CONTRACT DOCUMENTS
AND
SPECIFICATIONS
FOR

BANKFIELD SEWAGE PUMP STATION PROJECT P-874

CITY OF CULVER CITY

BID NO. #_____

Public Works Department
City of Culver City

9770 Culver Boulevard

Culver City, CA 90232-0507

(310) 253-5600

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NOTICE INVITING BIDS

CITY OF CULVER CITY
NOTICE INVITING SEALED BIDS
FOR

BANKFIELD SEWAGE PUMP STATION PROJECT P-874
BID NO. #_____

1. **ANNOUNCEMENT**

Notice is hereby given that sealed bids will be accepted by the City of Culver City, California, for furnishing all labor, services, materials, and equipment, and performing all work to provide for a complete and acceptable project, including site work for:

BANKFIELD SEWAGE PUMP STATION PROJECT P-874, BID NO. #_____

In the City of Culver City and in strict accordance with the plans and specifications in the Office of the Public Works Director and City Engineer of the City of Culver City, 9770 Culver Boulevard, Culver City, CA. 90232.

2. **DESCRIPTION OF WORK:**

The work to be done consists of furnishing all materials, equipment, tools, labor and incidentals as required in the specifications and contract documents, for the following project(s): **"Bankfield Sewage Pump Station Project P-874".**

3. **COMPLETION OF WORK:**

All work to be done under this contract shall be completed within _____ **calendar days**, beginning on the date the Contractor actually commences the Work or on the tenth (10th) day after the issuance of the "Notice to Proceed" by the City Engineer, whichever comes first.

4. **BIDDING PROCEDURES**

All bids and bidding procedures must comply with the "Instruction to Bidders", Section B of the Bid Documents.

5. **SUBMISSION OF BIDS**

Bids must be filed with the Office of the City Clerk, at 9770 Culver Boulevard, Culver City, CA. 90232, not later than ***3:00 PM*** on _____ at which time they will be publicly opened in the City Council Chambers. Bids will later be referred to the City Council of the City of Culver City for the appropriate action.

6. **BID SECURITY**

Each Bidder shall submit a form of Bid Guaranty such as a money order, a cashier's check, certified check, cash, or surety bond for the sum of ten percent (10%) of the total amount of the bid and made payable to the City of Culver City as a guaranty that the Bidder, if its bid is accepted, will enter into a satisfactory contract and furnish a bond for the faithful performance thereof, and for the payment of labor and materials costs, and insurance in accordance with the requirements of the contract documents.

7. **BID DOCUMENTS**

A copy of the plans and specifications (contained on a DVD) shall be obtained only from the Engineering Division counter, 9770 Culver Blvd., Culver City, Ca 90232, 2nd floor in City Hall only, (310) 253-5600, for a ***$_____*** fee. There is a ***$_____*** mailing fee in addition to the non-refundable fee, or your Federal

Express number. Any addendum will be e-mailed and/or faxed only to the bid holders that have obtained the bid package directly from the City's Engineering Division.

8. **PRE-BID CONFERENCE (NON-MANDATORY)**

A Pre-bid Conference will be held on _____ at _____ in the _____ Conference Room, 9770 Culver Boulevard, First Floor, Culver City, CA 90232. Attendance of all bidders at this pre-bid conference is not mandatory.

9. **FORM AND STYLE OF BIDS**

Bids must be prepared on the forms provided with the BID DOCUMENTS and must be in compliance with the INSTRUCTIONS TO BIDDERS. Bidders shall not change the wording of the forms provided, except as required by Addendum.

10. **QUESTIONS/REQUESTS FOR INTERPRETATION**

Pursuant to Section B-4, all questions shall be directed to Mate Gaspar, P.E. Project Manager at 310.253.5602 *or mate.gaspar@culvercity.org*.

11. **RIGHT TO REJECT BIDS**

The Owner reserves the right to reject any or all bids as the best interests of the Owner may dictate. Bidders are referred to Section B-18 of the "INSTRUCTIONS TO BIDDERS," for additional qualification requirements.

12. **WAGE RATES AND PUBLIC WORKS CONTRACTOR REGISTRATION PROGRAM**

In accordance with the California Labor Code, no worker employed in work under contract to the Owner shall be paid less than the State of California Prevailing wage rates. Contractor shall comply with all other Federal, State and local laws related to labor.

Pursuant to California Labor Code Section 1771.1(a), "A contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, as defined in this chapter, unless currently registered and qualified to perform public work pursuant to Section 1725.5. It is not a violation of this section for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Section 10164 or 20103.5 of the Public Contract Code, provided the contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded."

13. **CONTRACTOR'S LICENSE**

All bidders shall be licensed under provisions of Chapter 9, Division 3 of the Business and Professions Code of the State of California to do the type of work contemplated in the project. In accordance with provisions of California Public Contract Code Section 3300, the Owner has determined that the Contractor shall possess a valid Class **"A"** License at the time that the bid is submitted. Failure to possess the specified license shall render the bid as non-responsive

BY ORDER OF THE COUNCIL OF THE CITY OF CULVER CITY, CALIFORNIA

By: _____
Jeremy Green, City Clerk

PUBLISHED: Culver City News on _____

--End of Section—

SECTION B

INSTRUCTIONS TO BIDDERS

SECTION B - INSTRUCTIONS TO BIDDERS

1. DEFINITIONS

Alternate Bid
"Alternate Bid" shall mean an amount stated in the Bid as set forth in the supplementary bid forms, to be added to or deducted from the Total Base Bid, if the corresponding substitution or change in the Work, materials or other items as described in the Bid Documents, is accepted by Owner.

Total Base Bid
"Total Base Bid" shall mean the sum stated in the Total Base Bid Form for which the Bidder offers to perform the Work described in the Bidding Documents. The Total Base Bid is the base to which work, materials, or other items may be added to or from which work, materials, or other items may be deleted, for sums stated in the Alternate Bid form.

Bid Date
"Bid Date" shall mean the deadline (including date and time) set forth in the Notice Inviting Bids accompany these Instructions.

Bid Form
"Bid Forms" shall mean the Total Base Bid Form, the Supplementary Bid Forms, and other additions attached hereto, all of which constitute part of the Bid Documents.

Bid Documents
"Bid Documents" shall mean all documents provided by Owner to Bidder for Bidder's use and consideration in preparation of its Bid. Bidding documents include the Notice Inviting Bids, these Instructions to Bidders and any supplements or additions hereto, the Bid Proposal Form, the Supplementary Bid Forms, the Statement of Contractor's Qualifications, other sample bid and contract forms, the Contract Documents, Drawings, Plans, and Specifications, all documents referenced in the Contract Documents, and all Addenda issued prior to execution of the Contract.

Bidder
"Bidder" shall mean any individual, firm, partnership, corporation, or combination thereof, submitting a Bid for the work, acting directly or through a duly authorized representative.

Sub-bidder
"Sub-bidder" shall mean a person or entity who submits a Bid to a Bidder for materials, equipment or labor (including quantity surveyors) for a portion of the Work and who is identified on the appropriate Supplementary Bid Form.

Contract Documents
"Contract Documents" shall mean all documents executed by Owner and Bidder to evidence their agreements relating to the Work. The Contract Documents include, but are not limited to, the Owner-Contractor Agreement; any supplementary and other conditions or provisions; the Drawings, the Plans, the Specifications and all Addenda issued prior to execution of the Owner-Contractor Agreement; and all modifications thereof.

Unit Price
"Unit Price" shall mean an amount stated in the Supplementary Bid Form as a price unit of measurement for materials, equipment and/or services or a portion of the Work as described in the Bid Documents, and shall include all elements of the described portion of the Work, including materials, labor, overhead and profit.

Work

"Work" shall mean the construction required by the Contract Documents and includes all tools, materials, and labor necessary to produce such construction and all materials and equipment incorporated or to be incorporated in such construction.

2. BID AND BID FORMS

Owner Supplied Forms
Bid forms (Section C, “Bid Forms”) have been provided with this document by the Office of the Public Works Director/City Engineer of the City of Culver City. All bids for this project must be submitted on said original supplied by the Office of the City Engineer of the City of Culver City. Bid forms shall be completely filled out and signed by the Bidder or, if a partnership, by all partners or, if a corporation, by its President, Secretary and Treasurer, in the designated spaces.

Filling-in Forms
All blank spaces for unit prices, extensions and totals must be filled in. Signatures shall be completely and personally executed. If erasures are made, they must be initialed by the Bidder over his signature.

Modifications Prohibited
Bids shall not contain any recapitulation, inserted by the Bidder, of work to be done. Alternative proposals will not be considered unless specifically requested. No oral or telephone modifications will be considered.

Submitting Bids
All bids must be submitted in sealed envelopes bearing on the outside the name of the Bidder, the Bidder's business address and the name of the project for which the bid is submitted. Any bid received after the scheduled closing time for receipt of bids will be returned to the Bidder unopened. It is the sole responsibility of the Bidder to see that his bid is timely received.

ALTERNATE BIDS
The Contractor shall complete bid schedules for all Alternate Bids. Failure to complete all bid schedules will be considered a non-responsive bid.

Bids May Be Rejected
Bids may be rejected if there is any alteration of the bid form, additions not called for, conditional bids, qualifying provisions, incomplete entries, or irregularities of any kind. The Owner reserves the right to reject any or all bids.

3. ADDENDA

3.1 Addenda

Addenda will be e-mailed and/or faxed to all bidders who have received complete sets of Bid documents from the Engineering Division counter, 9770 Culver Blvd., Culver City, Ca 90232. Copies of Addenda will be made available for inspection in the Office of the Public Works Director/City Engineer at 9770 Culver Boulevard, Culver City, California, 90232.

It is the bidder’s responsibility to provide its e-mail and fax number to ensure timely delivery of addenda.

3.2 Acknowledgment of Addenda

Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge its receipt in the Bid Form. Failure to acknowledge all addenda may result the bid proposal being deemed as non-responsive by the City.

4. INTERPRETATION OF PLANS AND SPECIFICATIONS

If any person contemplating submitting a bid for the project is in doubt as to the meaning of any requirement of plans or specifications or finds any discrepancies in or omissions from the plans or specifications, he may submit to the Public Works Director/City Engineer a written request for an interpretation or correction thereof. The person making the request will be responsible for its prompt delivery. Interpretations or corrections will be made by addenda to specifications or by dated revisions of plans with a copy of each addition or change being furnished, through the Public Works Director/City Engineer or Construction Manager, to each known prospective Bidder. Questions concerning the contract form, bonding requirements or similar documents shall be directed to the City Attorney through the Office of the City Engineer.

5. EXAMINATION OF SITE, PLANS, SPECIFICATIONS AND OTHER DOCUMENTS

Each Bidder shall carefully examine the plans, these specifications and the forms for all other contract documents, and shall visit the site of the proposed work to fully inform him/herself of all existing conditions and limitations that may affect the execution and cost of work under the contract. He/She shall include in the individual bid prices the cost of all labor, materials, supplies, overhead and profit for each such bid item. The failure or omission of any Bidder to obtain and examine the plans or specifications, any form, instrument, addendum, or any other document, or to visit and acquaint him/herself with conditions at the construction site, shall in no respect relieve him/her from any obligation imposed by his/her bid or by award or execution of the contract. The submission of a bid shall be taken as prima facie evidence that the Bidder has read, understands and agrees to comply with all instructions contained herein.

6. COMPLETE BIDDING AND CONTRACT DOCUMENTS

A complete set of Bid documents contains the following documents:

1. Notice Inviting Bids, Section A;
2. Instruction to Bidders, Section B;
3. Any or all addenda/addendum;
4. Bid Forms, Section C;
5. Award and Execution of Contract, Section D;
6. Special Provisions, Section E;
7. Technical Specifications, Section F, appendices and appended drawings.

7. BID GUARANTY

Bid Guaranty Enclosed With Bid

Each bid shall be presented under sealed cover and be accompanied by an approved form of Bid Guaranty such as a cashier's check, money order, certified check or cash, or surety bond in favor of the Owner for an amount of at least ten percent (10%) of the amount of the bid as a guaranty that the Bidder will provide bonds and insurance, and enter into a contract with the Owner for construction of the project. No bid shall be considered, unless such Bid Guaranty is enclosed.

In lieu of the foregoing, any bid may be accompanied by a surety bond in said amount, furnished by a surety authorized to do surety business in the State of California, guaranteeing that said bidder will enter into the contract and file the required bonds within the designated period.

Owner to Enforce Bid Guaranty

If within the time frame specified in Section B-18 of these Specifications, the successful bidder fails or neglects to enter into the contract and file the required bonds, the Owner may deposit in its treasury said bid security and not return it to the defaulting bidder.

Bid Guaranty Return

Upon execution of the contract with the successful Bidder, the Bid Guaranties of all Bidders will be returned by the City Clerk of the City of Culver City.

8. REJECTION OF BIDS

The Owner reserves the right to reject any or all bids and to waive any apparent clerical errors or discrepancies, or minor informalities if to do so seems to best serve the interests of the Owner.

9. WITHDRAWAL OF BIDS

Any Bidder may withdraw his bid, without obligation, either personally or by written request, at any time prior to the scheduled closing time for receipt of bids, provided that such personal or written request is delivered to the place specified in Section 5 of the "NOTICE INVITING BIDS" for receipt of Bids, prior to the Bid Date.

10. FACSIMILE MODIFICATION OF BIDS

No facsimile modification of bids will be allowed.

