1" = 1'-0"
REV 00

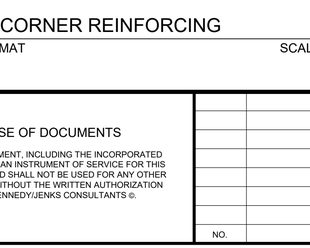
NOTES:
1. SEE PLANS FOR CURB LOCATION AND DIMENSIONS.



CURB — S-3320

SCALE: 1-1/2" = 1'-0"
REV 00

NOTES:
1. VERTICAL REINFORCING NOT SHOWN.
2. THESE DETAILS SHALL BE APPLICABLE TO ALL WALL CORNERS UNLESS NOTED OTHERWISE ON THE PLANS.
3. ALL SPLICES ARE IN THE VERTICAL PLANE.



PLAN AT CORNER

PLAN AT INTERSECTION

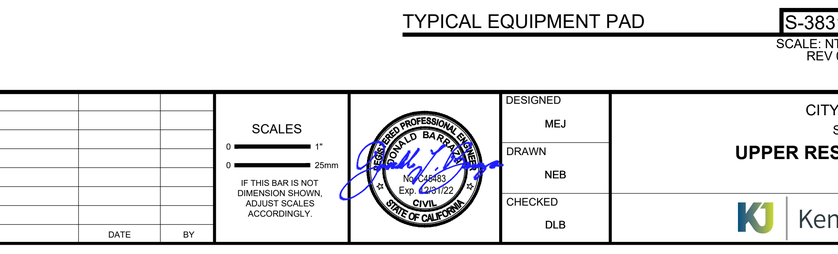
A = VERTICAL CONSTRUCTION JOINT NEAREST TO WALL CORNER. WITH WATERSTOP AT CONTAINMENT STRUCTURES.
A^x = DISTANCE FROM INSIDE CORNER FACE TO NEAREST VERTICAL CONSTRUCTION JOINT IN SIMILARLY NUMBERED WALL. "A" SHALL NOT BE LESS THAN DIMENSIONS INDICATED BY THESE DETAILS; NOR GREATER THAN INDICATED ON PLAN DRAWINGS; BUT IN ANY CASE THE SUM OF TWO ADJACENT "A" DIMENSIONS SHALL NOT EXCEED 30 FEET.
B = STANDARD LAP SPLICE LENGTH. USE SPLICE LENGTH FOR THE SMALLER OF THE TWO BARS BEING SPLICED.
C = STANDARD HOOK
D = TYPICAL CORNER REINFORCEMENT. SIZE SHALL MATCH LARGEST ADJACENT WALL HORIZONTAL REINFORCEMENT; SPACING SHALL MATCH MINIMUM ADJACENT WALL HORIZONTAL REINFORCEMENT SPACING.

WALL CORNER REINFORCING — S-3412

DOUBLE MAT

SCALE: 3/8" = 1'-0"
REV 00

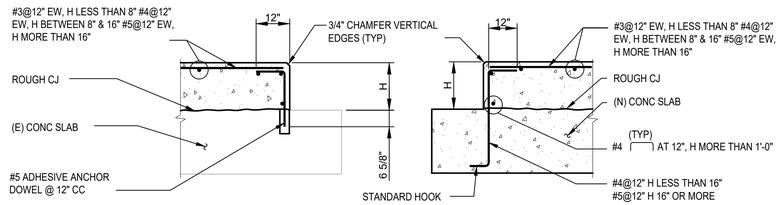
NOTES:
1. PROVIDE ADDITIONAL VERTICAL REINF EQUAL IN LENGTH TO THE UNINTERRUPTED BARS.
2. EXTEND ADDITIONAL HORIZONTAL REINF 5'-0" MIN BEYOND EITHER SIDE OF OPENING (HOOK BARS IF 5'-0" NOT AVAILABLE).
3. THIS DETAIL APPLIES TO ALL WALLS AND SLABS USED FOR RETAINING LIQUIDS AND SOIL.



ADDIT REINF AT OPENINGS — S-3421

PRESSURE WALLS AND SLABS

SCALE: 1" = 1'-0"
REV 00



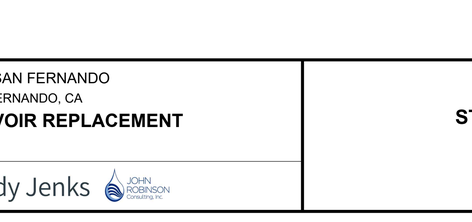
ON EXISTING CONCRETE SLAB

ON NEW CONCRETE SLAB

NOTES:
1. PLACE ALL EQUIPMENT ON CONCRETE BASES.
2. SEPARATE ALL STEEL SURFACES BEARING ON CONC BY A GROUT LAYER.
3. FOR INSTALLATION AT EXISTING SLABS, THE CONTRACTOR SHALL LOCATE AND AVOID DRILLING THRU EXISTING REINFORCING STEEL.

TYPICAL EQUIPMENT PAD — S-3831

SCALE: NTS
REV 00

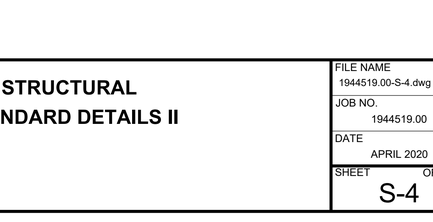


SUPPORT MATERIAL SCHEDULE		
GRATING	FRAME ANGLE	ANCHOR STRAPS
GALV STEEL	GALV STEEL	STEEL
STAINLESS	STAINLESS	STEEL
ALUMINUM	STAINLESS	STEEL

FLOOR PLATE SUPPORT — S-3550

EMBEDDED ANGLE

SCALE: 3" = 1'-0"
REV 00



SUPPORT MATERIAL SCHEDULE		
GRATING	FRAME ANGLE	ANCHOR STRAPS
GALV STEEL	GALV STEEL	STEEL
STAINLESS	STAINLESS	STEEL
ALUMINUM	STAINLESS	STEEL
FIBERGLASS	STAINLESS	STEEL

GRATING SUPPORT — S-3560

EMBEDDED ANGLE

SCALE: 3" = 1'-0"
REV 00

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER — RONALD BARRETT — No. C48183 Exp. 12/31/22 — CIVIL — STATE OF CALIFORNIA

DESIGNED MEJ
DRAWN NEB
CHECKED DLB

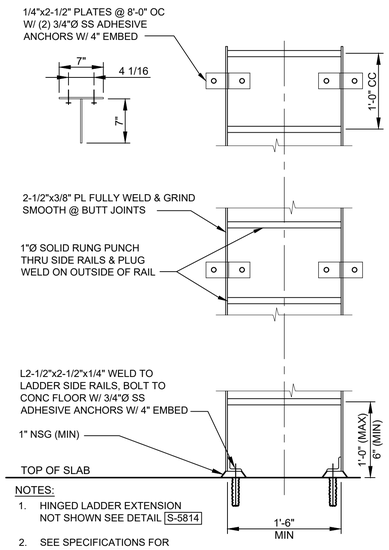
CITY OF SAN FERNANDO
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STRUCTURAL
STANDARD DETAILS II

FILE NAME 1944519.00-S-4.dwg
JOB NO. 1944519.00
DATE APRIL 2020
SHEET S-4 OF ##

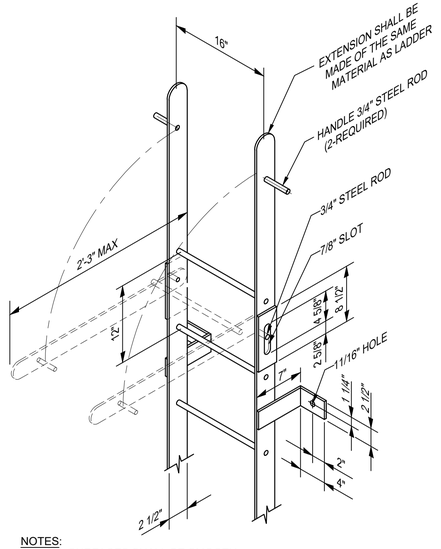
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NOTES:
1. HINGED LADDER EXTENSION NOT SHOWN SEE DETAIL S-5814
2. SEE SPECIFICATIONS FOR OTHER REQUIREMENTS

MAN LADDER S-5813

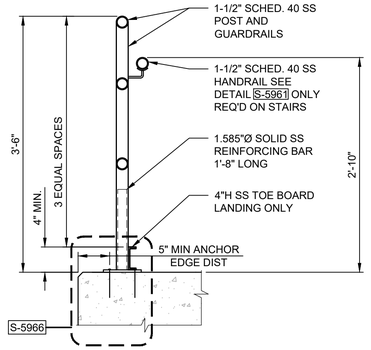
SCALE: 1" = 1'-0"
REV 00



NOTES:
1. ALL SURFACES SHALL BE SMOOTH
2. ALL JOINTS SHALL BE WELDED PER XXXXXX WITH LATEST REVISION.
3. AFTER FABRICATION GRIND AS REQUIRED AND CLEAN

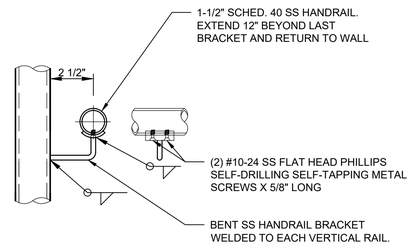
HINGED LADDER EXTENSION S-5814

SCALE: NTS
REV 00



SS GUARDRAIL AT CONC BASE MOUNT S-5960

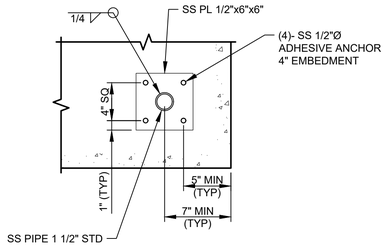
SCALE: NTS
REV 00



NOTES:
1. PROVIDE BITUMINOUS COATING BETWEEN SS AND DISSIMILAR MATERIALS.
2. ALL STAINLESS STEEL SHALL BE SS316.

HANDRAIL MOUNTING DETAIL S-5961

SCALE: NTS
REV 00



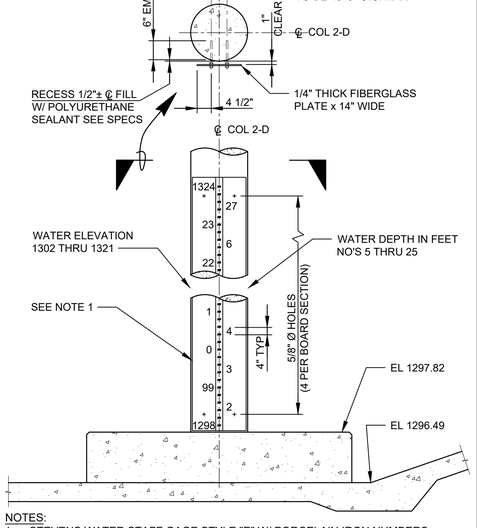
PLAN VIEW

NOTES:
1. SEE PLANS FOR POST LAYOUT. POST SPACING SHALL NOT EXCEED 5'-0" ON CENTER.
2. CONCRETE THICKNESS = 7" MIN.

SS GUARDRAIL POST ANCHORAGE S-5966

TOP-MOUNT

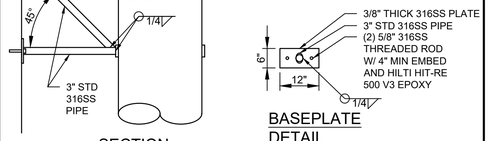
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REV 00

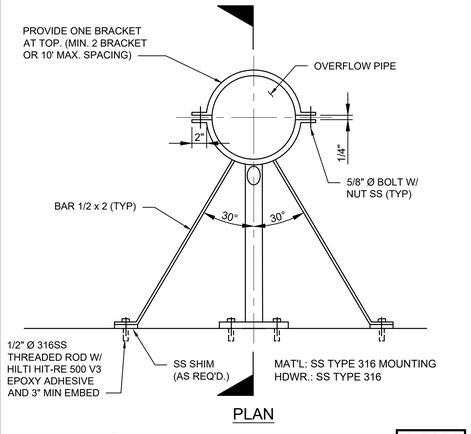


NOTES:
1. STEVENS WATER STAFF GAGE STYLE "E" W/ PORCELAIN IRON NUMBERS. PROVIDE FULL NUMBERS OR ELEVATIONS AT TOP & BOTTOM OF GAGE BOARDS AS SHOWN, AND AT 5'-0" INTERVALS FROM TOP DOWN. PLACE SINGLE NUMBERS AT EACH FOOT MARK. ATTACHMENTS TO GAGE BOARDS SHALL BE MADE WITH ROUND HEAD SS SHEET SCREWS WITH FELT WASHERS, TYPICAL.

WATER LEVEL STAFF GAGE DETAIL S-5970

SCALE: NTS
REV 00





PIPE BRACKET S-5990

SCALE: NTS
REV 00

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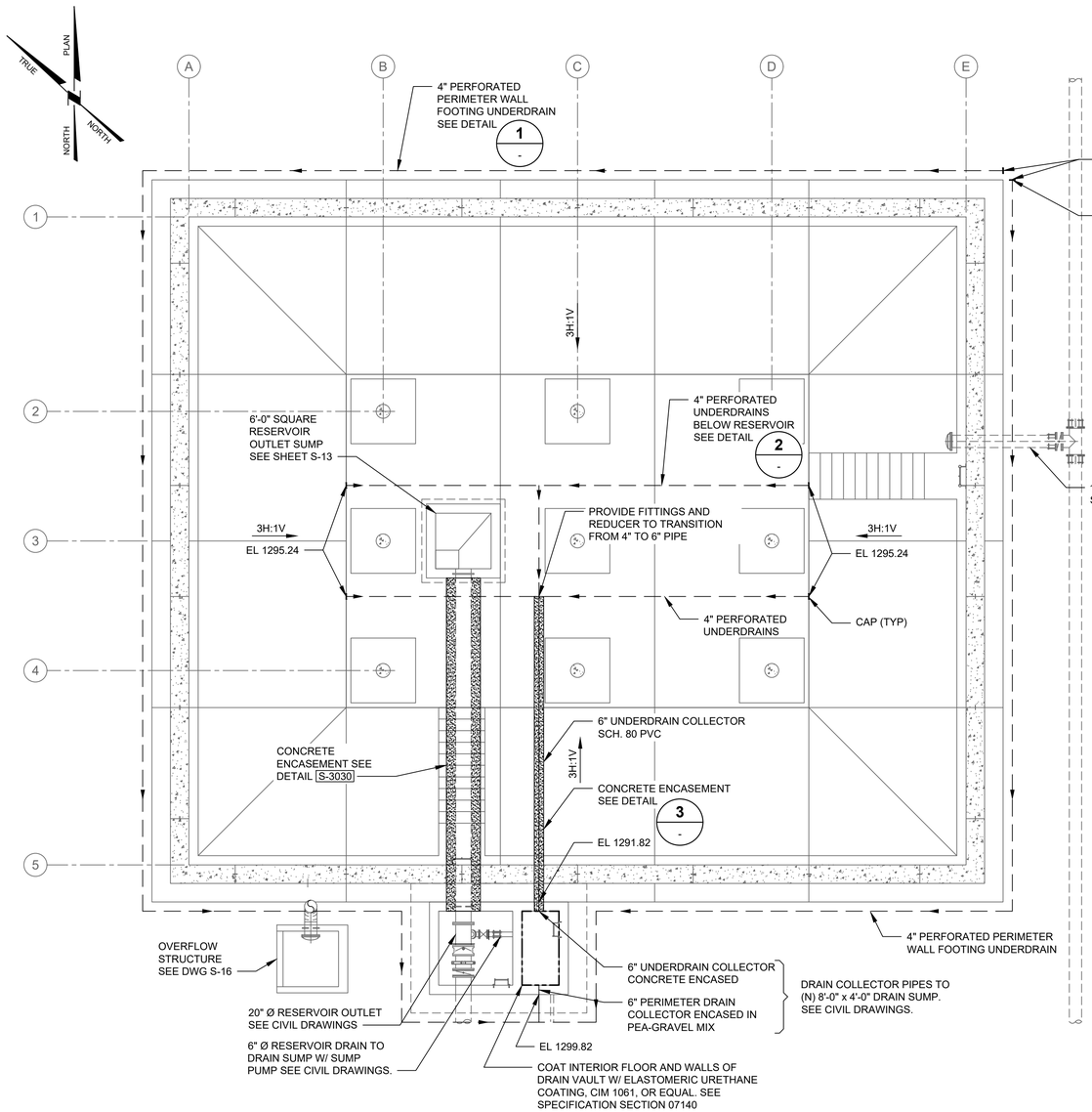
CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

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STRUCTURAL
STANDARD DETAILS III

FILE NAME 1944519.00-S-5.dwg
JOB NO. 1944519.00
DATE APRIL 2020
SHEET S-5 OF ##

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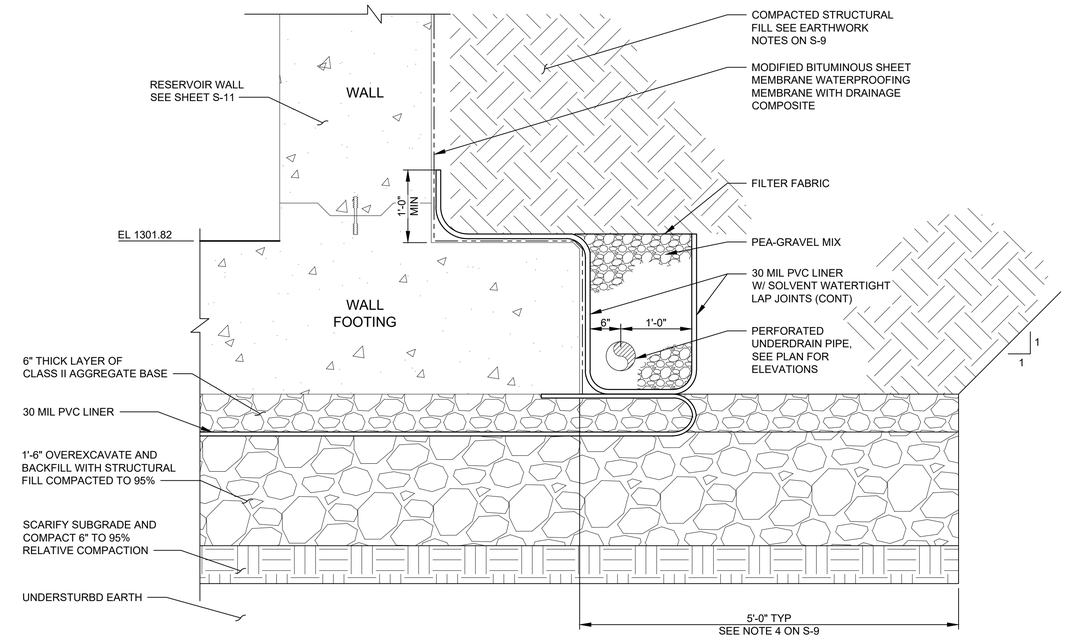
UNDERDRAIN PLAN

0 5 10

1/8"=1'-0"

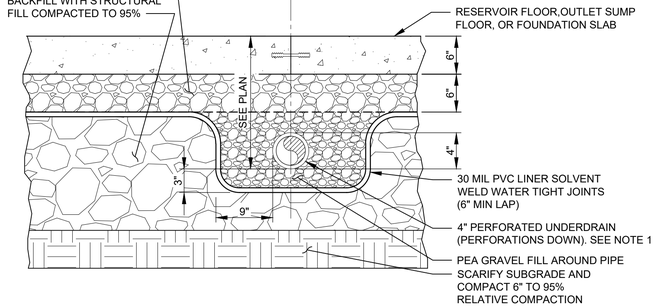
LEGEND

- SDR-35 OR SCH 40 PVC PIPE
- PERFORATED UNDERDRAIN PIPE (SEE NOTE 1)
- ENCASEMENT FOR PIPE (SEE NOTE 2)



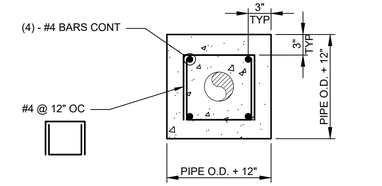
PERIMETER UNDERDRAIN

SCALE: NTS



UNDERDRAIN BELOW RESERVOIR

SCALE: NTS



PROVIDE ENCASEMENT WHERE INDICATED ON UNDERDRAIN PLAN

UNDERDRAIN ENCASEMENT

SCALE: NTS

NOTES

1. PERFORATED UNDERDRAIN PIPE AND FITTING MATERIAL SHALL MEET THE REQUIREMENTS OF ASTM D1784 FOR CLASS 12454-B OR 12454-C AS DEFINED THEREIN AND CONFORM TO THE REQUIREMENTS OF ASTM D3032, CLASS SDR 35 OR AASHTO M278. UNDERDRAIN PIPE SHALL HAVE TWO ROWS OF 1/2-INCH DIAMETER HOLES WITH HOLE SPACING 5-INCH CENTER TO CENTER. ROWS SHALL BE 120 DEGREES APART WITH PERFORATIONS ORIENTED DOWN. SEE NOTE 9 ON S-9.
2. 6" CONCRETE ENCASEMENT SHALL BE PROVIDED FOR EACH RUN OF PIPE (UNPERFORATED) PER DETAIL 3 ON THIS DRAWING AND TO THE EXTENTS SHOWN ON THE PLAN. THE CONTRACTOR CAN ENCASE MULTIPLE PIPES IN ONE ENCASEMENT WHERE FEASIBLE.

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CITY OF SAN FERNANDO

SAN FERNANDO, CA

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STRUCTURAL

RESERVOIR UNDERDRAIN PLAN AND DETAILS

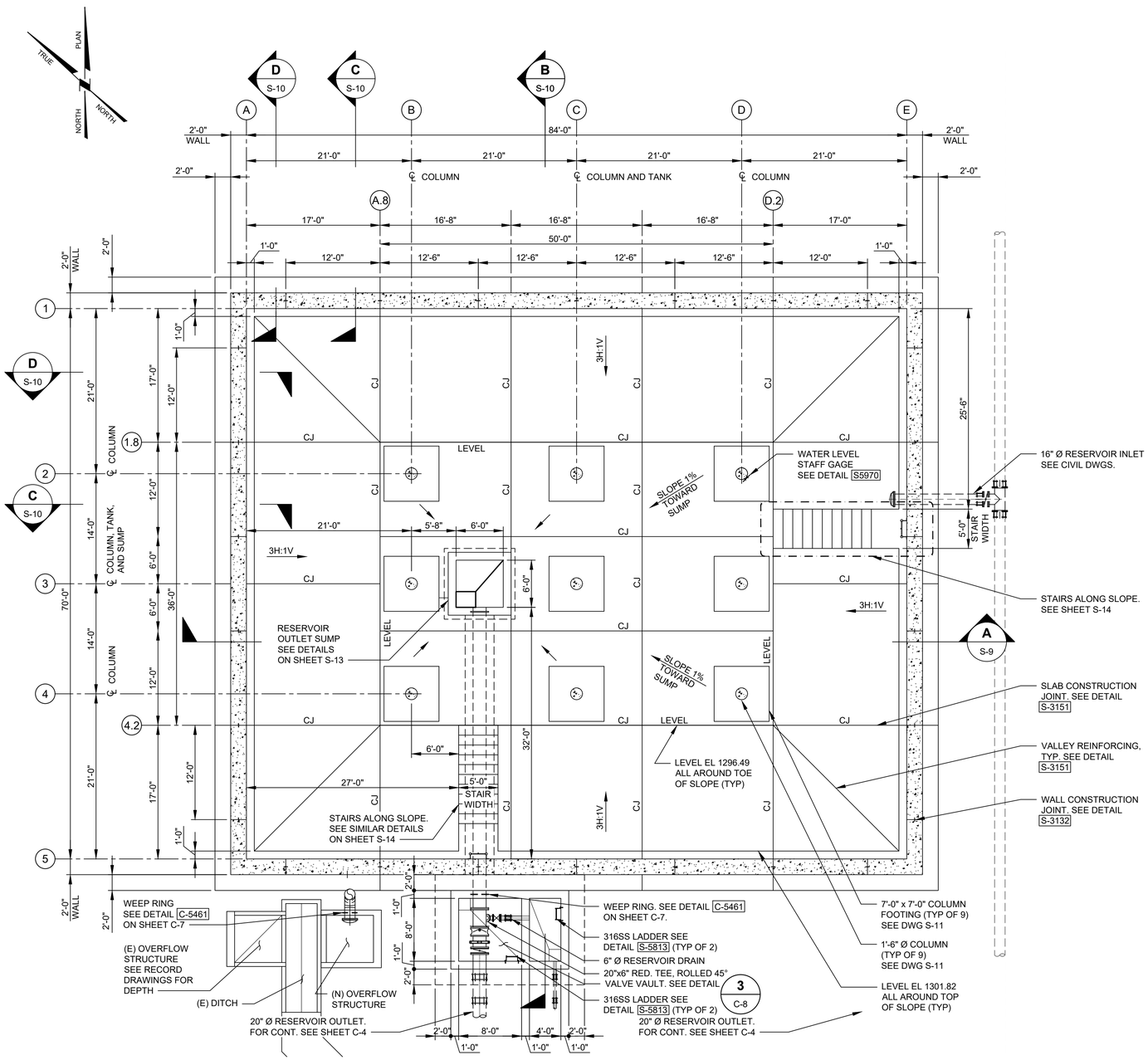
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JOB NO. 1944519.00

DATE APRIL 2020

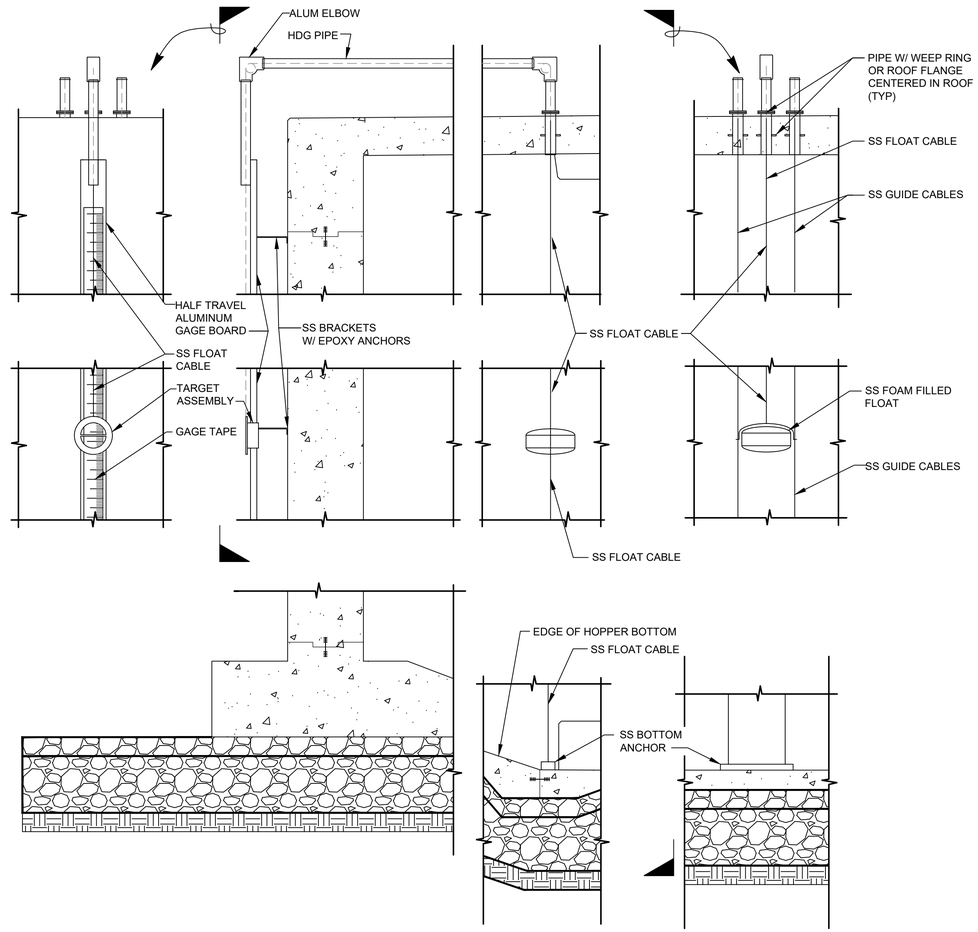
SHEET S-6 OF ##

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FOUNDATION PLAN

0 5 10
1/8"=1'-0"



LEVEL INDICATOR DETAIL

4 S-8

0 1 2 3
1/2"=1'-0"

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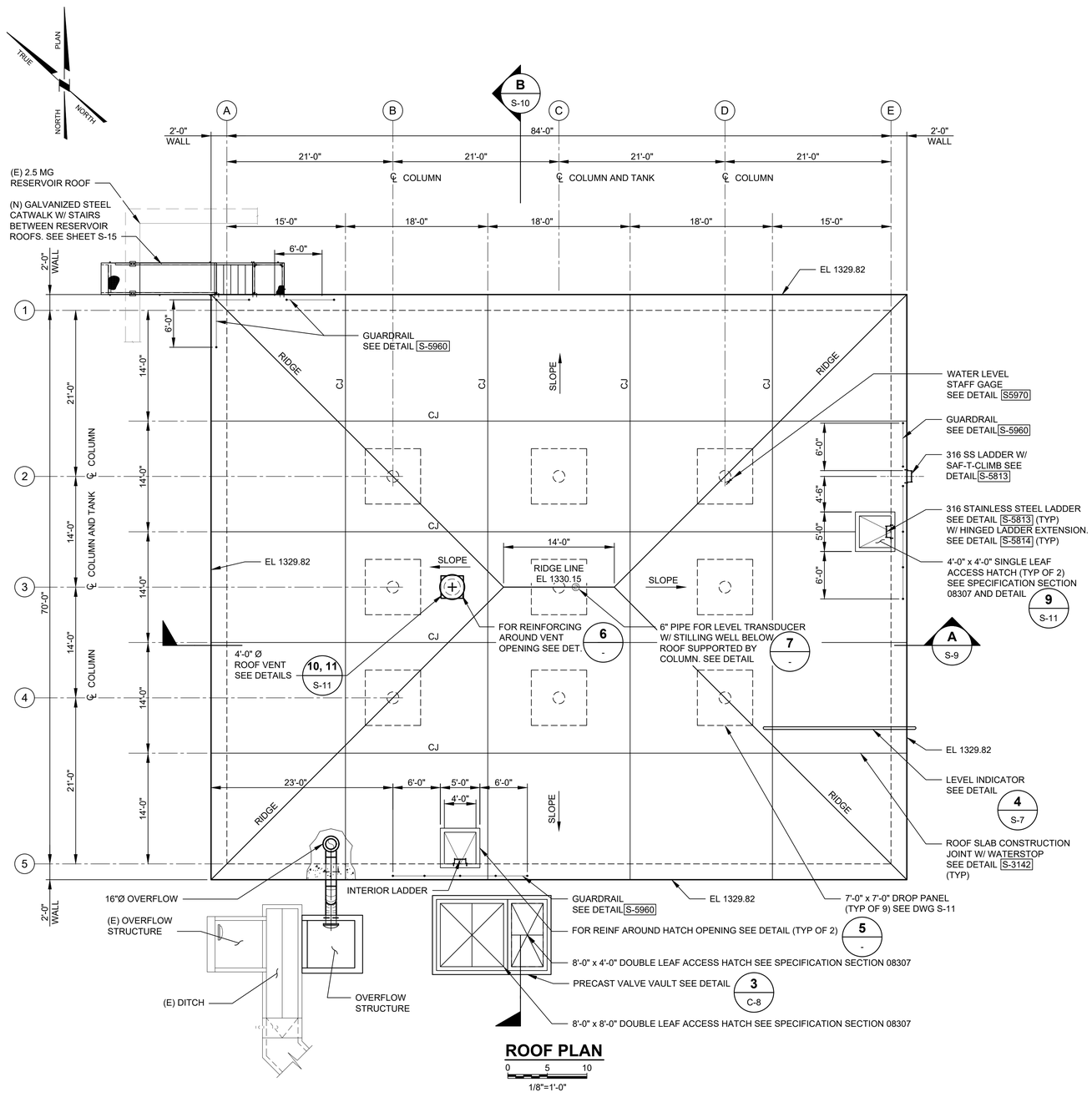
CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

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STRUCTURAL
RESERVOIR FOUNDATION PLAN AND COLUMN DETAIL

FILE NAME 1944519.00-S-7.dwg
JOB NO. 1944519.00
DATE APRIL 2020
SHEET S-7 OF ##

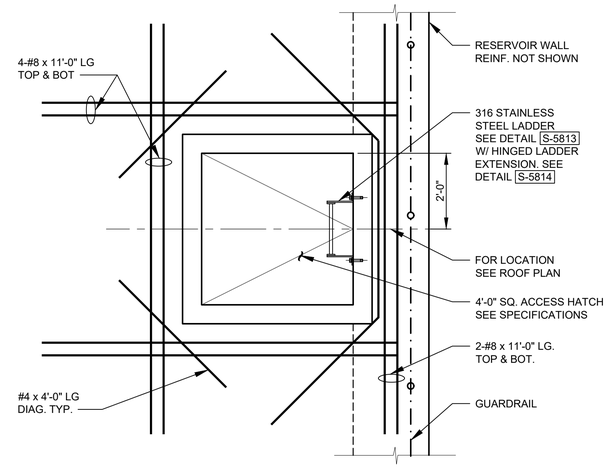
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ROOF PLAN

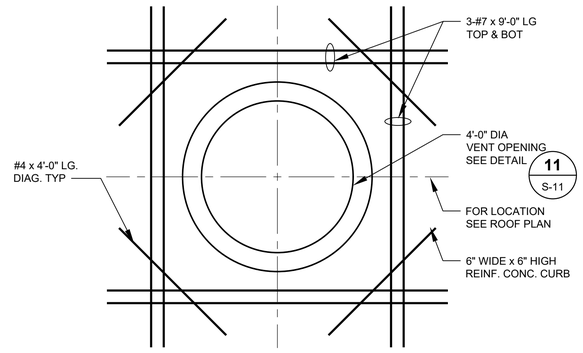
0 5 10

1/8"=1'-0"



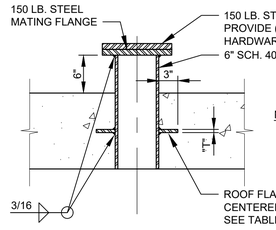
REINFORCING AROUND HATCH OPENING 5 -

SCALE: 1/2" = 1'-0"



REINFORCING AROUND VENT OPENING 6 -

SCALE: 1/2" = 1'-0"



ROOF FLANGE PLATE THICKNESS "T"	
PIPE SIZE	STEEL PLATE
30" & UNDER	1/4"
31" TO 60"	5/16"

DETAIL 7 -

SCALE: NTS

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CITY OF SAN FERNANDO
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STRUCTURAL
RESERVOIR ROOF PLAN AND PIPE PENETRATION AND MANWAY HATCH DETAILS

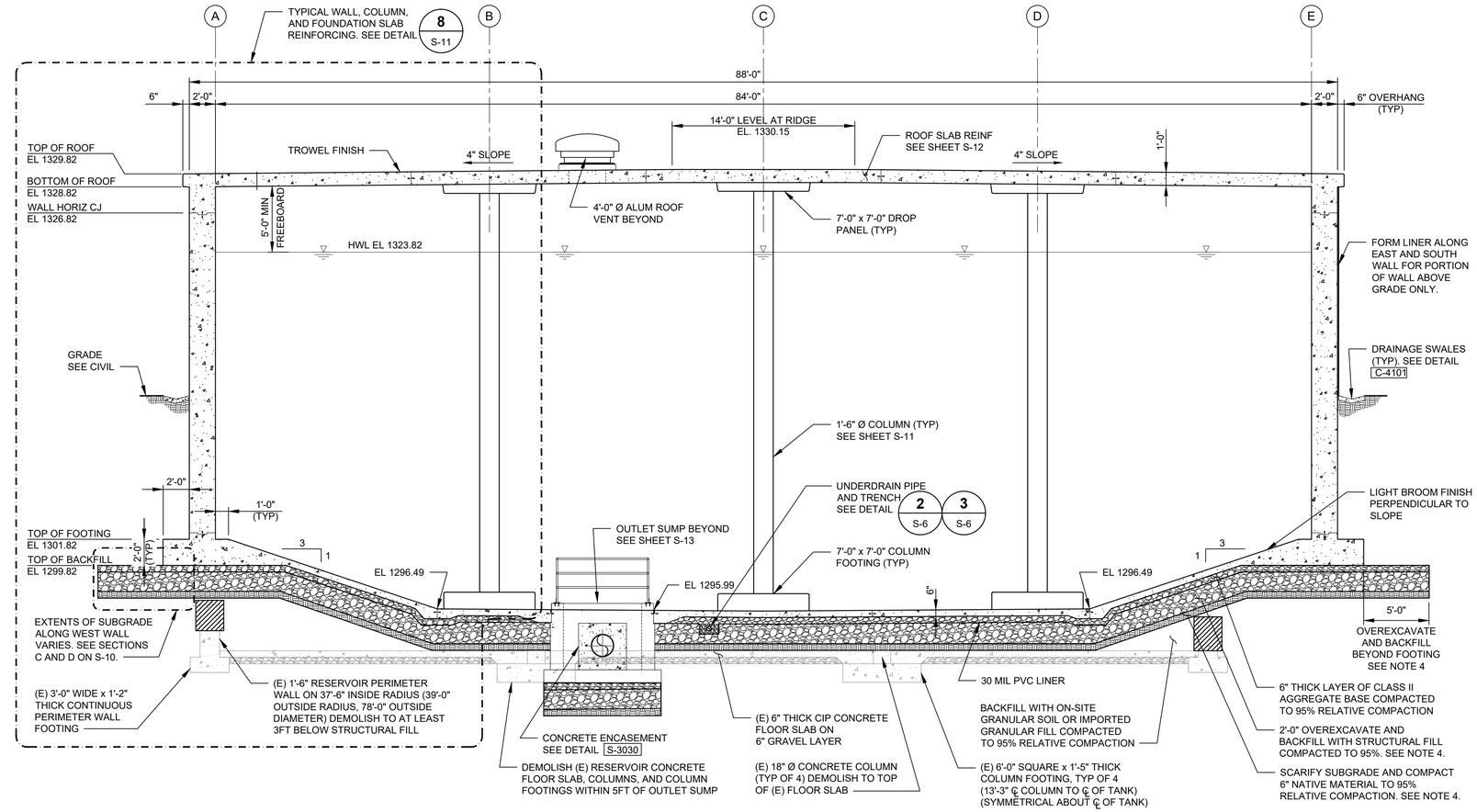
FILE NAME 1944519.00-S-8.dwg

JOB NO. 1944519.00

DATE APRIL 2020

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NOTES
1. CATWALK AND GUARDRAIL NOT SHOWN. SEE SHEET S-15.