11. OPENING OF BIDS

Bid will be opened and publicly read aloud at the time and place designated in the Notice Inviting Bids.

12. BIDDERS INTERESTED IN MORE THAN ONE BID

No person, firm or corporation shall be allowed to make, or file, or be interested in, more than one bid for the same work, unless alternative bids are specifically requested. A person, firm or corporation that has submitted a sub proposal to a Bidder or that has quoted prices of materials to a Bidder is not hereby disqualified from submitting a sub proposal or quoting prices to other Bidders.

13. NON-COLLUSION DECLARATION

The Owner requires all Bidders to execute a Non-Collusion Declaration in the bid proposal included in the Bid Documents. The Owner also reserves the right to require that the Bidder shall, before awarding any subcontract, obtain from any or all proposed Subcontractors a Non-Collusion Declaration in the form included in the Bid Documents.

14. LIST OF SUBCONTRACTORS FILED WITH BID

In accordance with the provisions of the Public Contracts Code of the State of California relating to listing of subcontractors, each Bidder must submit with his bid the name and location of place of business of each proposed Subcontractor who will perform work or labor or render service to the Bidder for the construction of the project covered by the bid, in an amount in excess of one-half of one percent (0.5%) of the Bidder's bid and shall state the portion of the work which will be done by each Subcontractor.

15. LICENSING OF CONTRACTORS

All Bidders and Subcontractors submitting bids shall be licensed in accordance with the provisions of the Business and Professions Code of the State of California pertaining to the licensing of contractors. The license shall be valid and active at the time of submitting a bid, and remain so throughout the duration of the Contract for the successful bidder and sub-bidders.

16. APPROXIMATE ESTIMATES

The quantities set forth on the bid form, if any, are approximate only, being given as a basis for the comparison of bids; and the Owner does not, expressly or by implication, agree that these will be the final quantities. The Bidder agrees that the Owner will not be responsible if any of said quantities are found to be incorrect; and the Bidder agrees not to make any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done. If any error, omission or misstatement shall be discovered in the estimated quantities, the same shall not invalidate the contract executed pursuant to this bid or release the Bidder from the execution and completion of the whole or part of the work herein specified, in accordance with these specifications and the plans herein mentioned and the prices herein agreed upon and fixed therefore, or excuse him from any of the obligations or liabilities hereunder, or entitle him to any damages or compensation otherwise than as provided for in the contract executed pursuant to this bid.

17. GENERAL REQUIREMENTS

It is the purpose of the Owner, pursuant to these specifications, to realize work on a project, which is complete in every detail and respect. The Bidder shall furnish all equipment, materials and labor and perform all work required to accomplish this purpose. The Bidder shall not omit any item of work or fail to furnish any element, component or part thereof, whether or not such is specifically called for in the Contract Documents, which is necessary for a satisfactory completion of the project.

18. AWARD OF CONTRACT

The contract will be awarded to the lowest responsible and responsive Bidder. If award is made, it will be based on the lowest responsive and responsible total base bid Contract price. Selection of any or all alternates shall be at the sole discretion of the Owner. The Owner, however, reserves the right to reject any or all bids, and, so far as permitted by law, to waive any informality in the bids received in order to serve the best interests of the Owner. If an award is made, the contract shall be awarded within ninety (90) days after the opening of the bids. Within ten (10) days of the mailing by the Owner of notification of award of contract and the contract form, Bidder shall provide and return to the Owner all required bonds and insurance documents and the executed formal contract. In determining if a Bidder is a responsive bidder, the Owner shall consider the following in addition to other requirements in these bid documents:

a. Quality of services offered.

b. Proven capacity of the Bidder to perform the contract or provide the supplies or services required in a timely and competent manner. The evaluation of the Contractor's capacity to perform the contract or provide the supplies or services required in a timely and competent manner shall be based on the information provided by the Contractor in Section C-5 "Declaration of Bidder's Qualifications," as well as other pertinent data available to the Owner.

c. Character, integrity, reputation, judgment, experience and efficiency of the Bidder.

19. BONDS

The successful bidder will be required to file and pay for costs of bonds in the proper sums from a bonding company acceptable to the Owner. Forms for these bonds are included in Section D. The "Labor and Materials Payment Bond" and "Faithful Performance Bond" shall be for one hundred percent (100%) of the contract price (including base bid, adjustments and addenda).

20. INSURANCE CERTIFICATES AND POLICIES

Proof of insurance in an amount required by the Bid Specifications Section D-4 must be provided and endorsed to name: the City of Culver City, members of its City Council, its boards and commissions, officers, agents, and employees as additional insured for the particular operations of the insured which affect the Owner.

21. HOLD HARMLESS.

To the fullest extent permitted by law, Contractor shall indemnify, defend (at Contractor's sole expense, with legal counsel approved by CITY) and hold harmless the City of Culver City, members of its City Council, its boards and commissions, officers, agents, and employees (hereinafter, "Indemnitees"), from and against all loss, damage, cost, expense, liability, claims, demands, suits, attorneys' fees and judgments arising from or in any manner connected to Consultant 's or its employees or agent's wrongful or negligent acts, errors or omissions related to this Agreement. This indemnification includes, but is not limited to, tort liability to a third person for bodily injury and property damage.

Contractor agrees that this obligation to indemnify, defend and hold harmless extends to liability and/or claims arising from INDEMNITEES' active or passive negligence.

Notwithstanding the foregoing, nothing herein shall be construed to require Consultant to indemnify an INDEMNITEE from any claim arising from the sole negligence or willful misconduct of that INDEMNITEE.

The duty to defend referenced herein is wholly independent from the duty to indemnify, arises upon written notice by City to Contractor of a claim within the potential scope of this indemnification provision, and exists regardless of any determination of the ultimate liability of Contractor, City or any Indemnitee.

22. ASSIGNMENT OF CONTRACT RESTRICTED

No assignment by the Bidder of any contract to be entered into in accordance with Notice Inviting Bids and these instructions or any part thereof, or of funds to be received there under, will be recognized by the Owner unless such assignment had prior written approval of the Owner and the surety on all bonds had notice of such assignment in writing and has consented thereto in writing.

In entering into the Contract or any Subcontract for the Project, the Contractor and Subcontractor offer and agree to assign to the Owner all right, title and interest in and to all causes of action they may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 [commencing with Section 16700] of Part 2 of Division 7 of the Business and Professions Code), arising from the Contract or any Subcontract. This assignment shall be deemed made and effective at the time the Owner tenders final payment to the Contractor, without further acknowledgment by the parties.

23. SHORING

Pursuant to the provisions of the California Labor Code Section 6707, each bid submitted in response to this Invitation to Bid shall contain, as a bid item, adequate sheeting, shoring, and bracing, or equivalent method, for protection of life and limb in trenches and open excavation, which shall conform to applicable safety orders. By listing this sum, the bidder warrants that its action does not convey tort liability to the Owner, the Engineer, the Construction Manager, and their employees, agents and subconsultants.

24. OTHER PERMITS, FEES AND LICENSES

The Contractor shall, prior to the start of construction, obtain, pay, and comply with all necessary permits as required as the result of its work, including but not limited to the permit(s) described herein and as attached in the appendix**.**

In addition to the requirements above noted, the Contractor **shall possess a valid City of Culver City business license** at the time of contract agreement execution and for the duration of the contract. The fee for said business license shall be based upon the total amount bid for the contract. Amount of fee may be obtained from the City of Culver City, Finance Department, Treasury Division at (310) 253-5870.

All bidders are encouraged to utilize Culver City subcontractors and suppliers to the extent they are available, competitive and qualified. However, no bid will be affected either positively or negatively by the inclusion or exclusion of such Culver City businesses.

-- End of Section --

SECTION C

BID FORMS

BID FORM

FIRM NAME _____

ADDRESS _____

_____

TELEPHONE _____

FAX NUMBER _____

FOR

BANKFIELD SEWAGE PUMP STATION PROJECT P-874

FOR

CITY OF CULVER CITY
CULVER CITY, CALIFORNIA

BID NO. #_____

1 TOTAL BID BASE FORM

TO THE HONORABLE CITY COUNCIL
CITY OF CULVER CITY, CALIFORNIA

This Bid is submitted in accordance with the advertised "Notice Inviting Bids" requesting sealed bids for furnishing all labor, services, materials and equipment and performing all work necessary for: **Bankfield Sewage Pump Station Project P-874.**

Having carefully examined the location of the proposed work and the Bid Documents for same and read the accompanying proposed requirements, and attended the pre-bid conference, the undersigned Bidder hereby proposes and agrees to enter into a contract to furnish all equipment, materials and labor necessary to complete all work described in the Bid Documents for the project under the supervision of the City Engineer of the City of Culver City for the sum set forth in the following schedule **Bankfield Sewage Pump Station Project P-874.**

The undersigned further agrees, in case of award, to execute the contract for the within described work and improvements, within ten (10) days following written notice of award of contract. All work to be done under this contract shall be completed within **four hundred fifty-five (455) calendar days** beginning on the date stipulated in the written Notice to Proceed issued by the City Engineer.

Liquidated damages of **$_____** per calendar day shall be assessed based upon the applicable number of days noted above. The Contract Time shall commence on the date the Contractor actually commences the Work or on the tenth (10th) day after the issuance of the Notice to Proceed, whichever comes first. The Contractor shall retain the right to fully complete (including Final Completion, Punch List Correction and project Close-Out) the Work in less days than established by above, however, neither shall a reduction or increase to the Contract Sum be made, if the Work is so fully completed in less days than established by this Section C-1, no Claim shall be made or granted for Compensable Delay, or any other increase in Contract Sum, if, for any reason, including but not limited to delay caused by the Owner, the Contractor does not so fully complete the Work in less days than established herein.

(NOTE: All amounts and totals given in the Bid Schedule are subject to verification by the Owner.)

Bankfield Sewage Pump Station Project P-874

BID SCHEDULE

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	Unit Cost	TOTAL
1	Mobilization, Demobilization and Clean-up (maximum 5% of total bid)	1	LS	$	$
2	Excavation Safety Measures Including Dewatering	1	LS	$	$
3	Traffic Control	1	LS	$	$
4	Survey Staking and Verification of Utility Locations, Field Dimensions and Existing Electrical Work	1	LS	$	$
5	Start-Up and Testing	1	LS	$	$
6	Record Documents, O&M Manuals and Warranties	1	LS	$	$
7	Spare Parts and Training	1	LS	$	$
8	Clearing and Grubbing, Site Demolition and Soil Preparation	1	LS	$	$
9	Site Demolition	1	LS	$	$
10	Building Demolition	1	LS	$	$
11	Grading and Structural Excavation	1	LS	$	$
12	Paving and Flatwork	1	LS	$	$
13	Pump Station	1	LS	$	$
14	Reinforced Concrete Masonry Unit Wall	1	LS	$	$
15	Motorized Rolling Gates	1	LS	$	$
16	Chain Link Fence	40	LF	$	$
17	Double Leaf Swing Vehicle Gate	2	EA	$	$
18	10-Inch Force Mains	750	LF	$	$
19	15-Inch Vitrified Clay Gravity Sewer Pipe	105	LF	$	$
20	12-Inch Vitrified Clay Gravity Sewer Pipe	235	LF	$	$
21	Pre-Cast Concrete Manholes	3	EA	$	$
22	Crushed Aggregate Base (CAB) Material Below Wet Well Excavation as Required to Stabilize the Ground Due to High Groundwater Prior to Placement of Foundation. Assumes Two Foot Total Depth of CAB	30	CY	$	$

ITEM NO.	ITEM DESCRIPTION	ESTIMATED QUANTITY	UNIT	Unit Cost	TOTAL
23	Crushed Aggregate Base (CAB) Material Below 12" and 15" VCP Gravity Sewer as Required to Stabilize the Ground Due to High Groundwater Prior to Placement of Bedding and VCP Sewer. Assumes Two Foot Total Depth of CAB	60	CY	$	$
24	Temporary Trailer and Utilities	1	LS	$	$
A1	Stipulated Bid Item – Allowance for Reimbursement for Permit Fees	1	LS	$10,000.00	$10,000.00
A2	Stipulated Bid Item – Allowance for Reimbursement for SCE Power Service and Transformer	1	LS	$50,000.00	$50,000.00
A3	Stipulated Bid Item – Allowance for Cabinetry, Desk, Shelving and Miscellaneous Related Items	1	LS	$10,000.00	$10,000.00
A4	Stipulated Bid Item – Allowance for Field Orders			$100,000.00	$100,000.00
TOTAL BID SCHEDULE IN FIGURES (Bid items 1-24 and A1-A4):					$
TOTAL BID SCHEDULE IN WORDS (Bid items 1-24 and A1-A4):					

THE CONTRACT WILL BE AWARDED TO THE RESPONSIBLE CONTRACTOR WHO SUBMITS THE LOWEST TOTAL BASE BID AMOUNT WITH RESPONSIVE AND RESPONSIBLE BID PROPOSAL. THE CITY RESERVES THE RIGHT TO AWARD THE CONTRACT AMOUNT BASED ON AVAILABLE BUDGET AND PRIORITIES.

The undersigned has carefully checked the above figures and understands that the City, or any officer thereof, will not be responsible for any errors or omissions on the part of the undersigned in submitting this bid. In case of a discrepancy between words and figures, the figures shall prevail, and in case of a discrepancy between unit prices and totals, the unit prices shall prevail. The unit price amounts for each item shall include all indirect costs (i.e., permit fee, business license fee, mobilization, coordination, supervision, overhead and profit, etc.), incidental work (i.e. traffic control, safety devices, protection of utilities, utility investigation and "pot holes," work necessary for the protection of life and limb, etc.) and other work required by the contract but not listed above.

Payment for all work on the above items shall be made subject to verification in the field of the actual quantity of work performed.

Exclusions: Includes everything necessary to complete the project with the following exceptions only:

_____

_____

_____

_____

_____

_____

2 RECEIPT AND ACKNOWLEDGMENT OF ADDENDUM

We acknowledge that the following addenda numbers have been received and have been examined as part of the Contract Documents. Failure to acknowledge any or all addenda or addendum may result the bid proposal being deemed as non-responsive by the City.

Addenda Number	Date Received	Initials

3 CERTIFICATION

The undersigned Bidder certifies that:

1. Bidder has, by investigation of the site of the work and otherwise, understands the nature and location of the work and has fully informed the Owner as to all conditions and matters, which can in any way affect the work or cost thereof.

2. Bidder will cooperate fully with the Owner to ensure the Owner's best interests are protected and the work expedited to completion. In the event of any disagreement, the City Engineer shall fully review the matter and provide a determination. His judgment shall be final and binding upon all parties concerned.

3. Where demolition is necessary for the project described herein, the successfully awarded Contractor shall conform to the South Coast Air Quality Management District (S.C.A.Q.M.D.) Rule 1403, as amended. The Contractor shall mail the Rule 1403 Notification within five (5) calendar days after the Notice to Commence Work is mailed by the Owner. Once the S.C.A.Q.M.D Rule 1403 Notification has been post marked and mailed, the Contractor shall begin work no later than fifteen (15) calendar days after the mailing date. The duration set for the completion of this project will begin on the date work actually commences by the Contractor. In any case, the work shall not begin later than twenty (20) days after the date in which the Owner mailed the Notification to Commence Work.

4. All bonds, certificates, endorsement forms shall be submitted at the time of the execution of the contract.

THE UNDERSIGNED BIDDER IS AWARE OF THE FACT THAT THE OWNERRESERVESTHE RIGHT TO REJECT ANY OR ALL BIDS BUT THAT IF A BID IS ACCEPTED, THE CONTRACT WILL BE AWARDED TO THE LOWEST RESPONSIBLE AND RESPONSIVE BIDDER.

4 BIDDER INFORMATION

Name of Individual Bidder: _____

Bid Prepared By: _____

Business Address: _____

_____

Business Telephone Number: _____

Fax Number: _____

Contractor License No: _____ Class: _____

OR:

California Public Works Contractor Registration No: _____

Name of Partnership Bidder: _____

Bid Prepared By: _____

Business Address: _____

Fax Number: _____

Business Telephone Number: _____

List Names and Business addresses of All Partners Below:

_____

_____

_____

If the Bidder is a Corporation, list corporate information below:

Name of Corporate Bidder: _____

By: _____
(Signature of President of Corporation)

By: _____
(Signature of Secretary of Corporation)

By: _____
(Signature of Treasurer of Corporation)

Business Address: _____

_____

Business Telephone Number:_____

Fax Number:_ _____

Corporation organized under laws of State of:_ _____

Contractor License No: _____ Class:_ _____

5 DECLARATION OF BIDDER'S QUALIFICATIONS

Each Bidder must be properly licensed and must submit the following information on this form. If necessary, include supplement information as a separate package.

5.1 Authorization and Declaration

The undersigned hereby authorizes and requests any person, firm or corporation to furnish any information requested by Owner or their designated representative in verification of the recitals comprising this Declaration of Bidder's Qualifications. The undersigned declares under penalty of perjury that all of the qualification information submitted with this form is true and correct and that this Declaration was executed in

_____

(City, County) of California, on _____ (Date).

Signature:_____ _____

Title (Printed):_____ _____

5.2 Business Name, Address, Telephone Numbers (if different than Section C-4)

_____

Business Name:

Business Address:

Business Telephone & Fax Numbers:

_____

5.3 License

Bidders must be licenses in the State of California as **"A" or "C-10" Contractor.**

Complete the information requested below.

_____ _____ _____ _____

License Number	Class	Date Issued	Expiration Date
_____	_____	_____	_____
License Number	Class	Date Issued	Expiration Date
_____	_____	_____	_____
License Number	Class	Date Issued	Expiration Date

5.4 Surety

A. Indicate the names of all surety companies utilized by Bidder in last five (5) years and state if the Surety(ies) bonding the Bidder's jobs have had to complete any part of Bidder's Contract (attach separate sheet if necessary).

_____ _____
Surety Name & Address Period Covered

_____
Jobs Completed by Surety

_____ _____
Surety Name & Address Period Covered

_____
Jobs Completed by Surety

B. If a Bid Guaranty (Section C-7) is provided in lieu of a Bid Bond (Section C-6), the Bidder shall attach a notarized statement from Surety(ies) proposed to be utilized on the project, indicating Bidder's total bonding capacity and certifying that: (1) currently available bonding capacity exceeds **$3,000,000** and (2) Surety(ies) will provide bonding in the event that Bidder is awarded the project.

C. Indicate below that the surety is licensed and admitted as a surety insurer in the State of California.

_____

_____
Surety Name and Address

_____
Licensed & Admitted in CA
(Y/N)

_____
Surety Name and Address

_____
Licensed & Admitted in CA
(Y/N)

_____
Surety Name and Address

_____
Licensed & Admitted in CA
(Y/N)

D. Indicate below those projects with disputed amounts in excess of $50,000 or portions of any such project, which have been terminated by an Owner, Owner's representative, or other contracting party and which required completion by another party in the last five (5) years. State the project Name, Location, Owner, with address and phone number, contract amount, and reason for disputed amount or termination (attach separate sheet if necessary.)

_____
Project Name and Location

_____ _____
Owner Contract Value

_____
Reasons for Disputed Amount or Termination

_____
Disputed Amount

5.5 Insurance

A. Provide a notarized statement from the Worker's Compensation carrier specifying Contractor's current Experience Modification Rate for Worker's Compensation for the State of California. In addition, provide a list of the above referenced ratings and corresponding company for the last three (3) years.

B. Provide statement from insurance carrier indicating that the minimum scope and limits of insurance will be provided as required in Section D-4, of this document.

C. Indicate below that the surety is licensed and admitted as a surety insurer in the State of California.

_____
Ins. Co. Name and Address

_____
Licensed & Admitted in CA/Y/N

_____
Ins. Co. Name and Address

_____
Licensed & Admitted in CA/Y/N

5.6.1 Construction Experience

Furnish a list of at least three (3) similar (scope of work and cost) projects completed in the past five (5) years, two (2) of which must have been built in the State of California. Provide the following information for each project on the attached form. Copy additional forms as required.

i Project name and location

ii Contact name, address and telephone number for Owner & Architect/Engineer

iii Base and final contract amounts

iv Type of project and major project components. Provide approximate percent of construction cost associated with each construction component.

v Date project was completed (i.e., date of filing of Notice of Completion, etc.).

vi Indicate completion rate of projects by showing initial contract time, time extensions, and number of days that project was completed early or late, all expressed in calendar days.

SIMILAR PROJECTS FOR LAST FIVE (5) YEARS

1. _____
Project Name and Location

_____ _____
Owner Engineer

_____
Address and telephone

_____
Project Components

_____ _____
Contract Amounts ($) Date Completed

2. _____
Project Name and Location

_____ _____
Owner Engineer

_____
Address and telephone

_____
Project Components

_____ _____
Contract Amounts ($) Date Completed

3. _____
Project Name and Location

_____ _____
Owner Engineer

_____
Address and telephone

_____
Project Components

_____ _____
Contract Amounts ($) Date Completed

4. _____
Project Name and Location

_____ _____
Owner Engineer

_____
Address and telephone

_____
Project Components

_____ _____
Contract Amounts ($) Date Completed

5. _____
Project Name and Location

_____ _____
Owner Engineer

_____
Address and telephone

_____
Project Components

_____ _____
Contract Amounts ($) Date Completed

.

5.7 Staff Roster/Functions

List all members of your staff that will be assigned to or responsible for work on this project (except clerical) and show their job titles/functions. Include Company Officers.

Name	Function	Years w/Firm	Years Total

5.8 Arbitration and Litigation History

Indicate below all arbitration and/or litigation against bidder in the last five (5) years, including all claims by owners. Indicate yes or no (Y/N) which claims were resolved against bidder in litigation or arbitration or which resulted against in any payment by the Bidder or its insurers/sureties or reduction in compensation on any Bidder. Failure to provide this information on any contract undertaken in the past five (5) years may result in disqualification. Indicate final status (Resolved or Unresolved) of each claim. Attach separate sheet if necessary.

Project Name		Amount of Claim
Nature of Claim	Resolution (Y/N) Against Bidder	Final Status

Project Name		Amount of Claim
Nature of Claim	Resolution (Y/N) Against Bidder	Final Status

Project Name		Amount of Claim

Nature of Claim	Resolution (Y/N) Against Bidder	Final Status

6 BID BOND

KNOW ALL MEN BY THESE PRESENTS:

That we, _____, as Principal, and _____, as Surety (Local Agent Contact Telephone Number , _____), are held and firmly bound unto the Owner in the sum of _____Dollars ($_____) to be paid to said Owner its successors and assigns, for which payment well and truly will be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH:

That if the certain Bid of the above-bounden Principal submitted for the following improvement project:

BANKFIELD SEWAGE PUMP STATION PROJECT P-874

is accepted by the Owner through action of its legally constituted contracting authorities and if the above-bounden Principal, its heirs, executors, administrators, successors and assigns shall duly enter into and execute a contract for such construction in strict accordance with the specifications and drawings on file at the office of the City Engineer, in the City Hall, Culver City, and shall execute and deliver the required Faithful Performance Bond and Payment Bond, and Insurance Certificates within ten (10) days after the date of notification by and from said Owner that said contract is ready for execution, then this obligation shall become null and void; otherwise, it shall be and remain in full force and virtue.

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

_____
Signature

_____
Surety

_____
Title

By:_____

_____
Company

7 BID GUARANTY

BID GUARANTY

Note: The following statement shall be used if other than a bid surety bond accompanies bid.

"Accompanying this proposal is a money order*, certified check*, cashier's check*, cash*, payable to the order of the Owner in the amount of Dollars ($ _____ _____) which is ten percent (10%) of the total amount of this bid. The proceeds of this bid guaranty shall become the property of said Owner provided this bid is accepted by said Owner, through action of its legally constituted contracting authorities, and the undersigned fails to execute a contract and furnish the required bonds within the stipulated time. Otherwise, the proceeds of this bid guaranty shall be returned to the undersigned."

_____
Signature

_____
Title

_____
Company

(*Delete the inapplicable words)

8 NONCOLLUSION DECLARATION

NONCOLLUSION DECLARATION

(To Be Executed By Bidder and Submitted With Bid)

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 his or her 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 he or she 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].

Name: _____

Title: _____

Signature of Bidder _____

9 SUPPLEMENTARY BID FORMS, NO. 1

SUPPLEMENTARY BID FORM NO. 1

LISTING OF PROPOSED SUBCONTRACTORS

BANKFIELD SEWAGE PUMP STATION PROJECT P-874

For portions of the Work equaling or exceeding 1/2 of one percent (0.5%) of the Base Bid, the undersigned Bidder proposes to use the subcontractors listed below. Except as otherwise approved by the Owner, the undersigned Bidder shall perform all other portions of the Work with his own forces.

Portion of the Work Bid Number & $ amount of subcontracting work	Subcontractor Name, Address, & License No. & California Public Works Contractor Registration No:

The signature must be identical to that shown on the Bid.

If additional sheets are required, you must copy this form.

Bidder:_____

By:_____

Its:_____

SUPPLEMENTARY BID FORM NO. 2

LISTING OF PROPOSED SUPPLIERS

Pursuant to **INSTRUCTIONS TO BIDDERS** for the work titled:

BANKFIELD SEWAGE PUMP STATION PROJECT P-874

Portion of the Work	Supplier's Name and Address

-- End of Section --

AGREEMENT, BONDS AND INSURANCES

SECTION D

AWARD AND EXECUTION OF CONTRACT

SECTION D - AWARD AND EXECUTION OF CONTRACT

1 SAMPLE AGREEMENT

CULVER CITY PUBLIC WORKS DEPARTMENT
AGREEMENT WITH

Contractor

This Agreement is made and entered into by and between the City of Culver City (City) and Name of Contractor (Contractor)

WHEREAS, Contractor submitted its total base bid the total lump sum for: Amount of Bid Dollars ($00.00) for the completion of the Name of Project (Project. No. P-) as further described in the Scope of Services; and

WHEREAS, Contractor represents it has that degree of specialized expertise and holds all licenses necessary to practice and perform the service contemplated; and

WHEREAS, after reviewing all bids submitted and declaring that the Contractor submitted the lowest responsible and responsive bid, City's City Council, at its meeting of meeting date, awarded the contract for the work to Contractor.

NOW, THEREFORE, THE PARTIES HERETO AGREE as follows:

SCOPE OF SERVICES

Contractor shall provide all services described in accordance with the Contract Documents, as defined below, relating to the Name of Project (Project. No. P-) and follow the work schedules defined therein.