RESERVOIR SECTION A

0 4 8
3/16"=1'-0"

S-7

HYDROSTATIC TESTING

ROOF CONSTRUCTION SHALL BE COMPLETED PRIOR TO HYDROSTATIC TESTING OF THE STRUCTURE AND SHALL NOT COMMENCE BEFORE A MINIMUM OF 28 DAYS AFTER THE LAST ROOF CONCRETE PLACEMENT. HYDROSTATIC TESTING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 03340. STRUCTURAL BACKFILL OF WALLS BELOW GRADE WALLS SHALL NOT COMMENCE UNTIL THE QUALITATIVE AND QUANTITATIVE RESERVOIR HYDROSTATIC TESTS HAVE BEEN SUCCESSFULLY COMPLETED AND REPAIRS HAVE BEEN COMPLETED AND ARE FAVORABLY REVIEWED BY THE ENGINEER.

EARTHWORK NOTES:

1. **GROUNDWATER:** GROUNDWATER LEVELS FLUCTUATE WITH THE SEASONS AND LOCAL ZONES OF PERCHED GROUNDWATER MAY BE PRESENT WITHIN THE NEAR-SURFACE DEPOSITS DUE TO LOCAL CONDITIONS OR DURING RAINY SEASONS.
2. **SUBSURFACE CONDITIONS:** REFER TO ALL THE PREVIOUS BORING LOGS FOR SUBSURFACE CONDITIONS. SOME VARIATIONS IN THE CONTINUITY AND NATURE OF SUBSURFACE CONDITIONS WITHIN THE PROJECT SITE SHOULD BE ANTICIPATED.
3. **FILL:** THE THICKNESS OF COMPACTED FILL PLACED UNDERNEATH THE SHALLOW FOOTINGS SHALL BE KEPT UNIFORM. ROCKS LARGER THAN TWO (2.0) INCHES IN THE LARGEST DIMENSION SHALL NOT BE PLACED AS FILL. ON-SITE FINE-GRAINED SOILS (CLAYS AND SILTS) SHALL NOT BE RE-USED AS FILL. SOILS CONTAINING ORGANIC MATERIALS (ROOTS, GRASS, PLANTS, ETC.) SHALL NOT BE USED AS FILL.
4. **OVEREXCAVATION AND RECOMPACTION FOR RESERVOIR FOOTINGS AND FLOOR SLAB:** REMOVE ALL LOOSE SOILS, FILLS AND SOILS DISTURBED DURING DEMOLITION TO FIRM AND UNYIELDING COMPACTED FILL SOILS OR TO ACCEPTABLE NATIVE MATERIALS. THE MINIMUM DEPTH OF OVER-EXCAVATION SHALL BE AT LEAST 5 FEET BELOW THE GROUND SURFACE, OR 2 FEET BELOW BOTTOM OF PROPOSED SHALLOW FOUNDATIONS, WHICHEVER IS DEEPER. OVER-EXCAVATION SHALL EXTEND AT LEAST 5 FEET LATERALLY BEYOND THE LIMITS OF FOOTINGS OR AS LIMITED BY THE EXISTING STRUCTURES AND IMPROVEMENTS TO REMAIN IN PLACE. SCARIFY THE EXPOSED BOTTOM OF THE OVER-EXCAVATION AREA AT LEAST 6.0 INCHES, MOISTURE CONDITION AS NEEDED TO NEAR-OPTIMUM MOISTURE CONTENT AND COMPACT TO NINETY FIVE PERCENT (95%) RELATIVE COMPACTION.
5. **OVEREXCAVATION AND RECOMPACTION FOR RETAINING WALLS:** OVER-EXCAVATE AND RE-COMPACT TWO (2) FEET BELOW BOTTOM OF FOOTINGS AND EXTEND TWO (2) FEET LATERALLY BEYOND THE RETAINING WALL AREA. SCARIFY THE EXPOSED BOTTOM OF THE OVER-EXCAVATION AREA AT LEAST 6.0 INCHES, MOISTURE CONDITION AS NEEDED TO NEAR-OPTIMUM MOISTURE CONTENT AND COMPACT TO NINETY FIVE PERCENT (95%) RELATIVE COMPACTION.
6. **OVEREXCAVATION AND RECOMPACTION FOR SIDEWALKS AND PARKING AREAS:** REMOVE AND RECOMPACT THE UPPER 24-INCHES OF SITE SOILS. EXTEND THE OVER-EXCAVATION TWO (2) FEET LATERALLY BEYOND THE SIDEWALK AND SURFACE PARKING AREAS. COMPACT THE UPPER 12- INCHES OF SUBGRADE BELOW NEW PAVEMENT TO 95 PERCENT RELATIVE COMPACTION.
7. **PROTECTION OF ADJACENT IMPROVEMENTS (UTILITIES AND STRUCTURES):** OVEREXCAVATION SHALL NOT UNDERMINE ADJACENT IMPROVEMENTS. REMEDIAL GRADING SHALL NOT EXTEND WITHIN A PROJECTED 1:1 (HORIZONTAL TO VERTICAL) PLANE PROJECTED DOWN FROM THE OUTER EDGE OF ADJACENT IMPROVEMENTS. EXCAVATION SHALL NOT DISTURB ADJACENT UTILITIES OR UNDERMINE ANY ADJACENT STRUCTURES TO REMAIN. EXISTING UTILITIES SHALL BE REMOVED AND ADEQUATELY CAPPED AT THE PROJECT BOUNDARY LINE OR SALVAGED/REROUTED AS DESIGNED.
8. **UNSUITABLE BEARING MATERIALS ON EXCAVATION BOTTOMS:** IF LOOSE, YIELDING SOIL CONDITIONS ARE ENCOUNTERED AT EXCAVATION BOTTOMS, NOTIFY THE OWNER AND DEPENDING ON INPUT FROM THE GEOTECHNICAL ENGINEER OVER-EXCAVATE AND PREPARE AS NOTED BELOW:
   a. OVER-EXCAVATE UNTIL A FIRM BOTTOM IS REACHED.
   b. SCARIFY OR OVER-EXCAVATE AN ADDITIONAL 18 INCHES DEEP, AND THEN PLACE AT LEAST 18-INCH-THICK LAYER OF COMPACTED BASE MATERIAL (CAB OR EQUIVALENT) TO BRIDGE THE SOFT BOTTOM. BASE MATERIALS SHALL BE COMPACTED TO 95% RELATIVE COMPACTION.
   c. OVER-EXCAVATE AN ADDITIONAL 18 INCHES DEEP, AND THEN PLACE A LAYER OF GEOTEXTILE REINFORCEMENT (MIRAFI HP570, OR EQUIVALENT), THEN PLACE AN 18-INCH-THICK LAYER OF COMPACTED BASE MATERIAL (CAB OR EQUIVALENT) TO BRIDGE THE SOFT BOTTOM. BASE MATERIAL SHALL BE COMPACTED TO 95% RELATIVE COMPACTION. AN ADDITIONAL LAYER OF GEOTEXTILE REINFORCEMENT MAY BE NEEDED ON TOP OF BASE MATERIAL DEPENDING ON THE ACTUAL SITE CONDITIONS.
9. **FOUNDATION BOTTOM SUBDRAINS, UNDERDRAINS, WALL DRAINS:** CONSTRUCT SUBDRAIN SYSTEMS OF A MINIMUM 4-INCH DIAMETER, RIGID ABS (SDR-35) OR SCHEDULE 40 PVC PIPE WITH GLUED MANUFACTURED PIPE FITTING AND CAPS. SLOPE THE DRAINPIPE AT A MINIMUM 2% GRADIENT TO PROVIDE GRAVITY FLOW. PERFORATED PIPES SHALL BE LAID WITH PERFORATIONS DOWN. DO NOT CONNECT SURFACE DRAIN SYSTEMS TO THE SUBDRAIN SYSTEM.
10. **SUBGRADE PREPARATION BENEATH RESERVOIR FLOOR SLAB:** FINAL SUBGRADE SOILS FOR RESERVOIR FLOOR SLAB SHALL BE UNIFORM AND NON-YIELDING. TO OBTAIN A UNIFORM SUBGRADE, SOILS SHALL BE WELL MIXED AND UNIFORMLY COMPACTED. THE SUBGRADE SOILS SHALL BE NON-EXPANSIVE AND WELL-DRAINED. THE NEAR-SURFACE SITE SOILS SHALL BE FREE DRAINING. AT LEAST THE UPPER 4.0 INCHES OF SUBGRADE SOILS UNDERNEATH THE RESERVOIR SHALL BE COMPRISED OF WELL-DRAINED GRANULAR SOILS SUCH AS SANDS, GRAVEL OR CRUSHED AGGREGATE SATISFYING THE FOLLOWING CRITERIA:
    a. MAXIMUM SIZE ≤ 1.5 INCHES
    b. PERCENT PASSING U.S. #200 SIEVE ≤ TWELVE PERCENT (12%)
    c. SAND EQUIVALENT ≥ 30
    d. MOISTURE CONDITION THE SUBGRADE SOILS BEFORE PLACING CONCRETE.
11. **SITE DRAINAGE:** PROVIDE POSITIVE DRAINAGE AWAY FROM THE RESERVOIR STRUCTURE TO PREVENT PONDING AND TO REDUCE PERCOLATION OF WATER INTO STRUCTURAL BACKFILL. ANY LANDSCAPE AREAS IMMEDIATELY ADJACENT TO THE RESERVOIR FOUNDATIONS SHALL SLOPE AWAY WITH A MINIMUM FIVE PERCENT (5%) SLOPE GRADIENT FOR AT LEAST 10 FEET MEASURED PERPENDICULAR TO THE FACE OF THE STRUCTURE WALLS. IMPERVIOUS SURFACES WITHIN 10 FEET OF THE FOUNDATIONS SHALL HAVE A MINIMUM TWO PERCENT (2%) SLOPE AWAY FROM THE STRUCTURE. PLANTERS AND LANDSCAPED AREAS ADJACENT TO THE STRUCTURE PERIMETER SHALL MINIMIZE WATER INFILTRATION INTO THE SUBGRADE SOILS. GUTTERS AND DOWNSPOUTS SHALL BE INSTALLED ON THE ROOF, AND RUNOFF SHALL BE DIRECTED TO THE STORM DRAIN THROUGH NON-EROSIVE DEVICES. PROVIDE SUITABLE DRAINAGE PROVISIONS TO LOWER LEVEL AREAS.
12. **TEMPORARY EXCAVATIONS:** KEEP SURFACES EXPOSED IN SLOPE EXCAVATIONS MOIST BUT NOT SATURATED TO MINIMIZE RAVELING AND SLOUGHING DURING CONSTRUCTION. MAKE ADEQUATE PROVISIONS TO PROTECT THE SLOPES FROM EROSION DURING PERIODS OF RAINFALL. SURCHARGE LOADS, INCLUDING CONSTRUCTION, SHALL NOT BE PLACED WITHIN 5 FEET OF THE UNSUPPORTED TRENCH EDGE. COMPLY WITH ALL APPLICABLE REQUIREMENTS OF THE CALIFORNIA CONSTRUCTION AND GENERAL INDUSTRY SAFETY ORDERS, THE OCCUPATIONAL SAFETY AND HEALTH ACT OF 1987 AND CURRENT AMENDMENTS, AND THE CONSTRUCTION SAFETY ACT. IF POTENTIALLY UNSTABLE SOIL CONDITIONS ARE ENCOUNTERED, MODIFICATIONS OF SLOPE RATIOS FOR TEMPORARY CUTS WILL BE REQUIRED. IF THE EXCAVATION OCCURS NEAR EXISTING STRUCTURES, SPECIAL CONSTRUCTION CONSIDERATIONS WILL BE REQUIRED DURING EXCAVATION TO PROTECT THESE EXISTING STRUCTURES DURING CONSTRUCTION. THE PROPOSED EXCAVATION SHALL NOT CAUSE LOSS OF BEARING AND/OR LATERAL SUPPORT OF THE EXISTING STRUCTURES.
13. **TEMPORARY EXCAVATION SUPPORT (SHORING):** DESIGN AND PROVIDE ALL TEMPORARY SHORING REQUIRED FOR THE EXCAVATIONS FOR ALL CONSTRUCTION SHOWN ON THE CONTRACT DOCUMENTS DUE TO SPACE LIMITATIONS, PROPERTY LINE BOUNDARIES, BECAUSE OF NEARBY EXISTING STRUCTURES OR FACILITIES AND TRAFFIC LOADING. TEMPORARY SHORING MAY CONSIST OF THE USE OF CONVENTIONAL SOLDIER PILES AND LAGGING DESIGNED AS CANTILEVERED OR TIE-BACK SHORING OR OTHER SYSTEMS. SHORING SHALL BE DESIGNED BY AN EXPERIENCED STRUCTURAL OR CIVIL ENGINEER REGISTERED IN THE STATE OF CALIFORNIA. LIMITED SOIL INFORMATION FOR THE DESIGN OF EXCAVATION SUPPORT SYSTEMS IS CONTAINED IN THE GEOTECHNICAL INVESTIGATION PREPARED BY CONVERSE CONSULTANTS IN THE REPORT DATED 29 SEPTEMBER 2020. CONTRACTOR'S SHALL RETAIN GEOTECHNICAL CONSULTANTS IF ADDITIONAL INFORMATION IS REQUIRED FOR THE DESIGN OF SHORING. DRILLED EXCAVATIONS FOR SOLDIER PILES MAY REQUIRE THE USE OF DRILLING FLUIDS OR TEMPORARY CASING TO PREVENT CAVING AND TO MAINTAIN AN OPENED HOLE FOR PILE INSTALLATION. DUE TO SANDY NATURE OF ON-SITE SOILS, SOME CAVING DURING THE DRILLING OF SOLDIER-PILE BORINGS SHOULD BE ANTICIPATED. A SOLDIER PILE SYSTEM WILL REQUIRE CONTINUOUS LAGGING OR GUNITING TO CONTROL CAVING AND SLOUGHING IN THE EXCAVATION BETWEEN SOLDIER PILES. AT A MINIMUM, DESIGN TEMPORARY SHORING TO RESIST LATERAL EARTH PRESSURE, SURCHARGE PRESSURES DUE TO MISCELLANEOUS LOADS, SUCH AS SOIL STOCKPILES, EXISTING STRUCTURES, VEHICULAR TRAFFIC OR CONSTRUCTION EQUIPMENT LOCATED ADJACENT TO THE SHORING, SURCHARGE PRESSURES FROM THE EXISTING STRUCTURES. ALL SHORING SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH STATE AND FEDERAL SAFETY REGULATIONS.
14. **EXCAVATION SUPPORT SYSTEM MONITORING AND REPORTING:** EXISTING STRUCTURES ADJACENT TO EXCAVATION SHALL BE MONITORED FOR DISTRESS OR EXCESSIVE VIBRATION DURING EXCAVATION. A LICENSED SURVEYOR SHALL BE RETAINED TO ESTABLISH MONUMENTS ON SHORING AND THE SURROUNDING GROUND PRIOR TO EXCAVATION. SUCH MONUMENTS SHALL BE MONITORED FOR HORIZONTAL AND VERTICAL MOVEMENT DURING CONSTRUCTION. RESULTS OF THE MONITORING PROGRAM SHALL BE PROVIDED IMMEDIATELY TO THE CONTRACTOR'S ENGINEER RESPONSIBLE FOR THE DESIGN OF THE SHORING AND THE OWNER'S REPRESENTATIVE FOR REVIEW AND EVALUATION. ADJACENT BUILDING ELEMENTS SHALL BE PHOTO-DOCUMENTED PRIOR TO BEGINNING CONSTRUCTION.
15. **SPECIAL INSPECTION OF SOILS:** THE CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE WHEN EXCAVATION BOTTOMS HAVE BEEN REACHED PRIOR TO THE PLACEMENT OF COMPACTED FILL FOR OBSERVATION BY THE GEOTECHNICAL ENGINEER OF RECORD. STRUCTURAL FILL AND BACKFILL SHALL BE PLACED AND COMPACTED DURING CONTINUOUS OBSERVATION AND TESTING. FOOTING EXCAVATIONS SHALL BE OBSERVED PRIOR TO PLACEMENT OF STEEL AND CONCRETE. SEE THE SPECIAL INSPECTION AND TESTING SCHEDULE FOR SOILS ON SHEET S-2 FOR ADDITIONAL REQUIREMENTS.

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CHECKED DLB

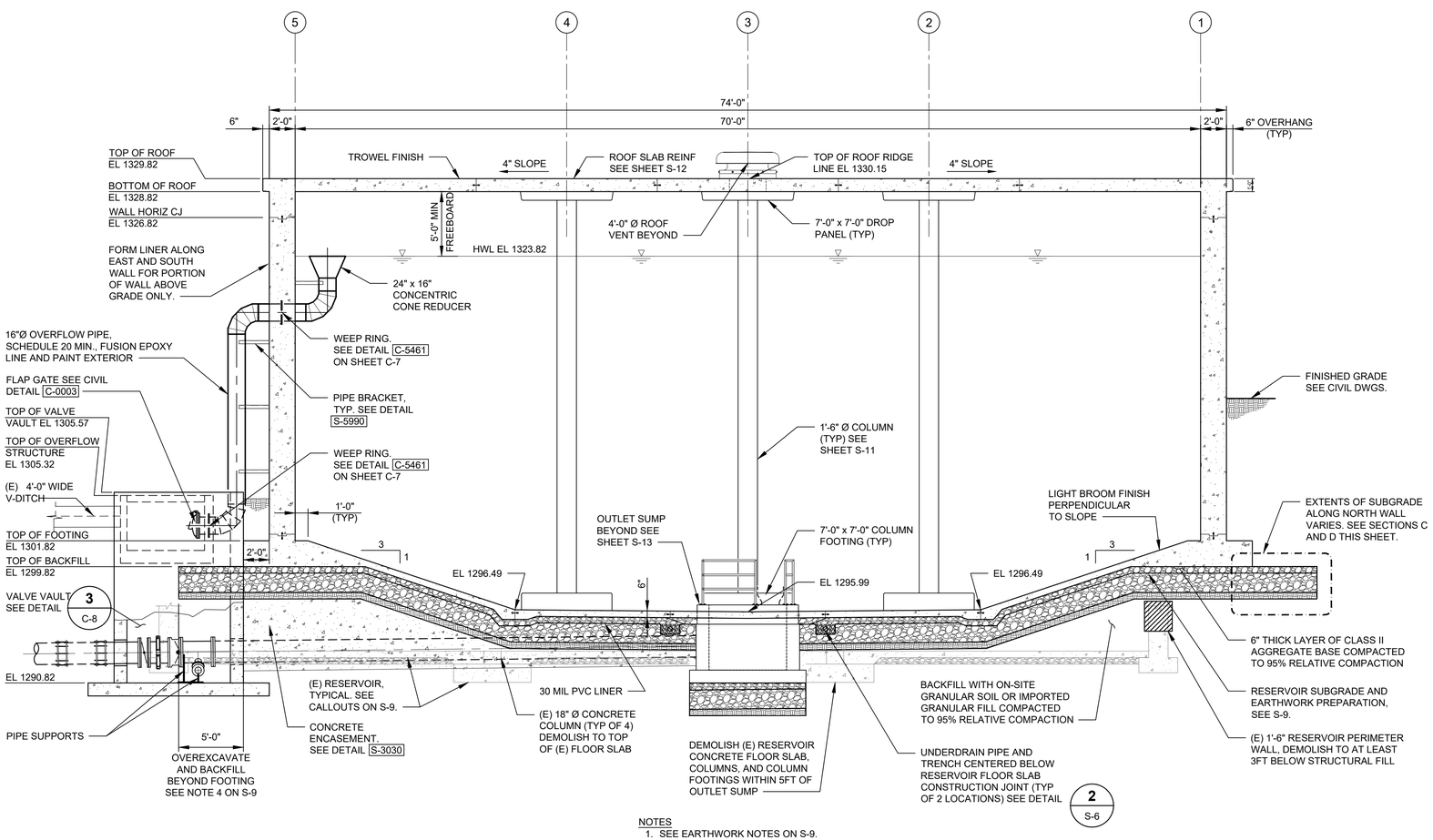
CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

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STRUCTURAL
RESERVOIR SECTION I

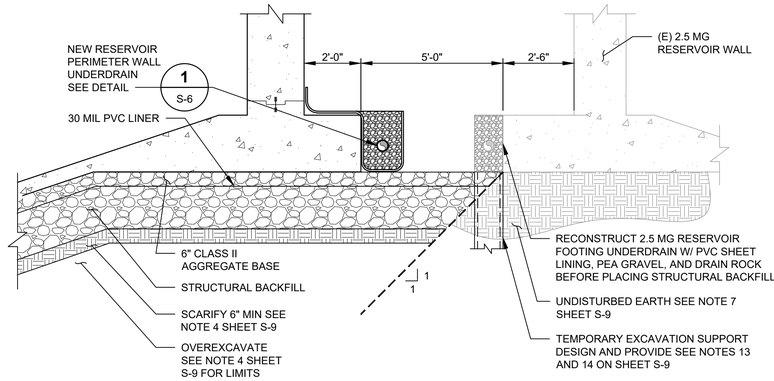
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JOB NO. 1944519.00
DATE APRIL 2020
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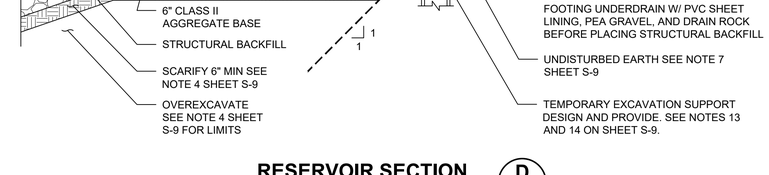


NOTES
1. SEE EARTHWORK NOTES ON S-9.
2. CATWALK AND GUARDRAIL NOT SHOWN. SEE SHEET S-15.

RESERVOIR SECTION B
S-7
0 4 8
3/16"=1'-0"



RESERVOIR SECTION C
S-7
0 2 4
3/8"=1'-0"



RESERVOIR SECTION D
S-7
0 2 4
3/8"=1'-0"

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SCALES
0 1"
0 25mm
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DESIGNED MEJ
DRAWN NEB
CHECKED DLB

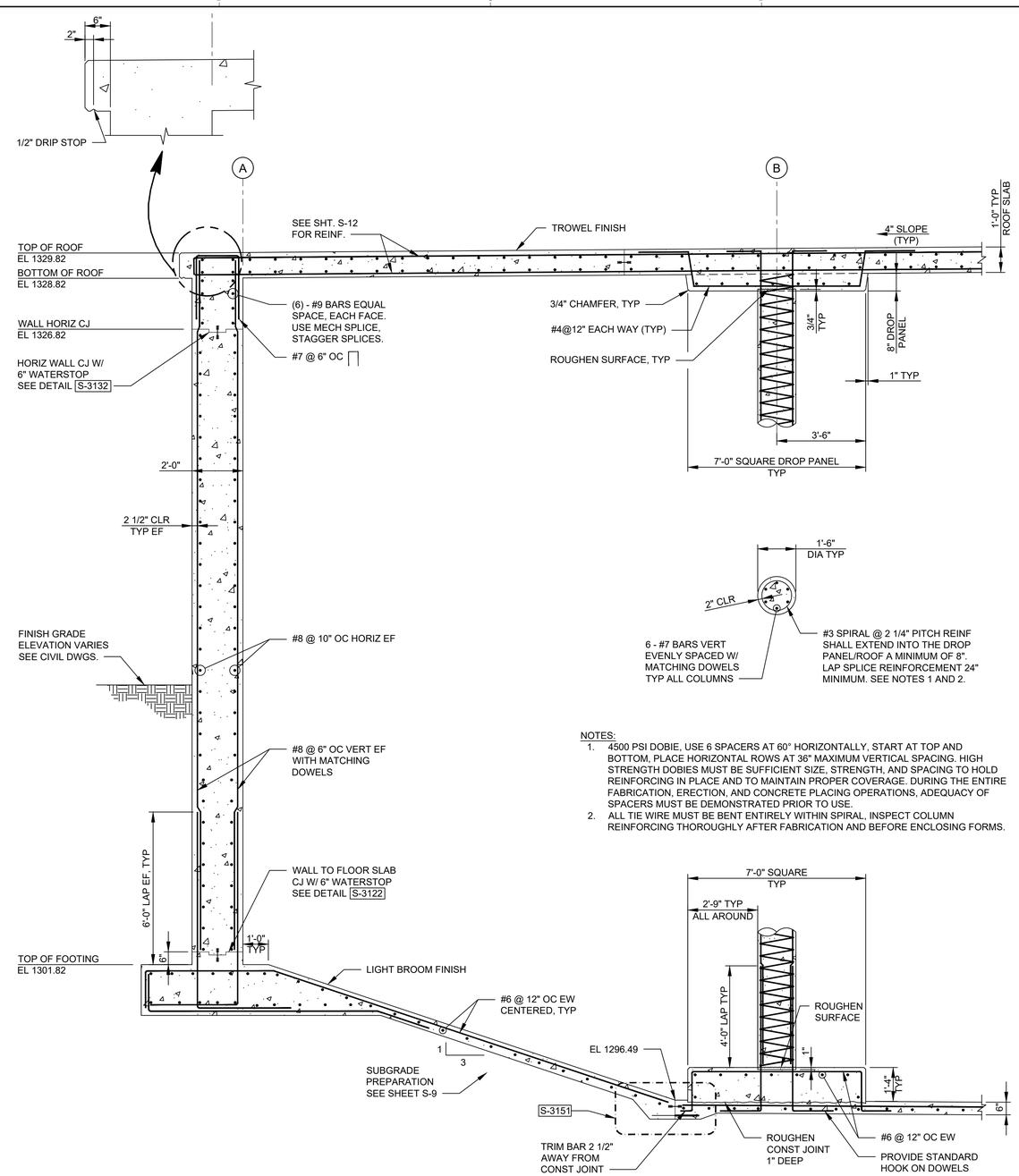
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STRUCTURAL
RESERVOIR SECTION II

FILE NAME 1944519.00-S-10.dwg
JOB NO. 1944519.00
DATE APRIL 2020
SHEET S-10 OF ##

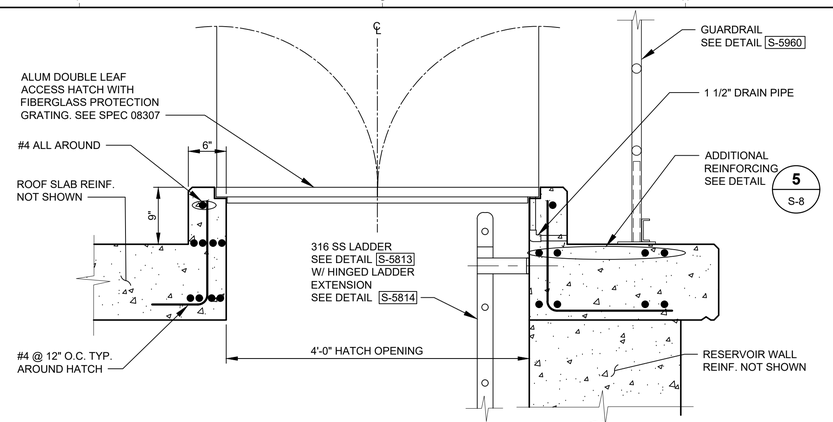
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NOTES:
1. 4500 PSI DOBIE, USE 6 SPACERS AT 60° HORIZONTALLY, START AT TOP AND BOTTOM, PLACE HORIZONTAL ROWS AT 36" MAXIMUM VERTICAL SPACING. HIGH STRENGTH DOBIES MUST BE SUFFICIENT SIZE, STRENGTH, AND SPACING TO HOLD REINFORCING IN PLACE AND TO MAINTAIN PROPER COVERAGE. DURING THE ENTIRE FABRICATION, ERECTION, AND CONCRETE PLACING OPERATIONS, ADEQUACY OF SPACERS MUST BE DEMONSTRATED PRIOR TO USE.
2. ALL TIE WIRE MUST BE BENT ENTIRELY WITHIN SPIRAL, INSPECT COLUMN REINFORCING THOROUGHLY AFTER FABRICATION AND BEFORE ENCLOSING FORMS.

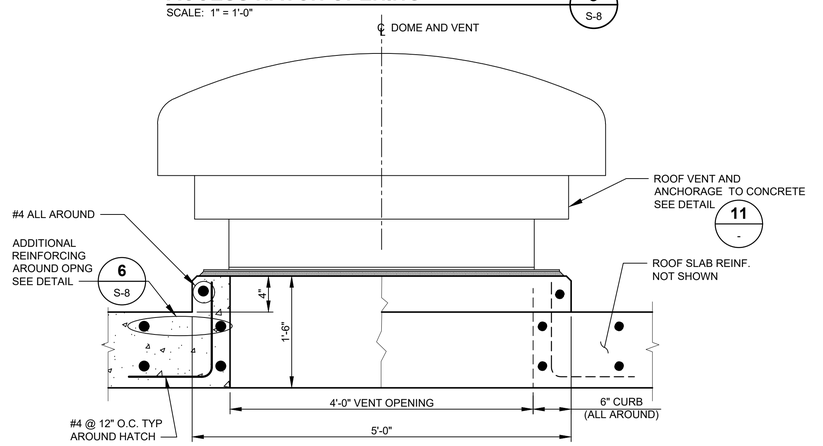
TYPICAL RESERVOIR REINFORCING

SCALE: 3/8"=1'-0" — 8 / S-9



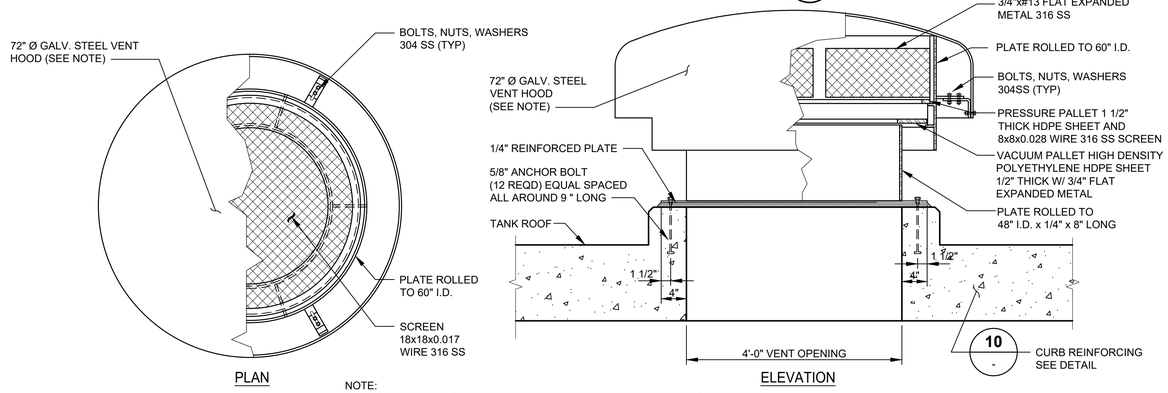
ACCESS HATCH OPENING

SCALE: 1" = 1'-0" — 9 / S-8



ROOF VENT OPENING CURB REINFORCING

SCALE: 1" = 1'-0" — 10 / S-8



NOTE:
1. PROVIDE VENT DESIGNED WITH A REMOVABLE HOOD IN ORDER TO ACCEPT A HIGH VOLUME AIR VENTILATOR WHICH RESTS ON THE OPEN TOP OF THE VENT.
2. ALL FERROUS METAL PARTS GALV. AFTER FABRICATION AND COAT PER SECTION 09960

ROOF VENT AND ANCHORAGE

SCALE: NTS — 11 / S-8

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SCALES
0 1"
0 25mm
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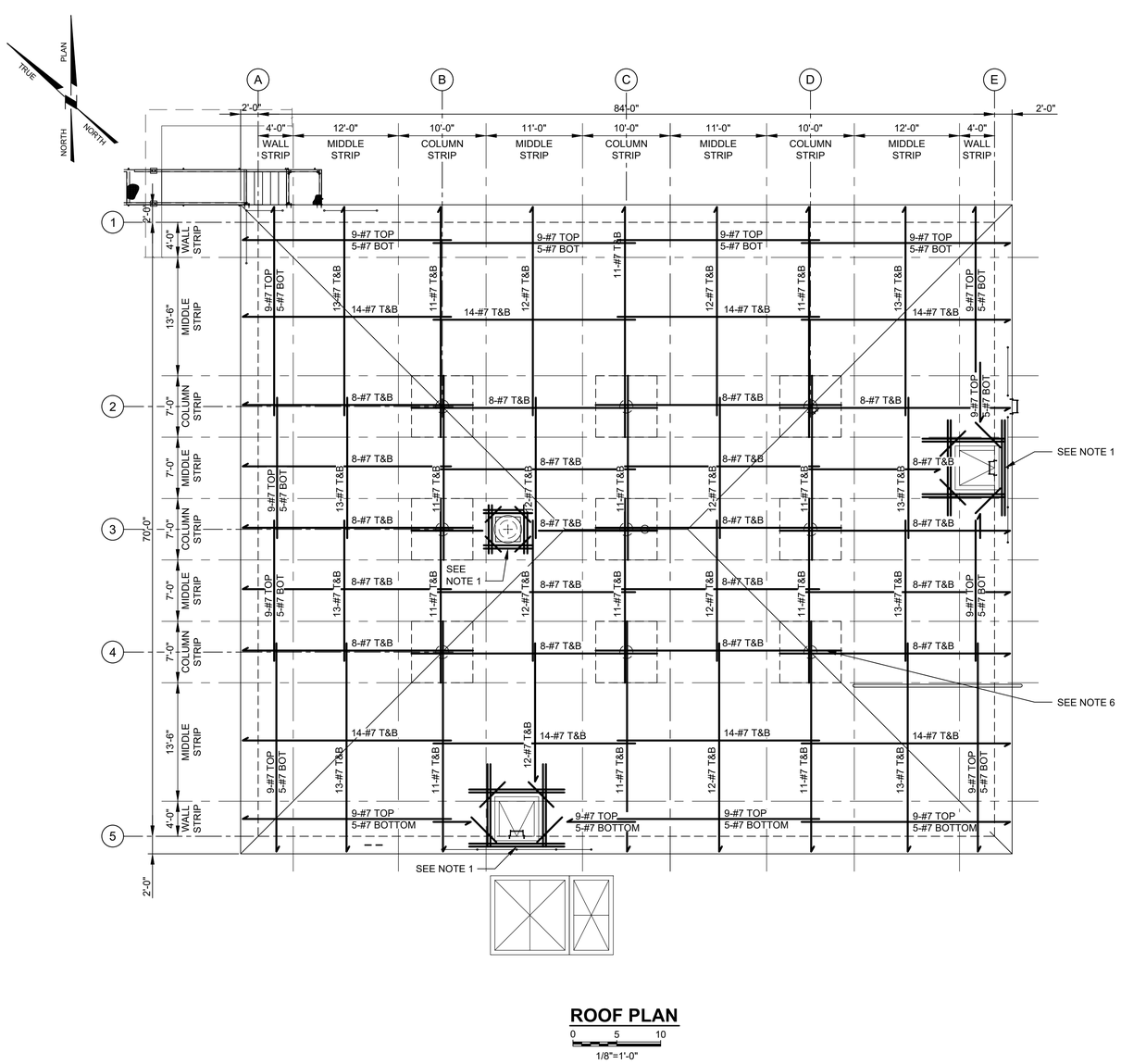
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STRUCTURAL
TYPICAL RESERVOIR REINFORCING AND HATCH AND VENT DETAILS

FILE NAME 1944519.00-S-11.dwg
JOB NO. 1944519.00
DATE APRIL 2020
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ROOF PLAN

0 5 10

1/8"=1'-0"

NOTES:

1. SEE S-8 FOR ADDITIONAL REINFORCING AROUND ACCESS HATCH AND ROOF VENT OPENINGS.
2. ROOF SLAB CONSTRUCTION JOINTS NOT SHOWN FOR CLARITY. SEE S-8 FOR CONSTRUCTION JOINT LOCATIONS.
3. SEE DETAIL S-3142 FOR ROOF SLAB CONSTRUCTION JOINT DETAIL.
4. SEE DETAIL S-3180 FOR ADDITIONAL REINFORCING AT ROOF SLAB CORNERS.
5. SEE DETAIL S-3010 FOR CONCRETE REBAR LAP SPLICE LENGTHS AND STAGGER. ALL TOP REINFORCING SHALL HAVE CLASS B TOP BAR LAP SPLICE LENGTHS MINIMUM UNLESS OTHERWISE NOTED OR SHOWN ON ROOF PLAN.
6. EXTEND TOP BAR LAPS FOR FULL LENGTH OF DROP PANEL, EACH WAY. NOT REQUIRED ON BOTTOM BARS.

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SCALES

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0 25mm

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DRAWN	NEB
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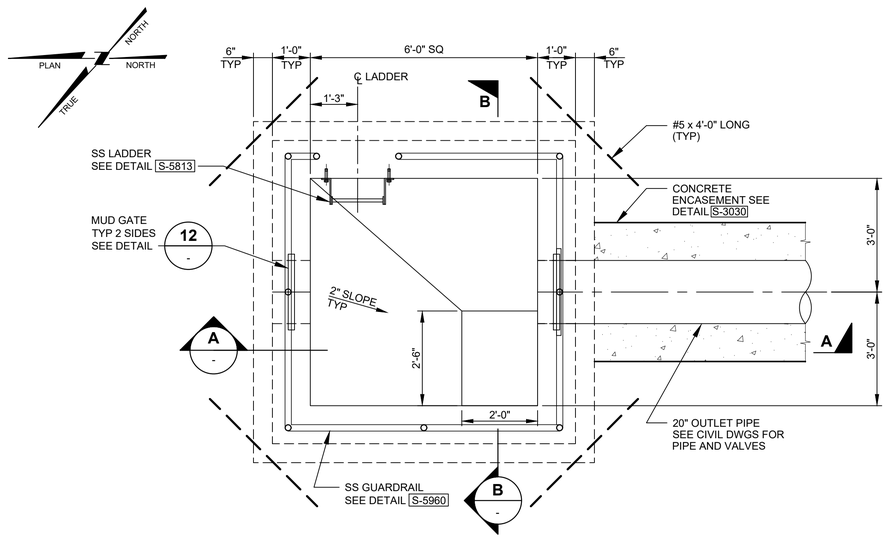
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STRUCTURAL
RESERVOIR ROOF REINFORCING PLAN

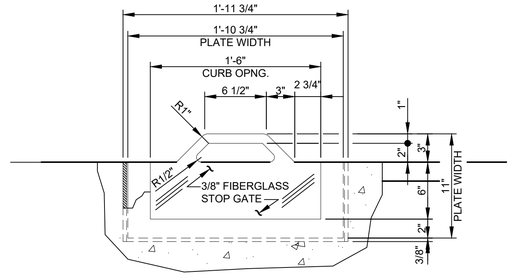
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SHEET	S-12 ##

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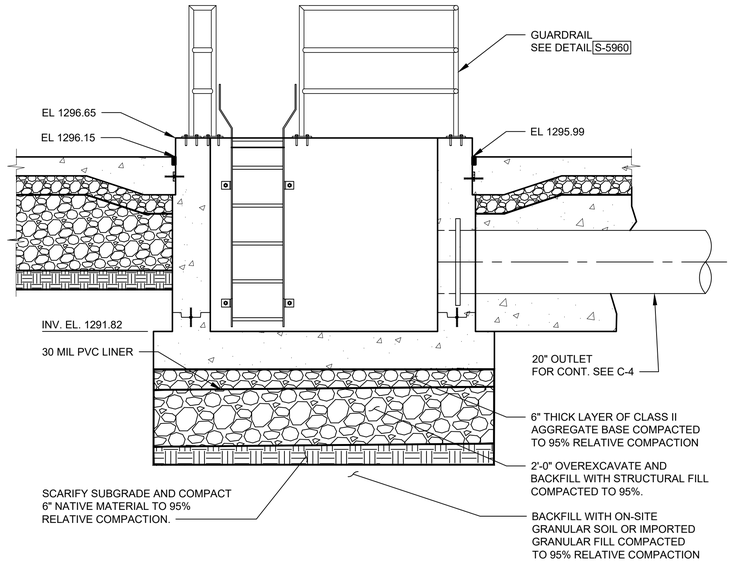
OUTLET SUMP PLAN

SCALE: 1/2" = 1'-0"



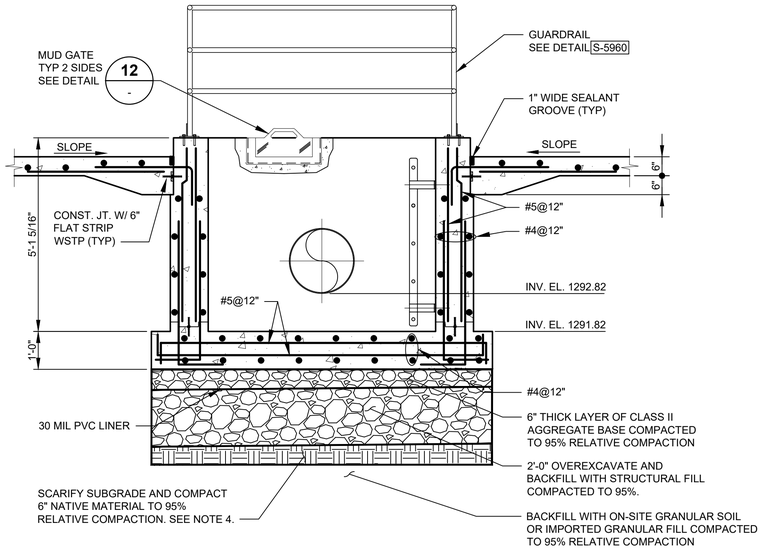
MUD GATE DETAIL 12

SCALE: 1 1/2"=1'-0"



SECTION A

SCALE: 1/2" = 1'-0"



SECTION B

SCALE: 1/2" = 1'-0"

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SCALES

0 1"

0 25mm

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DRAWN	NEB
CHECKED	DLB

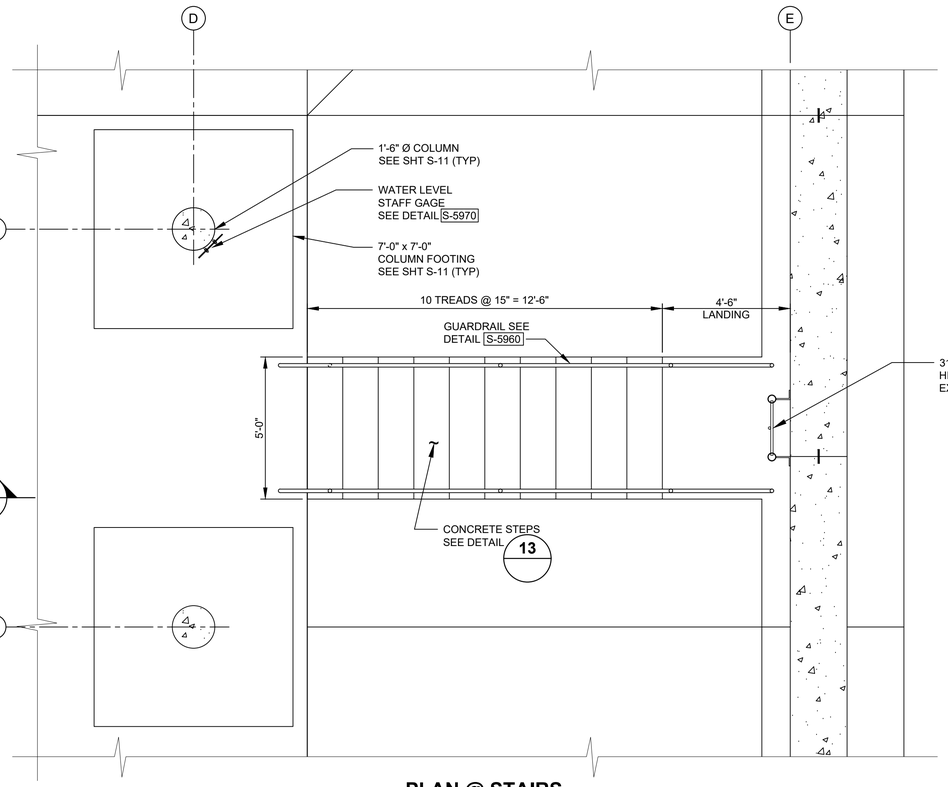
CITY OF SAN FERNANDO
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UPPER RESERVOIR REPLACEMENT

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STRUCTURAL
OUTLET SUMP PLAN, SECTIONS AND DETAILS

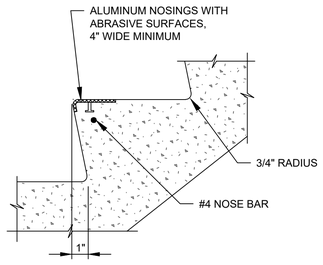
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SHEET	S-13 ##

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PLAN @ STAIRS

SCALE: 3/8" = 1'-0"

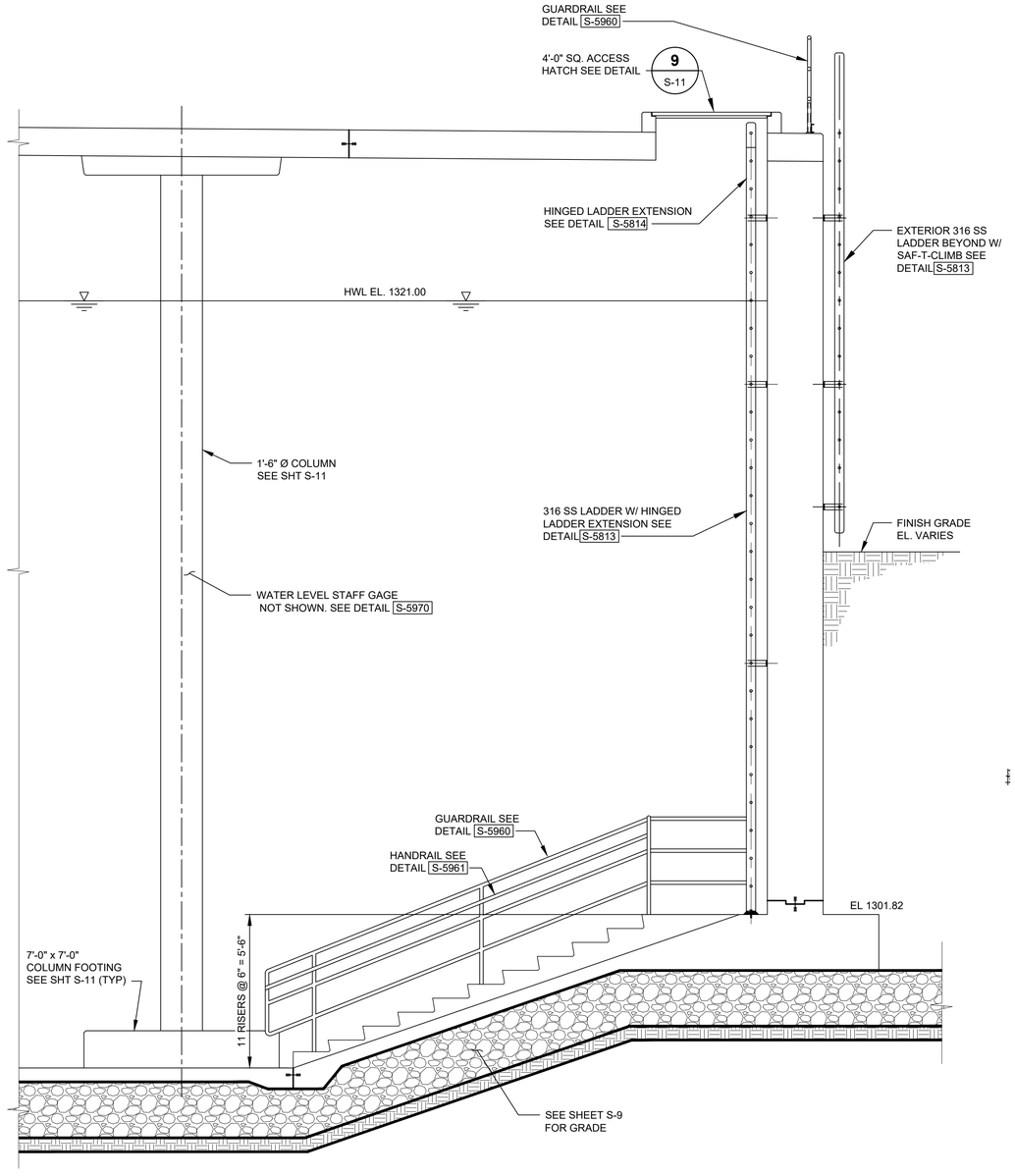


NOTE:

1. TREAD SHALL RECEIVE A STEEL TROWEL FINISH. IMMEDIATELY THEREAFTER. THE SURFACE SHALL BE SLIGHTLY ROUGHENED BY DRAWING A HAIRBRUSH LIGHTLY OVER THE SURFACE AT A RIGHT ANGLE TO THE DIRECTION OF TRAFFIC TO PRODUCE A NON-SKID SURFACE.

DETAIL 13

SCALE: NONE



SECTION A

SCALE: 3/8"=1'-0"

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SCALES

0 1"

0 25mm

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No. C 48183
Exp. 12/31/22
CIVIL
STATE OF CALIFORNIA

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SAN FERNANDO, CA

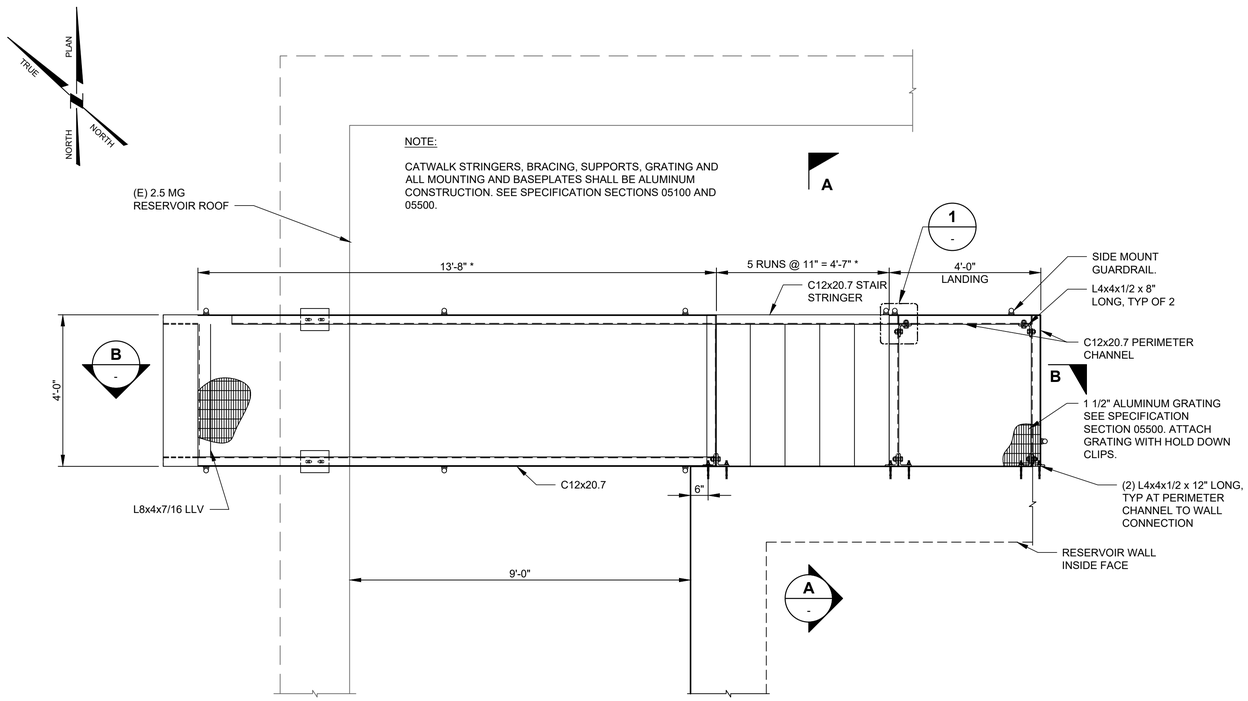
UPPER RESERVOIR REPLACEMENT

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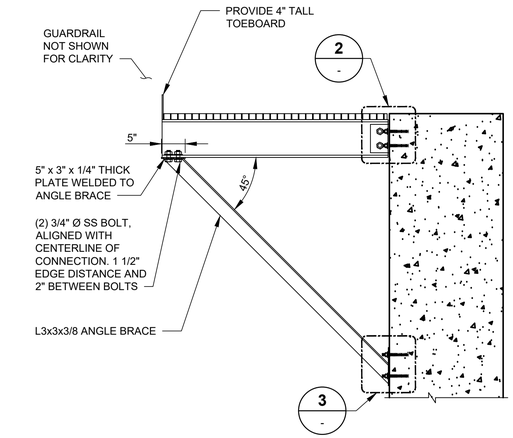
STRUCTURAL
RESERVOIR STAIRS PLAN, SECTIONS AND DETAILS

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JOB NO.	1944519.00
DATE	APRIL 2020
SHEET	S-14 ##

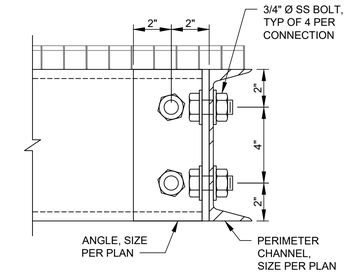
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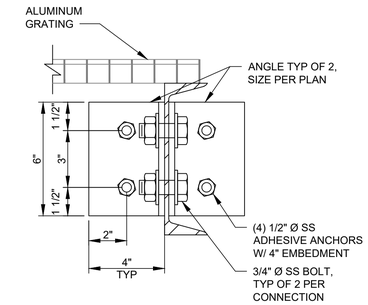
CATWALK PLAN
SCALE: 1/2" = 1'-0"



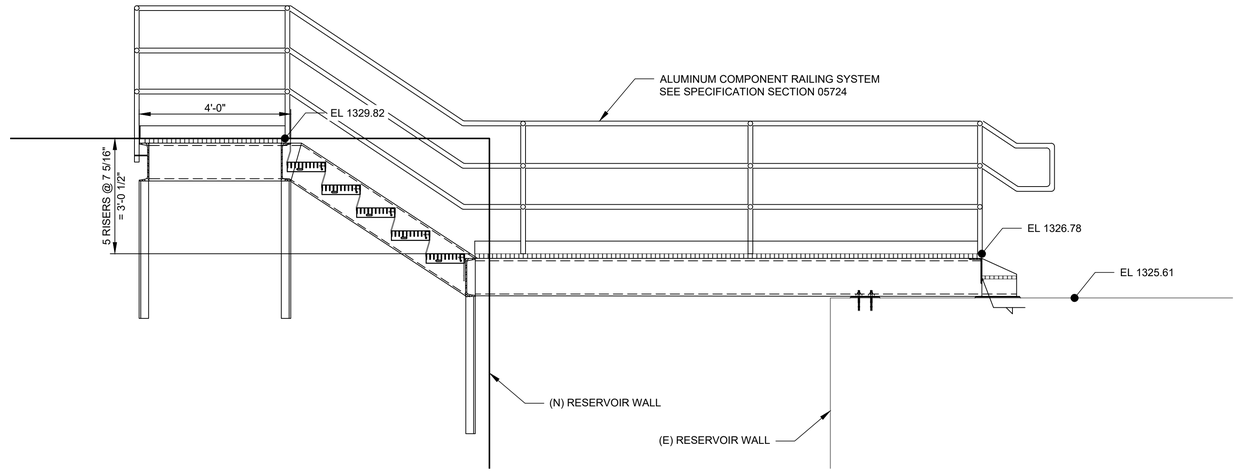
SECTION A
SCALE: 3/4" = 1'-0"



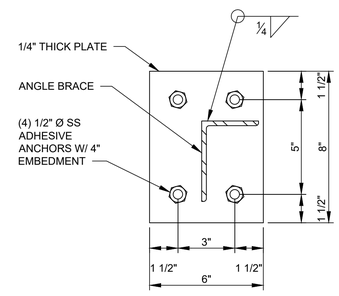
DETAIL 1
SCALE: 3" = 1'-0"



DETAIL 2
SCALE: 3" = 1'-0"



SECTION B
SCALE: 1/2" = 1'-0"



DETAIL 3
SCALE: 3" = 1'-0"

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0 25mm
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CHECKED	DLB

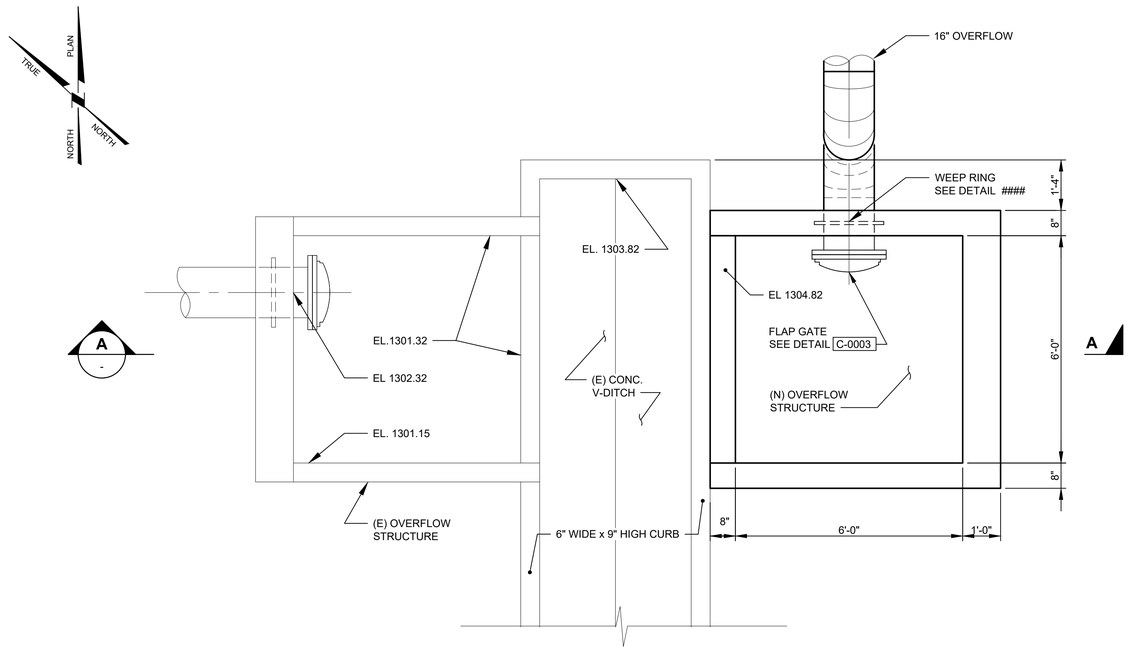
CITY OF SAN FERNANDO
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STRUCTURAL
CATWALK PLAN, SECTIONS AND DETAILS

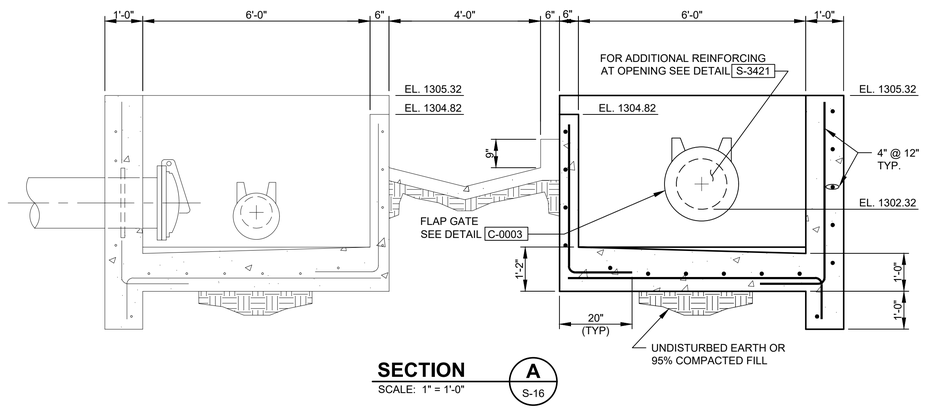
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OVERFLOW STRUCTURE - PLAN

SCALE: 1/2" = 1'-0"



SECTION A

SCALE: 1" = 1'-0"

S-16

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SCALES

0 1"

0 25mm

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No. C48183
Exp. 12/31/22
CIVIL
STATE OF CALIFORNIA

DESIGNED MEJ

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STRUCTURAL
OVERFLOW STRUCTURE PLAN, SECTIONS AND DETAILS

FILE NAME 1944519.00-S-16.dwg

JOB NO. 1944519.00

DATE APRIL 2020

SHEET S-16 OF ##

ABBREVIATIONS

a	CIRCUIT BREAKER AUX. CONTACT, CLOSED WHEN BREAKER IS CLOSED	FO	FIBER OPTIC	OL	THERMAL OVERLOAD RELAY
A	AMMETER, AMPERES	FREQ	FREQUENCY	PB	PULLBOX, PUSHBUTTON
AC	ALTERNATING CURRENT	FT	FEET, FOOT	PD	POSITIVE DISPLACEMENT
A/D	ANALOG TO DIGITAL	FU	FUSE	PE	PHOTOELECTRIC
ADJ	ADJUSTABLE	(F)	FUTURE	PEC	PHOTOELECTRIC CELL
AF	AMPERE FRAME	FVNR	FULL VOLTAGE, NON REVERSING	PF	POWER FACTOR
AFF	ABOVE FINISHED FLOOR	FVR	FULL VOLTAGE, REVERSING	PFR	POWER FACTOR RELAY
AIC	AMPERES INTERRUPTING CAPACITY	FWD	FORWARD	pH	MEASURE OF ACIDITY OR ALKALINITY
AL	ALUMINUM	GA	GAUGE	PH	PHASE
ALT	ALTERNATOR	GALV	GALVANIZED	PLC	PROGRAMMABLE LOGIC CONTROLLER
A/M	AUTO/MANUAL CONTROLLER	GEN	GENERATOR	PNL	PANEL
ANN	ANNUNCIATOR	GFI	GROUND FAULT INTERRUPTER	PNLBD	PANELBOARD
APPROX	APPROXIMATE	GND	GROUND	PRI	PRIMARY
AS	AMMETER SWITCH	GRS	GALVANIZED RIGID STEEL	PS	PRESSURE SWITCH
ASD	ADJUSTABLE SPEED DRIVE (DC)	H_2O_2	HYDROGEN PEROXIDE	PSI	POUNDS PER SQUARE INCH
AT	AMMETER TRIP	HH	HANDHOLE	PVC	POLYVINYL CHLORIDE
ATS	AUTOMATIC TRANSFER SWITCH	HMI	HUMAN MACHINE INTERFACE	PWR	POWER
AUTO	AUTOMATIC	HOA	HAND-OFF-AUTOMATIC	(RL)	RELOCATE
AUX	AUXILIARY	HOR	HAND-OFF-REMOTE	(RLD)	RELOCATED
AWG	AMERICAN WIRE GAGE	HORIZ	HORIZONTAL	RCPT	RECEPTACLE
b	CIRCUIT BREAKER AUX. CONTACT, CLOSED WHEN BREAKER IS OPEN	HP	HORSEPOWER	RCT	REPEAT CYCLE TIMER
		HPS	HIGH PRESSURE SODIUM	REQD	REQUIRED
BCG	BARE COPPER GROUND	HTR	HEATER	RM	ROOM
BLDG	BUILDING	HV	HIGH VOLTAGE	RPM	REVOLUTIONS PER MINUTE
C	CONDUIT, CONTACTOR	HZ	HERTZ (CYCLES PER SECOND)	RT	RESET TIMER
CAB	CABINET	IND LT	INDICATING LIGHT	RVSS	REDUCED VOLTAGE SELF STARTER
CAP	CAPACITOR	INCAND	INCANDESCENT	SCR	SILICON CONTROLLED RECTIFIER
CB	CIRCUIT BREAKER	INSTR	INSTRUMENT, INSTRUMENTATION		
CC	CONTROL CABLE, CLOSING COIL	I/O	INPUT/OUTPUT	SD	SMOKE DETECTOR
CHH	COMMUNICATION HANDHOLE	JB	JUNCTION BOX	SEC	SECONDS, SECONDARY
CL	CHLORINE	KA	KILOAMPERES	SECT	SECTION
CKT	CIRCUIT	KCMIL	THOUSANDS OF CIRCULAR MILS	SF	SUPPLY FAN
CMH	COMMUNICATION MANHOLE	KV	KILOVOLTS	SHH	SIGNAL HANDHOLE
CO	CONDUIT ONLY	KVA	KILOVOLT AMPERES	SHT	SHEET
COMM	COMMUNICATION	KVAR	KILOVOLT AMPERES REACTIVE	SIG	SIGNAL
COND	CONDUCTOR	KVARH	KILOVOLT AMPERES REACTIVE HOURS	SPECS	SPECIFICATIONS
CONT	CONTINUED, CONTINUATION	KW	KILOWATTS	SPD	SURGE PROTECTIVE DEVICE
CPT	CONTROL POWER TRANSFORMER	KWH	KILOWATT HOURS	SPDT	SINGLE POLE, DOUBLE THROW
CP	CONTROL PANEL	LCP	LOCAL CONTROL PANEL	SS	STAINLESS STEEL, SOLID STATE
CR	CONTROL RELAY	LOR	LOCAL-OFF-REMOTE	SW	SWITCH
CS	CONTROL SWITCH	LP	LIGHTING PANEL	SWBD	SWITCHBOARD
CT	CURRENT TRANSFORMER	LPS	LOW PRESSURE SODIUM	SWGR	SWITCHGEAR
CWP	COLD WATER PIPE	LTG	LIGHTING	SYNC	SYNCHRONIZING
DC	DIRECT CURRENT	LT(S)	LIGHT(S)	TB	TERMINAL BLOCK
DIA	DIAMETER	(M)	MODIFIED	TC	TELEPHONE CABINET
DIAG	DIAGRAM	mA	MILLIAMPERES	TEL	TELEPHONE
DISC	DISCONNECT	MAX	MAXIMUM	TEMP	TEMPERATURE
DISTR	DISTRIBUTION	MCB	MAIN CIRCUIT BREAKER	TSP	TWISTED SHIELDED PAIR
DN	DOWN	MCC	MOTOR CONTROL CENTER	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
DP	DISTRIBUTION PANEL	MCP	MOTOR CIRCUIT PROTECTOR		
DPDT	DOUBLE POLE, DOUBLE THROW	MFR	MANUFACTURER	TYP	TYPICAL
DPST	DOUBLE POLE, SINGLE THROW	MH	MANHOLE	UG	UNDERGROUND
DWG	DRAWING	MIN	MINIMUM	UH	UNIT HEATER
(E)	EXISTING	MISC	MISCELLANEOUS	UV	ULTRA VIOLET
EA	EACH	MLO	MAIN LUG ONLY	V	VOLTS
EF	EXHAUST FAN	MOV	MOTOR OPERATED VALVE	VA	VOLT-AMPERES
EHH	ELECTRICAL HANDHOLE	MS	MOTOR STARTER	VFD	VARIABLE FREQUENCY DRIVE (AC)
EL, ELEV	ELEVATION	MTD	MOUNTED	VAR	VOLT AMPERES REACTIVE
ELEC	ELECTRIC, ELECTRICAL	MTG	MOUNTING	VERT	VERTICAL
ELEM	ELEMENTARY	MTS	MANUAL TRANSFER SWITCH	VH	VAR-HOUR
EMERG	EMERGENCY	(N)	NEW	VS	VOLTMETER SWITCH
ENCL	ENCLOSURE	NC	NORMALLY CLOSED	W	WIRE, WATTS
EFFL	EFFLUENT	NEC	NATIONAL ELECTRICAL CODE	WHM	WATTHOUR METER
EQ	EQUAL	NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOC.	WHDM	WATTHOUR DEMAND METER
EQPT	EQUIPMENT			WR	WEATHER RESISTANT
ETM	ELAPSED TIME METER	NEUT	NEUTRAL	WT	WATERTIGHT
FACP	FIRE ALARM CONTROL PANEL	NIC	NOT IN CONTRACT	WTP	WATER TREATMENT PLANT
FDR	FEEDER	NO	NORMALLY OPEN, NUMBER	XFMR	TRANSFORMER
FF	FINISHED FLOOR	NTS	NOT TO SCALE		
FLEX	FLEXIBLE	OH	OVERHEAD		
FLUOR	FLUORESCENT	OT	OVER TEMPERATURE		

NOTE: ADDITIONAL ABBREVIATIONS ARE PROVIDED ON SHEET G-5

GENERAL NOTES:

G1. THESE DRAWINGS ARE DIAGRAMMATIC ONLY; EXACT LOCATIONS OF ELECTRICAL EQUIPMENT SHALL BE DETERMINED IN THE FIELD BY THE ENGINEER. THE INSTALLATION OF ALL EQUIPMENT SHOWN ON THESE DRAWINGS OR DESCRIBED IN THE SPECIFICATIONS SHALL CONFORM TO THE REQUIREMENTS SET FORTH IN THE LATEST EDITIONS OF ALL APPLICABLE CODES AND UTILITY COMPANY STANDARDS. CONTACT THE UTILITY COMPANY REPRESENTATIVES AND VERIFY THEIR REQUIREMENTS.