CONTRACT DOCUMENTS

The documents comprising the entire agreement between City and Contractor shall be collectively referred to as the "CONTRACT DOCUMENTS," and shall consist of and include the following:

This Agreement – including:

- Schedule of Values;
- List of Subcontractors;
- Labor and Materials Payment Bond;
- Faithful Performance Bond (including agent's Power of Attorney for each Bond);
- Non-Collusion affidavit ;
- Certificates of Insurance;
- Plans and Specifications for "Project name P-xxx)", Bid # ___ Dates ____
- All addenda setting forth any modifications or interpretations of those documents, (Addenda by number and date: Addendum No. x dated xxx);
- All documents incorporated into the foregoing;
- Change Orders;
- Notice to Proceed; and
- Notice of Completion

All the Contract Documents are intended to complement one another, so that any work called for in one and not mentioned in another is to be performed as if mentioned in all documents.

The terms of this Agreement shall prevail over any inconsistent provision of the other Contract Documents.

The Contract Documents constitute the entire agreement between the parties and supersede any and all other writings and oral negotiations.

NOTICE

All notices shall be in writing and delivered in person or sent by certified mail, postage prepaid. Notices required to be given to City shall be addressed as follows:

Charles D. Herbertson
Public Works Director/City Engineer
Public Works Department
City of Culver City
9770 Culver Blvd.
Culver City, CA 90232

Notices required to be given to the Contractor shall be addressed as follows:

Contractor
Address

It shall be the duty of Contractor to notify all subcontractors of the above Notice provisions.

CONTRACT PRICE

For Contractor's satisfactory completion of the scope of services, City shall pay Contractor a total sum of Amount of Compensation Dollars ($00.00) lawful money of the United States of America provided, that City's Public Works Director, in the exercise of his sole discretion, is authorized to increase that total fee by up to xxx Thousand Four xxx Dollars ($xx,xxx.00) for additional services due to unexpected causes.

EFFECTIVE DATE

The effective date of this agreement is the date it is signed on behalf of City.

IN WITNESS WHEREOF, the parties hereto have caused their names to be hereunto subscribed.

CONTRACTOR

Dated:_____ By: _____

_____
Its_____

By:

_____
Its_____

CITY OF CULVER CITY, CALIFORNIA

Dated:_____ By: _____
John Nachbar
City Manager

APPROVED AS TO CONTENT:

Charles D. Herbertson
Public Works Director/City Engineer

APPROVED AS TO FORM:

Carol A. Schwab
City Attorney

APPROVED AS TO FINANCING:

Jeff Muir
Chief Financial Officer

APPROVED AS TO BUSINESS TAX CERTIFICATE:

Treasury Division

2 LABOR AND MATERIALS PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: that

WHEREAS, THE City of Culver City, County of Los Angeles, State of California, has awarded to:

_____

_____

hereinafter designated as the Principal, a contract for:

Bankfield Sewage Pump Station Project P-874

in the City of Culver City, California, which contract is incorporated wherein by this reference; and

WHEREAS, said Principal is required to furnish a bond in connection with said contract, providing that if said Principal or any of his or its Subcontractors shall fail to pay for any materials, provisions, equipment or supplies used in, upon or about the performance of the work contracted to be done, or for any work or labor done thereon of any kind, the Surety on this bond will pay the same to extent hereinafter set forth;

NOW, THEREFORE, WE, _____

_____

as Principal and _____

_____

as Surety, are held and firmly bound unto the City of Culver City, hereinafter called the Owner in the sum of: _____ Dollars ($ _____) lawful money of the United States of America for the payment of which sum well and truly to 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 said Principal, his or its heirs, executors, administrators, successors or assigns shall fail to pay for any materials, provisions or other supplies used in, upon, for or about the performance of the work contracted to be done, or for any work or labor thereon of any kind, as required by the provisions of an act of the Legislature of the State of California entitled, "An Act to secure the payment of claims or persons employed by Contractors upon public works, and the claim of persons who furnish materials, supplies, teams, implements or machinery used or consumed by such Contractors in the performance of such work, and prescribing the duties of certain public officers with respect thereto," approved May 10, 1919, as amended, and provided that the persons, companies or corporations so furnishing said materials, provisions or other supplies, appliances or power used in, upon, for or about the performance of the work contracted to be executed or performed, or any person, company or corporation renting or hiring implements, machinery or power for or contributing to said work to be done, or any person who performs work or labor upon the same, or any person who supplies both work or labor upon the same, or any person who supplies both work and material therefor, shall have complied with the provision of said Act, then said Surety will pay the same in or to an amount not exceeding the amount herein above set forth, and also will pay in case suit is brought upon this bond, such reasonable attorneys' fees, as shall be fixed by the court, awarded and taxed as in aforementioned Statute provided. This bond shall inure to the benefit of any and all persons, companies, and corporations entitled to file claims under said Act, so as to give a right of action to them or their assigns in any suit brought upon this bond.

FURTHER, the said Surety for value received hereby stipulates and agrees that no change, extension of time, alteration or modification of the contract documents or of the work to be performed

thereunder shall in any way affect its obligations on this bond and it does hereby waive notice of any such change, extension of time, alteration or modifications of the contract documents or of work to be performed thereunder.

IN WITNESS WHEREOF, three (3) identical counterparts of this instrument, each of which shall for all purposes be deemed an original thereof, have been duly executed by the Principal and Surety herein named, on the _____ day of _____ , 200__. The name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

_____
Principal

By:_____

_____
Surety

By:_____

3 FAITHFUL PERFORMANCE BOND

FAITHFUL PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: that

WHEREAS, the City of Culver City, in the County of Los Angeles, State of California, has awarded to:

_____

herein designated as the Principal, a contract for the construction of

Bankfield Sewage Pump Station Project P-874

in the City of Culver City, California, which contract is incorporated herein by this reference; and

WHEREAS, said Principal is required under the terms of said contract to furnish a bond for the faithful performance of said contract;

NOW, THEREFORE, WE_____

as Principal and _____
as Surety, are held and firmly bound unto the City of Culver City, hereinafter called the Owner in the sum of:

_____Dollars ($_____) lawful money of the United States of America for payment of which sum well and truly to be made we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that, if the hereby bound Principal, his or its heirs, executors, administrators, successors or assigns shall in all things stand to and abide by and well and truly keep and perform all the undertakings, terms, covenants, conditions and agreements in the said contract and any alteration thereof, made as therein provided, all within the time and in the manner therein designated and in all respects according to their true intent and meaning, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

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

IN WITNESS WHEREOF, three (3) identical counterparts of this instrument, each of which shall for purposes be deemed an original thereof, have been duly executed by the Principal and Surety herein named on the _____ day of _____ , 20__. The name and corporate seal of each corporate party being hereto affixed, and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

Principal _____

By:_____

Surety _____

By:_____

4 INSURANCE REQUIREMENTS

A. Policy Requirements.

Contractor/ Consultant shall submit duly executed certificates of insurance for the following:

1. An occurrence based Comprehensive General Liability ("CGL") policy, at least as broad as ISO Form CG 0001, in the minimum amount of One Million Dollars ($1,000,000) each occurrence, with not less than Two Million Dollars ($2,000,000) in annual aggregate coverage.

The CGL Policy shall have the following requirements:

a. The policy shall provide coverage for personal injury, bodily injury, death, accident and property damage and advertising injury, as those terms are understood in the context of a CGL policy. The coverage shall not be excess or contributing with respect to City's self-insurance or any pooled risk arrangements;

b. The policy shall provide $1,000,000 combined single limit coverage for owned, hired and non-owned automobile liability;

c. The policy shall include coverage for liability undertaken by contract covering, to the maximum extent permitted by law. Consultant's obligation to indemnify the Indemnitees as required under Paragraph 6 of this agreement;

d. The Policy shall not exclude coverage for Completed Operations Hazards or Athletic or Sports Participants; and

e. **The City of Culver City, members of its City Council, its boards and commissions, officers, agents, and employees will be named as an additional insured** in an endorsement to the policy, which shall be provided to the City and approved by the City Attorney.

2. Business Automobile Liability Insurance coverage in the amount of One Million Dollars ($1,000,000), providing coverage for use of mobile equipment (i.e. heavy mobile equipment or vehicles primarily for use in an off-road environment), to the extent that (1) such mobile equipment will be used within the City limits or on City business, and (2) coverage for mobile equipment is not otherwise covered by the CGL policy listed in subparagraph (a), above.

3. For Professional Services: Professional/Negligent Acts, Errors and Omissions Insurance in the minimum amount of One Million Dollars ($1,000,000) per claim, and shall include coverage for separate "personal injury" alleged to have been committed in the course of rendering professional services, unless such coverage is provided by the CGL policy listed in subparagraph (a), above.

4. Workers' Compensation limits as required by the Labor Code of the State of California with Employers' Liability limits of One Million Dollars ($1,000,000.00) per accident, if the Agreement will have Consultant employees working within the City limits.

B. Waiver by City.

City may waive one or more of the coverages listed in Section A, above. This waiver must be express and in writing, and will only be made upon a showing by the Consultant that its operations in and with respect to City are not such as to impose liability within the scope of that particular coverage.

C. Additional Insurance Requirements.

1. All insurance listed in Paragraph A shall be issued by companies licensed to do business in the State of California, with a claims paying ability rating of "BBB" or better by S&P (and the equivalent by any other Rating Agency) and a rating of A:VII or better in the current Best's Insurance Reports;

2. Consultant shall provide City with at least thirty (30) days prior written notice of any modification, reduction or cancellation of any of the Policies required in Paragraph A, or a minimum of ten (10) days notice for cancellation due to non-payment.

3. City may increase the scope or dollar amount of coverage required under any of the policies described above, or may require different or additional coverages, upon prior written notice Consultant.

SECTION E

SPECIAL PROVISIONS

(SUPPLEMENTS AND MODIFICATIONS TO GENERAL PROVISION OF THE
THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION)

SECTION 1 -- TERMS, DEFINITIONS, ABBREVIATIONS & SYMBOLS

Except as modified by the Special Provisions, Technical Provisions, Standard Drawings and the Project Plans, all work shall be in accordance with the Provisions of the latest edition of the STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION (SSPWC), including all Supplemental Amendments, as published by Building News, Inc., Los Angeles, California, which Specifications are hereinafter referred to as the Standard Specifications.

The herein stated Special Provisions supplement and revise the aforementioned standard Specifications. Any reference to "Section" or "Subsection" in these Special Provisions shall refer to the aforementioned Standard Specifications unless noted otherwise.

1-2 DEFINITIONS

In this subsection, substitute where applicable, or add the following:

Agency	The City of Culver City, for which the work is being performed.
Board	The City Council of the City of Culver City.
City	The City of Culver City.
Engineer (or) City Engineer	The City Engineer of the City of Culver City or other person designated by the City Engineer acting either directly or through authorized agents.
Working Day	All days beginning with the Notice to Proceed and ending with the “completion Date”, except the following:

a. Saturday and Sunday.
b. Any day designated as a holiday by the City.
c. Any day designated as a holiday in a Master Labor Agreement binding the Contractor
d. Any day the Contractor is prevented from working for cause as established in 6-6 of these specifications. Any day the Contractor is prevented from working during the first (5) hours of the workday with at least sixty percent (60%) of normal work force for cause as established in 6-6 of these specifications

SECTION 2 -- SCOPE AND CONTROL OF THE WORK

2-1 AWARD AND EXECUTION OF CONTRACT Add the following:

The Bidder is required to examine carefully the site of work, Bid Proposal forms and all other Contract documents for the work contemplated. The Submission of a Bidder's Proposal shall be considered conclusive evidence that the Bidder has investigated and is satisfied as to the conditions to be encountered, as to the character, quality and quantities of work to be performed and materials to be furnished, and as to the requirements of all the above documents.

2-5 PLANS AND SPECIFICATIONS

2-5.1. General Add the following:

Except as modified by the Special Provisions, Technical Provisions, Standard Drawings and the Project Plans, all work shall be in accordance with the Provisions of the latest edition of the

STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION (SSPWC), including all Supplemental Amendments, as published by Building News, Inc., Los Angeles, California, which Specifications are hereinafter referred to as the Standard Specifications, and when applicable, the California Department of Transportation (Caltrans) Standard Specifications, latest edition, except the following:

Traffic Signal, Lighting, Pavement Striping and Markers, Roadside Sign Work

For roadside sign, traffic striping and pavement marking, pavement markers, and traffic signal and lighting work, the technical provisions provided within Section 56-2, "Roadside Signs,", Section 84," Traffic Stripes and Pavement Markings", Section 85, "Pavement Markers", and Section 86, "Signals, Lighting and Electrical Systems," of the State of California Department of Transportation (Caltrans) Standard Specifications, latest edition, hereafter "State Specification" or "State Standard Specification," shall supersede related provisions of the SSPWC. Except as otherwise specified on the Plans or in these General or Technical Provisions, all work relating to traffic signals and street lighting, including all equipment, materials, components, and the installation thereof, shall be in accordance with the latest edition of the State Standard Plans and Section 86, of the latest edition of the State Standard Specifications. The order of precedence for said State Standard Plans shall be lower than that of the Special Provisions and Plans but higher than that of the Standard Plans and Specifications.

Work within Caltrans Right of Way

Shall conform to the approved plans and permit requirements.

Work within City of Los Angeles Right of Way

Shall conform to the approved plans and permit requirements.