G2. THIS IS A GENERALIZED LEGEND SHEET. THIS CONTRACT MAY NOT USE ALL INFORMATION SHOWN.

G3. NOTIFY THE ENGINEER IMMEDIATELY IF CONFLICTS IN EQUIPMENT LOCATIONS ARE DISCOVERED OR IF PROBLEMS ARISE DUE TO FIELD CONDITIONS, LACK OF INFORMATION OR ANY OTHER REASON. NO PAYMENT WILL BE MADE FOR CHANGES WHICH HAVE NOT BEEN FAVORABLY REVIEWED BY THE ENGINEER.

G4. INFORMATION SHOWN MAY NOT BE ALL INCLUSIVE. SEE ALSO ANSI C37.2, Y1.1, Y32.2, AND Y32.9.

G5. VERIFY ALL COLOR REQUIREMENTS BEFORE ORDERING MATERIALS.

G6. REFER TO THE MECHANICAL DRAWINGS FOR CERTAIN CONTROL DIAGRAMS AND EXACT LOCATIONS OF MECHANICAL EQUIPMENT AND FOR CERTAIN CONNECTIONS TO BE MADE TO ELECTRICAL CIRCUITS.

PLAN NOTES:

P1. CONDUIT SIZE AND FILL SHALL BE AS INDICATED. WHERE NO SIZE IS SHOWN, THE CONDUIT SHALL BE SIZED IN ACCORDANCE WITH THE EDITION OF THE NATIONAL ELECTRICAL CODE ADOPTED BY THE AUTHORITY HAVING CODE ENFORCEMENT JURISDICTION. WHERE NO FILL IS INDICATED, THE FILL SHALL BE 2#12. PROVIDE 3/16 INCH NYLON PULL ROPE IN EACH EMPTY CONDUIT.

P2. LOWER CASE LETTERS ADJACENT TO A SWITCH OR LIGHT FIXTURE INDICATE A SWITCHED CIRCUIT. FOR FOUR LAMP FIXTURES WIRED IN PAIRS WITHIN EACH FIXTURE, THE "a" SWITCH CONTROLS THE OUTER LAMPS AND THE "b" SWITCH CONTROLS THE INNER LAMPS; WIRE 3 LAMP FIXTURES SIMILARLY.

P3. CONDUIT AND WIRE LAYOUT FOR LIGHTING AND RECEPTACLES NOT SHOWN. PROVIDE PER NEC.

P4. ONLY MAJOR DUCTBANK ROUNTING IS SHOWN ON PLANS. REFER TO CONDUIT DEVELOPMENT/SCHEDULE SHEETS FOR COMPLETE INFORMATION ON REQUIRED CONDUITS. DETERMINE ROUTING PER SPECIFICATION SECTION 16010 1.01.A.5.

PLAN SYMBOLS

- OH — OVERHEAD POWER LINE
- UNDERGROUND CONDUIT
- MULTIPLE CONDUIT RUN
- CONDUIT ENCASED BELOW SLAB
- CONDUIT CONCEALED IN WALL OR CEILING
- CONDUIT EXPOSED
- 3/4"C-3#12 — CALLOUT INDICATING CONDUIT SIZE, NUMBER OF WIRES AND WIRE SIZE
- 135 — CALLOUT INDICATING CONDUIT PER SCHEDULE
- CONDUIT RUN, HATCH MARKS INDICATE NO. OF #12 CONDUCTORS NO HATCH MARKS IS 2#12 UNLESS OTHERWISE NOTED
- HOME RUN TO PANELBOARD OR AS INDICATED
- FLEXIBLE CONDUIT
- CONDUIT RUN, BROKEN AND CONTINUED ON SAME SHEET OR AS NOTED
- CAP ON CONDUIT STUB
- OPEN CIRCLE DENOTES UPWARD CONDUIT RISER
- SEMI CIRCLE DENOTES DOWNWARD CONDUIT RISER
- INDICATES REMOVAL
- FA — FIRE ALARM CONDUIT
- T — TELEPHONE CONDUIT
- S — SECURITY SYSTEM CONDUIT
- 120V SURFACE MOUNTED PANELBOARD
- 120V FLUSH MOUNTED PANELBOARD
- 480V SURFACE MOUNTED PANELBOARD
- 480V FLUSH MOUNTED PANELBOARD
- M — MOTOR
- DISCONNECT SAFETY SWITCH
- COMBINATION MOTOR STARTER
- S_{MS} — MANUAL MOTOR STARTER
- CONTROL STATION
- EQUIPMENT MOUNTING STAND
- GROUND ROD AND BOX
- INSTRUMENT
- EMH EHH SHH — ELECTRIC MANHOLE / POWER HANDHOLE / SIGNAL HANDHOLE
- K — INTRUSION REMOTE KEY PAD
- D — INTRUSION DOOR SWITCH
- SAP — SECURITY ALARM PANEL
- EQUIPMENT CONNECTION

- S_* — SINGLE POLE SWITCH
- 2 = 2 POLE, 3 = 3 WAY, 4 = 4 WAY, K = KEY OPERATED, WR = WEATHER RESISTANT, D = DIMMER, P = SWITCH WITH PILOT LIGHT
- S^{ab} — SINGLE POLE SWITCH (NOTE P2)
- FIXTURE (NOTE P2) SEE FIXTURE SCHEDULE
- FIXTURE WITH NIGHT LIGHTING (UNSWITCHED) OR FIXTURE WITH SELF-CONTAINED EMERGENCY BALLAST/BATTERY
- WALL/CEILING MOUNTED FIXTURE
- WALL/CEILING MOUNTED FIXTURE NIGHT LIGHTING (UNSWITCHED)
- POLE MOUNTED FIXTURE
- WALL/CEILING MOUNTED EXIT LIGHT - DIRECTIONAL ARROW WHERE INDICATED, SHADED AREA INDICATES ILLUMINATED FACE
- EMERGENCY LIGHT WITH SELF CONTAINED BATTERY
- A ELEV / CTK # — LIGHT FIXTURE IDENTIFICATION
- SINGLE RECEPTACLE, 120V
- SINGLE RECEPTACLE, 240V
- DUPLEX WALL RECEPTACLE, 120V WR = WEATHER RESISTANT G = GROUNDED IG = ISOLATED GROUND GF = GROUND FAULT INTERRUPTER DOUBLE DUPLEX WALL RECEPTACLE, 120V
- DUPLEX FLOOR RECEPTACLE, 120V
- H X" — MULTI-OUTLET ASSEMBLY WITH SINGLE RECEPTACLE, 120V SPACING (X INCHES) AS NOTED, MOUNTING HEIGHT AS NOTED
- RECEPTACLE, 480V
- WALL/CEILING MOUNTED JUNCTION BOX
- J — FLOOR RECESS MOUNTED JUNCTION BOX
- T — THERMOSTAT, WALL MOUNTED
- WALL TELEPHONE OUTLET (+12")
- DATA WALL OUTLET
- TELE-DATA WALL OUTLET
- FLOOR OUTLETS
- F — FIRE ALARM PULL STATION
- F — FIRE ALARM FLASHING LIGHT
- F — FIRE ALARM HORN
- B — BELL
- BUZZER
- H — HEAT DETECTOR
- S — SMOKE DETECTOR
- FACP — FIRE ALARM CONTROL PANEL
- PROXIMITY SENSOR
- WALL SENSOR
- ANTENNA
- CAMERA

SINGLE LINE SYMBOLS

- GROUND CONNECTION
- SWITCH, 3 POLE EXCEPT WHERE NOTED. RATING IN AMPERES AS NOTED
- AUTOMATIC TRANSFER SWITCH 3 POLE, RATING AS NOTED
- ST — SHUNT TRIP
- TB-# / #A / 1 — FUSE
- FUSE CUTOUT
- 100AF / 100AT — CIRCUIT BREAKER, 3-POLE EXCEPT WHERE NOTED. RATING IN AMPERES AS NOTED. TOP INDICATION IS FRAME SIZE, BOTTOM IS TRIP RATING.
- 100A / MCP — MCP CIRCUIT BREAKER, 3-POLE EXCEPT WHERE NOTED. RATING IN AMPERES AS NOTED. TOP INDICATION IS CONTINUOUS CURRENT RATING.
- TM / 100AT — THERMAL-MAGNETIC CIRCUIT BREAKER, 3-POLE EXCEPT WHERE NOTED. RATING IN AMPERES AS NOTED. BOTTOM INDICATION IS INSTANTANEOUS TRIP RATING.
- POWER CIRCUIT BREAKER DRAWOUT ABOVE 1500V RATING AS NOTED
- CURRENT TRANSFORMER
- VOLTAGE TRANSFORMER
- POWER OR DISTRIBUTION TRANSFORMER RATING AS NOTED
- 100 — MOTOR. NUMBER INDICATES HORSEPOWER
- GEN — GENERATOR
- CONTROL PACKAGE PROVIDED WITH THE DRIVEN EQUIPMENT
- BUS STAB ON MCC OR SWITCHGEAR, CORD & PLUG CONNECTION FOR MOTORS
- OL — THERMAL OVERLOAD
- * A - AMMETER, V - VOLTMETER, WH - WATTHOUR METER, GS - GROUND FAULT SENSOR
- AS — AMMETER SWITCH
- VS — VOLTMETER SWITCH
- 2 — ELEMENTARY DIAGRAM REFERENCE NUMBER
- K — KIRK KEY INTERLOCK
- POWER RECEPTACLE FOR PORTABLE EQUIPMENT
- # — RELAY DEVICE FUNCTION, # PER ANSI NUMBER C37.2
- TERMINATOR / POTHEAD
- SPLICE, TERMINATION
- 1 — MOTOR STARTER NUMBER INDICATES NEMA SIZE
- 5 — CAPACITOR - KVAR INDICATED
- VFD — VFD - VARIABLE FREQUENCY DRIVE SS - SOLID STATE STARTER
- VFD 5 5 — VFD WITH BYPASS CONTACTOR, CONTACTOR NEMA SIZE AS INDICATED
- SS — SS STARTER WITH BUILT-IN FULL SPEED CONTACTOR
- SPD — SURGE PROTECTIVE DEVICE
- MOTOR HEATER — MOTOR HEATER

ELEMENTARY DIAGRAM SYMBOLS

- FUSE. RATING IN AMPERES
- M MOTOR; ETM ELAPSED TIME METER
- ** CONTROL DEVICE COIL. PREFIX NUMBER, WHEN USED, DISTINGUISHES BETWEEN DEVICES OF THE SAME TYPE.
  - ** ALT - ALTERNATOR; CR - CONTROL RELAY; GR - GENERAL RELAY; ISR - INTRINSICALLY SAFE RELAY; LR - LATCH RELAY; PR - PROBE RELAY; SV - SOLENOID VALVE; TD - TIME DELAY RELAY; TR - TIMING RELAY
- 1 CR — 2-2, 3, 0, 0 — CROSS REFERENCE TO ANOTHER DIAGRAM; NORMALLY OPEN CONTACT ON THE OTHER DIAGRAM; SPARE CONTACTS ON RELAY. IF OMITTED, THEN THE SPEC. REQUIREMENTS REGARDING SPARE CONTACTS APPLY.; NORMALLY CLOSED CONTACT ON THIS DIAGRAM
- ? — INDICATING LIGHT
- ? — PUSH-TO-TEST INDICATING LIGHT
  - * COLORS: A - AMBER, B - BLUE, C - CLEAR, G - GREEN, R - RED, N - NEON, W - WHITE, Y - YELLOW
- ON OFF — SINGLE POLE SWITCH NORMALLY OPEN / CLOSED
- START STOP — EMERGENCY PUSHBUTTON NORMALLY OPEN / CLOSED
- START STOP — PUSHBUTTON NORMALLY OPEN / CLOSED
- SWITCH 1-POLE / 3-POLE
- H O A — MULTI-POSITION SELECTOR SWITCH
- H O A — HAND-OFF-AUTOMATIC SWITCH X-INDICATES CONTACTS CLOSED
- H O R — HAND-OFF-REMOTE SWITCH X-INDICATES CONTACTS CLOSED
- TERMINAL
- H1 H3 H2 H4 / X1 X2 — CONTROL POWER TRANSFORMER

AMP/FRAME

- AMPS / POLES — CIRCUIT BREAKER, MCP 1-POLE / 3-POLE
- GROUND CONNECTION
- INSTRUMENT
- NO CR NC CR — CONTACT NORMALLY OPEN / CLOSED
- BUS STAB ON MCC; CORD & PLUG CONNECTION FOR MOTORS
- SCR

SENSING SWITCHES		
CLOSE ON		SENSED VARIABLE
RISING	FALLING	
FS	FS	FLOW
LS	LS	LEVEL
PS	PS	PRESSURE
TS	TS	TEMPERATURE
LIMIT SWITCHES		
ZS	CLOSE ON REACHING LIMIT	
ZS	CLOSE ON LEAVING LIMIT	

TIMED CONTACTS			
SYMBOL	NORMAL	OPEN TO CLOSED	CLOSED TO OPEN
TR	OPEN	DELAYED	INSTANTANEOUS
TR	CLOSED	INSTANTANEOUS	DELAYED
TR	OPEN	INSTANTANEOUS	DELAYED
TR	CLOSED	DELAYED	INSTANTANEOUS

BUZZER; BELL; HORN

OL — THERMAL OVERLOAD

ELEMENTARY DIAGRAMS

E1 UNDERLINED WORDS SHOWN AT A PUSHBUTTON, LIGHT, SELECTOR SWITCH, ETC. INDICATE THE LEGEND PLATE REQUIREMENT FOR THAT PARTICULAR DEVICE. ANY ADDITIONAL NAMEPLATES ARE INDICATED ON ELEVATIONS WITH THE REQUIRED NAMEPLATE INSCRIPTIONS.

E2 "NORMAL" STATUS OF SWITCHES OR CONTACTS IS THE SHELF POSITION.

E3 NUMBERS AND LETTERS IDENTIFY DEVICE.

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REGISTERED PROFESSIONAL ENGINEER — ZACHARY C. DEVLIN — No. E21170 — ELECTRICAL — STATE OF CALIFORNIA — 04/23/21

DESIGNED	ZCD
DRAWN	RM
CHECKED	JRM

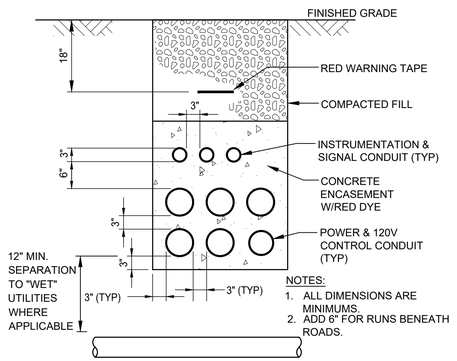
CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

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ELECTRICAL
ABBREVIATIONS AND GENERAL NOTES

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JOB NO.	1944519.00
DATE	APRIL 2020
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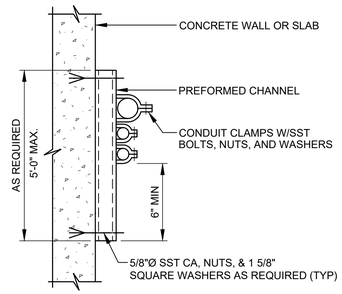
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TYPICAL UNREINFORCED DUCT BANK

1

SUB-TITLE
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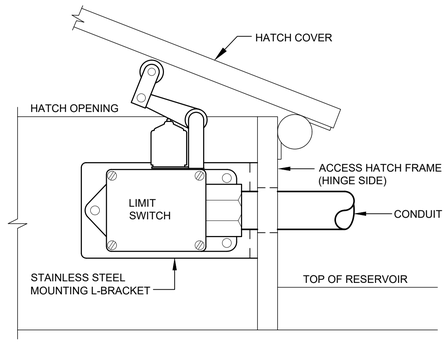


NOTES:
1. THIS DETAIL TYPICAL FOR BOTH VERTICAL AND HORIZONTAL MOUNTING.
2. PREFORMED CHANNEL, FITTINGS AND CLAMPS SHALL BE HOT-DIP GALVANIZED STEEL. FIELD COAT ALL CUTS PER SPECIFICATIONS.
3. CHANNELS TO BE SPACED AT 5'-0" OC MAXIMUM.

CONDUIT SUPPORT

2

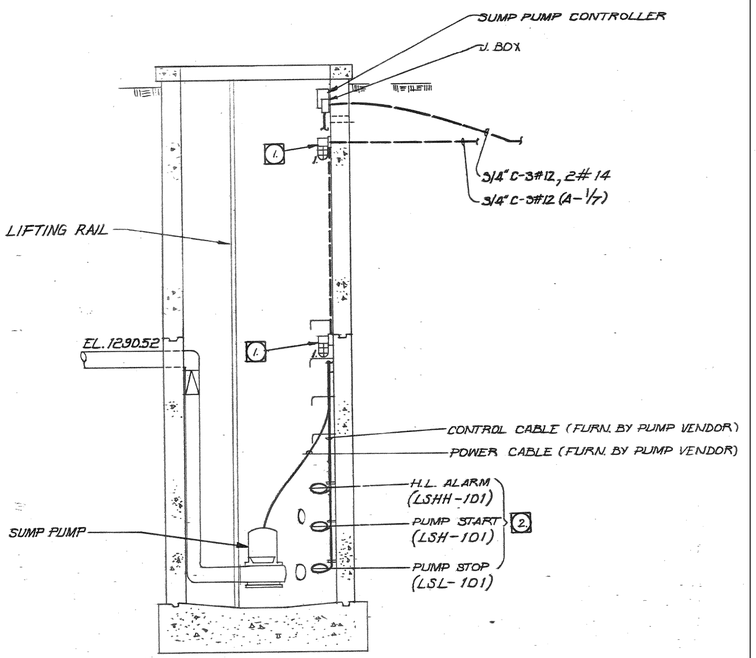
SUB-TITLE
SCALE: NTS



HATCH LIMIT SWITCH DETAIL 2

3

SUB-TITLE
SCALE: NTS

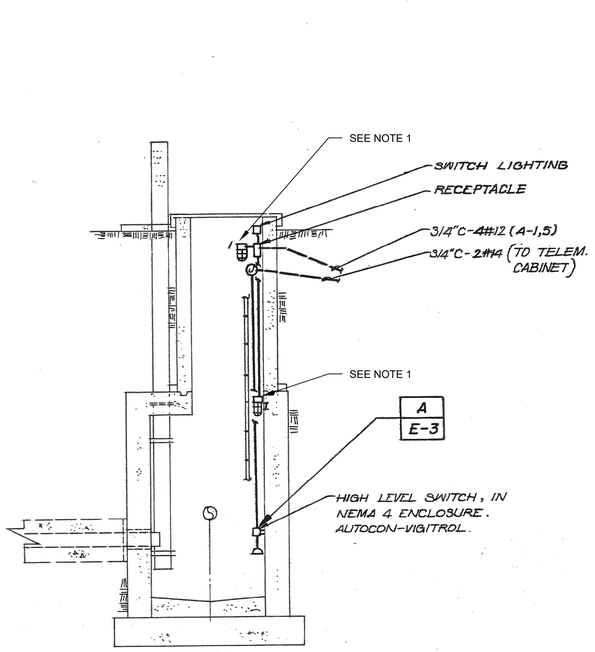


NOTES:
1. THIS DETAIL IS A REPRODUCTION OF THE ORIGINAL CONSTRUCTION DOCUMENT AND SHOWS THE EXISTING EQUIPMENT CONFIGURATION.
2. DISCONNECT AND REMOVE ALL EXISTING LIGHTS, RECEPTACLE, SUMP PUMP, CONDUITS, CONDUCTORS AND APPURTENANCES LOCATED ON AND AROUND MANHOLE.
3. PROVIDE TWO NEW TYPE B FIXTURES AT SAME HEIGHTS AS EXISTING FIXTURES. PROVIDE NEW SUMP PUMP AND LEVEL SWITCHES. PROVIDE NEW EXHAUST FAN RECEPTACLE. PROVIDE NEW CONDUITS AND CONDUCTORS REQUIRED TO SERVE ALL NEW EQUIPMENT AS SHOWN ON SHEET E-7.

EXISTING COLLECTOR MANHOLE

4

SUB-TITLE
SCALE: NTS

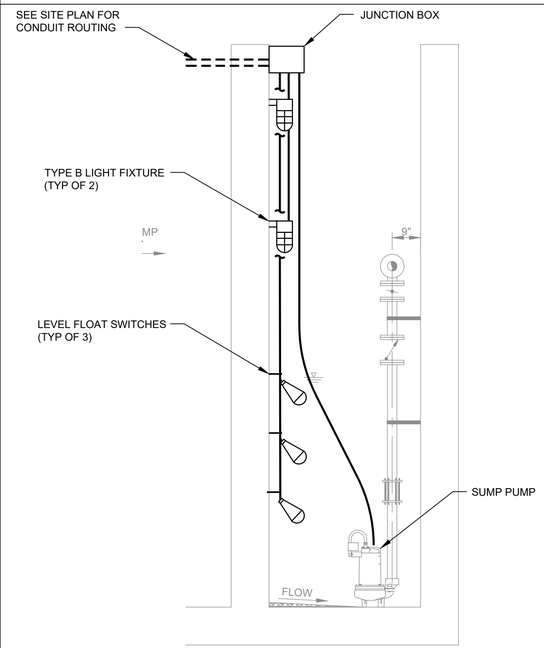


NOTES:
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2. DISCONNECT AND REMOVE ALL EXISTING CONDUITS, CONDUCTORS AND APPURTENANCES LOCATED ON AND AROUND MANHOLE.
3. PROVIDE TWO NEW TYPE B FIXTURES AT SAME HEIGHTS AS EXISTING FIXTURES. PROVIDE NEW EXHAUST FAN RECEPTACLE. PROVIDE NEW LEVEL SWITCH. PROVIDE NEW CONDUITS AND CONDUCTORS REQUIRED TO SERVE ALL NEW EQUIPMENT AS SHOWN ON SHEET E-7.

EXISTING OBSERVATION MANHOLE

5

SUB-TITLE
SCALE: NTS



NOTES:
1. PROVIDE TWO NEW TYPE B FIXTURES (COORDINATE WITH OWNER FOR HEIGHTS), PROVIDE SUMP PUMP AND LEVEL SWITCHES, AND PROVIDE NEW CONDUITS AND CONDUCTORS REQUIRED TO SERVE ALL NEW EQUIPMENT AS SHOWN ON SHEET E-7.

DRAIN SUMP

6

SUB-TITLE
SCALE: NTS

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SCALES
0 1"
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REGISTERED PROFESSIONAL ENGINEER
ZACHARY C. DEVLIN
No. E21170
ELECTRICAL
STATE OF CALIFORNIA
04/23/21

DESIGNED	ZCD
DRAWN	RM
CHECKED	JRM

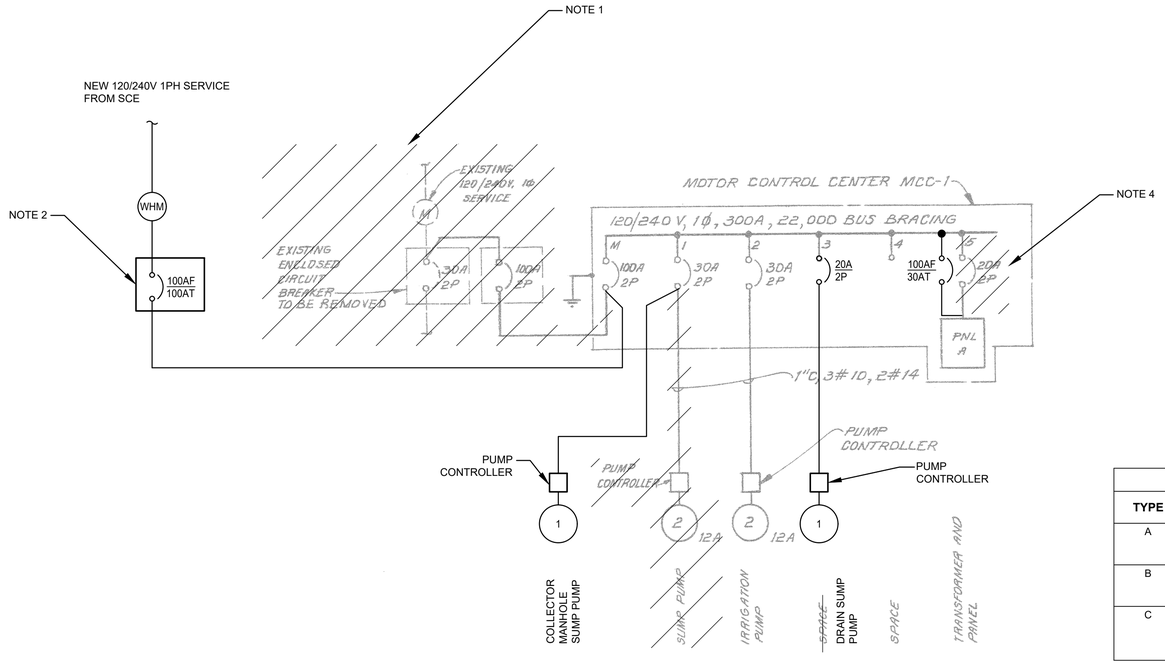
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SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

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ELECTRICAL DETAILS

FILE NAME	1944519.00-E-2.dwg
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NOTES

1. DISCONNECT AND REMOVE EXISTING SERVICE ENTRANCE EQUIPMENT.
2. PROVIDE NEW SERVICE ENTRANCE EQUIPMENT (METER SOCKET AND SERVICE DISCONNECT) IN ACCORDANCE WITH SCE REQUIREMENTS.
3. PROVIDE NEW 20A SINGLE POLE BREAKER IN EXISTING SPACE.
4. REPLACE EXISTING 20A PANEL A MAIN BREAKER WITH NEW 30A BREAKER. PROVIDE NEW 3-#10AWG, 1-#10G MAIN FEEDER CONDUCTORS.

LIGHTING FIXTURE SCHEDULE

TYPE	DESCRIPTION	LAMPS	WATTS /FIXTURE	MANUFACTURER CATALOG NUMBER	MOUNTING
A	WALLPACK, LED WITH INTEGRAL PHOTOELECTRIC CELL AND TAMPER PROOF SCREWS	LED	45	LITHONIA #TWP LED 20C 700 40K T3M 120 PE TP DBLXD OR EQUAL	SURFACE WALL
B	WALL-MOUNTED LED, GASKETED VAPORTIGHT, CAST ALUMINUM CORROSION-RESISTANT HOUSING	LED	15	LITHONIA #OLTWM	SURFACE WALL
C	SURFAcE-MOUNTED LED FLOOD, GASKETED VAPORTIGHT, CAST ALUMINIUM CORROSION RESISTANT HOUSING	LED	200	HOLOPHANE PSLED P5 40K MVOLT 45	SURFACE CEILING

NOTE 3

(E) PANEL A					FED FROM: MCC				
240	/120 VOLTS, SINGLE PHASE, 3 WIRE	BUS: 100A		AIC: 10KA		MAIN: 30A/2P	MOUNTING: MCC		
CKT. NO.	DESCRIPTION	CONNECTED KVA		TRIP AMPS/ POLES	CKT. NO.	DESCRIPTION	CONNECTED KVA		TRIP AMPS/ POLES
		A	B				A	B	
1	LIGHTS	0.6		20/1	2	MCC SPACE HEATER	0.2		20/1
3	FLOODLIGHTS		1.0	20/1	4	MCC RECEPT		0.2	20/1
5	PORTABLE EXH FAN RECEPT	0.7		20/1	6	TELEMETRY	0.5		20/1
7	PORTABLE EXH FAN RECEPT		0.7	20/1	8	CONTROL POWER		0.3	20/1
9	GATE OPERATOR	1.4		20/1	10	RESERVOIR NO. 3 SITE LIGHTING	0.4		20/1
11	SPACE		0.0	-	12	RESERVOIR NO. 4 SITE LIGHTING		0.8	20/1
13	SPACE	0.0		-	14	SPACE	0.0		-
15	SPACE		0.0	-	16	SPACE		0.0	-
PHASE SUBTOTALS (KVA):		2.7	1.7				1.1	1.3	
PHASE TOTALS (KVA):							**3.8**	**2.9**	
TOTAL KVA:								**6.7**	KVA
TOTAL AMPERES:								**28**	A

NOTE 3

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NO.	REVISION	DATE	BY

SCALES

0 1"
0 25mm

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REGISTERED PROFESSIONAL ENGINEER ZACHARY C. DEVLIN No. E21170 ELECTRICAL STATE OF CALIFORNIA

04/23/21

DESIGNED ZCD
DRAWN RM
CHECKED JRM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

ELECTRICAL ONE LINE DIAGRAM AND PANELBOARD SCHEDULE

FILE NAME 1944519.00-E-3.dwg
JOB NO. 1944519.00
DATE APRIL 2020
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NOTES

1. DISCONNECT AND REMOVE ALL EXISTING CONDUITS, CONDUCTORS AND APPURTENANCES LOCATED ON AND AROUND RESERVOIR 4. PROTECT IN PLACE ALL OTHER CONDUIT, CONDUCTORS, AND EQUIPMENT TO REMAIN.
2. PROVIDE NEW WORK AS SHOWN ON SHEET E-5. DEMOLITION SHALL NOT BEGIN UNTIL NEW ELECTRIC AND TELEPHONE SERVICES ARE ESTABLISHED AND ALL RESERVOIR 3 EQUIPMENT HAS BEEN RE-FED TO ALLOW RESERVOIR 3 TO REMAIN IN SERVICE THROUGHOUT THE DURATION OF CONSTRUCTION.

USE OF DOCUMENTS

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SCALES
0 1"
0 25mm
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REGISTERED PROFESSIONAL ENGINEER ZACHARY C. DEVLIN No. E21170 ELECTRICAL STATE OF CALIFORNIA
04/23/21

DESIGNED	ZCD
DRAWN	RM
CHECKED	JRM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc

ELECTRICAL
DEMO SITE PLAN

FILE NAME	1944519.00-E-4.dwg
JOB NO.	1944519.00
DATE	APRIL 2020
SHEET	E-4 OF ##

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(E) RESERVOIR NO. 3

(E) POLE
NOTE 5

S-005

(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY

S-001

P-001

S-004

P-012

P-013

C-015

B
S-10

SIGNAL JUNCTION BOX

S-002

S-003

(E) LE-104

(E) LIT-104

LIT-105

P-010

C-013

POWER/CONTROL JUNCTION BOX

P-011

C-014

(E) POWER/CONTROL JUNCTION BOX

ZS-107B

ACCESS HATCH 2 INTRUSION SWITCH JUNCTION BOX

P-015

(E) ZS-106

ACCESS HATCH 1 INTRUSION SWITCH JUNCTION BOX

ZS-107A

C-012

GATE OPERATOR KEYPAD 2

C-017

GATE OPERATOR 2
NOTE 2

P-008

C-010

P-009

C-011

DRAIN SUMP PUMP CONTROL PANEL

P-014

C-005

(E) LSHH-103

LSH-101

LSHH-101

LSL-101

DRAIN SUMP

6
E-2

COLLECTOR MANHOLE SUMP PUMP CONTROL PANEL

P-006

C-006

P-016

C-018

C-016

GATE OPERATOR 1
NOTE 2

LSH-102

LSH-108

LSHH-108

LSL-108

(E) OVERFLOW STRUCTURE

DRAIN SUMP PUMP

RESERVOIR NO. 4

GATE OPERATOR KEYPAD 1

NEW HIGH-SPEED DATA SERVICE TO BE DETERMINED BY OWNER

P-005

P-017

C-004

C-019

(E) COLLECTOR MANHOLE
SEE NOTE 3

(E) OBSERVATION MANHOLE
SEE NOTE 4

MAN HOLE JUNCTION BOX

COLLECTOR MANHOLE SUMP PUMP

4
E-2

5
E-2

NEW ELECTRIC SERVICE METER AND DISCONNECT

PLAN VIEW 1 E-5

0 10 20

1"=10'

NOTES

1. ALL CONDUITS SHOWN AS EXPOSED SHALL BE SURFACE-MOUNTED ON EXTERIOR FACE OF RESERVOIR ROOF AND WALLS.
2. PROVIDE DUAL SWING GATE OPERATORS, LIFTMASTER CSW200UL WITH MK500GS KEYPAD OR EQUAL. CONFIGURE TO BE CONTROLLED BY HARDWIRED KEYPADS AS WELL AS WIRELESS REMOTE CONTROL. INSTALL COMPLETE WITH ALL APPURTENANCES IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.
3. PROVIDE SUMP PUMP WITH ASSOCIATED CONTROLLER AND FLOAT SWITCHES. PROVIDE TWO TYPE B LIGHT FIXTURES, MOUNTED AT SAME HEIGHTS AS EXISTING FIXTURES, AND RECEPTACLE FOR PORTABLE EXHAUST FAN.
4. PROVIDE NEW RECEPTACLE, LEVEL SWITCH, AND TWO TYPE B LIGHT FIXTURES, MOUNTED AT SAME HEIGHTS AS EXISTING FIXTURES. PROVIDE NEW CONDUITS AS SHOWN TO RE-FEED EQUIPMENT.
5. PROVIDE TWO CAMERAS. MOUNT ON EXISTING POLE. AIM ONE CAMERA TO COVER NORTH PROPERTY LINE, AND ONE CAMERA TO COVER ENTRANCE GATE. COORDINATE WITH OWNER FOR CAMERA MODEL AND MOUNTING HEIGHT.

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REGISTERED PROFESSIONAL ENGINEER
ZACHARY C. DEVLIN
No. E21170
ELECTRICAL
STATE OF CALIFORNIA
04/23/21

DESIGNED ZCD

DRAWN RM

CHECKED JRM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON CONSULTING, INC.

ELECTRICAL SITE PLAN

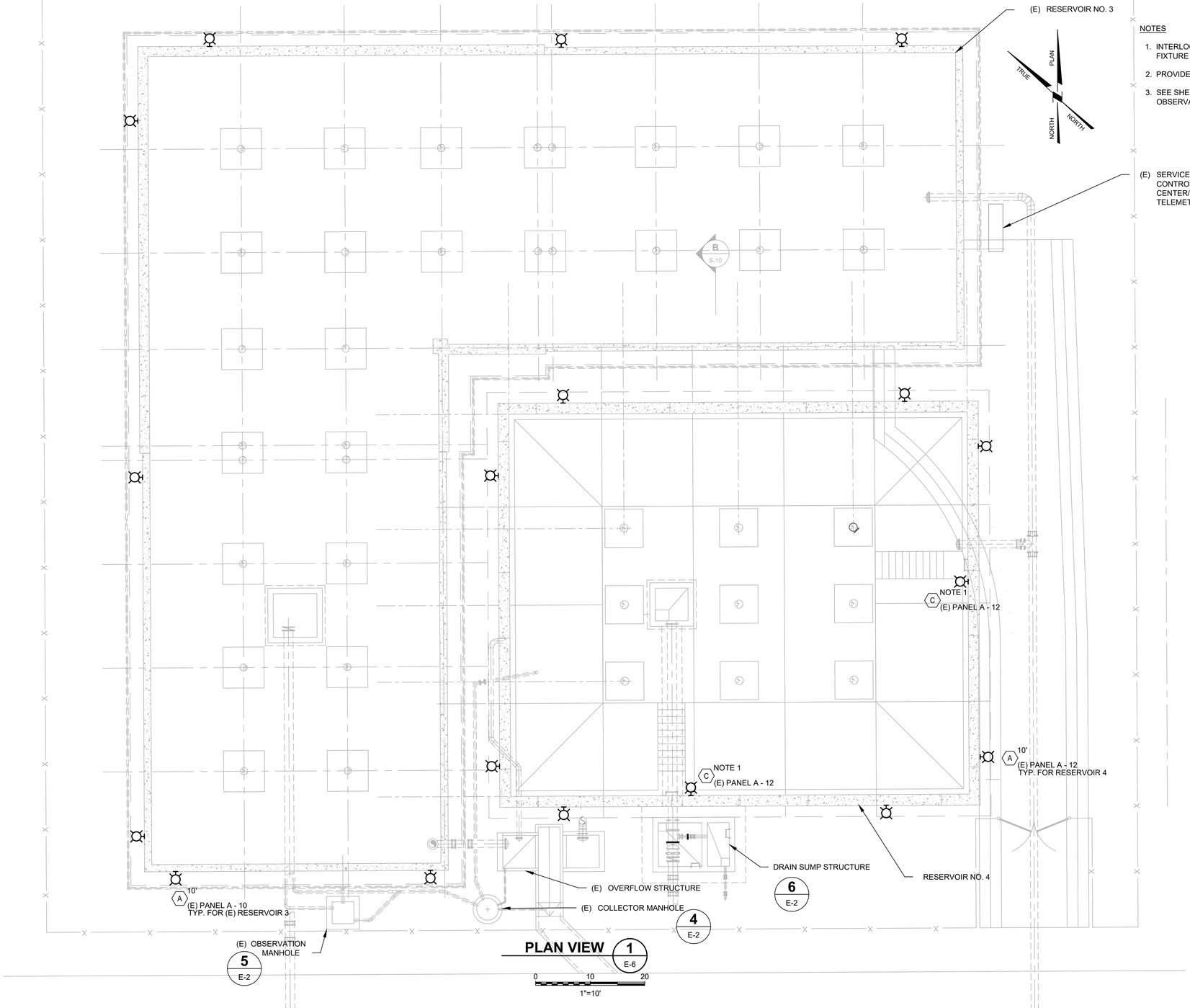
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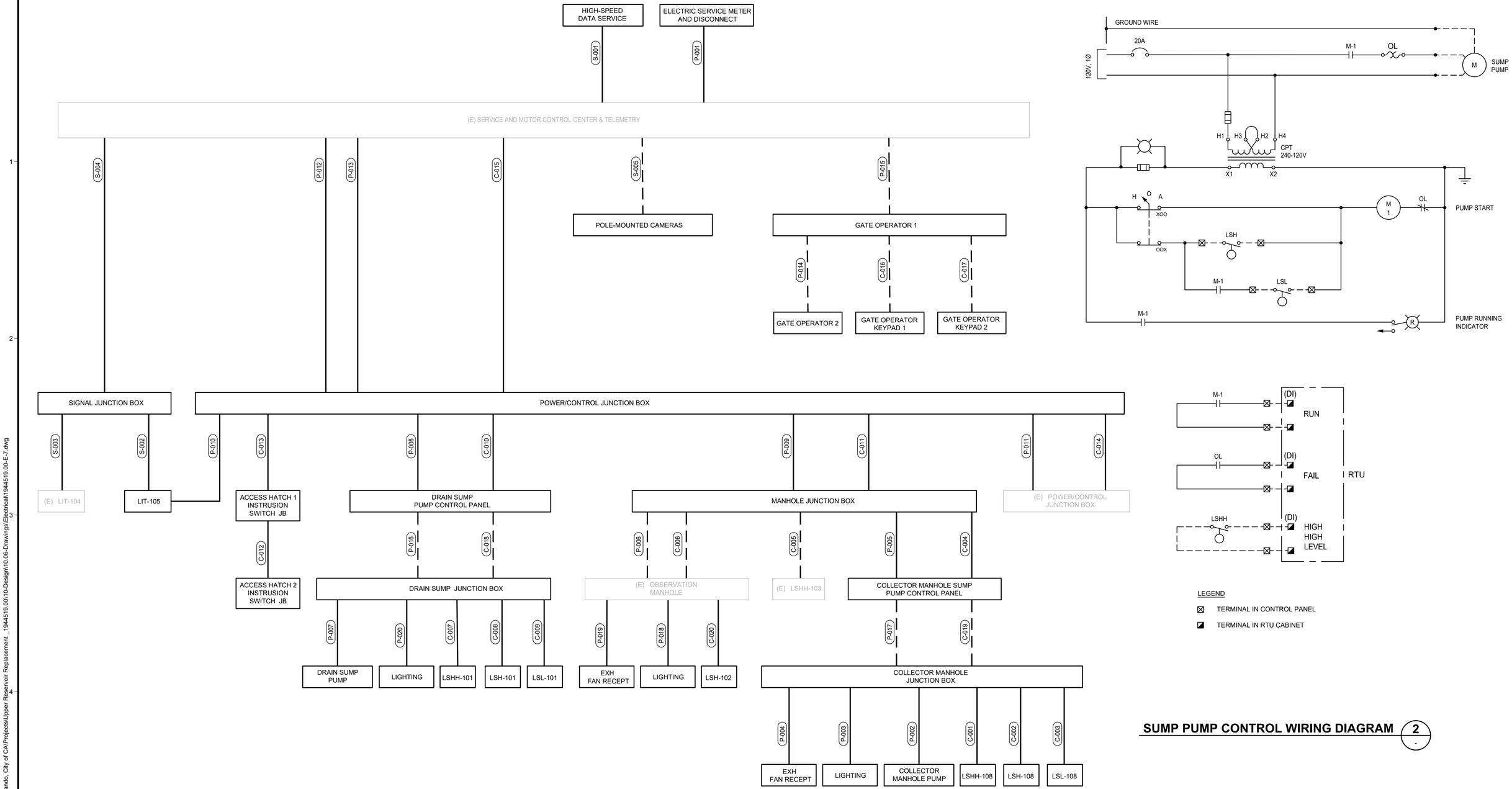
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ELECTRICAL LIGHTING PLAN

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CONDUIT BLOCK DIAGRAM 1

SUMP PUMP CONTROL WIRING DIAGRAM 2

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CITY OF SAN FERNANDO
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ELECTRICAL
CONDUIT BLOCK DIAGRAM

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CONDUIT AND WIRE SCHEDULE

NUMBER	FROM	TO	SIZE (")	POWER	CONTROL	SIGNAL	COMMENTS
P-001	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	ELETRICAL SERVICE METER AND DISCONNECT	1-1/2"	3#1, 1#6G			
P-002	COLLECTOR MANHOLE JUNCTION BOX	COLLECTOR MANHOLE PUMP	3/4"	2#10, 1#10G			
P-003	COLLECTOR MANHOLE JUNCTION BOX	LIGHTING	3/4"	2#12, 1#12G			
P-004	COLLECTOR MANHOLE JUNCTION BOX	EXH FAN RECEPT	3/4"	2#12, 1#12G			
P-005	COLLECTOR MANHOLE JUNCTION BOX	COLLECTOR MANHOLE SUMP PUMP CONTROL PANEL	1"	4#12, 2#10, 1#10G			
P-006	MANHOLE JUNCTION BOX	(E) OBSERVATION MANHOLE	1"	4#12, 1#12G			
P-007	DRAIN SUMP JUNCTION BOX	DRAIN SUMP PUMP	3/4"	2#12, 1#12G			
P-008	POWER/CONTROL JUNCTION BOX	DRAIN SUMP PUMP CONTROL PANEL	1"	4#12, 1#12G			
P-009	POWER/CONTROL JUNCTION BOX	MANHOLE JUNCTION BOX	1"	8#12, 2#10, 1#10G			
P-010	POWER/CONTROL JUNCTION BOX	LIT-105	3/4"	2#12, 1#12G			
P-011	POWER/CONTROL JUNCTION BOX	(E) POWER/CONTROL JUNCTION BOX	3/4"	4#12, 1#12G			
P-012	POWER/CONTROL JUNCTION BOX	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	1-1/2"	18#12, 1#12G			
P-013	POWER/CONTROL JUNCTION BOX	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	1"	2#10, 1#10G			
P-014	GATE OPERATOR 1	GATE OPERATOR 2	1"	2#12, 1#12G			
P-015	GATE OPERATOR 1	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	1"	2#12, 1#12G			
P-016	DRAIN SUMP PUMP CONTROL PANEL	DRAIN SUMP PUMPJUNCTION BOX	1"	2#12, 1#12G			
P-017	COLLECTOR MANHOLE SUMP PUMP CONTROL PANEL	COLLECTOR MANHOLE JUNCTION BOX	1"	4#12, 2#10, 1#10G			
P-018	(E) OBSERVATION MANHOLE	LIGHTING	3/4"	2#12, 1#12G			
P-019	(E) OBSERVATION MANHOLE	EXH FAN RECEPT	3/4"	2#12, 1#12G			
P-020	DRAIN SUMP JUNCTION BOX	LIGHTING	3/4"	2#12, 1#12G			
P-021	POWER/CONTROL JUNCTION BOX	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	1"	2#12, 1#12G			
C-001	COLLECTOR MANHOLE JUNCTION BOX	LSHH-108	3/4"		2#14, 1#14G		
C-002	COLLECTOR MANHOLE JUNCTION BOX	LSH-108	3/4"		2#14, 1#14G		
C-003	COLLECTOR MANHOLE JUNCTION BOX	LSL-108	3/4"		2#14, 1#14G		
C-004	COLLECTOR MANHOLE JUNCTION BOX	COLLECTOR MANHOLE SUMP PUMP CONTROL PANEL	1"		6#14, 1#14G		
C-005	MANHOLE JUNCTION BOX	(E) LSHH-103	3/4"		2#14, 1#14G		
C-006	MANHOLE JUNCTION BOX	(E) OBSERVATION MANHOLE	3/4"		2#14, 1#14G		
C-007	DRAIN SUMPJUNCTION BOX	LSHH-101	3/4"		2#14, 1#14G		
C-008	DRAIN SUMPJUNCTION BOX	LSL-101	3/4"		2#14, 1#14G		
C-009	DRAIN SUMPJUNCTION BOX	LSH-101	3/4"		2#14, 1#14G		
C-010	POWER/CONTROL JUNCTION BOX	DRAIN SUMP PUMP CONTROL PANEL	1"		6#14, 1#14G		
C-011	POWER/CONTROL JUNCTION BOX	MANHOLE JUNCTION BOX	1"		10#14, 1#14G		
C-012	ACCESS HATCH 2 INTRUSION SWITCH JB	ACCESS HATCH 1 INTRUSION SWITCH JB	3/4"		2#14, 1#14G		
C-013	ACCESS HATCH 1 INTRUSION SWITCH JB	POWER/CONTROL JUNCTION BOX	3/4"		4#14, 1#14G		
C-014	POWER/CONTROL JUNCTION BOX	(E) POWER/CONTROL JUNCTION BOX	3/4"		4#14, 1#14G		
C-015	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	POWER/CONTROL JUNCTION BOX	1"		24#14, 1#14G		
C-016	GATE OPERATOR 1	GATE OPERATOR KEYPAD 1	3/4"				MFR CABLE
C-017	GATE OPERATOR 1	GATE OPERATOR KEYPAD 2	3/4"				MFR CABLE
C-018	DRAIN SUMP PUMP CONTROL PANEL	DRAIN SUMP JUNCTION BOX	1"		6#14, 1#14G		
C-019	COLLECTOR MANHOLE SUMP PUMP CONTROL PANEL	COLLECTOR MANHOLE JUNCTION BOX	1"		6#14, 1#14G		
C-020	(E) OBSERVATION MANHOLE	LSH	3/4"		2#14, 1#14G		
S-001	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	HIGH SPEED DATA SERVICE	1"			1-CAT6	
S-002	SIGNAL JUNCTION BOX	LIT-105	1"			1-PR#16(SH)	
S-003	SIGNAL JUNCTION BOX	(E) LIT-104	1"			1-PR#16(SH)	
S-004	SIGNAL JUNCTION BOX	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	1"			2-PR#16(SH)	
S-005	(E) SERVICE AND MOTOR CONTROL CENTER & TELEMETRY	POLE-MOUNTED CAMERAS	1"			2-CAT6	

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SCALES

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0 25mm

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REGISTERED PROFESSIONAL ENGINEER
ZACHARY C. DEVLIN
No. E21170
ELECTRICAL
STATE OF CALIFORNIA
04/23/21

DESIGNED ZCD

DRAWN RM

CHECKED JRM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

ELECTRICAL
CONDUIT AND WIRE SCHEDULE

FILE NAME 1944519.00-E-8.dwg

JOB NO. 1944519.00

DATE APRIL 2020

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VALVES

- GATE VALVE
- GLOBE VALVE
- PLUG VALVE
- CHECK VALVE
- DUCKBILL CHECK VALVE
- BALL CHECK VALVE
- PINCH VALVE
- DIAPHRAGM VALVE
- BUTTERFLY VALVE
- BALL VALVE
- BALL VALVE CLOSED
- NEEDLE VALVE
- PLUG (COCK)
- PRESSURE REDUCING REGULATING VALVE, SELF-CONTAINED
- BACK PRESSURE REGULATING VALVE, SELF-CONTAINED
- PRESSURE REDUCING REGULATOR WITH EXTERNAL PRESSURE TAP
- 3-WAY VALVE
- 4-WAY VALVE
- ANGLE VALVE
- PRESSURE RELIEF VALVE
- FOOT VALVE
- * FC = FAIL CLOSED LC = LOCKED CLOSED
  FO = FAIL OPEN LO = LOCKED OPEN
- CLOSED DURING NORMAL OPERATION
- SHADING INDICATES PORT TO BE CLOSED DURING NORMAL OPERATION. DOT INDICATES PORT TO BE CLOSED DURING ALTERNATE OPERATION.

VALVE OPERATORS

- DIAPHRAGM
- DIAPHRAGM PRESSURE BALANCED
- DIAPHRAGM
- MOTOR
- CYLINDER OPERATOR
- S SOLENOID
- SV SOLENOID VALVE

FLOW PRIMARY ELEMENTS

- ORIFICE PLATE
- SINGLE PORT PITOT TUBE OR PITOT-VENTURI TUBE
- VENTURI TUBE
- AVERAGING PITOT TUBE
- FLUME
- WEIR
- TURBINE OR PROPELLER-TYPE PRIMARY ELEMENT
- THERMAL MASS FLOWMETER
- POSITIVE DISPLACEMENT TYPE FLOW TOTALIZING INDICATOR
- VORTEX SENSOR
- TARGET TYPE SENSOR
- FLOW NOZZLE
- M MAGNETIC FLOWMETER
- SONIC FLOWMETER
- X X ROTAMETER
- X X ROTAMETER WITH INTEGRAL VALVE

LINES

- MAIN PROCESS
- SECONDARY PROCESS
- INSTRUMENT CONNECTION
- EQUIPMENT ENCLOSURE
- EQUIP ID — EQUIPMENT TO/FROM IDENTIFIER
- SH (#) — REFERENCE SHEET/GRID NUMBER
- SYSTEM — SYSTEM DESCRIPTOR
- 24" BW — PIPE SYSTEM / PIPE SIZE IN INCHES
- TOP / MIDDLE / BOTTOM — AAABBBCCCDDD — EQUIPMENT TAG (SEE EQUIPMENT ASSET TAGGING STANDARD)
  - THREE DIGIT ITEM NUMBER
  - THREE DIGIT EQUIPMENT CODE
  - THREE DIGIT SYSTEM SERVICE CODE
  - THREE DIGIT PLANT ZONE NUMBER
- MECHANICAL
- OR
- CONNECTED
- NOT CONNECTED

MISCELLANEOUS

- FLANGE
- UNION
- Y STRAINER
- FLOW STRAIGHTENING VANE
- TEE
- SCREWED CAP
- WELDED CAP
- BLIND FLANGE
- REDUCER
- HB HOSE BIBB CONNECTION
- CHEMICAL PIPING FLEXIBLE CONNECTION/ FLEXIBLE HOSE
- FLEXIBLE TANK CONNECTION
- BRAIDED METAL HOSE
- METAL BELLOWS
- EXPANSION JOINT
- FLEXIBLE COUPLING
- FLANGED COUPLING ADAPTER
- SLUICE GATE OR SLIDE GATE
- DRAIN
- SPRAY NOZZLE
- DIAPHRAGM SEAL
- ANNULAR SEAL
- RUPTURE DISK, PRESSURE
- RUPTURE DISK, VACUUM
- P PURGE
- SIGHT GLASS
- THERMOMETER WELL
- CALIBRATION CYLINDER
- PULSATION DAMPER
- AIR RELIEF VALVE
- AIR RELEASE
- LEVEL PROBE
- CHEMICAL DIFFUSER
- INJECTION MIXER
- STATIC MIXER
- EDUCTOR/INJECTOR
- * AV - AIR VALVE T - TRAP
  F - FILTER FH - FIRE HYDRANT
- WATER LINE
- GRAVITY FLOW

MISCELLANEOUS

- VENT
- FLAME ARRESTOR
- BUBBLER
- HEAT TRACE
- SILENCER — SILENCER
- SNUBBER
- SONIC SENSOR — RF ADMITTANCE ANTENNA
- DISCONNECT'
- 55 GAL DRUM
- * DENOTES SUPPLIED BY MFR
- STEEL TANK
- PLASTIC TANK
- FLAT TOP TANK
- OPEN TOP TANK
- PRESSURE VESSLES (VERTICAL AND HORIZONTAL)
- HORIZONTAL HEAT EXCHANGER
- VERTICAL HEAT EXCHANGER

EQUIPMENT

- M MIXER
- M VERTICAL TURBINE PUMP
- M SUBMERSIBLE PUMP
- PUMP BLOWER
- PUMP
- METERING PUMP
- PUMP PROGRESSIVE CAVITY
- ROTARY PUMP
- PERISTALTIC PUMP
- TURBINE PUMP
- HORIZONTAL SCREW CONVEYOR
- INCLIINED SCREW CONVEYOR
- BELT CONVEYOR
- VERTICAL TURBINE PUMP HEAD
- VERTICAL TURBINE PUMP T-HEAD
- VERTICAL TURBINE PUMP CAN
- VERTICAL TURBINE PUMP INTAKE

NOTES:

1. THIS IS A GENERALIZED LEGEND SHEET.
2. SEE ALSO ISA S5.1, S5.3 AND S7.3.
3. INSTRUMENTS MARKED WITH AN ASTERISK ARE FURNISHED WITH THE EQUIPMENT.
4. REFER TO ISA RP7.7 FOR INSTRUMENT AIR QUALITY STANDARDS.

TYPICAL CONNECTION

- X X IN-LINE DEVICE
- X X DIRECT CONNECTION TO PROCESS
- X X TEMPERATURE ELEMENT WITH WELL
- X X RADIATION OR SONIC SENSING
- X X FILLED SYSTEM, DIAPHRAGM SEAL CONNECTION

EQUIPMENT CONTINUED

- M SUBMERSIBLE PUMP
- DU DRIVE UNIT
- GATE - NORMALLY CLOSED
- GATE - NORMALLY OPEN
- EYE WASH
- EYE WASH/SHOWER
- FAN

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REGISTERED PROFESSIONAL ENGINEER — JEFFREY R. MOORE — No. E 18977 Exp. 12/31/21 — STATE OF CALIFORNIA

DESIGNED	LR
DRAWN	RM
CHECKED	JRM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
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I&C
PROCESS LEGEND

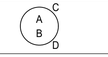
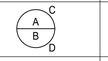
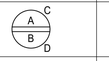
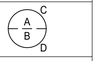
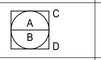
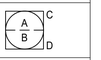
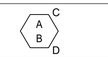
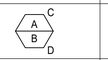
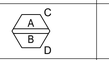
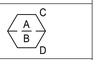
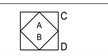
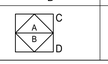
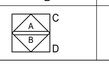
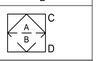
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INSTRUMENT SYMBOL IDENTIFIERS

	FIRST LETTER (1)		SUCCEEDING LETTERS (15)		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (2)(3)(4)		ALARM		
B	BURNER, COMBUSTION (2)		USER'S CHOICE (5)	USER'S CHOICE (5)	USER'S CHOICE (5)
C	USER'S CHOICE (3a)(5)			CONTROL (23a)(23e)	CLOSED (27b)
D	DENSITY	DIFFERENTIAL	DAMPER		
E	VOLTAGE (2)		SENSOR (PRIMARY ELEMENT)		
F	FLOW, FLOW RATE (2)	RATIO (FRACTION) (2b)			
G	USER'S CHOICE		GLASS, VIEWING DEVICE (16)		
H	HAND (2)				HIGH (27A)(28A)(29)
I	CURRENT (ELECTRICAL)(2)		INDICATE (17)		
J	POWER (2)		SCAN (18)	SCAN (18)	
K	TIME, TIME SCHEDULE (2)	TIME RATE OF CHANGE (12c)(13)		CONTROL STATION (24)	
L	LEVEL (2)		LIGHT (19)		LOW (27b)(28)(29)
M	MOISTURE	MOMENTARY	MOTION	MOTOR	MIDDLE, INTERMEDIATE
N	USER'S CHOICE (5)		USER'S CHOICE (5)	USER'S CHOICE (5)	USER'S CHOICE (5)
O	USER'S CHOICE (5)		ORIFICE, RESTRICTION		OPEN (27a)
P	PRESSURE, VACUUM (2)		POINT (TEST) CONNECTION		
Q	QUANTITY (2)	INTEGRATE, TOTALIZE	INTEGRATE, TOTALIZE		
R	RADIATION (2)		RECORD (20)		RUN
S	SPEED, FREQUENCY (2)	SAFETY (14)		SWITCH (23b)	STOP
T	TEMPERATURE (2)			TRANSMIT	
U	MULTI VARIABLE (2)(6)		MULTIFUNCTION (21)	MULTIFUNCTION (21)	MULTIFUNCTION (21)
V	VIBRATION, MECHANICAL ANALYSIS (2)(4)(7)			VALVE, DAMPER, OR LOUVER (23c)(23e)	
W	WEIGHT, FORCE (2)		WELL, PROBE		
X	UNCLASSIFIED (8)	X AXIS (11c)	ACCESSORY DEVICES (22) UNCLASSIFIED (8)	UNCLASSIFIED (8)	UNCLASSIFIED (8)
Y	EVENT, STATE, PRESENCE (2)(9)	Y AXIS (11c)		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION (2)	Z AXIS (11c), SAFETY INSTRUMENTED SYSTEM (30)		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

NOTE: NUMBERS IN PARANTHESES REFER TO EXPLANATORY NOTES IN ANSI/ISA-5.1-2009, SECTION 4.2

GENERAL INSTRUMENT OR FUNCTION SYMBOLS	FIELD MOUNTED	PRIMARY LOCATION ACCESSIBLE TO OPERATOR	AUXILIARY LOCATION ACCESSIBLE TO OPERATOR	NORMALLY INACCESSIBLE OR BEHIND THE PANEL
DISCRETE INSTRUMENTS				
SHARED DISPLAY, SHARED CONTROL				
COMPUTER FUNCTION				
PROGRAMMABLE LOGIC CONTROL				



A: ISA IDENTIFICATION LETTERS (SEE TABLE OR REFER TO ANSI/ISA-5.1-2009; TABLE 4.1)
B: LOOP NUMBER, MINIMUM OF FOUR CHARACTERS (####)
C: USER DESCRIPTOR
D: MEASUREMENT (REFER TO ANSI/ISA-5.1-2009; TABLE 5.2.2)
E & F: PROCESS CONTROL DESCRIPTORS

J-4 FUNCTION BLOCK DESIGNATORS

- SUMMING
- DIFFERENCE
- INTEGRAL
- DERIVATIVE
- MULTIPLYING
- DIVIDING
- CONVERT:
- ROOT EXTRACTION
- SQUARE ROOT
- EXPONENTIAL
- HIGH SELECTING
- LOW SELECTING
- BIAS
- NONLINEAR OR UNSPECIFIED FUNCTION

* E - VOLTAGE
I - CURRENT
P - PNEUMATIC
A - ANALOG
B - BINARY
H - HYDRAULIC
O - ELECTROMAGNETIC, SONIC
R - RESISTANCE (ELECT)
D - DIGITAL

J-6 HANDSWITCH DESIGNATORS

HOA	HAND-OFF-AUTO	LR	LOCAL-REMOTE
HOR	HAND-OFF-REMOTE	OC	OPEN-CLOSE
F-R	FORWARD-REVERSE	OCA	OPEN-CLOSE-AUTO
1-0	ON-OFF	A/M	AUTO-MANUAL

INSTRUMENT SERVICES

- AS — INSTRUMENT AIR SUPPLY (NOTE 4)
- ES — 120 VAC ELECTRICAL SERVICE (DIFFERENT VOLTAGES ARE SPECIFICALLY NOTED)

PLC INPUT/OUTPUT

- DISCRETE INPUT
- ANALOG INPUT
- DISCRETE OUTPUT
- ANALOG OUTPUT

MISCELLANEOUS

- EQUIP ID — EQUIPMENT TO/FROM IDENTIFIER
- SH (#) — REFERENCE SHEET/GRID NUMBER
- SYSTEM — SYSTEM DESCRIPTOR



INTERLOCK. NUMBER IS THE CROSS REFERENCE TO A SPECIFIC ELEMENTARY DIAGRAM OR TO A SPECIFIC CONTROL STRATEGY DESCRIBED IN THE SPECS



PILOT LIGHT

INSTRUMENT LINE SYMBOLS

- INSTRUMENT OR CONNECTION TO PROCESS
- PNEUMATIC SIGNAL
- ELECTRIC ANALOG SIGNAL
- ELECTRIC DISCRETE SIGNAL
- HYDRAULIC SIGNAL — L — L
- CAPILLARY TUBE — X — X
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (UN-GUIDED)
- INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
- ELECTRIC SIGNAL LINE ARROW
- HARDWIRED INTERLOCK — I
- LINE BREAK OR GAP
- ELECTRICAL — CONNECTED / NOT CONNECTED

- FIBER DEVICE LEVEL RING — F10
- COPPER DEVICE LEVEL RING — C10
- HART — H — H
- MODBUS — MB — MB
- SERIAL — S — S
- CONTROL NET — CN — CN
- COPPER ETHERNET — C — C
- FIBER OPTIC ETHERNET — F — F
- WIRELESS ETHERNET — W — W
- DEVICENET — DN — DN
- PROFIBUS DP — PBD — PBD
- PROFIBUS PA — PBA — PBA

NOTES:

1. THIS IS A GENERALIZED LEGEND SHEET.
2. SEE ALSO ISA S5.1, S5.3 AND S7.3.
3. INSTRUMENTS MARKED WITH AN ASTERISK ARE FURNISHED WITH THE EQUIPMENT.
4. REFER TO ISA RP7.7 FOR INSTRUMENT AIR QUALITY STANDARDS.
5. REFER TO DIVISION 17, ABBREVIATION APPENDIX FOR SPECIFIC NOMENCLATURE.

USE OF DOCUMENTS

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NO.	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER — JEFFREY R. MOSS — No. E 18977 Exp. 12/31/21 — STATE OF CALIFORNIA

DESIGNED LR
DRAWN RM
CHECKED JRM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

I&C
INSTRUMENTATION LEGEND

FILE NAME 1944519.00-I-2.dwg
JOB NO. 1944519.00
DATE APRIL 2020
SHEET I-2 OF ##

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SCADA

RTU

SITE POWER
EA 100
ES 100

RES 4 LEVEL
LI 105
LIT 105

DS HI-HI LEVEL
LAHH 101
LSHH 101

PUMP FAIL
YAF 101

PUMP RUN
YI 101

MH HI-HI LEVEL
LAHH 108
LSHH 108

PUMP FAIL
YAF 108

PUMP RUN
YI 108

O'FLOW BOX HI-HI
LAHH 103
LSHH 103

RES 3 LEVEL
LI 104
LIT 104

INTRUSION
ZA 106
ZS 106

OBS MH HIGH LEV
LAH 102
LSH 102

LCP-101
240VAC
HS 101
HOA
YC 101
YL 101

LCP-108
HS 108
HOA
YC 108
YL 108
240VAC

LIT 105
LI 109
ZS 107A
ZS 107B

BOOSTER PUMP STATION NO. 2 AT WATER DISTRICT YARD

RESERVOIR NO.4

VALVE VAULT
20"
1"
6"
OUTLET TIE-IN

FQI 110
1"
SAMPLE STATION

HOA
HS 108B
HOA
HS 108C
BOOSTER NO. 1 & 2 PUMP STATION

LSH 101
LSL 101

FROM OBSERVATION MANHOLE
LSH 108
LSL 108

DRAIN SUMP
COLLECTOR MANHOLE

OVERFLOW BOX

LIT 104
ZS 106
LE 104
RESERVOIR NO. 3

LSH 102
TO COLLECTOR MANHOLE

M

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0 25mm
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REGISTERED PROFESSIONAL ENGINEER
JEFFREY R. MEYERS
No. E 18977
Exp. 12/31/21
STATE OF CALIFORNIA

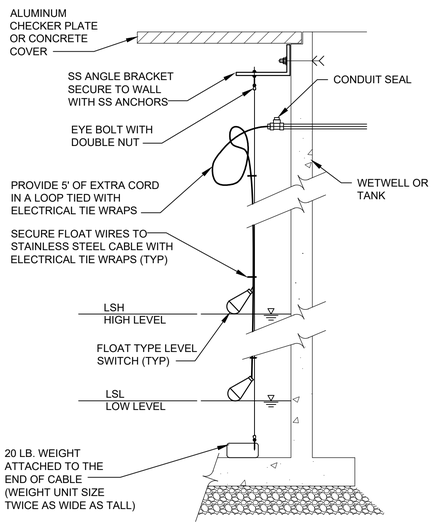
DESIGNED	LR
DRAWN	RM
CHECKED	JRM

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

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SHEET	I-3
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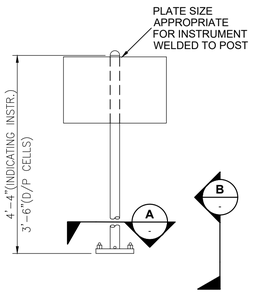


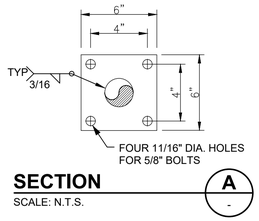
NOTES:
1. LENGTH OF CABLE SHALL NOT BE EXCESSIVE CAUSING SIGNIFICANT SLACK.

FLOAT TYPE LEVEL SWITCH INSTALLATION DETAIL

1

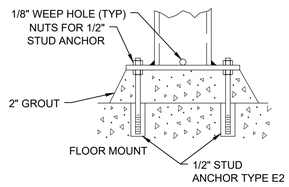
SUB-TITLE
SCALE: NTS





SECTION A

SCALE: N.T.S.



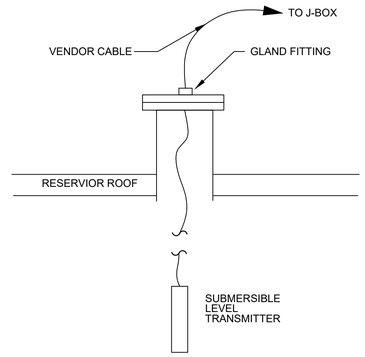
VIEW B

SCALE: N.T.S.