If the contractor, in the course of the work, becomes aware of any claimed errors or omissions in the contract documents or in the City's field work, it shall immediately inform the City Engineer. The City Engineer shall promptly review the matter, and if he/she finds an error or omission has been made, he/she shall determine the corrective actions and advise the Contractor accordingly. If the corrective work associated with an error or omission increase or decrease the amount of work called for in the Contract, the City shall issue an appropriate Change Order. After discovery of an error or omission by the Contractor, any related work performed by the Contractor shall be done at its risk unless authorized by the City Engineer.

Where applicable, the latest edition of the Uniform Building Code (UBC), and Amendments and the Culver City Municipal Code shall be adhered to.

Comply with the provisions for safety practices set forth in the "Manual of Accident Prevention on Construction", published by the Associated General Contractors of America (AGC) 213/263-1500, and to comply with the State of California Occupational Safety and Health Act (Cal-OSHA).

2-5.3.3 Shop Drawings Add the following:

Within fourteen (14) calendar days after the Award of Contract, the Contractor shall, at his or her expense, transmit by letter to the Engineer for review and acceptance, shop drawings and/or other available instructive and descriptive information from the manufacturer, when and as required by the Plans or Special Provisions, or requested by the Engineer. Shop drawings will normally not be required for standard items in common use for which adequate manufacturers' literature is available.

The Contractor shall consecutively number, thoroughly check, approve and sign each Shop Drawing and transmit the Shop Drawings by letter to the Engineer for review. In the event that certain Shop Drawings are unacceptable to the City, they will be rejected by the Engineer. The Contractor shall thereafter, correct said drawings and resubmit same in quadruplicate within seven (7) calendar days.

In the event that in the process of development of the Shop Drawings, it is discovered that there are defects and/or errors on the Plans, resulting in conflict between said Plans and the Shop Drawings, or if the Shop Drawings show variation from the Plans and/or Contract requirements because of standard shop practice or other reasons, the Contractor shall thoroughly describe and explain said defects and/or conflicts in his transmittal letter to the Engineer.

The Engineer's review of the Shop Drawings will be for general design and arrangement only, and shall not relieve the Contractor from responsibility for errors of any sort in the Shop Drawings or of the responsibility for executing the work in accordance with the Contract. The Contractor shall be solely responsible for the correctness of the drawings, for shop fits and field connections, and for the results obtained by use of such drawings. The Contractor shall verify and be fully responsible for all dimensions and job-site conditions affecting the work and shall be responsible for furnishing and installing the proper materials required by the Contract, whether or not indicated on the Shop Drawings when reviewed.

2-9 SURVEYING

2-9.1 Permanent Survey Markers Revise to add the following:

The contractor shall preserve and replace any obliterated survey markers or monuments at his cost throughout the project limits.

2-9.2 Survey Service Delete the entire subsection and substitute the following:

The **Contractor** shall pay and provide usual and customary construction staking. The Contractor shall submit to the City for approval, the qualifications of the Licensed Land Surveyor prior to commencing the construction staking.

2-11 INSPECTION Add the following:

The City Engineer, or his authorized agent, shall at all times have access to work during construction, and shall be furnished with every reasonable facility for ascertaining full knowledge regarding the process, workmanship, and character or materials used and employed in the work. Whenever required, the Contractor shall furnish to the City for test, and free of charge, samples of any one of the materials proposed to be used in the work. Said samples shall be delivered by the Contractor at the place within the City of Culver City designated by the City Engineer. Rejected material must be immediately removed from the work by the Contractor and shall not again be brought back to the site of the improvement.

The Contractor shall be responsible to reimburse the City for its actual inspection services cost for any work that is outside the normal working days or working hours (as defined by Section 6-7 of this Special Provisions) , if approved the by Engineer.

See permits and plans for work within City of Los Angeles Right of Way for additional inspection requirements.

Twenty-Four Hour Notice

The Contractor shall give at least twenty-four (24) hours advance notice of the time when Contractor or Contractor's subcontractor will start or resume the various units of operations of the work as per the contract, or resume said units of operations when they have been suspended per the contract.

The above notice is to be directed to the City Engineer through the Construction Manager, and is to be given during working hours (8 a.m. to 5 p.m.; closed alternate Fridays), exclusive of Saturday, Sunday or holidays for the purpose of permitting the Engineer to make necessary assignments of the Engineer's representative or inspector on the work.

Uncovering of Uninspected Work
Any work performed in conflict with said notice, without the presence or approval of the inspector, or work covered up without notice, approval or consent may be rejected or ordered to be uncovered for examination at Contractor's expense and shall be removed at Contractor's expense, if so ordered by the City Engineer or his/her representative or inspector on the work. Any unauthorized or defective work, defective material or workmanship or any deficient work that may be discovered shall be corrected immediately without extra charge even though it may have been overlooked in previous inspections and estimates.

Changes Authorized in Writing
All authorized alterations affecting the requirements and information given on the approved plans shall be in writing. No changes shall be made on any original plan or drawing after the same has been approved by the Engineer. Deviations from the approved plans, as may be required by the exigencies of construction, will be determined in all cases by the Engineer and authorized in writing.

Protests
If the Contractor considers any work demanded of Contractor to be outside the requirements of the Contract, or if Contractor considers any instruction, ruling or decision of the Inspector or Engineer to be unfair, Contractor shall within three (3) calendar days after any such demand is made, or instruction, ruling or decision is given, state clearly and in detail the Contractor's objections and reasons therefore. Except for such protest and objections as are made of record, in the manner and within the time above stated, the Contractor shall be deemed to have waived and does thereby waive all claims for extra work, damages and extensions of time on account of demands, instructions, rulings and decisions of the Public Works Director/City Engineer.

Upon receipt of any such protest from the Contractor, the Engineer shall review the demand, instruction, ruling or decision objected to and shall promptly advise the Contractor, in writing, of Public Works Director/City Engineer's final decision, which shall be binding on all parties, unless within the ten (10) calendar days thereafter the Contractor shall file with the Owner, a formal protest against said decision of the Public Works Director/City Engineer. The Owner shall consider and render a final decision on any such protest within thirty (30) calendar days of receipt of same.

SECTION 3 - CHANGES IN WORK

3-3 EXTRA WORK

3-3.1 General Add the following:

The Contractor shall not perform any extra work prior to written authorization from the Engineer.

3-3.2.3 Markup Delete the entire paragraph and substitute the following:

Work by Contractor When extra work is to be paid for on a force account basis, the labor, materials, equipment rental and other items of expenditures, the percentage of markup applied to the Contractor's direct cost for all overhead and profit shall be as follows:

(1)	Labor.....	12
(2)	Materials.....	12
(3)	Equipment Rental.....	12
(4)	Other Items and Expenditure.....	12

Work by Subcontractor. When all or any part of the extra work is performed by a Subcontractor, the markup established above in this section shall be applied to the Subcontractor's actual cost of such work. A markup of 10 percent on the first $5,000 of the subcontracted portion of the extra work and a markup of 5 percent on work added in excess of $5,000 of the subcontracted portion of the extra work may be added by the Contractor.

To the sum of the costs and markups provided for in this section, 1% shall be added as compensation for bonding.

3-3.3 Daily Reports By Contractor Add the following:

Material charges shall be substantiated by valid copies of vendor's invoices. Such invoices shall be submitted with the daily extra work reports, or if not available, they shall be submitted with subsequent daily extra work reports. When these daily extra work reports are agreed upon and signed by both parties, said reports shall become the basis of payment for the work performed.

3-4 CHANGED CONDITIONS Add the following after the last paragraph:

This subsection shall not apply to utilities.

3-5 DISPUTED WORK Add the following:

All claims which do not exceed the sum of three hundred seventy-five thousand dollars ($375,000) shall be resolved pursuant to the provisions of Public Contract Code Section 20104 through 20104.6, "Resolution of Construction Claims".

Notice - The Contractor shall notify the Public Works Director/City Engineer, in writing, of its intention to make claim. Claims pertaining to decisions provided above for such other determinations by the Construction Manager shall be filed in writing to the Public Works Director/City Engineer prior to the commencement of such work. Written notice shall use the words "Notice of Potential Claim". Such Notice of Potential Claim shall state the circumstances and the reasons for the claim, but need not state the amount.

Additionally, no claim for additional compensation or extension of time for a delay will be considered unless the above provisions are complied with. No claim filed after the date of final payment will be considered.

It is agreed that unless notice is properly given, the Contractor shall not recover costs incurred by it as a result of the alleged extra work, changed work or other situation which had proper notice been given would have given rise to right for additional compensation. The Contractor should understand that timely notice of potential claim is of great importance to the Public Works Director/City Engineer and Owner, and is not merely a formality. Such notice allows the Owner to consider preventative action, to monitor the Contractor's increases costs resulting from the situation, to marshall facts, and to plan its affairs. Such notice by the Contractor, and the fact that the Public Works Director/City Engineer has kept account of the cost as aforesaid, shall not in any way be construed as proving the validity of the claim.

Records of Disputed Work - In proceeding with a disputed portion of the Work, the Contractor shall keep accurate records of its costs and shall make available, to the Public Works Director/City Engineer, a daily summary of the hours and classification of equipment and labor utilized on the disputed work, as well as a summary of any materials or any specialized services which are used. Such information shall be submitted to the Public Works Director/City Engineer on a monthly basis, receipt of which shall not be construed as an authorization for or acceptance of the disputed work.

Submission of Claim Costs - Within 30 days after the last cost of work for which the Contractor contends it is due additional compensation is incurred, but if costs are incurred over a span of more than 30 days, then within 15 days after the thirtieth day and every month thereafter, the Contractor shall submit to the Public Works Director/City Engineer as best the Contractor is able its costs

incurred for the claimed matter. Claims shall be made in itemized detail and should the Public Works Director/City Engineer be dissatisfied with format or detail of presentation, upon request for more or different information, the Contractor will promptly comply, to the satisfaction of the Public Works Director/City Engineer. If the additional costs are in any respect not quantifiable with certainty, they shall be estimated as best can be done. In case the claim is found to be just, it shall be allowed and paid for as provided in the Standard Specification.

SECTION 4 - CONTROL OF MATERIALS

4-1 MATERIALS AND WORKMANSHIP Add the following:

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No materials, supplies or equipment for the work under this Contract shall be purchased subject to any security agreement or other agreement by which an interest therein or any part thereof is retained by the seller or supplier. The Contractor warrants clear and good title to all materials, supplies and equipment installed and incorporated in the work, and agrees upon completion of all work to deliver the premises, together with all improvements and appurtenances constructed or placed thereon by Contractor, to the Owner free from any claims, liens, encumbrances or charges, and further agrees that neither Contractor nor any person, firm or corporation furnishing any material or labor for any work covered by the Contract shall have any right to a lien upon the premises or any improvement or appurtenance thereon, provided that this shall not preclude the Contractor from installing metering devices or other equipment of utility companies the title of which is commonly retained by the utility company. Nothing contained in this article, however, shall defeat or impair the right of such persons furnishing materials or labor under any bond given by the Contractor for their protection of any right under any law permitting such persons to look to funds due the Contractor in the hands of the Owner.

The provisions of this Section shall be inserted in all subcontracts and material contracts, and notices of its provisions shall be given to all persons furnishing materials for the work when no formal contracts are entered into for such materials.

4-1.2 Protection of Work And Materials Add the following:

Until acceptance of the Work, the Contractor shall have the charge and care of the Work and Materials to be used therein and shall bear the risk of injury, loss, or damage, to any part thereof (regardless of whether partial payments have been made on such damaged portions of the Work) by the action of the elements or from any other cause, whether or not arising from the non-execution of the Work. The Contractor shall rebuild, repair and restore and make good all injuries, losses, or damages to any portions of the Work or materials occasioned by any cause before its completion and acceptance and shall bear the expense thereof, except for such injuries, losses or damages as are directly and proximately caused by the acts of the Owner.

4-1.3 Inspection Requirements

4-1.4 Tests of Materials The third sentence of the first paragraph shall be deemed revised to read as follows:

Unless otherwise called for hereinafter in these Special Provisions, all testing during construction will be performed by the City in such number and at such locations as deemed necessary by the Engineer to insure compliance with the Plans and Specifications; the cost of all initial testing will be borne by the City; the cost of all retesting will be borne by the Contractor, and the amount due the City for said retesting will be deducted from the Contractor's progress payments.

4-1.6 Trade Names or Equals Delete the last sentence of the second paragraph and substitute the following:

Wherever catalog numbers and specific brands or trade names not preceded by designation "similar and equal" nor followed by the designation "or equal" are used in conjunction with a

designated material, product thing, installation, or service mentioned in these Specifications, to ensure compatibility with existing facilities, no substitutions will be favorably reviewed.

Within ten (10) working days from the date of bid opening, the Contractor shall, at his expense, submit a written request to the Engineer for each desired substitution, accompanied by complete descriptive information from the manufacturer, samples as requested by the Engineer, complete detailed test results from a licensed independent testing laboratory of the City's choice if requested by the Engineer, and if requested by the Engineer, an evaluation report from a qualified licensed professional engineer, all for final evaluation by the Engineer. If in the Engineer's opinion, the requested substitution is of lesser quality or in variance with that specified, or if the information submitted is insufficient or incomplete, the requested substitution will be disallowed and the specified materials or equipment shall be furnished. Except as hereafter provided, no request for substitutions submitted, after the 10-working -day deadline specified will be considered.

If alternative named or substitutions are proposed by the Contractor and favorably reviewed by the City, the Contractor is responsible for providing at no additional cost to the Owner, any engineering designs, any electrical, mechanical, structural, or other related changes or testing that may be required to accommodate or provide the particular material or equipment the Contractor desires to use. Any deviation from the Specifications or the Drawings resulting from the type of material or equipment to be used shall not be the basis for any "extra charges" above and in excess of the original bid price of the work.

In addition the Contractor is responsible for all additional costs to the Owner, and its agents and representatives, for evaluation of data submitted by the Contractor for alternative named or substitutions and any redesign necessary. The Owner shall deduct said costs from the Contract monies due the Contractor.

In the event that a substitute is favorably reviewed, fifty percent (50%) of all savings shall be credited to the Owner.

SECTION 5 - UTILITIES

5-1 LOCATION Add the following:

Prior to performing any excavation, the Contractor shall determine, by potholing, the location and depth of all utilities, including service connections, which have been marked by the respective owners and which may affect or be affected by its operations. The Contractor shall pothole all utility crossings on public streets. The Contractor shall verify depth of all service utility crossings under sidewalk. Contractor shall locate all existing utilities, including storm and sewer main and laterals, within the project vicinity and shall exercise due care to ensure that existing utility facilities are not damaged during his operations. The existence of sewer mains or storm drains is evidenced by the manhole structures and catch basins. When in doubt, the Contractor shall contact the utility operator concerned before proceeding further.

Pipelines, conduits and other facilities may be buried within the limits of the work or adjacent thereto and may or may not be shown or indicated on the Plans. The Public Works Director/City Engineer possesses records of certain utility facilities located within the public right-of-way. These records are available for inspection by the Contractor at the Engineer's Office. In making these records available, the Owner does not warrant or guarantee the accuracy or completeness of the information contained therein and does not represent that the facilities shown on said records actually exist at the locations shown or elsewhere or that the Contractor may not encounter facilities not identified in said records. The sewer service laterals are owned by the property owners and will not be marked by the City. Sewer system atlas sheet is available upon request for contractor’s reference. However, the City shall not guarantee the accuracy of the information. It shall be the Contractor’s responsibility to locate and pothole all laterals. The Contractor at its expense shall repair sewer laterals that are damaged as the result of contractor’s activities.

At signalized intersections with Red Light Enforcement Camera Systems, the Contractor shall coordinate with the Red Light Enforcement Camera manufacture and/or maintenance company to identify the substructure (e.g. conduit runs) and for notification of work prior to construction.

The Contractor shall immediately notify the Engineer of any potential conflict with the proposed improvements. The cost of repair to any utility damaged by the contractor due to failure to determine location and depth as required herein shall be borne by the Contractor. Full compensation for determining location and depth of utilities shall be considered as included in the prices bid for other items of work, and no additional compensation will be allowed.

5-2 PROTECTION Add the following:

The contractor shall adjust all existing sewer, storm drain, and other utility manhole lids and covers, water meter boxes and covers, gas meter boxes and covers, valve covers, etc. to grade unless specifically designated for adjustment by others on the Plans. Payment for adjustment of said items to grade shall be considered as part of related bid items for which payment is made and no separate payment will be made therefore.

SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF THE WORK

6-1 CONSTRUCTION SCHEDULE AND COMMENCEMENT OF WORK Add the following:

The Contractor must provide to the Engineer's Representative within five (5) days after receiving the "Notice to Proceed", a Critical Path Method (CPM) construction schedule in the format of a Gantt Chart and revised schedules thereafter as required by the Engineer when the Contractor's activities differ or are expected to differ from the latest existing schedule.

In addition, if requested by the Engineer, the Contractor shall submit a detailed "two-week look-ahead" schedule bi-weekly, including a narrative report, showing the activities or portions of activities completed and look ahead during the reporting period. The report shall state the percentage of the work completed and scheduled, the remaining duration, and the progress along the critical path in terms of days ahead or behind the allowable dates as of the report date. Any changes made by the Contractor to the schedule shall be listed.

If, in the opinion of the Construction Manager, the project is behind schedule, the Contractor shall 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.

Notice To Procure Equipment and Material will be issued prior to the Notice to Proceed with construction.

6-3 SUSPENSION OF WORK Add the following:

If the Contractor fails to correct defective or unauthorized work as required by the Contract Documents or fails to carry out the Work in accordance with the Contract Documents or any other applicable rules and regulations, the Owner, by a written order of the Owner's representative or signed personally by an agent specifically so empowered by the Owner, in writing, may order the Contractor to stop the work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. All delays in the Work occasioned by such stoppage shall not relieve the Contractor of any duty to perform the Work or serve to extend the time for its completion. Any and all necessary corrective work done in order to comply with the Contract Documents shall be performed at no cost to the Owner.

In the event that a suspension of Work is ordered, as provided in this paragraph, the Contractor, at its expense, shall perform all work necessary to provide a safe, smooth, and unobstructed passageway through construction for use by public, pedestrian, and vehicular traffic, during the period of such use by suspension. Should the Contractor fail to perform the Work as specified, the Owner may perform such work and the cost thereof may be deducted from monies due the Contractor under the Contract.

The Owner shall also have authority to suspend the Work wholly or in part, for such period as the Owner may deem necessary, due to unsuitable weather, or to such other conditions as are considered unfavorable for the suitable prosecution of the Work. Such temporary suspension of the Work will be considered justification for time extensions to the Contract in an amount equal to the period of such suspension if such suspended work includes the current critical activity on the latest favorably reviewed progress schedule.

6-4 DEFAULT BY CONTRACTOR Add the following:

The Contract may be canceled by the Owner without liability for damage when, in the Owner's opinion, the Contractor is not complying in good faith, has become insolvent, or has assigned or subcontracted any part of the work without the Owner's consent. In the event of such cancellation, the Contractor will be paid the actual amount due based on the quantity of work satisfactorily completed at the time of cancellation, less damages caused to the Owner by acts of the Contractor causing the cancellation. The Contractor, in having tendered a bid, shall be deemed to have waived any and all claims for damages because of cancellation of the Contract for any such reason. If the Owner declares the Contract canceled, for any of the above reasons, written notice to that effect shall be served upon the Surety. The Surety shall, within five (5) working days, assume control and perform the work as successor to the Contractor.

If the Contractor fails to begin delivery of material and equipment, to commence work within the time specified, to maintain the rate of delivery of material, to execute the work in the manner and at such locations as specified, or fails to maintain a work program which will ensure the Owner's interest or, if the Contractor is not carrying out the intent of the Contract, the Public Works Director/City Engineer's written notice may be served upon Contractor, and the Surety on Contractor's faithful performance bond, demanding satisfactory compliance with the Contract.

If the Contractor or Contractor's Surety does not comply with such notice within five (5) working days after receiving it, or after starting to comply fails to continue, the Owner may exclude the Contractor from the premises and take possession of all material and equipment, and complete the work by Owner forces or by letting the unfinished work to another contractor, or by a combination of such methods. In any event, the cost of completing the work will be charged against the Contractor and Contractor's Surety, and may be deducted from any money due or becoming due from the Owner. If the sums under the Contract are insufficient for completion, the Contractor or Surety shall pay to the Owner within five (5) working days after the completion, all costs in excess of the Contract price.

If the Surety assumes any part of the work, Surety shall take the Contractor's place in all respects for that part, and shall be paid by the Owner for all work performed by Surety in accordance with the Contract. If the Surety assumes the entire Contract, all money due the Contractor at the time of Contractor's default shall be payable to the Surety as the work progresses subject to the terms of the Contract.

The provisions of this Section shall be in addition to all other rights and remedies available to the Owner under law.

6-5 TERMINATION OF CONTRACT Add the following:

The Owner may terminate the Contract at its own discretion or when conditions encountered during the work make it impossible or impracticable to proceed, or when the Owner is prevented from proceeding with the Contract by law, or by official action of a public authority. The Contractor will

be compensated for works satisfactorily completed up to the date of termination of the contract by the Owner.

If all or any part of the work shall be damaged or destroyed by war, or acts of foreign aggression, fire, storm, lighting, flood, earthquake, settlement of defective soil, expansion or contraction, cracking or deflection, tidal wave, water, oil (surface or subsurface), mob violence or other casualty before the final completion of the work, the Contractor, upon notice from the Owner, shall resume construction and proceed in accordance with the Plans and Specifications. Provided that such damage or destruction was not caused by any condition related to Contractor's non-conformance with the provisions of these contract documents, the Owner will bear the total cost of removing and/or replacing all damaged and/or destroyed work. However, if the Owner exercises its option to abandon the project because of damage or destruction to the work by any of the above-mentioned causes, Owner may terminate this Contract upon three days' notice to the Contractor. Within 30 days after the date of such termination, the Contractor shall be paid all actual costs of the work to the date of termination for which it had not been previously paid.

If the owner abandons the project, the owner shall have the right, at any time, to terminate this Contract by notice to the Contractor, in which event, the owner shall pay the contractor pro rata for all work actually provided up to the date of such notice, for which it had not been previously paid, and the Owner shall have no further liability or obligations under this contract.

6-6 DELAYS AND EXTENSION OF TIME Add the following:

The Contractor shall retain the right to fully complete (include final completion, punch list and project close out) the Work in less days than established by the contract agreement. However, neither shall a reduction or increase to the Contract Sum be made, if the Work is so fully completed in less days than established by the contract agreement nor shall a Claim be made or granted for Compensable Delay, or any other increase in Contract Sum, if, for any reason, including but not limited to delay caused by owner, the Contractor does not so fully complete the Work in less days than established herein.

When the Contractor foresees a delay in the prosecution of the Work and, in any event, immediately upon the occurrence of a delay, the Contractor shall notify the Public Works Director/City Engineer in writing of the probability of the occurrence and the estimated extent of the delay, and its cause. The Contractor shall take immediate steps to prevent, if possible, the occurrence or continuance of the delay. The Contractor agrees that no claim shall be made for delays which are not called to the attention of the Public Works Director/City Engineer at the time of their occurrence.

Non-excusable delays in the prosecution of the Work shall include delays which could have been avoided by the exercise of care, prudence, foresight, and diligence on the part of the Contractor or its subcontractors, at any tier level, or suppliers.

Only the physical shortage of material, caused by unusual circumstances, will be considered under these provisions as a cause for extension of time, and no consideration will be given to any claim that material could not be obtained at a reasonable, practical, or economical cost or price, unless it is shown to the satisfaction of the Public Works Director/City Engineer that such material could have been obtained only at exorbitant prices entirely out of line with current rates, taking into account the quantities involved and usual practices in obtaining such quantities. A time extension for shortage of material will not be considered for material ordered or delivered late or whose availability is affected by virtue of the mishandling of procurement. The above provisions apply equally to equipment to be installed in the work.

6-7 TIME OF COMPLETION

6-7.2 Working Day Revise to read as following:

Working Day — All days beginning with the Notice to Proceed and ending with the “completion Date”, except the following:

a. Any day the Contractor is prevented from working for cause as established in 6-6 of these specifications.

b. Any day the Contractor is prevented from working during the first (5) hours of the workday with at least sixty percent (60%) of normal work force for cause as established in 6-6 of these specifications

The following days have been designated as holidays by the City of Culver City:

New Year's Day	January 1
Martin Luther King, Jr. Day	3rd Monday in January
Memorial Day	Last Monday in May
Independence Day	July 4
Labor Day	1st Monday in September
Thanksgiving	4th Thursday in November
Day after Thanksgiving	
Christmas Day	December 25

In addition, Culver City observes a "Holiday Slowdown" during which no work may take place within the public right-of –way. On arterial streets and commercial streets, Holiday slowdown will be observed during the Thanksgiving week, the Christmas week, and the New Year's week; On all other streets, Holiday slowdown will be observed during the Thanksgiving days(including the days before and after), the Christmas days(including the days before and after), and the New Year's Days(and the days before). During the slowdown, the Contractor shall maintain job site and public safety and schedule to perform work outside the public right-of–way. No time extension will be granted due to the failure of the Contractor to schedule the work appropriately.

Add the following subsection:

6-7.4 Work Hours

The Contractor's working hours shall be limited to the hours between 9:00 A.M. and 6:00 P.M. Monday through Friday, excluding recognized holidays. Workdays are defined in Section 6-7.2 of the Standard Specifications and as modified above.

Work hours other than normal work hours will not be allowed without prior consent of the City Engineer.

For work performed at night, the Contractor shall provide adequate lighting for proper prosecution of the work for the safety of the workers and the public, and for proper inspection.

Work in Caltrans Right of Way may have more restricted working/lane closure hours. The contractor shall adhere to all Caltrans encroachment permit requirements.

6-8 COMPLETION, ACCEPTANCE, AND WARRANTY Add the following:

Completion Date: The project is considered complete and the counting of days for time of completion ends when the City's Project Manager confirms in writing that the Contractor has completed the Work in accordance with the Contract, including completion of all physical work and punch list items, and cleanup work including removal of construction materials/equipment/signage, and does not including warranties or maintenance. Any documentation required in the Contract and by Law does not necessarily need to be furnished by the Contractor by completion date but must be received prior to final payment.

Final Acceptance Date: The date on which the City Council accepts the Work as complete.

The guarantees and agreements set forth hereof shall be secured by a surety bond. Said bond the Contractor may, at his option, provide for the faithful performance bond furnished under the contract to remain in force and effect for said amount until the expiration of said one year period.