INSTRUMENT MOUNTING STAND

2

SUB-TITLE
SCALE: NTS



LEVEL INSTRUMENT DETAIL

3

SUB-TITLE
SCALE: NTS

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NO.	REVISION	DATE	BY

SCALES
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0 25mm
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REGISTERED PROFESSIONAL ENGINEER
JEFFREY R. MOTT
No. E 18977
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STATE OF CALIFORNIA

DESIGNED LR
DRAWN RM
CHECKED JRM

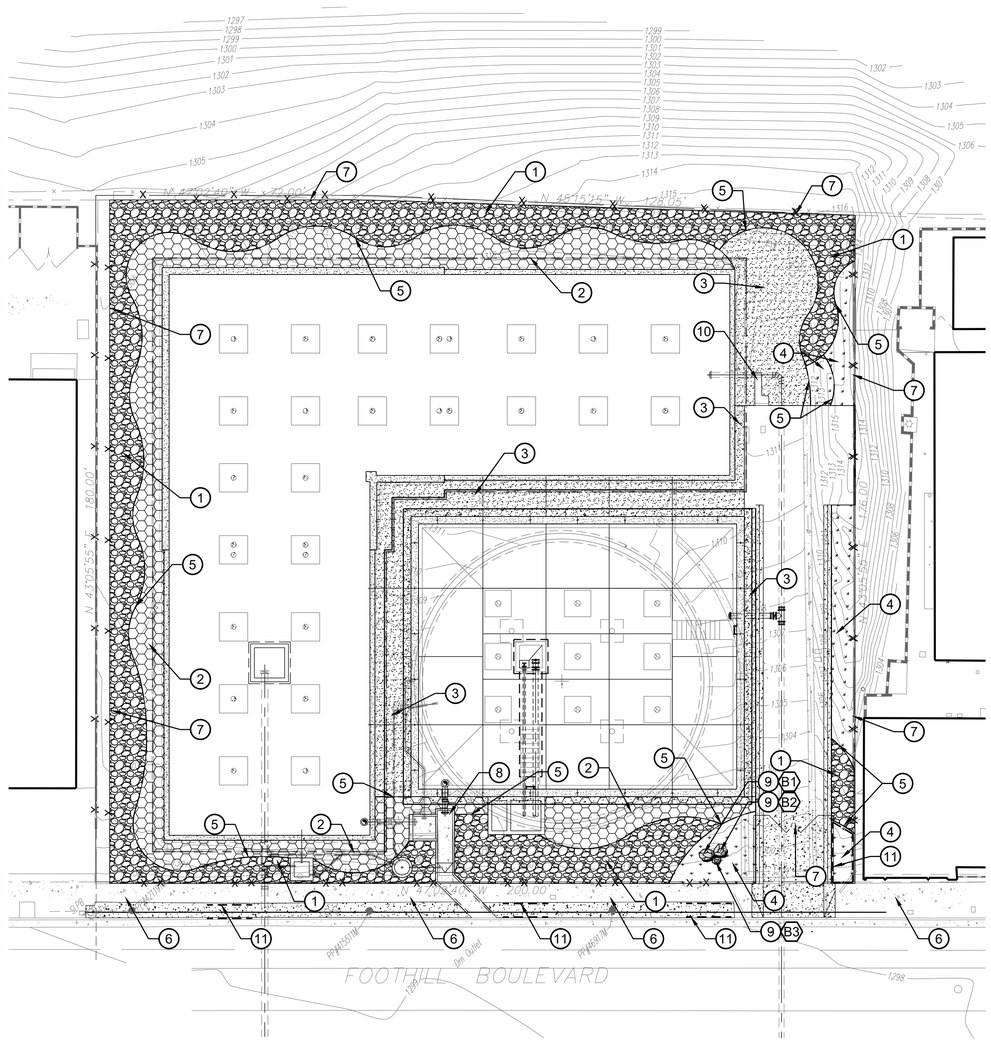
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UPPER RESERVOIR REPLACEMENT

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INSTRUMENTATION DETAILS

FILE NAME 1944519.00-I-4.dwg
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CONSTRUCTION LEGEND

1. GRAVEL PAVING - REFER TO DETAIL '3', SHEET 'LC-2'
2. STABILIZED DECOMPOSED GRANITE - REFER TO DETAIL '1', SHEET 'LC-2' COLOR: INDIAN RED DECOMPOSED GRANITE
3. STABILIZED DECOMPOSED GRANITE - REFER TO DETAIL '1', SHEET 'LC-2' COLOR: CALIFORNIA GOLD DECOMPOSED GRANITE
4. PLANTING - REFER TO PLANTING PLAN
5. HEADER BOARD - REFER TO DETAIL '4', SHEET 'LC-2'
6. EXISTING CONCRETE SIDEWALK, SHALL REMAIN AND BE PROTECTED
7. REFER TO THE CIVIL PLANS FOR FENCING AND GATES
8. EXISTING CONCRETE SITE FEATURE SHALL REMAIN AND BE PROTECTED
9. BOULDERS - REFER BOULDER LEGEND THIS SHEET
10. EXISTING BACKFLOW DEVICE SHALL REMAIN AND BE PROTECTED DURING ALL PHASES OF CONSTRUCTION
11. ROOT BARRIER - REFER TO DETAIL '5', SHEET 'LC-2'

BOULDER LEGEND

- B1 — 6'X6'X6' BOULDERS
- B2 — 4'X4'X4' BOULDERS
- B3 — 2'X2'X2' BOULDERS

LANDSCAPE BOULDERS AVAILABLE FROM SOUTHWEST BOULDER AND STONE (714) 882-1010

INSTALL PER DETAIL '2', SHEET 'LC-2'. FINAL LOCATION OF BOULDERS TO BE APPROVED BY ENGINEER.

PLANTING PLAN NOTES

1. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, AND EQUIPMENT NECESSARY TO FURNISH AND INSTALL PLANT MATERIAL AS SHOWN ON THE DRAWINGS AND AS DESCRIBED IN THE SPECIFICATIONS.
2. UNLESS DESIGNATED ON THE DRAWINGS OTHERWISE, STRUCTURAL IMPROVEMENTS AND HARDSCAPE SHALL BE INSTALLED PRIOR TO PLANTING OPERATIONS.
3. ALL WORK ON THE IRRIGATION SYSTEM, INCLUDING HYDROSTATIC, COVERAGE, AND OPERATIONAL TESTS AND THE BACKFILLING AND COMPACTION OF TRENCHES SHALL BE PERFORMED PRIOR TO PLANTING OPERATIONS.
4. PLANT LIST ON THE DRAWINGS SHALL BE USED AS A GUIDE ONLY. CONTRACTOR SHALL TAKEOFF AND VERIFY SIZES AND QUANTITIES BY PLAN CHECK.
5. SAMPLES OF FERTILIZERS, ORGANIC AMENDMENT, SOIL CONDITIONERS, AND SEED, IF APPLICABLE, SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL, PRIOR TO INCORPORATION. CONTRACTOR SHALL FURNISH TO THE ENGINEER A CERTIFICATE OF COMPLIANCE FOR SUCH FURNISHED MATERIALS.
6. LOCATIONS OF PLANT MATERIAL SHALL BE REVIEWED AND APPROVED ON SITE BY THE ENGINEER PRIOR TO INSTALLATION.
7. CONTRACTOR SHALL PROPOSE ON AMENDMENTS AS STATED IN THE SPECIFICATIONS. CONTRACTOR SHALL OBTAIN AGRICULTURAL SOILS TESTING AND RECOMMENDATIONS AFTER GRADING OPERATIONS AND PRIOR TO PLANT INSTALLATION. CONTRACTOR SHALL ALLOW FOR SOIL TESTING IN THEIR BID.
8. IF, DURING PLANTING OPERATIONS THERE SEEMS TO BE MINIMAL OR NO PERCOLATION IN PLANTING PITS, CONTRACTOR SHALL CEASE PLANTING OPERATIONS AND IMMEDIATELY NOTIFY THE ENGINEER TO DISCUSS ALTERNATIVE TO MAINTAINING POSITIVE ROOTBALL DRAINAGE MEASURES.
9. TREES PLANTED WITHIN FIVE FEET (5') OF HARDSCAPE OR STRUCTURES SHALL BE INSTALLED WITH A ROOT BARRIER AS APPROVED BY THE CITY/OWNER'S AUTHORIZED REPRESENTATIVE.
10. SHRUB AREAS SHALL RECEIVE A 3" THICK LAYER OF FOREST FLOOR COMPOSTED WOOD MULCH $\frac{1}{2}$"- 1 $\frac{1}{2}$" SIZE. OR EQUAL. MULCH SHALL HAVE A MINIMUM 80% RECYCLED CONTENT.
11. REFER TO SHEET, 'LP-1' FOR THE PLANT LIST, NOTES AND DETAILS.

CONSTRUCTION PLAN NOTES

1. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, AND EQUIPMENT FOR THE INSTALLATION OF ALL IMPROVEMENTS AS SHOWN ON THE DRAWINGS AND AS DESCRIBED IN THE SPECIFICATIONS.
2. CONTRACTOR SHALL REVIEW ALL EXISTING SITE CONDITIONS PRIOR TO SUBMITTING BID AND PRIOR TO COMMENCING INSTALLATION. IF ANY DISCREPANCIES EXIST, THEY SHOULD BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CITY'S/OWNER'S AUTHORIZED REPRESENTATIVE.
3. DEVIATIONS BETWEEN THE DRAWINGS AND ACTUAL FIELD CONDITIONS SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CITY'S/OWNER'S AUTHORIZED REPRESENTATIVE.
4. COSTS INCURRED DUE TO REPAIR, RESTORATION, OR REPLACEMENT OF EXISTING IMPROVEMENTS WHICH ARE DESIGNATED "TO BE PROTECTED" OR "TO REMAIN" WHICH ARE DAMAGED AS A RESULT OF CONSTRUCTION OPERATIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
5. UNLESS DESIGNATED ON THE DRAWINGS OTHERWISE, ALL MATERIALS DESIGNATED FOR REMOVAL SHALL BE DISPOSED OF OFF-SITE IN A LEGAL MANNER.
6. HARDSCAPE AND STRUCTURAL ELEMENTS SHALL BE PLACED PER GEOTECHNICAL SOILS REPORT. IF SUCH REPORT IS UNAVAILABLE, CONTRACTOR SHALL DISCUSS PLACEMENT ON SUITABLE GRADE WITH THE CITY'S/OWNER'S AUTHORIZED REPRESENTATIVE.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND STAKING ALL SEWER, WATER AND UTILITY LINES ABOVE OR BELOW GRADE THAT MIGHT BE DAMAGED AS A RESULT OF CONSTRUCTION OPERATIONS. CONTRACTOR SHALL ASSUME SOLE RESPONSIBILITY FOR ANY COST INCURRED FOR REPAIR, RESTORATION, OR REPLACEMENT OF AFOREMENTIONED UTILITIES DAMAGED AS A RESULT OF CONSTRUCTION OPERATIONS.
8. ABANDONED PIPES SHALL BE CAPPED OR PLUGGED IN A MANNER APPROVED BY THE CITY'S/OWNER'S AUTHORIZED REPRESENTATIVE.
9. IF APPLICABLE CONCRETE INDICATED FOR SAWCUTTING AND REMOVAL SHALL BE CUT TO A TRUE LINE WITH NEATLY SAWED EDGES. IF A SAWCUT IS WITHIN THREE FEET (3') OF AN EXISTING EXPANSION OR CONTROL JOINT, CONCRETE SHALL BE REMOVED TO THAT NEAREST JOINT.
10. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS, MANUFACTURER'S CUT OR DATA SHEETS FOR APPROVAL PRIOR TO ORDERING MATERIALS. CONTRACTOR SHALL FURNISH TO THE CITY'S/OWNER'S AUTHORIZED REPRESENTATIVE A CERTIFICATE OF COMPLIANCE FOR SUCH FURNISHED MATERIALS.
11. UNLESS DESIGNATED ON THE DRAWINGS OTHERWISE, MATERIALS TO BE PURCHASED AND FURNISHED BY THE CONTRACTOR SHALL BE NEW.
12. PROJECT GEOTECHNICAL REPORT OR RECOMMENDATIONS BY A STRUCTURAL ENGINEER SHALL TAKE PRECEDENCE FOR ALL SOIL CONDITIONS, MATERIALS, REINFORCEMENT, DIMENSIONS, AND SUBBASE.
13. CONTRACTOR SHALL REMOVE ALL THE ON-SITE EXISTING TREES. IN ADDITION, ALL STUMPS SHALL BE REMOVED TO 24" BELOW GRADE. CONTRACTOR SHALL REVIEW THE SIZE WITH THE ENGINEER, PRIOR TO CONSTRUCTION, FOR REVIEW AND APPROVAL.
14. REFER TO THE CIVIL PLANS FOR ELECTRICAL.

NOTES:

1. REFER TO SHEET 'LC-2' FOR GENERAL CONSTRUCTION DETAIL NOTES
2. REFER TO SHEET 'LC-2' FOR CONSTRUCTION DETAILS
3. REFER TO SHEET 'LI-1' FOR IRRIGATION PLAN REFER TO SHEET 'LP-1' FOR PLANTING PLAN
4. CAD FILES SHALL BE PROVIDED UPON REQUEST FOR LAYOUT AND DELINEATION OF GRAVEL AND COBBLESTONE HEADER BOARD.

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SCALE: 1"=20'

0' 10' 20' 40' 80'

nuvis
LANDSCAPE ARCHITECTURE
20250 SW ACACA ST., SUITE 260
NEWPORT BEACH, CA
U.S.A. 92660
PH: 714.754.7311

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NO.	REVISION	DATE	BY

SCALES

0 1"

0 25mm

IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED LANDSCAPE ARCHITECT — T. STONE No. 4787 — Signature — SEPTEMBER 30, 2021 Expiration Date — 04/26/2021 Date — STATE OF CALIFORNIA

DESIGNED	T.MUNOZ
DRAWN	J.GUADARRAMA
CHECKED	T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON consulting inc.

CONSTRUCTION PLAN

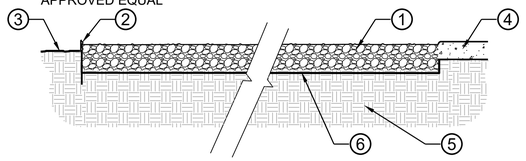
FILE NAME	
JOB NO.	1944519.00
DATE	04-26-2021
SHEET	LC-1 ##
OF	

GENERAL CONSTRUCTION DETAIL NOTES

1. THE FOLLOWING NOTES APPLY TO ALL DETAILS AS SHOWN IN THIS SET OF DOCUMENTS, UNLESS OTHERWISE NOTED.
2. FOR ADDITIONAL INFORMATION REFER TO CONSTRUCTION NOTES ON SHEET 'LC-1'.
3. REFER TO CONSTRUCTION LEGEND FOR INFORMATION RELATIVE TO COLOR, TYPE AND FINISH ON SHEET 'LC-1'.
4. UNLESS OTHERWISE NOTED, NEW FINISH SURFACE SHALL BE FLUSH WITH ADJACENT EXISTING SURFACES.
5. FINISH GRADE: 2" BELOW ADJACENT TO NON-TURF AREAS.
6. FINAL LOCATION OF CONSTRUCTION ELEMENTS, DRAINAGE DEVICES, SITE AMENITIES, IRRIGATION EQUIPMENT, AND PLANT MATERIAL MAY REQUIRE ADJUSTMENT DUE TO FIELD CONDITIONS AND SHALL BE APPROVED PRIOR TO CONSTRUCTION.
7. CONTRACTOR SHALL VERIFY ALL MATCHING MATERIALS AND COLORS PRIOR TO INSTALLATION. CONTRACTOR SHALL NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO INSTALLATION.
8. UNLESS OTHERWISE NOTED, ALL REVIEWS AND APPROVALS SHALL OCCUR PRIOR TO CONSTRUCTION, AND PRIOR TO PURCHASE OF MATERIAL PER SPECIFICATIONS.

NOTES:
1. CONTRACTOR SHALL SUBMIT 'CALIFORNIA GOLD CRUSH STONE' COLOR & SIZE SAMPLES TO ENGINEER FOR REVIEW & APPROVAL PRIOR TO PURCHASE
2. CALIFORNIA GOLD CRUSH STONE SHALL BE 1"-3" DIA.
3. AVAILABLE FROM SOUTHWEST BOULDER AND STONE, (714) 882-1010 OR AN APPROVED EQUAL.

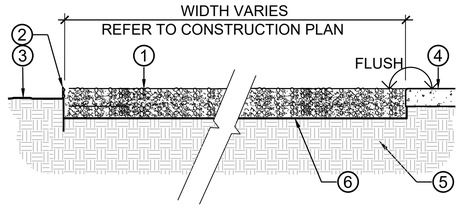
1. 3" THICK GRAVEL. INSTALL FLUSH W/ PAVING.
2. METAL HEADER - REFER TO DETAIL '4', THIS SHEET
3. FINISH GRADE- 1/2" BELOW METAL HEADER FOR SHRUB/GROUNDCOVER AREAS; FLUSH AT CONCRETE PAVING SURFACE.
4. EXISTING PAVING
5. 95% COMPACTED SUBGRADE
6. WEED FABRIC BARRIER BENEATH GRAVEL - MIRAFI MSCAPE WEED FABRIC OR AN APPROVED EQUAL



3 GRAVEL PAVING
SCALE: NTS

NOTES:
1. STABILIZED DECOMPOSED GRANITE PAVING SHALL BE INSTALLED BY A MANUFACTURER'S APPROVED PAVING INSTALLER.

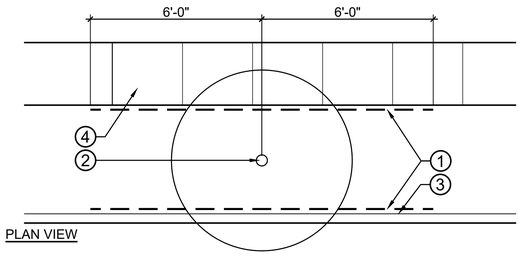
1. 4" THICK STABILIZED DECOMPOSED GRANITE (D.G.). INSTALL FLUSH W/ PAVING. COLOR SHALL BE PER CONSTRUCTION PLAN. SUBMIT SAMPLE FOR APPROVAL PRIOR TO ORDER & INSTALLATION. INSTALL STABILIZED DECOMPOSED GRANITE PER MANUFACTURER'S SPECIFICATION. AVAILABLE AT SOUTHWEST BOULDER AND STONE,PHONE: (714)882-1010 WWW.SOUTHWESTBOULDER.COM OR AN APPROVED EQUAL
2. METAL HEADER - REFER TO DETAIL '4', THIS SHEET
3. FINISH GRADE-2" BELOW HEADER FOR SHRUB/GROUNDCOVER AREAS
4. EXISTING PAVING
5. 95% COMPACTED SUBGRADE
5. WEED FABRIC BARRIER BENEATH DECOMPOSED GRANITE - MIRAFI MSCAPE WEED FABRIC OR AN APPROVED EQUAL



1 STABILIZED DECOMPOSED GRANITE PAVING
SCALE: NTS

NOTES:
1. CONTRACTOR SHALL PROVIDE A ROOT BARRIER FOR ALL TREES LOCATED WITHIN 5'-0" OF PAVING. ROOT BARRIER SHALL BE DEEP ROOT CORP. #UB24-2. ROOT BARRIER SHALL EXTEND 6'-0" IN EACH DIRECTION FROM THE CENTER OF THE TREE TRUNK. ROOT BARRIER TO BE INSTALLED PER MANUFACTURES RECOMMENDTIONS.

1. ROOT BARRIER
2. TREE TRUNK
3. BACK OF CURB / WALL
4. SIDEWALK / PAVING

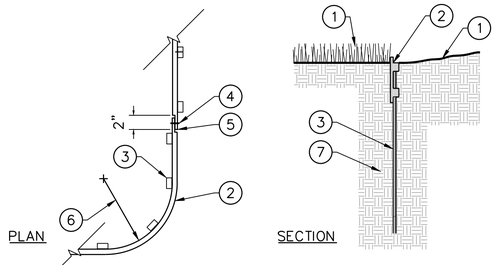


PLAN VIEW

5 ROOT BARRIER
SCALE: NTS

NOTES:
1. EDGING PRODUCT & ACCESSORIES ARE AVAILABLE FROM PERMALOC (800) 356-9660, OR AN APPROVED EQUAL.
2. INSTALL EDGING PER MANUFACTURER'S DETAILS & SPECS.
3. ALL METAL SHALL BE BR-BRONZE DURAFLEX FINISH

1. SHRUB PLANTING BED
2. PERMALOC PROSLIDE ALUMINUM EDGING- 3/16"X 4"OR EQUAL.
3. 12" ALUMNUM STAKE- TOP LOCK INTO PERFORMED LOOPS ON THE EDGING.
4. TOP OF EDGING TO BE MAXIMUM OF ½" ABOVE SURFACE MATERIAL.
5. INSTALL MIRAFI MSCAPE WEED FABRIC BARRIER FABRIC PER MANUFACTURER'S SPECIFICATIONS
6. REFER TO MANUFACTURER'S RECOMMENDATION FOR MINIMUM RADIUS
7. UNDISTURBED NATIVE GRADE OR CERTIFIED COMPACTED SUBGRADE



PLAN SECTION

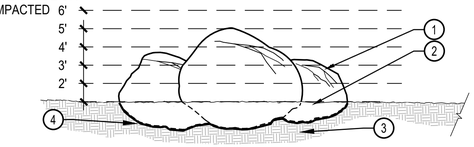
4 METAL HEADER
NTS

NOTES:
1. ALL BOULDERS SHALL BE BURIED 30% OF OVERALL HEIGHT, WIDTH AND LENGTH.
2. FINAL LOCATION OF ALL BOULDERS SHALL BE PER THE ENGINEER.
3. CONTRACTOR TO PROVIDE SAMPLE BOULDER FOR REVIEW AND APPROVAL BY ENGINEER PRIOR TO PURCHASE.
4. BOULDERS SHALL BE NATIVE GRAY GRANITE BOULDERS

BOULDER MEASUREMENT CHART:
APPROX. SIZE:
A: 6'x6'x6'
B: 4'x4'x4'
C. 2'X2'X2'

BOULDER TYPE: AVAILABLE AT SOUTHWEST BOULDER AND STONE PHONE: (714)882-1010 OR APPROVED EQUAL.

1. REFER TO NOTES FOR SIZES
2. FINISH GRADE
3. UNDISTURBED NATIVE GRADE OR 95% CERTIFIED COMPACTED SUBGRADE.
4. WEED FABRIC BARRIER BENEATH BOULDER - MIRAFI MSCAPE WEED FABRIC OR AN APPROVED EQUAL



2 BOULDER INSTALLATION
SCALE: NTS

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SCALES
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REGISTERED LANDSCAPE ARCHITECT — No. 4787 — STATE OF CALIFORNIA
Signature
SEPTEMBER 30, 2021
Expiration Date
04/26/2021
Date

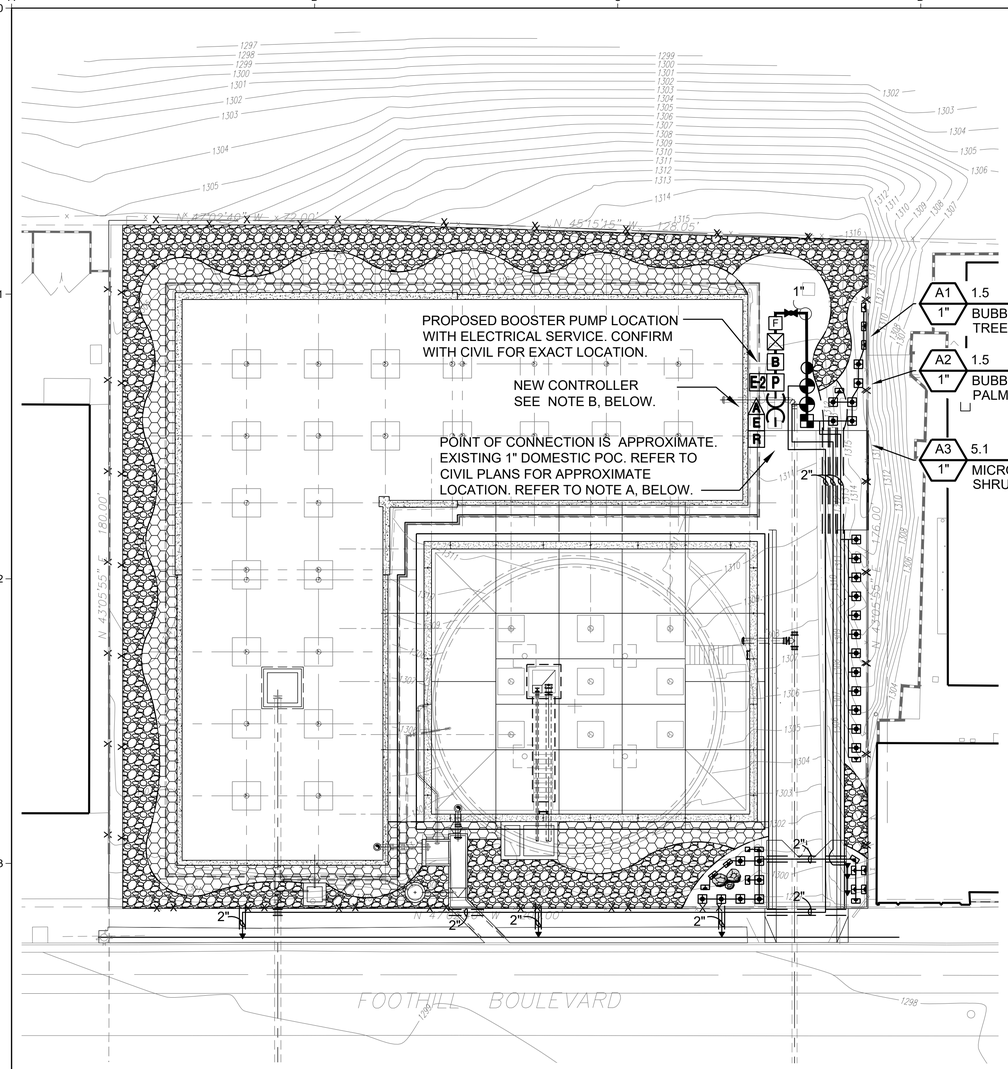
DESIGNED	T.MUNOZ
DRAWN	J.GUADARRAMA
CHECKED	T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

CONSTRUCTION DETAILS

FILE NAME	
JOB NO.	1944519.00
DATE	04-26-2021
SHEET	OF LC-2 ##



IRRIGATION LOCATION NOTES:

1. BACKFLOW PREVENTER LOCATION SHOWN ON THESE DRAWINGS IS APPROXIMATE. THE CONTRACTOR SHALL STAKE OUT THE BACKFLOW PREVENTER, AND IRRIGATION APPURTENANCE LOCATION FOR REVIEW AND APPROVAL BY ENGINEER PRIOR TO INSTALLATION OF THIS EQUIPMENT. FINAL LOCATION AND EXACT POSITIONING OF BACKFLOW PREVENTER AND ALL IRRIGATION APPURTENANCE SHALL BE DETERMINED BY THE ENGINEER. MODIFICATIONS OF THE BACKFLOW PREVENTER AND ALL IRRIGATION APPURTENANCE AS REQUESTED BY THE ENGINEER SHALL BE PROVIDED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNERS/OWNER'S AUTHORIZED REPRESENTATIVE. FAILURE TO OBTAIN ENGINEER'S APPROVAL PRIOR TO THE INSTALLATION SHALL CAUSE THE CONTRACTOR TO MAKE OWNERS/OWNER'S AUTHORIZED REPRESENTATIVE DIRECTED REVISION AT NO CHARGE. CONTRACTOR SHALL NOTIFY ALL LOCAL JURISDICTIONS FOR INSPECTION AND TESTING OF INSTALLED BACKFLOW PREVENTION DEVICE.

2. CONTROLLER LOCATION SHOWN ON THESE DRAWINGS IS APPROXIMATE. THE LANDSCAPE CONTRACTOR SHALL STAKE OUT THE CONTROLLER LOCATION FOR REVIEW AND APPROVAL BY THE ENGINEER PRIOR TO INSTALLATION OF THIS EQUIPMENT. THE CONTRACTOR IS RESPONSIBLE FOR ELECTRICAL CONNECTION FROM 120 VOLT POWER SOURCE TO THE CONTROLLER AND ALL WIRE CONNECTIONS FROM ALL VALVES AND APPURTENANCE VALVES TO TERMINAL STRIP. REFER TO ENGINEER'S DRAWING'S FOR POWER SOURCE. ALL ELECTRICAL WORK SHALL CONFORM TO LOCAL STATE AND NATIONAL ELECTRICAL CODES AND REGULATIONS. FINAL LOCATION AND EXACT POSITIONING OF THE CONTROLLER SHALL BE DETERMINED BY THE ENGINEER. MINOR MODIFICATIONS OF CONTROLLER REQUESTED BY THE ENGINEER SHALL BE PROVIDED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNERS/OWNER'S AUTHORIZED REPRESENTATIVE. FAILURE TO OBTAIN ENGINEER'S APPROVAL PRIOR TO THE INSTALLATION SHALL CAUSE THE CONTRACTOR TO MAKE ENGINEER DIRECTED REVISIONS AT NO ADDITIONAL COST TO THE OWNERS/OWNER'S AUTHORIZED REPRESENTATIVE.

3. ELECTRIC CONTROL VALVES AND ISOLATION VALVE LOCATIONS ON THESE DRAWINGS ARE APPROXIMATE. THE CONTRACTOR SHALL STAKE OUT EACH ELECTRICAL CONTROL VALVE AND ISOLATION VALVE LOCATION FOR REVIEW AND APPROVAL BY ENGINEER PRIOR TO INSTALLATION OF ALL VALVES. FINAL LOCATION AND EXACT POSITIONING FOR ELECTRIC CONTROL VALVES AND ISOLATION VALVES SHALL BE DETERMINED BY ENGINEER. MINOR MODIFICATIONS OF ELECTRIC CONTROL VALVES AND ISOLATION VALVE LOCATIONS AS REQUESTED BY THE ENGINEER SHALL BE PROVIDED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNERS/OWNER'S AUTHORIZED REPRESENTATIVE. FAILURE TO OBTAIN ENGINEER'S APPROVAL PRIOR TO THE INSTALLATION SHALL CAUSE THE CONTRACTOR TO MAKE ENGINEER DIRECTED REVISIONS AT NO ADDITIONAL COST TO THE OWNERS/OWNER'S AUTHORIZED REPRESENTATIVE. IN GENERAL UNLESS OTHERWISE DIRECTED BY ENGINEER, ALL VALVES SHALL BE INSTALLED ONE FOOT FROM EDGE OF HARDSCAPE, WALK OR CURB IN SHRUB PLANTING AREAS.

4. ELECTRICAL CONTRACTOR TO SUPPLY 120 VAC (2.5 AMP) SERVICE TO CONTROLLER LOCATION. IRRIGATION CONTRACTOR TO MAKE FINAL CONNECTION FROM ELECTRICAL STUB-OUT TO CONTROLLER. IRRIGATION CONTROL WIRE SHALL BE #14, U.L. APPROVED FOR DIRECT BURIAL. COMMON WIRE SHALL BE #12 U.L. APPROVED AND SHALL BE WHITE IN COLOR. WIRING TO INDIVIDUAL REMOTE CONTROL VALVES SHALL BE COLOR OTHER THAN WHITE.

5. THESE PLANS ARE DIAGRAMMATIC, THE MAINLINE AND RELATED IRRIGATION EQUIPMENT IS SHOWN WITHIN THE PAVING FOR CLARITY ONLY. THE ACTUAL LOCATION OF MAINLINE AND RELATED IRRIGATION EQUIPMENT SHALL BE WITHIN PLANTER AND A MINIMUM OF 24" OFF ADJACENT HARDSCAPE AND OTHER OBSTACLES, TYPICAL.

MWELO

THE IRRIGATION IS SUPPLIED BY A POTABLE WATER CONNECTION.

THERE IS NO SPECIAL LANDSCAPE AREA (SLA) AS PART OF THESE PLANS.

PRESSURE REGULATING DEVICES ARE REQUIRED IF WATER PRESSURE IS BELOW OR EXCEEDS THE RECOMMENDED PRESSURE OF THE SPECIFIED IRRIGATION DEVICES.

CHECK VALVES OR ANTI-DRAIN VALVES ARE REQUIRED ON ALL SPRINKLER HEADS WHERE LOW POINT DRAINAGE COULD OCCUR.

A DIAGRAM OF THE IRRIGATION PLAN SHOWING HYDROZONES SHALL BE KEPT WITH THE IRRIGATION CONTROLLER FOR SUBSEQUENT MANAGEMENT PURPOSES.

A CERTIFICATE OF COMPLETION SHALL BE FILLED OUT AND CERTIFIED BY EITHER THE SIGNER OF THE LANDSCAPE PLANS, THE SIGNER OF THE IRRIGATION PLANS, OR THE LICENSED LANDSCAPE CONTRACTOR FOR THE PROJECT.

A FINAL REPORT FOR THE TESTING AND ADJUSTING OF ALL NEW SYSTEMS SHALL BE COMPLETED PRIOR TO FINAL APPROVAL BY THE FIELD INSPECTOR. THIS REPORT SHALL BE SIGNED BY THE INDIVIDUAL RESPONSIBLE FOR PERFORMING THESE SERVICES.

AN IRRIGATION AUDIT REPORT SHALL BE COMPLETED AT THE TIME OF FINAL INSPECTION.

AT THE TIME OF FINAL INSPECTION, THE PERMIT APPLICANT MUST PROVIDE THE ARCHITECT, IOR, AND OAR OF THE PROPERTY WITH A CERTIFICATE OF COMPLETION, CERTIFICATE OF INSTALLATION, IRRIGATION SCHEDULE AND A SCHEDULE OF LANDSCAPE AND IRRIGATION MAINTENANCE.

AN OPERATIONS AND SYSTEMS MANUAL SHALL BE PROVIDED TO THE OWNER OR REPRESENTATIVE AND TO THE FIELD INSPECTOR AT THE TIME OF FINAL INSPECTION.

SYSTEM DESIGN IS BASED ON A MINIMUM OPERATING PRESSURE 45.0 (P.S.I.) AND A MAXIMUM DEMAND 30.0 (G.P.M.) AS SHOWN AT EACH POINT OF CONNECTION ON THE DRAWINGS. CONTRACTOR SHALL VERIFY PRESSURE AND DEMAND AT EACH POINT OF CONNECTION PRIOR TO COMMENCING INSTALLATION AND SUBMIT SUCH IN WRITING TO THE ARCHITECT, IOR, AND OAR. IF ANY DISCREPANCIES EXIST, THEY SHOULD BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ARCHITECT, IOR, AND OAR.

NOTES

1. REFER TO CIVIL SHEETS FOR CONNECTIONS FROM THE WATER TANKS AND THE IRRIGATION SYSTEM. ALSO SEE DETAILS ON LI-5.
2. REFER TO DARYL GREEN, OF GREEN PRODUCTS 949-584-7311 FOR PUMP AND INTEGRATED PIPING SYSTEM. SEE DETAILS ON LI-5.

SLEEVING LEGEND	
SYMBOL	SLEEVING TYPE
	MAINLINEE SLEEVING
	LATERAL AND WIRE SLEEVING

SCH 40 PVC SLEEVING CHART

1 1/4" SLEEVE	1-4 WIRES	1/2" PIPE
1 1/2" SLEEVE	5-10 WIRES	3/4" PIPE
2" SLEEVE	11-20 WIRES	1" PIPE
2 1/2" SLEEVE	21-30 WIRES	1 1/4" PIPE
3" SLEEVE	31-40 WIRES	1 1/2" PIPE
4" SLEEVE	41-60 WIRES	2" PIPE
6" SLEEVE	61-99 WIRES	2 1/2"/3" PIPE
8" SLEEVE	100+ WIRES	4" PIPE
10" SLEEVE	N/A	6" PIPE

NOTE

REFER TO SHEET LI-2 FOR IRRIGATION LEGEND AND NOTES LI-3, LI-4, AND LI-5 FOR DETAILS. LI-6 FOR CALCULATIONS.

NOTE

ALL IRRIGATION EQUIPMENT ARE SHOWN DIAGRAMMATICAL, INSTALL ALL IRRIGATION EQUIPMENT IN PLANTING AREAS, TYPICAL.

VALVE IDENTIFICATION

CONTROLLER DESIGNATION
VALVE STATION NUMBER
VALVE SIZE
A1 9.2 3/4"
VALVE G.P.M.
HYDROZONE

LATERAL LINE SIZING CHART

SPRINKLER TYPE	GALLONS PER MINUTE	PIPE SIZE
ROTORS	1-8 9-18 19-28 29-55	1" 1 1/4" 1 1/2" 2"
SPRAYS & BUBBLERS AND SUBSURFACE	1-5 6-10 11-20 21-28 29-55	3/4" 1" 1 1/4" 1 1/2" 2"

NOTE A:
POINT OF CONNECTION (P.O.C.) SHALL BE TO THE EXISTING DOMESTIC WATER IRRIGATION MAINLINE. POINT OF CONNECTION ARE AT THE APPROXIMATE LOCATION SHOWN ON THE PLAN. CONNECT TO EXISTING 1" POC AND INSTALL AND PRESSURE REGULATOR.

STATIC WATER PRESSURE	45 PSI
DESIGN WATER PRESSURE	30 PSI
MAXIMUM SYSTEM DEMAND	5 GPM
RESDIUAL WATER PRESSURE	10 PSI

NOTE B:
CONTROLLER "A" SHALL BE A RAIN BIRD ESP-ME3 MODULAR W/ 4 STATION CAPACITY. INSTALL CONTROLLER IN VIT STRONG BOX STAINLESS STEEL TOP MOUNT CONTROLLER MODEL SB-18SS. WIRE ALL NEW VALVES IN LIMITS OF CONSTRUCTION WORK FOR THIS PROJECT TO CONTROLLER "A". 120 VOLT A.C. ELECTRICAL TO CONTROLLER "A" LOCATION SHALL BE PROVIDED BY ELECTRICAL CONTRACTOR. IRRIGATION CONTRACTOR TO MAKE FINAL CONNECTION TO THE CONTROLLER.