Such repair and replacement shall be made promptly upon receipt of written notice from the Engineer. If the Contractor fails to make such repair and replacement promptly, the Engineer may cause the work to be done and the costs incurred thereby shall become the liability of the Contractor and his or her Surety.

If in the opinion of the Engineer, defective work creates a dangerous condition or requires immediate correction or attention to prevent further loss to the City or to prevent interruption of operations of the City, the City will attempt to give the notice required by this article. If the Contractor cannot be contacted or does not comply with the Engineer's request for correction within a reasonable time as determined by the Engineer, the City may, notwithstanding the Provisions of this article, proceed to make such correction or provide such attention, and the costs of such correction or attention shall be charged against the Contractor.

This article does not in any way limit the warranty on any items for which a longer warranty is specified or on any items for which a manufacturer gives a guarantee for a longer period, nor does it limit other remedies of the City in respect to latent defect, fraud implied warranties, or assigned claims.

6-9 LIQUIDATED DAMAGES. Delete the entire subsection and substitute the following:

Failure of the Contractor to complete the Work within the time allowed will result in damages being sustained by the Agency. Such damages are, and will continue to be, impracticable and extremely difficult to determine. For each consecutive calendar day in excess of the time specified for completion of the Work, as adjusted in accordance with 6-6, the Contractor shall pay to the Agency, or have withheld from moneys due it, the sum of **$_____**. Execution of the contract under these Specifications shall constitute agreement by the Agency and Contractor that **$_____** per calendar day is the minimum value of the costs and actual damage caused by failure of the Contractor to complete the Work within the allotted time. Such sum is liquidated damages and shall not be construed as a penalty, and may be deducted from payments due the Contractor if such delay occurs.

In addition to the liquidated damages specified, if the Contractor fails to complete the work within the time specified for completion, plus any authorized time extensions, the Agency shall have the right to charge to the Contract all or any part, as it may deem proper, of the actual costs of inspection, supervision and other overhead expenses that are directly chargeable to the project and that accrue after the expiration of such specified time for completion plus authorized extensions. This charge will be addition to the payment of liquidated damages.

6-11 LEGAL ACTIONS AGAINST THE CITY Add the following subsection:

In the event litigation is brought against the City concerning compliance by the City with State or Federal laws, rules or regulations applicable to highway work, the provisions of this section shall apply.

a. If, pursuant to court order, the City prohibits the Contractor from performing all or any portion of the work, the delay will be considered a right of way delay within the meaning of Subsection 6-6 of the Standard Specification unless the contract is terminated as hereinafter provided, in which event compensation payable to the Contractor shall be determined in accordance with said termination provisions.

b. If, pursuant to court order (other than an order to show cause) the City is prohibited from requiring the Contractor to perform all or any portion of the work, the City may, if it so elects,

eliminate the enjoined work pursuant to Section 3 of the Standard Specifications or terminate the contact in accordance with Subsections 6-3 and 6-5 of the Standard Specifications.

c. If the final judgment in the action prohibits the City from requiring the Contractor to perform all or any portion of the work, the City will either eliminate the enjoined work pursuant to Sections 3 of the Standard Specifications or terminate the Contract in accordance with Subsections 6-3 and 6-5 of the Standard Specifications.

d. Termination of the Contract and the total compensation payable to the Contractor in the event of termination shall be governed by the following:

(1) The Engineer will issue the Contractor a written notice specifying that the Contract is to be terminated. Upon receipt of said written notice and, except as otherwise directed in writing by the Engineer, the Contractor shall:

a. Stop all work under the contract, except that specifically directed to be completed prior to acceptance.
b. Perform work the Engineer deems necessary to secure the project for termination.
c. Remove equipment and plan from the site of the work.
d. Take such action as is necessary to protect materials from damage.
e. Notify all Subcontractors and suppliers that the contract is being terminated and that their contracts of orders are not to be further performed unless otherwise authorized in writing by the Engineer.
f. Provide the Engineer with an inventory list of all materials previously produced, purchased or ordered from suppliers for use in the work and not yet used in the work, including its storage location and such other information as the Engineer may request.
g. Dispose of materials not yet used in the work as directed by Engineer. It shall be the Contractor's responsibility to provide the City with good title to all materials purchased by the City hereunder, including materials for which partial payment has been made as provided in Subsection 9-3.2 of the Standard Specifications, and with bills of sale or other documents of title for such materials.
h. Subject to the prior written approval of the Engineer, settle all outstanding liabilities and all claims arising out of subcontracts or orders for materials terminated hereunder. To the extent directed by the Engineer, the Contractor shall assign to the City all the right title and interest of the Contractor under subcontracts or orders for materials terminated hereunder.
i. Furnish the Engineer with the documentation required to be furnished by the Contractor under the provisions of the contract including, on projects as to which Federal funds are involved, all documentation required under the Federal requirements included in the contract.
j. Take such other actions as the Engineer may direct.

(2) Acceptance of the Contract as hereinafter specified shall not relieve the Contractor of responsibility for damage to materials except as follows:

A. The Contractor's responsibility for damage to materials for which partial payment has been made as provided in Subsection 9-3.2 of the Standard Specifications, and for materials furnished by the City for use in the work and unused, shall terminate when the Engineer certifies that such materials have been stored in the manner and at the locations he has directed.
B. The Contractor's responsibility for damage to materials purchased by the City subsequent to the issuance of the notice that the contract is to be terminated shall terminate when title and delivery of the materials has been taken by the City.
C. When the Engineer determines that the Contractor has completed the work under the contract directed to be completed prior to termination and such other work as may have been ordered to secure the project for termination, he will recommend that the Engineer formally accept the Contract, and immediately upon and after

such acceptance by the Engineer, the Contractor will not be required to perform any further work thereon and shall be relieved of his contractual responsibilities for injury to persons or property which occurs after the formal acceptance of the project by the Engineer.

(3) The total compensation to be paid to the Contractor shall be determined by the Engineer on the basis of the following:

a. The reasonable cost to the Contractor, without profit, for all work performed under the contract, including mobilization, demobilization and work done to secure the project for termination. Reasonable cost will include a reasonable allowance for project overhead and general administrative overhead not to exceed a total of seven percent (7%) of direct costs of such work.

When in the opinion of the Engineer, the cost of a contract item of work is excessively high due to costs incurred to remedy or replace defective or rejected work, the reasonable cost to be allowed will be the estimated reasonable cost of performing such work in compliance with the requirements of the Plans and Specifications and the excessive actual cost shall be disallowed.

b. A reasonable allowance for profit on the cost of the work performed as determined under Subsection (a), provided the Contractor establishes to the satisfaction of the Engineer that it is reasonably probable that he would have made a profit had the contract been completed and provided further that the profit allowed shall in no event exceed four percent (4%) of said cost.

c. The reasonable cost to the Contractor of handling material returned to the vendor, delivered to the City or otherwise disposed of as directed by the Engineer.

d. A reasonable allowance for the Contractor's administrative costs in determining the amount payable due to termination of the contract.

All records of the Contractor and his Subcontractors, necessary to determine compensation in accordance with the provisions of this section, shall be open to inspection or audit by representatives of the City at all times after issuance of the notice that the contract is to be terminated and for a period of three years, and such records shall be retained for that period.

After acceptance of the work by the Engineer, the Engineer may make payments on the basis of interim estimates pending issuance of the Final Estimate when in his opinion the amount thus paid, together with all amounts previously paid allowed, will not result in total compensation in excess of that to which the Contractor will be entitled. All payments, including payment upon the Final Estimate shall be subject to deduction for prior payments and amounts, if any, to be kept or retained under the provisions of the contract.

The provisions of this section shall be included in all subcontracts.

SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR

7-1 CONTRACTOR'S EQUIPMENT AND FACILITIES Add the following:

The routing of trucks with gross vehicle weight exceeding 6,000 pounds through Culver City shall be subject to the provision of City Code Section 7.02.210 and the Contract Documents. Contractor shall submit a proposed haul route plan to the Engineer for approval. Said plan shall be approved prior to mobilization. **The Contractor is advised that any violation of the California Vehicle Code and Culver City Code (such as truck routing, overweight, improper licensing, etc.) will**

result in citation and fines by the Police Department. Contractor shall be responsible for the immediate cleanup of all spills of any nature resulting from his operation.

Parking of Contractor's employee's vehicles or any other vehicles not utilized in the construction activity will be restricted during construction and shall not take place in public parking areas outside of the construction zone, unless shown otherwise on the plan or unless by arrangement with the Engineer.

Any commercial vehicle, the laden or unladen weight of which exceeds six thousand (6,000) pounds, shall use the following streets designated as truck routes:

A. Adams Boulevard.
B. Centinela Avenue.
C. Culver Boulevard, between west City boundary and Sepulveda Boulevard.
D. Fairfax Avenue.
E. Higuera Street, between Hayden Avenue/Place and Jefferson Boulevard.
F. Jefferson Boulevard.
G. La Cienega Boulevard.
H. National Boulevard.
I. Sawtelle Boulevard, between Culver/ Washington off-ramp of the San Diego Freeway and Braddock Drive.
J. Sawtelle Boulevard, between Matteson Avenue and Venice Boulevard.
K. Sepulveda Boulevard.
L. Slauson Avenue, east of Jefferson Boulevard.
M. Venice Boulevard.
N. Washington Boulevard, east of La Cienega Boulevard.

Most direct route shall be used to and from the restricted street from the truck route.

7-1.2 Temporary Utility Services Add the following:

Contractor is responsible to obtain and pay for construction water. Any water drawn from fire hydrant shall be coordinated through Golden State Water Company (Contact telephone No. 310.838.1324) located at 10785 Washington Blvd in Culver City.

7-2 LABOR

7-2.2 LAWS

7-2.2 LAWS Add the following paragraphs:

Attention is directed to the provisions in Sections 1777.5 (Chapter 1411, Statutes of 1968) and 1777.6 of the Labor Code concerning the employment of apprentices by the Contractor or any Subcontractor under the Contractor. The Contractor and any Subcontractor under him shall comply with the requirements of said Sections in the employment of apprentices.

Pursuant to the provisions of Section 1770 of the Labor Code, the Owner has ascertained the general prevailing rate of wages (which rate includes employer payments for health and welfare, vacation, pension and similar purposes) applicable to the work to be done, for straight time, overtime, Saturday, Sunday and holiday work. The holiday wage rate listed shall be applicable to all holidays recognized in the collective bargaining agreement of the particular craft, classification, or type of workmen concerned. These rates are set and on file with the City Clerk of Culver City. The Contractor shall pay travel and subsistence payments to each worker as such payments are defined and required in applicable collective bargaining agreements filed in connection with Labor Code Section 1773.8.

Any Contractor who shall be found in violation of the nondiscrimination provisions of the State of California Fair Employment Practices Act or similar provisions of Federal law or executive order in the performance of any contract with the City, thereby shall be found in material breach of such contract and thereupon the City shall have power to cancel or suspend the contractor, in whole or in part, or to deduct from the amount payable to such Contractor the sum of twenty-five dollars ($25.00) for each person for each calendar day during which such person was discriminated against, as damages for said breach of contract; or both. Only a finding of the State of California Fair Employment Practices Commission or the equivalent Federal agency or officer shall constitute evidence of a violation of contract under this section.

7-2.4 Payroll Records Add the following section:

7-2.4 Payroll Records

The Contractor's attention is directed to the following provisions of Labor Code Section 1776 (Stats. 1978, Ch. 1249). The Contractor shall be responsible for the compliance with these provisions by his Subcontractors.

a. Each Contractor and Subcontractor shall keep an accurate payroll record, showing the name, address, social security number, work classification, and straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker or other employee employed by him or her in connection with the public work.

b. The payroll records enumerated under subdivision (a) shall be certified and shall be available for inspection at all reasonable hours at the principal office of the Contractor on the following basis:

(1) A certified copy of an employee's payroll record shall be made available for inspection or furnished to such employee or his or her authorized representative on request.

(2) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection or furnished upon request to a representative of the body awarding the contract, the Division of Labor Standards Enforcement and the Division of Apprenticeship Standards of the Department of Industrial Relations.

(3) A certified copy of all payroll records enumerated in subdivision (a) shall be made available upon request to the public for inspection or for copies thereof. However, a request by the public shall be made through either the body awarding the contract, the Division of Apprenticeship Standards, or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided pursuant to paragraph (2), the requesting party shall, prior to being provided the records, reimburse the costs of preparation by the contractor, subcontractors, and the entity through which the request was made. The public shall not be given access to such records at the principal office of the Contractor.

c. The certified payroll records shall be on forms provided by the Division of Labor Standards Enforcement or shall contain the same information as the forms provided by the division.

d. Each Contractor shall file a **certified copy** of the records enumerated in subdivision (a) with the entity that requested such records within **10 days** after receipt of a written request.

e. Any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the awarding body, the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement shall be marked or obliterated in such a manner as to prevent disclosure of an individual's name, address and social

security number. The name and address of the Contractor awarded the contract or performing the contract shall not be marked or obliterated.

f. The Contractor shall inform the body awarding the contract of the location of the records enumerated under subdivision (a), including the street address, city and county, and shall, within five working days, provide a notice of a change of location and address.

g. The Contractor shall have **10 days** in which to comply subsequent to receipt of written notice specifying in what respects the contractor must comply with this section. In the event that the contractor fails to comply within the **10 day period**, he or she shall, as a penalty to the state or political subdivision on whose behalf the contract is made of-or awarded, forfeit **twenty-five dollars ($25)** for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Apprenticeship Standards or the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due.

h. The Contractor and Subcontractors shall submit to the City Engineer certified payrolls and copies of all payroll checks and paystubs showing all itemized deductions for each employee on a weekly basis during the term of this contract.