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0' 10' 20' 40' 80'

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REGISTERED LANDSCAPE ARCHITECT — JAMES R. STONE No. 5987 — Signature — SEPTEMBER 30, 2021 Expiration Date — 04/26/2021 Date — STATE OF CALIFORNIA

DESIGNED	T.MORITA
DRAWN	T.MORITA
CHECKED	T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

IRRIGATION PLAN AND NOTES

FILE NAME	
JOB NO.	1944519.00
DATE	04-26-2021
SHEET	LI-1 ##

IRRIGATION PLAN NOTES

1. CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, AND EQUIPMENT NECESSARY TO FURNISH AND INSTALL THE IRRIGATION SYSTEM AS SHOWN ON THE DRAWINGS, AS DESCRIBED IN THE SPECIFICATIONS, AND IN ACCORDANCE WITH APPLICABLE CODES AND ORDINANCES
2. DRAWINGS ARE DIAGRAMMATIC. CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTMENTS NECESSARY TO CONFORM TO ACTUAL FIELD CONDITIONS.
3. CONTRACTOR SHALL FLUSH ALL LINES AND ADJUST ALL HEADS FOR OPTIMUM PERFORMANCE IN ACCORDANCE WITH THE SPECIFICATIONS AND TO PREVENT OVERSPRAY ONTO HARDSCAPE AREAS OR STRUCTURAL ELEMENTS. THIS SHALL INCLUDE SELECTING THE BEST DEGREE OF ARC TO FIT ACTUAL SITE CONDITIONS AND TO THROTTLE THE FLOW CONTROL AT EACH VALVE TO OBTAIN THE OPTIMUM OPERATING PRESSURE FOR EACH SYSTEM. COSTS INCURRED DUE TO ANY ADJUSTMENTS FOR 100% COVERAGE, INCLUDING THOSE REQUESTED BY THE CITY'S AUTHORIZED REPRESENTATIVE SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
4. SYSTEM DESIGN IS BASED ON A MINIMUM OPERATING PRESSURE (P.S.I.) AND A MAXIMUM DEMAND (G.P.M.) AS SHOWN AT EACH POINT OF CONNECTION ON THE DRAWINGS. CONTRACTOR SHALL VERIFY PRESSURE AND DEMAND AT EACH POINT OF CONNECTION PRIOR TO COMMENCING INSTALLATION AND SUBMIT SUCH IN WRITING TO THE CITY'S AUTHORIZED REPRESENTATIVE. IF ANY DISCREPANCIES EXIST, THEY SHOULD BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CITY'S AUTHORIZED REPRESENTATIVE.
5. EQUIPMENT SHOWN IN HARDSCAPE AREAS ARE FOR DESIGN CLARIFICATION ONLY AND SHALL BE INSTALLED WHENEVER POSSIBLE WITHIN PLANTED AREAS A REASONABLE, REACHABLE DISTANCE FROM HARDSCAPE OR PLANTING AREAS
6. UNLESS OTHERWISE NOTED ON THE DRAWINGS, CONTRACTOR SHALL INSTALL WIRE AND PIPE UNDER HARDSCAPE AREAS IN P.V.C. SCHEDULE 40 SLEEVES PLACED PRIOR TO INSTALLING HARDSCAPE IN ACCORDANCE WITH APPLICABLE CODES.
7. WHEREVER POSSIBLE, CONTROL WIRES SHALL OCCUPY THE SAME TRENCH AS PIPES.
8. EACH CONTROLLER SHALL HAVE ITS OWN INDEPENDENT GROUND WIRE.
9. SPLICING OF 24 VOLT WIRES WILL NOT BE PERMITTED EXCEPT IN VALVE BOXES. CONTRACTOR TO LEAVE A 24" COIL OF EXCESS WIRE AT EACH SPLICE AND EVERY 100' ON CENTER ALONG WIRE RUN. TAPE WIRE BUNDLES 10' ON CENTER. NO TAPING WILL BE PERMITTED INSIDE SLEEVES.
10. CONTROL VALVES SHALL BE SIZED AS DESIGNATED ON THE DRAWINGS AND SHALL BE INSTALLED IN VALVE BOXES AS INDICATED IN THE DETAILS. BOXES SHALL BE SET FLUSH WITH THE FINISH GRADE OR SURFACE AND PERMANENTLY MARKED WITH THE LETTERS R.C.V.
11. CONTRACTOR SHALL INSTALL ANTI-DRAIN CHECK VALVES AS NECESSARY TO PREVENT LOW HEAD DRAINAGE.
12. ALL IRRIGATION HEADS ADJACENT TO HARDSCAPE SHALL BE POP-UP STYLE.
13. IRRIGATION HEADS SHALL BE SET PERPENDICULAR TO FINISH GRADE OF THE AREA TO BE IRRIGATED UNLESS OTHERWISE DESIGNATED ON THE PLANS.
14. TREE EMITTERS HEADS SHALL BE LOCATED ON THE UPHILL SIDE OF TREES.
15. PRESSURE REGULATING DEVICES ARE REQUIRED IF WATER PRESSURE IS BELOW OR EXCEEDS THE RECOMMENDED PRESSURE OF THE SPECIFIED IRRIGATION DEVICES.
16. A DIAGRAM OF THE IRRIGATION PLAN SHOWING HYDROZONE'S SHALL BE KEPT WITH THE IRRIGATION CONTROLLER FOR SUBSEQUENT MANAGEMENT PURPOSES.
17. A CERTIFICATE OF COMPLETION SHALL BE FILLED OUT BY THE CONTRACTOR AND CERTIFIED BY DESIGNER OF THE LANDSCAPE PLANS.
18. AN IRRIGATION AUDIT REPORT SHALL BE COMPLETED AT THE TIME OF FINAL INSPECTION, BY THE CONTRACTOR.
19. IRRIGATION SLEEVES SHOWN FOR MAJOR STREET AND DRIVEWAY CROSSINGS FOR CLARITY ONLY. ALL SLEEVES TO BE MINIMUM 2X DIAMETER OF PIPE SLEEVES. SLEEVING TO EXTEND MINIMUM 12 INCHES BEYOND PAVING OR AS NECESSARY TO ACCESS. CONTRACTOR SHALL INSTALL SLEEVING BELOW ALL PAVING, HARDSCAPE, ETC. AS SHOWN AND AS DIRECTED BY ENGINEER.

IRRIGATION MATERIALS LEGEND

SYMBOL	MANUFACTURER	MODEL NO. / DESCRIPTION	GPM	PSI	RADIUS	P/R (TRI.)	SHEET / DETAIL
▼	RAIN BIRD	RWS-B-C-1401 ROOT WATERING SYSTEM WITH 36" TUBE, .50 GPM BUBBLER AND CHECK VALVE ON RISER. INSTALL WITH SAND SOCK. INSTALL TWO PER TREES AND PALMS, KEEP TREES AND PALMS ON SEPARATE VALVES.	.5 (1.0 TOTAL)	30	NA	NA	LI-3, 8
	RAIN BIRD	1800-SAM-PRS 6" POP-UP SHRUB HEAD WITH SQ 2.5' RADIUS MPR SPRAY NOZZLE.	.12, .20, .40	30	2.5"	1.90, 1.57, 1.55	LI-4, 3
	MATCO-NORCA	MODEL 759 BRASS BALL VALVE - LINE SIZE OR APPROVED EQUAL. INSTALL WITHIN CARSON 910 PLASTIC ROUND GREEN VALVE BOX.					LI-3, 4
	BUCKNER/SUPERIOR	MODEL 3200 NORMALLY CLOSED, LINE SIZED, BRASS MASTER CONTROL VALVE. VALVE BOXES SHALL HAVE HDPE BODY AND LIDS.					LI-3, 2
F	RAIN BIRD	BRASS TEE, NYLON IMPELLER TYPE FLOW SENSOR MODEL OR APPROVED EQUAL. WIRE TO CONTROLLER PER MANUFACTURER'S RECOMMENDATIONS.					LI-3, 3
B	FEBCO/WILKINS	FEBCO 1" MODEL LF825Y BACKFLOW PREVENTER WITH WYE FILTER AND WILKENS 600/650 REDUCED PRESSURE VALVE, SEE PLANS FOR ADDITIONAL INFORMATION. INSTALL WITHIN V.I.T. SMOOTH TOUCH BACKFLOW ENCLOSURE MODEL NUMBER SBBC-45SS.					LI-3, 1
E	N/A	120 VOLT ELECTRICAL POWER, PROVIDED BY ELECTRICIAN, VERIFY ACTUAL LOCATION IN FIELD.					N/A
	SMARTLINE	SL 4800 12 STATION CONTROLLER INSTALL IN A V.I.T./STRONG BOX STAINLESS STEEL ENCLOSURE SB-18SS STRONG BOX ENCLOSURE. CONNECT FLOW SENSOR AND MASTER VALVE TO CONTROLLER IN SEPARATE SCH. 40 PVC CONDUIT WITH 14 AWG WIRE. WITH RSD-BE RAIN SENSOR. SEE PLANS FOR ADDITIONAL INFORMATION AND APPROXIMATE LOCATION.					LI-4, 5,7
R	RAIN BIRD	RSD-BE WIRED RAIN SENSOR, MOUNT IN RGVRSS ENCLOSURE ON THE SIDE OF THE SIDE OF THE CONTROLLER ENCLOSURE, WIRE TO THE CONTROLLER.					LI-5, 5
	N/A	POINT OF CONNECTION AT EXISTING 1" MAINLINE LOCATIONS PER PLANS. FOR REFERENCE ONLY. VERIFY SIZE & LOCATION IN FIELD PRIOR TO START OF WORK. SEE PLAN NOTES FOR ADDITIONAL INFORMATION.					N/A
P	SITE ONE	BOOSTER PUMP SYSTEM. PUMP ASSEMBLY INCLUDES FLOW CONTROL AND MAINLINE VALVE SWITCH. SEE CIVIL ENGINEERS PLANS FOR ADDITIONAL INFORMATION. REFER TO DARYL GREEN, OF GREEN PRODUCTS 949-584-7311 FOR PUMP AND INTEGRATED PIPING SYSTEM. SEE DETAILS ON L-5.					LI-5, 1,2
E2	N/A	460 VOLT (SINGLE/THREE) PHASE ELECTRICAL POWER FOR BOOSTER PUMP SYSTEM PROVIDED BY ELECTRICIAN, VERIFY ACTUAL LOCATION IN FIELD.					N/A
	RAIN BIRD	PESB SERIES PLASTIC REMOTE CONTROL VALVE, SIZE AS SHOWN. SIZE PER PLANS. INSTALL WITHIN CARSON 1419-12 PLASTIC GREEN VALVE BOX.					LI-3, 6
	RAIN BIRD	XCZ-100-PRB-COM SERIES REMOTE CONTROL VALVE WITH PRESSURE REGULATION. THE 1" DRIP RCV ASSEMBLY INSIDE A JUMBO RECTANGULAR VALVE BOX. INSTALL WITHIN CARSON 1730-12 PLASTIC GREEN VALVE BOX.					LI-3, 5
	RAIN BIRD	44LRC 1" QUICK COUPLER VALVE WITH LOCKING VINYL COVER AND A LASCO G13S-218 SWING JOINT. INSTALL INSIDE A 10" ROUND VALVE BOX.					LI-3, 7
	AS APPROVED	PVC PIPE 2" AND LARGER, CL. 315 PVC, SOLVENT WELD WITH SCH. 80 PVC FITTINGS, SCHEDULE 40 PVC MAINLINE PIPE - 1 1/2" AND SMALLER WITH SCHEDULE 40 PVC FITTINGS SOLVENT WIELD. 18" MIN. COVER. ALL MAINLINE TO BE INSTALLED WITH TRACER WIRE. 24" MIN. COVER. AS MAINLINES INSTALLED 18" BELOW FINISHED GRADE.					LI-4, 4
	AS APPROVED	PVC PIPE 3/4" - 1-1/2" SCH. 40, SOLVENT WELD WITH SCH. 40 PVC FITTINGS, AS LATERAL LINES INSTALLED 12" BELOW FINISHED GRADE.					LI-4, 4
	AS APPROVED	PVC PIPE SCH. 40 AS SLEEVING, 2 TIMES THE DIAMETER OF PIPE OR WIRE BUNDLE CARRIED (2" MINIMUM SIZE) INSTALL ALL PIPE AND WIRE UNDER PAVING, HARDSCAPE, ETC. (OR AS DIRECTED BY OWNER'S AUTHORIZED REPRESENTATIVE) INSIDE SLEEVES. SLEEVES UNDER PEDESTRIAN PAVING SHALL BE INSTALLED 24" BELOW FINISHED GRADE. ALL MAINLINE SLEEVES ARE TO BE CONSIDERED EXISTING VERIFY LOCATION IN FIELD. INSTALL MAINLINE SLEEVES 18" AWAY FROM EACH SIDE OF QUICK COUPLER VALVE.					LI-4, 6
NO SYMBOL	AS APPROVED	ALL SOLVENT WELD CONNECTIONS FOR BOTH MAINLINE AND LATERAL LINE SHALL BE MADE USING THE TWO-STEP PROCESS OF PRIMER AND SOLVENT CEMENT. PRIMER SHALL BE LOW VOC "PURPLE PRIMER". MAINLINE SOLVENT CEMENT SHALL BE WELD-ON 711 PVC INDUSTRIAL GRADE CEMENT. LATERAL LINE SOLVENT CEMENT SHALL BE WELD-ON 711 PVC INDUSTRIAL GRADE CEMENT. USE DAUBERS SIZED AT LEAST ONE-HALF THE SIZE OF THE LARGEST PIPE BEING JOINED. ALL SOLVENT CEMENTED JOINTS SHALL BE MADE PER THE PIPE AND FITTING MANUFACTURER'S RECOMMENDATIONS.					N/A
NO SYMBOL	3M	3M DIRECT BURY SPLICE KIT DBR/Y-6. DIRECT BURIAL (I.L. APPROVED) WATER-PROOF WIRE CONNECTORS FOR USE ON ALL WIRE SPLICES AND CONNECTIONS.					LI-4, 1
NO SYMBOL	CARSON	VALVE BOXES, SIZE PER EQUIPMENT LEGEND, WITH T-COVER LIDS AND CAPTIVE BOLT AND LOC-KIT. FOR ROUND AIR RELIEF VALVES USE MODEL 708, 10" ROUND SHALL BE MODEL 910, 12" STANDARD RECTANGULAR. SHALL BE MODEL 1419, 12" JUMBO RECT. SHALL BE MODEL 1220, SUPER JUMBO SHALL BE MODEL 1324, AND SUPER JUMBO XL SHALL BE MODEL 1730. FOR USE IN NON-VEHICULAR TRAFFIC SITUATIONS ONLY. DO NOT INSTALL IN CONCRETE, ASPHALT OR D.G.. VALVE BOX COVERS SHALL BE MARKED "RCV" WITH THE VALVE IDENTIFICATION NUMBER OR MV, FS,GV,BV HEAT BRANDED ONTO THE COVER IN 1-1/4" HIGH LETTERS / NUMBERS.					LI-4, 2
NO SYMBOL	CARSON	SPLICE BOX AS NECESSARY WITH T-COVER LIDS AND CAPTIVE BOLT AND LOC-KIT. 10" ROUND. SHALL BE MODEL 910. FOR USE IN NON-VEHICULAR TRAFFIC SITUATIONS ONLY. DO NOT INSTALL IN CONCRETE OR ASPHALT. SPLICE BOX COVERS SHALL BE MARKED "SB" HEAT BRANDED ONTO THE COVER IN 1-1/4" HIGH LETTERS / NUMBERS.					LI-4, 2
NO SYMBOL	PAIGE ELECTRIC	P7079D POLYETHYLENE INSULATED, SOLID COPPER CONDUCTOR IRRIGATION CONTROL WIRE #14UF AWG DIRECT BURIAL (U.L. APPROVED). PILOT WIRES SHALL BE RED IN COLOR, COMMON GROUND WIRE SHALL BE WHITE IN COLOR, SPARE WIRES SHALL BE YELLOW IN COLOR. WHERE MULTIPLE CONTROLLERS ARE USED ON THE PROJECT, EACH CONTROLLER SHALL HAVE A DIFFERENT COLOR FOR PILOT WIRES. THE CONTRACTOR SHALL ROUTE TWO (2) SPARE CONTROL WIRES (YELLOW) FROM THE CONTROLLER ALONG THE MAINLINE IN ALL DIRECTIONS AWAY FROM THE CONTROLLER. LOOP SPARE WIRES UP AND INTO EACH VALVE BOX ALONG THE MAINLINE, PROVIDING A 3 FOOT MINIMUM LOOP.					N/A

THE PORTIONS OF THE PLANS REGARDING IRRIGATION DESIGN ASPECTS OF THE PROJECT HAVE BEEN REVIEWED AND APPEAR TO BE IN SUBSTANTIAL CONFORMANCE WITH THE RECOMMENDATIONS CONTAINED IN THE CITY OF LOS ANGELES MODEL WATER EFFICIENT LANDSCAPE ORDINANCE, DATE: 02-29-2016. WE MAKE NO REPRESENTATIONS OF THE ACCURACY OF THE DIMENSIONS, MEASUREMENTS, CALCULATIONS OR ANY PORTION OF THE DESIGN.

"I HAVE COMPLIED WITH THE CRITERIA OF THE ORDINANCE AND APPLIED THEM ACCORDINGLY FOR THE EFFICIENT USE OF WATER IN THE IRRIGATION DESIGN PLAN."

BY: _____ DATE: 04/26/2021
NUVIS RLA # 1891
EXP. 9/30/21

I AGREE TO COMPLY WITH THE REQUIREMENTS OF THE WATER EFFICIENT LANDSCAPE ORDINANCE AND SUBMIT A COMPLETE LANDSCAPE DOCUMENT PACKAGE.

BY: _____ DATE: 04/26/2021
NUVIS RLA # 1891
EXP. 9/30/21

LOW WATER USE LANDSCAPE AREA (DRIP IRRIGATION):	1,012 S.F.(92%)
LOW WATER USE LANDSCAPE AREA (TREE BUBBLER IRRIGATION):	96 S.F. (08%)
MEDIUM WATER USE LANDSCAPE AREA (TREE BUBBLER IRRIGATION):	000 S.F. (0%)
MEDIUM WATER USE LANDSCAPE AREA (TREE DRIP IRRIGATION):	000 S.F. (0%)
HIGH WATER USE LANDSCAPE AREA (TURF IRRIGATION):	000 S.F. (0%)
TOTAL:	1,108 S.F. (100%)

NUVIS
LANDSCAPE ARCHITECTURE
20250 SW ACACA ST., SUITE 260
NEWPORT BEACH, C A
U. S. A. 92660
PH: 714.754.7311

USE OF DOCUMENTS

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER — DARYL L. GREEN — No. 2917 — LANDSCAPE ARCHITECT
Signature
SEPTEMBER 30, 2021
Expiration Date
04/26/2021
Date
STATE OF CALIFORNIA

DESIGNED T.MORITA
DRAWN T.MORITA
CHECKED T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

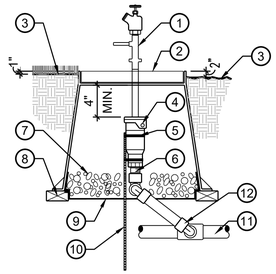
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IRRIGATION MATERIALS LEGEND AND NOTES

FILE NAME
JOB NO. 1944519.00
DATE 04-26-2021
SHEET LI-2 OF ##

NOTES:
1. TOP OF BOX: 1" ABOVE FINISH GRADE IN TURF AND 2" IN NON-TURF AREAS.
2. USE TEFLON TAPE ON ALL THREADED FITTINGS.

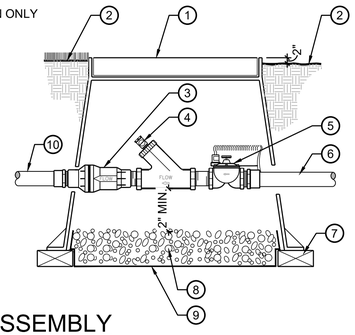
1. QUICK COUPLER KEY WITH MALE HOSE BIB CONNECTION AS SHOWN, KEY MUST CLEAR VALVE BOX
2. ROUND PLASTIC VALVE BOX WITH BOLT DOWN COVER USE STAINLESS BLOT NUT AND WASHER LABEL "QCV" ONTO LID
3. FINISH GRADE
4. QUICK COUPLER VALVE REFER TO LEGEND FOR SPECIFICATION
5. GALVANIZED PUNCH LOC (2 REQUIRED)
6. BRASS NIPPLE (LENGTH AS REQUIRED)
7. 3/4" CRUSHED GRAVEL, 2 CUBIC FEET
8. BRICK SUPPORT
9. LANDSCAPE FABRIC TO COVER BOTTOM AND ALL SIDES OF VALVE BOX
10. #4x36" REBAR STAKE
11. MAINLINE, SEE SPECIFICATIONS
12. PRE-ASSEMBLED TRIPLE SWING ARM (REFER TO LEGEND)



7 QUICK COUPLING VALVE ASSEMBLY
NO SCALE

NOTES:
1. FINISH GRADE: 1" BELOW FINISH SURFACE ADJACENT TO TURF AND 2" BELOW ADJACENT TO NON-TURF AREAS.

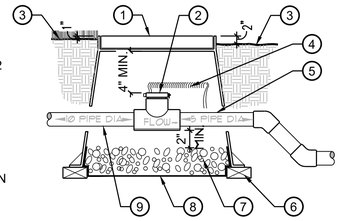
1. PLASTIC RECTANGULAR 'JUMBO' VALVE BOX WITH BOLT DOWN COVER, USE STAINLESS BOLT, NUT, AND WASHER BOX TO BE PLACED AT RIGHT ANGLE TO HARDSCAPE EDGE. BRAND "RCV" AND CONTROL STATION # ONTO LID, 1 1/2"-2" HIGH LETTERING
2. FINISH GRADE, 2" DIMENSION ONLY
3. PRESSURE REGULATOR, REFER TO LEGEND
4. WYE FILTER, REFER TO LEGEND
5. R.C.V., REFER TO LEGEND
6. PVC MAINLINE
7. BRICK SUPPORTS
8. 3/4" WASHED CRUSHED GRAVEL
9. LANDSCAPE FABRIC TO COVER BOTTOM AND ALL SIDES OF VALVE BOX
10. PVC TO DRIP SYSTEM



5 DRIP RCV ASSEMBLY
SCALE: NTS

NOTES:
1. TOP OF BOX: 1" ABOVE FINISH SURFACE IN TURF AND 2" IN NON-TURF AREAS.
2. INSTALL FLOW SENSOR AS PER THE MANUFACTURER'S RECOMMENDATIONS, WIRE TO IRRIGATION CONTROLLER.
3. USE 45 DEGREE ELLS TO ACHIEVE MAINLINE DEPTH ON THE DOWN STREAM SIDE OF THE FLOW SENSOR.

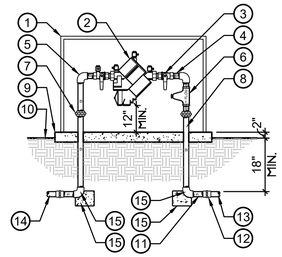
1. PLASTIC RECTANGULAR VALVE BOX WITH BOLT DOWN COVER, USE STAINLESS BOLT, NUT, AND WASHER. BOX TO BE PLACED AT RIGHT ANGLE TO HARDSCAPE EDGE. BRAND 'FS' ONTO LID, 1 1/2"-2" HIGH LETTERING
2. FLOW SENSOR, SEE LEGEND FOR SPECIFICATION
3. FINISH GRADE
4. 24" WIRE LOOP
5. PVC MAINLINE PIPE
6. BRICK SUPPORTS
7. 3/4" WASHED CRUSHED GRAVEL, 2 CUBIC FT.
8. LANDSCAPE FABRIC TO COVER BOTTOM AND ALL SIDES OF FLOW SENSOR BOX
9. PVC MAINLINE PIPE TO MASTER VALVE (NOT LESS THAN 10 PIPE DIAMETERS) PER SPECS AND PLAN



3 FLOW SENSOR
NO SCALE

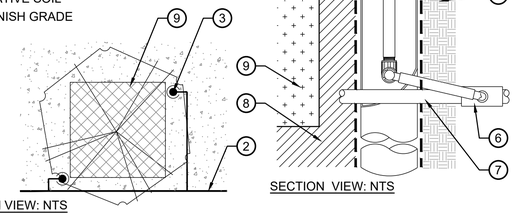
NOTES:
1. IF WYE STRAINER OR PRESSURE REGULATOR IS SPECIFIED, INSTALL ON EITHER THE HORIZONTAL PIPING OR ON THE DOWNSTREAM LEG AS SPACE PERMITS.
2. CONCRETE SLAB SHALL BE MINIMUM 4" THICK, 18" WIDE AND EXTEND AT LEAST 8" PAST THE BACKFLOW ASSEMBLY PIPING. IF BACKFLOW ENCLOSURE IS SPECIFIED IN THE LEGEND, THE CONCRETE SLAB SHALL BE THE SIZE REQUIRED BY THE MANUFACTURER.

1. BACKFLOW ENCLOSURE
2. R/P DEVICE SEE LEGEND FOR SPECIFICATIONS
3. BRASS BALL VALVE (TYP.)
4. BRASS NIPPLES MINIMUM 4"
5. BRASS ELL, 4 REQUIRED
6. PRESSURE REGULATOR OR WYE STRAINER
7. BRASS UNION, 2 REQUIRED
8. BRASS RISERS. LENGTH AS REQUIRED
9. CONCRETE SLAB, SEE NOTES
10. FINISH GRADE
11. SCH 80 PVC NIPPLE 6" MINIMUM
12. SCH 80 PVC FEMALE ADAPTER
13. PVC MAINLINE TO MASTER VALVE
14. PVC MAINLINE FROM METER
15. 12"x12"x12"x CONCRETE THRUST BLOCK FOR 3" DIA. PIPE OR SMALLER



1 3" AND SMALLER REDUCED PRESSURE BACKFLOW
NO SCALE

1. ROOT WATERING SYSTEM ASSEMBLY: RAINBIRD RWS-B-C-1402 4" DIA. X 36" LENGTH (INCLUDES 1402 0.50GPM BUBBLER W/ RISER, CHECK VALVE, GRATE, SWING ASSEMBLY, 1/2" MALE NPT INLET AND BASKET CANISTER)
2. PVC LATERAL LINE PIPE. SEE SPECIFICATIONS FOR TYPE AND DEPTH REQUIREMENTS
3. ROOT WATERING SYSTEM PER LEGEND
4. ROOT BALL OF TREE
5. RWS SAND SOCK (RWS-SOCK)
6. PVC SCH. 40 TEE OR ELL
7. PVC LATERAL LINE
8. AMENDED BACKFILL
9. ROOT BALL OF TREE
10. NATIVE SOIL
11. FINISH GRADE



PLAN VIEW: NTS

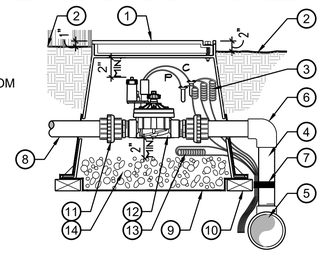
SECTION VIEW: NTS

8 TREE BUBBLER
SCALE: NTS

NOTES:
1. 2 BUBBLERS MIN. PER TREE

NOTES:
1. TOP OF BOX: 1" ABOVE FINISH SURFACE IN TURF AND 2" IN NON-TURF AREAS.

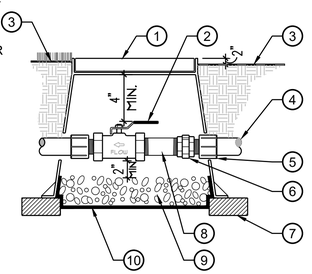
1. PLASTIC RECTANGULAR VALVE BOX WITH T-COVER AND CAPTIVE STAINLESS STEEL BOLT AND LOC-KIT. INSTALL BOX AT RIGHT ANGLE TO ADJACENT HARDSCAPE EDGE. LABEL "RCV" AND CONTROL STATION NUMBER ONTO LID
2. FINISH SURFACE
3. 24" WIRE LOOPS WITH WATERPROOF WIRE CONNECTORS
4. SCH.40 PVC PIPE OR SCH.80 T.O.E. NIPPLE WITH D.I. SERVICE TEE
5. SCH.80 PVC SLIP TEE OR LEEMCO DUCTILE IRON BBT SERVICE TEE FOR USE ON BELL AND GASKET MAINLINE PIPER
6. SCH.80 PVC SLIP 90° ELL
7. TAPE WIRES TO PIPE
8. SCH.40 PVC PIPE, SIZE PER RCV, TYP.
9. LANDSCAPE FABRIC TO COVER BOTTOM AND ALL SIDES OF VALVE BOX
10. BRICK SUPPORTS (4 TOTAL)
11. LASCO #896 PVC UNION SLIP X MIPT, SIZE PER RCV, TWO (2) REQUIRED FOR ASSEMBLY
12. ELECTRIC REMOTE CONTROL VALVE
13. SPARE CONTROL WIRE LOOP 48" LENGTH INTO EACH RCV BOX
14. 3/4" CRUSHED GRAVEL, 2 CUBIC FEET



6 REMOTE CONTROL VALVE ASSEMBLY
NO SCALE

NOTES:
1. BOX TO BE INSTALLED TO ALLOW FOR PROPER OPERATION OF BALL VALVE.
2. INSTALL BOX AT RIGHT ANGLE TO HARDSCAPE EDGE, INSTALL VALVE OFF-CENTER IN BOX TO ALLOW FOR HANDLE MOVEMENT.
3. INSTALL VALVE BOX EXTENSIONS AS REQUIRED TO ACHIEVE PROPER VALVE INSTALLATION AT MAINLINE DEPTH.
4. FINISH GRADE: 1" BELOW FINISH SURFACE ADJACENT TO TURF AND 2" BELOW ADJACENT TO NON-TURF AREAS.

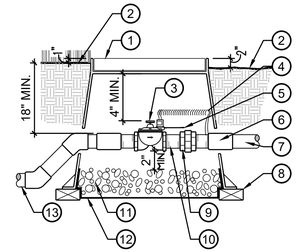
1. PLASTIC RECTANGULAR VALVE BOX WITH BOLT DOWN COVER, USE STAINLESS BOLT, NUT, AND WASHER BRAND "BV" ONTO LID, 1 1/2"-2" HIGH LETTERING
2. BALL VALVE, REFER TO LEGEND FOR SPECIFICATIONS
3. FINISH GRADE
4. PRESSURE SUPPLY LINE, DEPTH PER SPECIFICATIONS
5. PVC MALE ADAPTER
6. BRASS UNION
7. BRICK SUPPORTS (4 TOTAL)
8. BRASS NIPPLE
9. 3/4" WASHED CRUSHED GRAVEL, 2 CUBIC FEET
10. LANDSCAPE FABRIC TO COVER BOTTOM AND ALL SIDES OF VALVE BOX



4 BALL VALVE
NO SCALE

NOTES:
1. USE 45 DEGREE ELLS TO ACHIEVE MAINLINE DEPTH FROM UP-STREAM SIDE OF THE MASTER VALVE ASSEMBLY.
2. TOP OF BOX: 1" ABOVE FINISH SURFACE IN TURF AND 2" IN NON-TURF AREAS.
3. REFER TO LEGEND FOR MORE INFORMATION

1. PLASTIC RECTANGULAR VALVE BOX WITH BOLT DOWN COVER, USE STAINLESS BOLT, NUT, AND WASHER BOX TO BE PLACED AT RIGHT ANGLE TO HARDSCAPE EDGE. LABEL "MV" ONTO LID
2. FINISH GRADE
3. MASTER CONTROL VALVE
4. 24" WIRE LOOPS WITH WATERPROOF WIRE CONNECTORS
5. VALVE ID TAG
6. PVC SCH 40 FEMALE ADAPTER, 2 REQUIRED
7. PVC MAINLINE TO FLOW SENSOR, PIPE PER SPECS
8. BRICK SUPPORTS (4 TOTAL)
9. BRASS UNION
10. BRASS NIPPLE TYP.
11. 3/4" CRUSHED GRAVEL, 2 CUBIC FEET
12. LANDSCAPE FABRIC TO COVER BOTTOM AND ALL SIDES OF VALVE BOX
13. PVC MAINLINE PIPE FROM BASKET STRAINER PER SPECS



2 MASTER CONTROL VALVE
NO SCALE

nuvis
LANDSCAPE ARCHITECTURE
20250 SW ACACA ST., SUITE 260
NEWPORT BEACH, C A
U. S. A. 92660
PH: 714.754.7311

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED PROFESSIONAL LANDSCAPE ARCHITECT — M. STONE — No. 5891 — STATE OF CALIFORNIA
Signature
SEPTEMBER 30, 2021
Expiration Date
04/26/2021
Date

DESIGNED T.MORITA
DRAWN T.MORITA
CHECKED T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

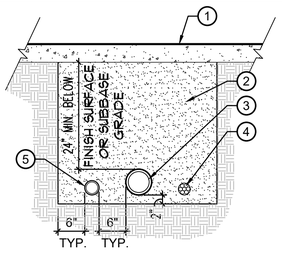
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IRRIGATION DETAILS

FILE NAME
JOB NO. 1944519.00
DATE 04-26-2021
SHEET LI-3 OF ##

NOTES:
1. PVC SLEEVES TO BE TWICE THE DIAMETER OF THE PIPE OR WIRE BUNDLE CARRIED.
2. DETAIL ALSO FOR PIPE INSTALLED IN ROCK SOIL.
3. ALL SLEEVES TO BE SCHEDULE 40 PVC.
4. EXTEND ALL SLEEVES 12" BEYOND EDGE OF HARDSCAPING AT BOTH ENDS.
5. 24" MINIMUM COVER ON MAINLINE 3" AND LARGER.

1. FINISH SURFACE
2. CLEAN SAND BACKFILL MINIMUM 90% COMPACTION
3. PRESSURE MAINLINE IN SCHEDULE 40 SLEEVE - SIZE SLEEVE TWICE DIAMETER OF PRESSURE SUPPLY LINE
4. CONTROL WIRES IN SLEEVE - SIZE PER PLAN. INSTALL ADJACENT TO PRESSURE SUPPLY LINE
5. NON-PRESSURE LATERAL LINE IN SLEEVE TWICE DIAMETER OF LATERAL LINE

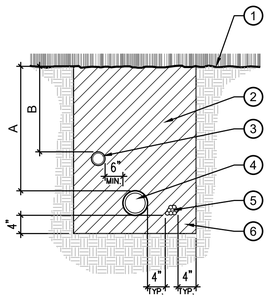


6 TYPICAL SLEEVING
NO SCALE

NOTES:
1. PIGTAIL AND LOOP CONTROL WIRE AT ALL 90° CHANGES IN DIRECTION.
2. PROVIDE A MINIMUM 10 FEET SEPARATION BETWEEN POTABLE AND RECLAIMED MAINLINE PIPING.
3. 24" MINIMUM COVER ON 3" MAINLINE AND LARGER.

1. FINISH GRADE
2. CLEAN BACKFILL - 90% COMPACTION REQUIRED
3. NON-PRESSURE LATERAL LINE. SNAKE PIPE IN TRENCH
4. PRESSURE SUPPLY LINE SNAKE PIPE IN TRENCH
5. CONTROL WIRES - BUNDLE AND TAPE AT 10' O.C. AND INSTALL ADJACENT TO PRESSURE SUPPLY LINE

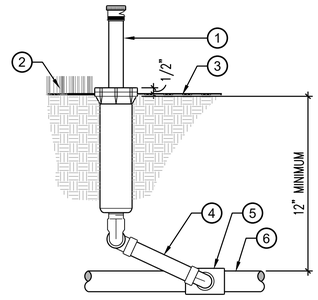
DIMENSION	A	B
1/2" TO 2-1/2" IN SIZE	18"	12"
3" TO 6" IN SIZE	24"	



4 TYPICAL TRENCHING
NO SCALE

NOTES:
1. LOCATE SPRINKLER HEADS 24" FROM WALKS, CURBS, MOWSTRIP AND HEADER BOARDS EDGE IN TURF AND GROUNDCOVER AREAS.
2. INSTALL SPRINKLER HEADS PLUMB. ADJUST SPRAYS OR NOZZLE STREAM TO COVER LANDSCAPE AREA WITHOUT OVERSPRAY ONTO PAVING, FENCES, WALLS OR BUILDINGS.

1. POP-UP SPRINKLER HEAD, SPRAY OR ROTOR REFER TO LEGEND FOR SPECIFICATIONS
2. INSTALL SPRINKLER HEAD FLUSH WITH FINISHED GRADE IN TURF AREAS
3. INSTALL SPRINKLER HEAD 1/2" ABOVE FINISHED GRADE IN SHRUB AREAS
4. PRE-ASSEMBLED TRIPLE SWING ARM (REFER TO LEGEND), LAY LENGTH TO BE 6" MINIMUM SIZE AS PER SPRINKLER OUTLET
5. SCH 40 PVC SxSxT TEE FITTING LATERAL x SPRINKLER INLET SIZE
6. LATERAL LINE, REFER TO SPECIFICATIONS FOR TYPE AND DEPTH REQUIRED

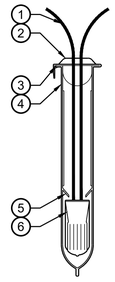


SECTION

3 POP-UP SPRAY HEAD
NO SCALE

NOTES:
1. KIT SHALL INCLUDE A SCOTCHLOK Y SPRING CONNECTOR, A POLYPROPYLENE TUBE AND A WATERPROOF SEALING GEL. TUBE SHALL BE SUPPLIED PRE-FILLED WITH GEL.
2. DIRECT BURY SPLICE KIT SHALL BE USED TO ELECTRICALLY CONNECT 2-3 #14 OR TWO (2) #12 PRE-STRIPPED COPPER WIRES. LARGER WIRES OR GREATER QUANTITIES OF WIRES SHALL REQUIRE A LARGER APPROVED WIRE CONNECTION.

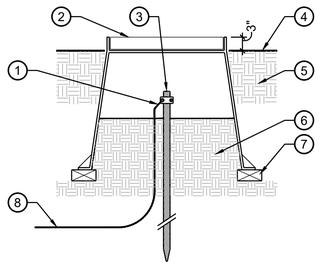
1. LOW VOLTAGE WIRES, THREE (3) MAXIMUM
2. WIRES PASS THROUGH GROOVES IN TUBE LID TO ALLOW LID TO CLOSE
3. CLOSE TUBE LID AFTER WIRE IS INSERTED INTO TUBE
4. POLY TUBE PRE-FILLED WITH WATERPROOF GEL
5. LOCK TABS PREVENTS WIRE REMOVAL ONCE CONNECTOR IS INSERTED
6. SCOTCHLOK ELECTRICAL SPRING CONNECTOR WIRES SHALL BE PRE-STRIPPED OF 1/2" OF THE INSULATION PRIOR TO INSERTION INTO THE CONNECTOR. TWIST CONNECTOR ONTO WIRES TO SEAT FIRMLY. SCOTCHLOK CONNECTOR AND WIRES INSERTED INTO TUBE UNTIL THE CONNECTOR PASSES LOCK TABS



1 TYP. WIRE CONNECTION
SCALE: NTS

NOTES:
1. FINISH GRADE: 2" BELOW FINISH SURFACE ADJACENT TO TURF AND 3" BELOW ADJACENT TO NON-TURF AREAS.

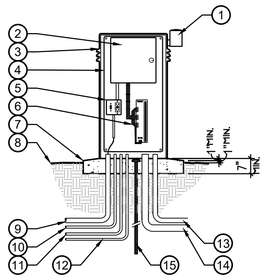
1. BARE COPPER GROUND WIRE (#6) CONNECT TO ROD W/ BRASS CLAMP
2. PLASTIC RECTANGULAR VALVE BOX HEAT BRAND "GR" ONTO LID
3. 5/8"x8' COPPER CLAD GROUND ROD
4. FINISH GRADE
5. NATIVE OR UNDISTURBED SOIL
6. FILL 1/2 OF BOX WITH COMPACTED SIT SOIL
7. BRICK SUPPORTS (4 REQ.)
8. BARE COPPER GROUND WIRE (#6) FROM CONTROLLER



7 GROUNDING ROD INSTALLATION
SCALE: NTS

NOTES:
1. PILOT WIRES SHALL BE ONE COLOR FOR EACH CONTROLLER. COMMON WIRES SHALL BE WHITE WITH DIFFERENT COLOR STRIPES FOR EACH AUTOMATIC CONTROLLER.
2. NO SPLICES SHALL BE MADE BETWEEN CONTROLLER AND REMOTE CONTROL VALVE UNDER 500 LINEAL FEET.
3. CONTROL WIRING SEQUENCE CORRESPONDS TO OPERATING SEQUENCE OF REMOTE CONTROL VALVES AND AUTOMATIC SPRINKLER CONTROL UNIT STATION CONNECTION SEQUENCE. SEQUENCE SHOWN ON DETAIL IS FOR REFERENCE ONLY. SEE IRRIGATION PLAN FOR CORRECT VALVE SEQUENCE.

1. RAIN SENSOR ATTACHED TO ENCLOSURE PER MANUFACTURERS RECOMMENDATIONS
2. CONTROLLER - REFER TO LEGEND FOR MAUFACTURER AND MODEL
3. STAINLESS STEEL, 18" OR 24" WIDE FRONT ENTRY CONTROLLER ENCLOSURE NEMA 3R RAINPROOF RATED
4. STAINLESS STEEL, U.L. LISTED. PREDRILLED, REMOVABLE BACKBOARD
5. POWER SWITCH AND RECEPTACLE
6. TERMINAL STRIP FOR REMOTE CONTROL VALVE WIRE CONNECTIONS
6. CONCRETE PAD - CL 520-C-2500. CONCRETE PAD MUST BE CONSTRUTED TO ENSURE 6" CLEARANCE AROUND THE ENCLOSURE. INSTALL A MINIMUM OF 3" ABOVE GRADE AND SLOPE TOP TO DRAIN AT A MINIMUM OF 2%
8. FINISH GRADE
9. 1 1/4" PVC CONDUIT FOR ELECTRIC SERVICE
10. 1" PVC CONDUIT FOR ET GAUGE WIRES (IF REQUIRED)
11. 1" PVC CONDUIT FOR TELEPHONE CONNECTION (IF REQUIRED)
12. 1" PVC CONDUIT FOR FLOW SENSOR / MCV WIRES (IF REQUIRED)
13. 1 1/4" PVC CONDUIT FOR COMMUNICATION CABLE TO OTHER CONTROLLERS (IF REQUIRED)
14. 3" PVC CONDUIT FOR CONTROL WIRES TO VALVES
15. 5/8"~ x 8' COPPER GROUND ROD W/ #10 GROUND WIRE AND CLAMP

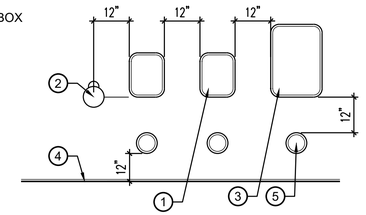


SECTION

5 PEDESTAL MOUNTED CONTROLLER
NO SCALE

NOTES:
1. CENTER VALVE BOX OVER REMOTE CONTROL VALVE TO FACILITATE SERVICING VALVE.
2. SET BOXES 2" ABOVE FINISH GRADE OR MULCH COVER IN GROUNDCOVER/SHRUB AREA AND 1" ABOVE FINISH GRADE IN TURF AREA.
3. SET RVC AND VALVE BOX ASSEMBLY IN GROUNDCOVER/SHRUB AREA WHERE POSSIBLE. INSTALL IN LAWN ONLY IF GROUNDCOVER DOES NOT EXIST ADJACENT TO LAWN.
4. SET BOXES PARALLEL TO EACH OTHER AND PERPENDICULAR TO EDGE.
5. AVOID HEAVILY COMPACTING SOIL AROUND VALVE BOXES TO PREVENT COLLAPSE AND DEFORMATION OF VALVE BOX SIDES.
6. BRAND VALVE BOX WITH CONTROLLER LETTER AND VALVE NUMBER USING 1 1/2 -2" LETTERING

1. TYPICAL 16"x21" RECTANGULAR VALVE BOX
2. TYPICAL QUICK COUPLING VALVE
3. TYPICAL 19"x26" OR LARGER VALVE BOX
4. EDGE OF LAWN, WALK, FENCE, CURB, ETC.
5. TYPICAL ROUND BALL VALVE BOX



2 VALVE BOX INSTALLATION
NO SCALE

nuvis
LANDSCAPE ARCHITECTURE
20250 SW ACACA ST., SUITE 260
NEWPORT BEACH, CA
U.S.A. 92660
PH: 714.754.7311

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED LANDSCAPE ARCHITECT — No. 4787 — STATE OF CALIFORNIA
Signature
SEPTEMBER 30, 2021
Expiration Date
04/26/2021
Date

DESIGNED	T.MORITA
DRAWN	T.MORITA
CHECKED	T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

IRRIGATION DETAILS

FILE NAME	
JOB NO.	1944519.00
DATE	04-26-2021
SHEET	LI-4 ##
OF	

BARRETT ENGINEERED PUMPS

SPECIALISTS IN PUMPS AND PUMPING SYSTEMS

PROJECT: SAN FERNANDO – UPPER RESERVOIR **December 2, 2020**

SYSTEM DESIGN PARAMETERS

IBCM1-.5-2-1.5/VFD-F/QP System Model Number	5 GPM System Design Flow Rate	45 PSI System Design Pressure	1 ½ INCH System Piping Size
0 PSI (flooded – reservoir) Minimum Suction Pressure	208/230 or 460 VAC System Electrical Voltage	1 or 3 PHASE 60 Hz System Electrical Phase and Frequency	
CM1-3 Pump Model Number	5 GPM Pump Capacity (GPM)	110 FEET Pump Total Head (Feet)	
1/2 HP Pump Horsepower	3500 RPM Pump RPM	System Full Load Amperage	

BOOSTER PUMP ASSEMBLY

1.1 Simplex water pressure booster system as designed and fabricated by Barrett Engineered Pumps. The system shall be a completely prefabricated system with pump, piping, electrical and structural elements.

1.2 Pump shall be:

1.2.1 Horizontal multi-stage centrifugal. Pump construction shall be stainless fitted with stainless steel casing, stainless steel impellers and bowls. Pump shall be equipped with mechanical seal. Pump shall be directly coupled to a C-face electric motor.

1.3 Electric motor shall be of the squirrel cage induction type suitable for full voltage starting. Motor shall be ODP to aid in cooling. Electric motor shall be rated for continuous service. The motor shall conform to the latest NEMA Standards for motor design and construction.

1.4 Pump Control Panel shall have a NEMA 4X plain front non-metallic enclosure with padlock latches. The Control Panel shall include power and control reset-able thermal circuit breakers, heavy duty magnetic starter with adjustable overload protection, Hand-Off-Auto switch to select mode of operation, and heavy duty numbered terminal strips for power and control wiring lead terminations.

1.5 Metal oxide varistor protected pump start relay(s) incorporated in panel to start pump with signal from each irrigation controller.

1.6 All system piping shall be type304 stainless steel. All fittings shall be stainless, with unions or flanges to allow for system disassembly or major component removal.

1.7 Isolation valves shall be all brass quarter turn ball valves with hard chrome ball.

1.8 Gauges shall be 2½" diameter face, glycerin filled with stainless casing and brass internals.

1.9 Flow switch shall be a 316 stainless steel and solid state thermal sensor designed to measure change in flow velocity and in temperature. The flow switch shall include an integrated bar graph with 10 LED lights and shall be capable of providing indication of flow (green), closed (orange), and open (red) conditions.

1695 National Ave. San Diego CA 92113
Phone (619) 232-7867 • FAX (619) 232-3029
Represented by: Green Product Sales • (949) 584-7311 • gps10@earthlink.net

1.10 Pump system shall be mounted on a mounting pad assembly consisting of a reinforced plastic support base, a three sixteenth inch thick 5052 H32 Marine Grade Aluminum mounting pad and 304 grade stainless steel fastening brackets. The support base shall be installed and compacted in earth allowing the top two inches of the support base to be exposed above the earth. The 5052 H32 Marine Grade Aluminum mounting pad shall be clamped to the support base with the stainless steel fastening brackets.

1.11 The system enclosure shall be of a vandal and weather resistant nature manufactured entirely of marine grade aluminum alloy 5052-H32, with a wall thickness of one eighth inch. The mounting base shall be manufactured entirely of stainless steel. The main housing shall be of solid sheet construction punched on the sides with a rectangular pattern for viewing backflow operation. The length of the enclosure shall be expandable to allow for site adjustment. The enclosure shall have a mounting lip on one end and a locking mechanism on the other end. The mounting base shall be submerged into the concrete a minimum of two inches, positioning the enclosure 2 ½ inches above the concrete for drainage purposes. The locking mechanism shall be of the full release type, which allows for complete removal of the enclosure from its mounting base without the use of tools. The handle controlling the locking mechanism shall be concealed within the surface of the enclosure and provide for a padlock.

1.12 Pump Assembly shall include the following option(s):

- ❑ **(VFD-F)** Where specified by the System Design Parameters, a **Fuji Variable Frequency Drive** system to receive feedback signal from system mounted stainless steel pressure transducer, and in conjunction with internal software driven PID control loop maintain customer adjustable constant system discharge pressure by varying the speed of the pump in response to varying system load.

1.13 The services of a factory representative or trained service professional shall be made available on the job site to check installation and perform the startup and instruct operating personnel. A startup report containing voltage and amperage readings, suction and discharge pressure readings, estimated flow conditions, and general operating characteristics shall be submitted to the Owner.

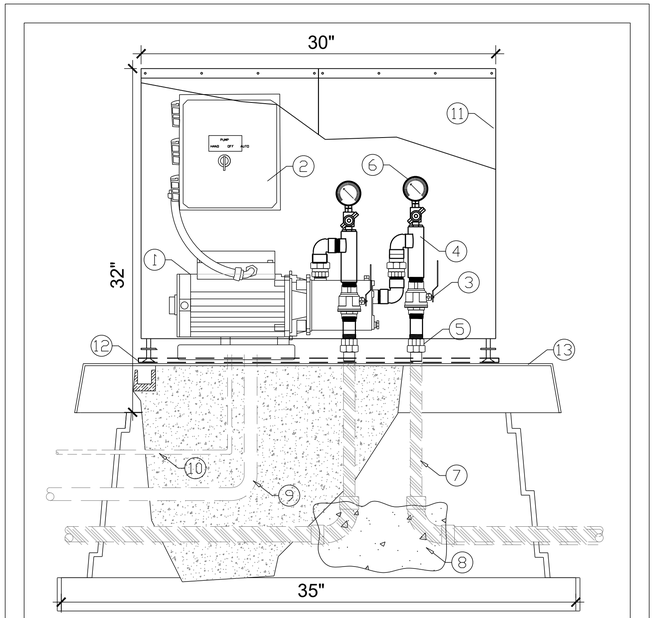
1.14 One electronic set of operating and maintenance manual shall be provided to the owner after startup and shall include parts manuals for major components, performance curve for pump, general sequence of operation, and electrical schematic for control panel.

1.14 The warranty period shall be a non-prorated period of 36 months from date of purchase.

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2 ENGINEERED PUMP

NOT TO SCALE



KEYNOTE LEGEND

1. CLOSE-COUPLED CENTRIFUGAL PUMP, STAINLESS STEEL FITTED.
2. NEMA 4X SIMPLEX CONTROL PANEL FOR AUTOMATIC OPERATION.
3. STAINLESS 1/4 TURN BALL VALVE
4. 1.5 INCH TYPE 304 STAINLESS STEEL.
5. STAINLESS UNION ADAPTER.
6. PRESSURE GAUGE, 2 1/2" DIAL, LIQUID FILLED, STAINLESS CASE, 0 - 200 PSI.
7. CONTRACTOR'S RESPONSIBILITY TO PROVIDE ALL INLET AND OUTLET PIPING; BRASS OR CAST IRON. WRAP WITH 20 MIL TAPE; DOUBLE WRAP
8. CONCRETE THRUST BLOCKS WHERE APPLICABLE
9. MAIN POWER CONDUIT.
10. IRRIGATION CONTROLLER SIGNAL CONDUIT.
11. MARINE GRADE ALUMINUM ENCLOSURE. MEASURES 20"D X 30"L X 32"H
12. STRUCTURAL ALUMINUM BASEPLATE.
13. QUICK PAD SUPPORT PAD - MEASURES 35' X 22"

BARRETT ENGINEERED PUMPS

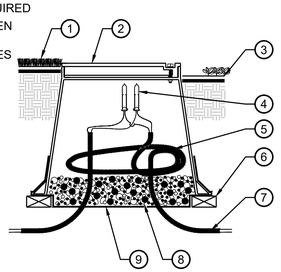
SIZE	DWG NO.	REV
	SAN FERNANDO UPPER RESERVOIR	
SCALE		SHEET

1 ENGINEERED PUMP DETAIL

NOT TO SCALE

NOTES:
1. TWO-WIRE PATH IN CONDUIT ONLY IF SPECIFIED ON LEGEND, SEE LEGEND.

1. FINISHED GRADE IN TURF AREA
2. PLASTIC RECTANGULAR VALVE BOX WITH A TAN COLORED LID AND LOCK KIT. INSTALL BOX AT RIGHT ANGLE TO THE ADJACENT HARDSCAPE EDGE. HEAT BRAND "PB" ONTO LID
3. FINISHED GRADE IN SHRUB AREA
4. 3M DBR/Y-6 WATERPROOF WIRE CONNECTORS
5. PROVIDE A 48" LONG COIL OF THE TWO WIRE PATH (FOR CONTROL VALVES, MASTER VALVE/FLOW SENSOR OR COMMUNICATION CABLE) IN EACH PULL BOX USED. PULL BOXES FOR SLEEVE CROSSING DO NOT REQUIRE WATERPROOF CONNECTORS UNLESS SPLICES ARE REQUIRE
6. BRICK SUPPORTS, FOUR (4) REQUIRED
7. TWO-WIRE PATH (CABLE) BETWEEN THE CONTROLLER AND ALL FIELD EQUIPMENT AND CONTROL VALVES
8. 3/4" CRUSHED GRAVEL, 4" MINIMUM DEPTH
9. LANDSCAPE FABRIC TO COVER BOTTOM AND ALL SIDES OF VALVE BOX



3 PULL BOX

SCALE: NTS

NUVIS
LANDSCAPE ARCHITECTURE
20250 SW ACACA ST., SUITE 260
NEWPORT BEACH, C A
U. S. A. 92660
PH: 714.754.7311

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED LANDSCAPE ARCHITECT — STONE No. 4971 — Signature — SEPTEMBER 30, 2021 Expiration Date — 04/26/2021 Date — STATE OF CALIFORNIA

DESIGNED	T.MORITA
DRAWN	T.MORITA
CHECKED	T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

IRRIGATION CALCULATIONS AND DETAILS

FILE NAME	
JOB NO.	1944519.00
DATE	04-26-2021
SHEET	LI-5 ##
OF	

Estimated Total Water Use

Equation: ETWU = ET_o x 0.62 x [((PF x HA)/IE) + SLA]; Considering precipitation ETWA = (ETo-Eppt) x 0.62 x [((PF x HA)/IE) +SLA]

Enter values in Pale Blue Cells

Tan Cells Show Results

Messages and Warnings

Irrigation Efficiency Default Value for overhead 0.75 and drip 0.81.

Plant Water Use Type	Plant Factor
Very Low	0 - 0.1
Low	0.2 - 0.3
Medium	0.4 - 0.6
High	0.7 - 1.0
SLA	1.0

Hydrozone	Select System From the Dropdown List click on cell below	Plant Water Use Type (s) (low, medium, high)	Plant Factor (PF)	Hydrozone Area (HA) (ft^2) Without SLA	Irrigation Efficiency (IE)	(PF x HA (ft^2))/IE
Zone 1	Overhead Spray	Low	0.30	48	0.75	19
Zone 2	Overhead Spray	Low	0.30	48	0.75	19
Zone 3	Drip	Low	0.30	1,012	0.81	375
Zone 4						
Zone 5						
Zone 6						
Zone 7						
Zone 8						
Zone 9						
Zone 10						
Zone 11						
Zone 12						
Zone 13						
Zone 14						
Zone 15						
Zone 16						
Zone 17						
Zone 18						
Zone 19						
Zone 20						
Zone 21						
Zone 22						
Zone 23						
Zone 24						
Zone 25						
Zone 26						
Zone 27						
Zone 28						
Zone 29						
Zone 30						
Zone 31						
Zone 32						
Zone 33						
Zone 34						
Zone 35						
						413
		SLA		0		0
			Sum	1,108		

Total Landscape Area including Special Landscape

Results

MAWA = 15,332

ETWU = 12,706 Gallons
1,699 Cubic Feet
16.99 HCF
0.04 Acre-feet
0.01 Millions of Gallons

ETWU complies with MAWA

C WATER EFFICIENT LANDSCAPE WORKSHEET

WATER PRESSURE CALCULATIONS

POC NUMBER	A	POC SIZE	1"
HYDRAULIC GRADE LINE	-	POC ELEVATION	-
ELEVATION DIFFERENCE	-	MINIMUM STATIC WATER PRESSURE	45
REMOTE CONTROL VALVE #	A3	REMOTE CONTROL VALVE SIZE	1"
R.C.V. DEMAND (GPM)	5.1	TOTAL DEMAND (GPM)	30
HIGHEST HEAD ELEVATION	-	STATIC PRESSURE AT R.C.V.	-

SIZE	DESCRIPTION		PSI LOSS	
1"	SERVICE LINE	1	0.0	PSI
1"	WATER METER	2	1.0	PSI
1"	BACKFLOW	3	12.0	PSI
1"	GATE VALVES	4	0.5	PSI
1"	MASTER CONTROL VALVE	5	0.5	PSI
1"	50 FEET OF MAINLINE: TYPE CLASS 200	6	2.0	PSI
-	FEET OF MAINLINE: TYPE	7	-	PSI
1"	REMOTE CONTROL VALVE	8	2.0	PSI
10%	LATERAL LINE LOSS	9	1.6	PSI
10%	FITTING LOSS	10	1.8	PSI
0	FT. OF ELEVATION CHANGE (P.O.C. TO HIGHEST HEAD)	11	0.0	PSI
TOTAL SYSTEM PRESSURE LOSS (SUM OF #1 THRU #11)		12	21.4	PSI
PRESSURE REQUIRED AT HEAD		13	30.0	PSI
TOTAL PRESSURE REQUIRED (SUM OF #12 AND # 13)		14	51.4	PSI
STATIC WATER PRESSURE (FROM ABOVE)		15	45.0	PSI
RESIDUAL PRESSURE (SUBTRACT # 14 FROM # 15)		16	-6.4	PSI
SET PRV OR MCV AT (# 14 PLUS 10 PSI)		17	0.0	PSI
PRESSURE BOOST, IF REQUIRED (#14-#15 + 20 PSI)		18	0.0	PSI

A PRESSURE LOSS CALCULATIONS

Maximum Applied Water Allowance Calculations for New and Rehabilitated Non-Residential Landscapes

Enter value in Pale Blue Cells

Tan Cells Show Results

Messages and Warnings

Click on the blue cell on right to Pick City Name	**San Fernando**	**City of San Fernando**
ET_o of City from Appendix A	**52.00**	**ET_o** (inches/year)
	96	Overhead Landscape Area (ft^2)
	1012	Drip Landscape Area (ft^2)
	0	SLA (ft^2)
Total Landscape Area	**1,108**	
Results:		
(ET_o) x (0.62) x [(0.45 x LA) + (1.0 - 0.45) X SLA)]	**16,075**	Gallons
	2,149	Cubic Feet
	21	HCF
	0	Acre-feet
	0	Millions of Gallons
MAWA calculation incorporating Effective Precipitation (Optional)		
Precipitation (Optional)		
ET_o of City from Appendix A	**52**	ET_o (inches/year)
Total Landscape Area	**1,108**	LA (ft^2)
Special Landscape Area	**0**	SLA (ft^2)
		Total annual precipitiation (inches/year)
Enter Effective Precipitation	**0.00**	Eppt (in/yr)(25% of total annual precipitation)
Results:		
MAWA = [(ET_o - Eppt) x (0.62)] x [(0.45 x LA) + ((1.0 - 0.45) x SLA)]	-	Gallons
	-	Cubic Feet
	-	HCF
	-	Acre-feet
	-	Millions of Gallons

B WATER EFFICIENT LANDSCAPE WORKSHEET

nuvis
LANDSCAPE ARCHITECTURE
20250 SW ACACA ST., SUITE 260
NEWPORT BEACH, CA
U.S.A. 92660
PH: 714.754.7311

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED LANDSCAPE ARCHITECT — TIMOTHY M. STONE No. 6187 — STATE OF CALIFORNIA
Signature
SEPTEMBER 30, 2021
Expiration Date
04/26/2021
Date

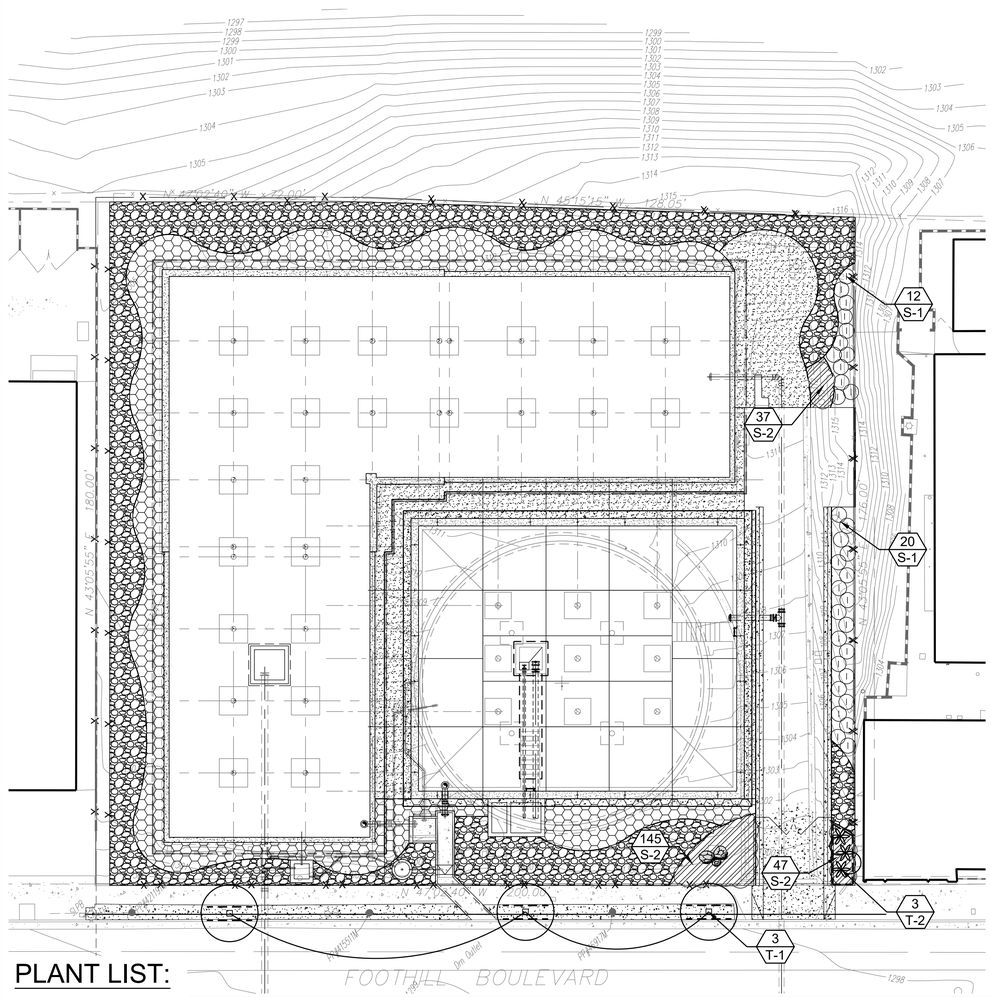
DESIGNED T.MORITA
DRAWN T.MORITA
CHECKED T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

IRRIGATION CALCULATIONS AND DETAILS

FILE NAME
JOB NO. 1944519.00
DATE 04-26-2021
SHEET LI-6 OF ##

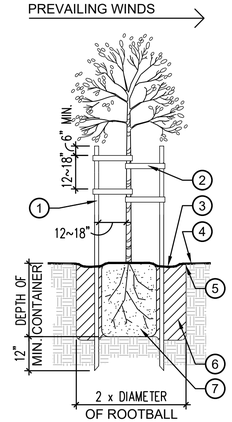


PLANT LIST:

CODE	SYMBOL	SCIENTIFIC NAME	COMMON NAME	SPACING	QTY	WUCOLS (WATER USE)	SIZE
	TREES						
T-1		LAGERSTROEMIA X FAURIEI 'TUSCARORA'	TUSCARORA CRAPE MYRTLE	PER PLAN	3	MOD	24" BOX STD.
T-2		TRACHYCARPUS FORTUNEI	CHINESE WINDMILL PALM	PER PLAN	3	LOW	24" BOX
	SHRUBS						
S-1		AGAVE ATTENUATA 'VARIEGATA'	VARIEGATED FOX TAIL AGAVE	48" O.C	32	LOW	5 GAL
S-3		SENECIO MANDRALISCAE	KLEINIA	18" O.C.	229	LOW	1 GAL

NOTES:
1. CROWN OF ROOTBALL TO BE 1" ABOVE FINISH GRADE.
2. FOR ADDITIONAL INFORMATION REFER TO PLANTING NOTES AND SPECIFICATIONS.

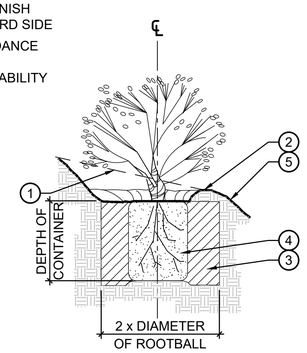
1. 2"Ø MINIMUM X 10' LODGE POLE STAKE BOTH SIDES, OR 'TOMAHAWK TREE STABILIZER SYSTEM' (800) 845-3343, OR APPROVED EQUAL
2. CINCH TIE, ARBOR TIE, OR APPROVED EQUAL
3. A SHALLOW BASIN 2" DEEP SHALL BE FORMED AROUND BALL BELOW FINISH GRADE. TREES PLANTED IN TURF AREAS SHALL NOT HAVE BASINS.
4. FINISH GRADE
5. TREES INSTALLED WITHIN TURF AREAS SHALL BE INSTALLED WITH 'ARBOR-GARD' OR APPROVED EQUAL AT BASE OF TRUNK.
6. BACKFILL IN ACCORDANCE WITH PROJECT AGRICULTURAL SUITABILITY SOILS REPORT
7. ROOTBALL



(DOUBLE STAKE 24" BOX)
3 TREE PLANTING
SCALE: NTS

NOTES:
1. CROWN OF ROOTBALL TO BE 1/2"-1" ABOVE FINISH GRADE.
2. FOR ADDITIONAL INFORMATION REFER TO PLANTING NOTES AND SPECIFICATIONS.

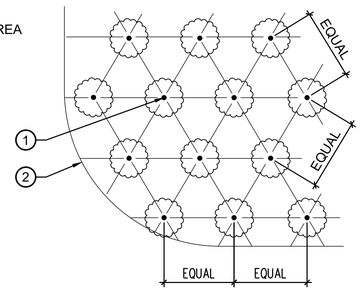
1. EDGE OF SLOPE BEYOND
2. A SHALLOW BASIN 2" DEEP SHALL BE FORMED AROUND ROOTBALL BELOW FINISH GRADE ON DOWNWARD SIDE
3. BACKFILL IN ACCORDANCE WITH PROJECT AGRICULTURAL SUITABILITY SOILS REPORT
4. ROOTBALL
5. FINISH GRADE



1 SHRUB PLANTING - SLOPE
SCALE: NTS

NOTES:
1. ALL PLANTS SHALL BE PLANTED AT EQUAL SPACING (TRIANGULAR UNLESS OTHERWISE INDICATED ON PLANS.
2. AS APPROPRIATE, CENTERLINE OF PLANTS SHALL BE 1/2 OF EQUAL SPACING MINIMUM FROM EDGE OF PLANTING AREA.
3. INFILL PLANTS AS REQUIRED TO MAINTAIN SPACING AT IRREGULAR EDGES.
4. FOR ADDITIONAL INFORMATION REFER TO PLANTING NOTES AND SPECIFICATIONS.

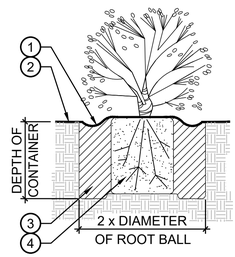
1. TYPICAL PLANT SPACING VARIES - SEE PLANT LEGEND AND/OR PLANS
2. EDGE OF PLANTING AREA



4 SHRUB SPACING
SCALE: NTS

NOTES:
1. CROWN OF ROOTBALL TO BE 1/2" - 1" ABOVE FINISH GRADE.
2. FOR ADDITIONAL INFORMATION REFER TO PLANTING NOTES AND SPECIFICATIONS.

1. A SHALLOW BASIN 2" DEEP SHALL BE FORMED AROUND ROOTBALL BELOW FINISH GRADE
2. FINISH GRADE
3. BACKFILL IN ACCORDANCE WITH PROJECT AGRICULTURAL SUITABILITY SOILS REPORT
4. ROOTBALL



2 SHRUB PLANTING
SCALE: NTS

NOTE:
1. REFER TO SHEET 'LC-1' FOR PLANTING PLAN NOTES

PLANT CALL-OUT
QUANTITY
PLANT SYMBOL CODE ##/X-#

CALL TOLL FREE 811
Know what's below. Call two working before you dig.
Underground Service Alert

SCALE: 1"=20'
0' 10' 20' 40' 80'

nuvis
LANDSCAPE ARCHITECTURE
20250 SW ACACA ST., SUITE 260
NEWPORT BEACH, CA
U.S.A. 92660
PH: 714.754.7311

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NO.	REVISION	DATE	BY

SCALES
0 1"
0 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

REGISTERED LANDSCAPE ARCHITECT
CHRISTOPHER R. STONE No. 6187
Signature
SEPTEMBER 30, 2021
Expiration Date
04/26/2021
Date
STATE OF CALIFORNIA

DESIGNED	T.MUNOZ
DRAWN	J.GUADARRAMA
CHECKED	T.MUNOZ

CITY OF SAN FERNANDO
SAN FERNANDO, CA
UPPER RESERVOIR REPLACEMENT

Kennedy Jenks | JOHN ROBINSON Consulting, Inc.

PLANTING PLAN, PLANT LIST, NOTES, AND DETAILS

FILE NAME	
JOB NO.	1944519.00
DATE	04-26-2021
SHEET	LP-1 ##