7-5 PERMITS Add the following:

The Contractor shall secure all necessary permits from all governing agencies having authority over any portion of the work. The Contractor shall obtain and pay for all other permits.

The Contractor shall obtain, pay, and comply with all permits, including but not limited to the permits requirements as shown in the ”Instruction to Bidders” part of this contract document, and give all notices necessary and incident to the due and lawful prosecution of the work and to the preservation of the public health and safety.

7-6 THE CONTRACTOR’S REPRESENTATIVE Add the following:

When and as directed by the City Engineer, the Contractor shall attend all conferences and meetings which the City Engineer deems necessary for the proper progress of work under this contract.

7-8 PROJECT SITE MAINTENANCE

7-8.1 General Add the following:

When and as often as required by the Engineer, the Contractor shall furnish and operate self-loading motor sweepers with spray nozzles, to keep paved areas affected by the work acceptably clean and dust free.

The Contractor shall remove graffiti from all work, materials, equipment, and signs within the project. Equipment, materials, or signs containing graffiti shall not be brought to the project. Any graffiti found on work, materials, equipment, or signs shall be cleaned or removed from the project within 24 hours from its discovery. The cost of graffiti removal shall be borne by the Contractor, and shall be considered as being included in the various Contract items.

Upon project completion, the contractor shall remove all dig-alert utility markings.

The Contractor shall have sole responsibility for providing security for his materials and equipment on and about the work site against theft and vandalism at all times for the duration of the contract. Contractor shall immediately replace all furniture, equipment, supplies, etc., which is being used or owned by the Owner or his/her designee at or on the project site or other areas under the security

of the Contractor that is stolen, lost or damaged through theft, vandalism, graffiti, Contractor's negligence or any similar activity.

7-8.2 Air Pollution Control Add the following:

The Contractor shall comply with all air pollution control rules, regulations, ordinances and statutes which apply to any work performed pursuant to the Contract, including any air pollution control rules, regulations, ordinances and statutes, specified in Section 11017 of the Government Code.

In the absence of any applicable air pollution control rules, regulations, ordinances or statues governing solvents, all solvents, including but not limited to the solvent portions of paints, thinners, curing compounds, and liquid asphalt used on the Project shall comply with the applicable material requirements of the South Coast Air Quality Management District (SCAQMD). All containers of paint, thinner, curing compound or liquid asphalt shall be labeled to indicate that the contents fully comply with said requirements.

Material to be disposed of shall not be burned, either inside or outside of the premises. The provisions of Section 300-1.3, "Removal and Disposal of Materials", of the SSPWC permitting disposal of material by burning shall not apply.

7-8.3 Noise Control Add the following:

The Contractor shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract.

The noise level requirements shall apply to all equipment on the job or related to the job, including, but not limited to, trucks, transit mixers or transient equipment that may or may not be owned by the Contractor. Each internal combustion engine used for any purpose on the job shall be equipped with a muffler of a type recommended by the manufacturer. The noise level shall be in compliance with Chapter 9, Section 9.07 of the Culver City Municipal Code.

Residential Restrictions—

For residential zones, hours of work shall be limited, in accordance with the Culver City Municipal Code pertaining to Mechanical Noise or Construction Noise near Residential Zones, which prohibits:

(a) The use or operation of any automobile, motorcycle, engine, machine or mechanical device, or other contrivance or facility, or the carrying on of any trade or business, causing between the hours of 8:00 p.m. and 8:00 a.m., any loud or unusual noise or sound, disturbing the peace of residents of a residentially zoned neighborhood.

(b) The use of any of the foregoing in construction or excavation work between the hours of 8:00 p.m. and 8:00 a.m., on weekday, or between the hours of 7:00 p.m. and 9:00 a.m. on a Saturday, or between the hours of 7:00 p.m. and 10:00 a.m. on a Sunday, which cause any loud or unusual noise or sound disturbing the peace of residents of a residentially zoned neighborhood.

Interference with Business Prohibited

Contractor must comply with Section 9.04.020(D) of the Culver City Municipal Code pertaining to Mechanical Devices, etc., Interfering with Business or Industrial Operations, which prohibits: The operation of any automobile, motorcycle, engine, machine or mechanical device or other contrivance or facility, or the carrying on of any trade or business, any loud or unusual noise or sound from which interferes with the transaction or conduct of any business or industrial operation in the surrounding area, unless the making of such noise is incident to the construction or repair of

buildings or equipment or is otherwise necessary to the protection or preservation of the property from which such noise or sound emanates.

7-8.4 Storage of Equipment and Materials Add the following:

It shall be the Contractor's responsibility to locate any storage sites for materials and equipment needed and such sites must be approved in advance by the City Engineer, and must be free of objectionable material. The Contractor must submit to the City Engineer for approval any and all agreement(s) between the Contractor and the property owner(s) of said storage site(s) and/or construction site(s) for approval prior to the start of construction. Said agreement(s) must provide for the restoration of the site(s) by the Contractor prior to the filing of "Notice of Completion" by the City Engineer.

Stockpiling or storage of materials on any public right-of-way or parking areas will not be permitted without the approval of the Engineer. Materials spilled along or on said right-of-way or parking areas shall be removed completely and promptly. All stockpile and storage areas shall be kept in a safe, neat, clean, and orderly fashion, and shall be restored to equal or better than original condition upon completion of the work

Contractor shall only use a haul route approved in writing by the Engineer. The Contractor shall keep the work site as well as the route to and from the disposal site clean at all times. The Contractor shall immediately remove and haul away all materials included in the various items of removals.

7-8.6 Water Pollution Control Add the following:

The Contractor shall comply with the requirements of Subsection 7-8.6 of the Standard Specifications and shall conduct his operations so as to prevent Portland cement, mud, silt or other materials from entering the surface drainage structures of the adjoining street and any underground storm drainage system. Contractor shall prepare and submit Storm Water Pollution Prevention Plan (SWPPP) prepared by qualified SWPPP developer for City's approval. Once approved, the Contractor shall comply with the requirements of project specific Storm Water Pollution Prevention Plan (SWPPP).

In addition to complying with all applicable federal, state and local laws and regulations, the Contractor shall take note of the NPDES (National Pollution Discharge Elimination System) Requirements. The Contractor shall take all precautionary actions and implement all necessary BMPs to prevent sewer discharges to any portion of the storm drain conveyance system including discharge of pollutants from activities such as paving operations, concrete waste washouts, cold-milling, vehicle and equipment fueling from entering storm drain systems. At the minimum, the following shall be implemented:

1. Handle, store, and dispose of materials properly.
2. Avoid excavation and grading activities during wet weather.
3. Construct diversion dikes and drainage swales around working sites.
4. Cover stockpiles and excavated soil with secured tarps or plastic sheeting.
5. Develop and implement erosion control plans (if applicable).
6. Check and repair leaking equipment away from construction sites.
7. Designate a location away from storm drains for refueling.
8. Cover and seal catch basins if work in their vicinity may allow debris or deleterious liquids to enter.
9. Use vacuum with all concrete sawing operations.
10. Never wash excess material from aggregate, concrete, or equipment onto a street.
11. Catch drips from paving equipment with drip pans or absorbent material.
12. Clean up all spills using dry methods.

7-9 PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS Add the following subsection:

The Contractor shall examine all adjoining premises (including for the purposes hereof, streets and sidewalks) and buildings, and ascertain, before beginning work, the depth of cellars, materials and construction of buildings and all existing conditions of such premises and the buildings thereon, and shall be governed thereby for the necessary, thorough, safe and satisfactory execution of all work called for herein, whether indicated on Plans and/or specified, or not, and all work and protective measures necessary to keep and leave the said premises and buildings in the same condition as they were before commencing work shall be done without any addition to the Contract Price. Wherever any parts of the existing adjoining buildings interfere with or are interfered with by the work to be performed hereunder, the Contractor shall make whatever changes necessary thereby, whether shown on the Plans, called for in the Specifications, or not shown or not called for. The Contractor, before commencing work on the premises, shall, if he sees fit, make a written report of the conditions as found at that time, noting particularly any defects in evidence, taking photographs of the exteriors, and, if necessary, photographs of interiors, and shall deliver to the Owner a copy of the written report of the examination and copies of photographs with the date of taking thereon. The Contractor shall invite the Owner and the owners of the respective properties and buildings to join with them in the examination of the premises and buildings. The Owner may, at its option, be present during the examination. If the Contractor fails to make the examination and report as herein specified, it will be deemed that the adjoining buildings and premises are in good condition, and all claims for damages, repairs and replacements must be treated by the Contractor on the basis that the buildings and premises were in good condition before work began.

The Contractor shall shore up, brace, underpin, secure, and protect all foundations, improvements, and other parts of existing structures adjacent to the work site, which may in any way be affected by excavation or other operations in connection with the work to be performed under this contract. The Contractor shall be responsible for giving all required notices to any joining property owner or other party before commencement of work.

7-10 PUBLIC CONVENIENCE AND SAFETY

7-10.1 Traffic and Access Add the following:

Traffic and access, including but not limited to vehicular and pedestrian traffic controls, maintenance of vehicular and pedestrian access, detours, and street closures, shall be in accordance with Subsection 7-10, of the latest edition of the Standard Specifications for Public Works Construction, including all its subsequent amendments; the latest edition of the Work Area Traffic Control Handbook ("WATCH") as published by the Building News, Inc., 990 Park Center Drive, Suite E, Vista, California 92081, and the following Special Provisions. In the event of conflict, the Special Provisions shall take precedence over the Work Area Traffic Control Handbook ("WATCH") and the Standard Specifications, and the Work Area Traffic Control Handbook ("WATCH") shall take precedence over the Standard Specifications.

The Contractor is solely responsible for the traffic control safety of pedestrians and vehicles on the public right-of-way within the Contractor's work area. The Contractor shall hold harmless and indemnify the Owner, and each of its officers and employees, for any and all damages to persons and property due to the Contractor's failure to maintain adequate traffic control and safety. It is the affirmative duty of the Contractor to maintain all of his traffic control devices on the project at all times, including night and/or weekends.

The Contractor shall notify by printed notice, the occupants of all properties within the construction zone of any access, parking and circulation restrictions and limitations that will be created by the construction at least 7 calendar days in advance of the commencement of construction. This notice shall be prepared by the City of Culver City, but be distributed by the Contractor.

Traffic Control Plans (TCP)
The Contractor shall submit detailed Traffic Control Plans (TCP) on 24” x 36” sheet which shall clearly show and describe all proposed lights, warning signs, barricades, delineators, temporary lane markings, temporary traffic signals or signs, and any and all other facilities proposed to be

installed. TCP shall be prepared by a Registered Civil or Traffic Engineer and shall show all lane closures, restrictions, tapers, and other disruptions of normal traffic flow, including pedestrian and vehicular detours. A schedule shall be included. TCP shall be submitted to the Engineer for approval no later than two (2) weeks after the award of contract. It shall be the Contractor's responsibility to immediately revise the TCP at the direction of the Engineer, and the Contractor hereby agrees that such Plan shall be strictly adhered to, and the Contractor hereby understands and agrees that its failure to provide any facility or device as shown on the TCP, or its deviation from said Plan, shall constitute a breach of contract. Traffic control set up in the field shall be inspected and approved by the City Engineer's Representative prior to commencement of any construction activity.

Business Access

Pedestrian and vehicular access shall be maintained to businesses fronting the Work except when construction of areas immediately fronting a business entrance precludes such access. Contractor shall notify affected business three (3) business days in advance of construction.

Contractor shall make provisions for deliveries to business including temporary loading zones

Convenient and safe pedestrian access to occupied residential and business property shall be maintained at all times. Access to mailboxes must be maintained at all times such that the postal delivery service is not- interrupted. Trash pick-up service shall not be interrupted. Access to vacant and unused property may be restricted when approved by the Engineer. Both vehicular and pedestrian access shall be maintained at all times to all other property except as otherwise specifically authorized in writing by the City's Engineer.

Temporary No Parking

The Contractor shall notify in writing residents of property adjoining the location of the work at least forty-eight (48) hours before the start of construction on that street. The Contractor is responsible for posting "temporary no-parking" signs at least forty-eight (48) hours before using the parking lane for construction purposes. The Contractor shall be responsible for furnishing, posting, and removing temporary "No Parking" and "No Driving" signs (as applicable) along project streets. Signs shall be posted on each side of the street with a maximum of 200 feet between signs. When necessary, the Contractor shall furnish posts. Pursuant to City requirements, "Temporary No Parking" signs must be posted and verified by the Culver City Police Department 48 hours prior to beginning of construction.

The Contractor shall coordinate with postal authorities for the temporary relocation of mailboxes. Contractor shall provide signage directing pedestrian and vehicular traffic to temporary mailbox locations.

In the case of work requiring excavation of the roadway which may interfere with the use by residents or businesses of their driveways, suitable provisions shall be made by the Contractor at such time as the exigencies of construction may demand a temporary blocking of said driveways. Efforts shall be made by the Contractor to minimize the duration of said blocking and to notify the residents of this need well in advance. Further, the Contractor shall provide access to each residential or commercial establishment each evening. Any trench or excavation in the street or alley which remains open after work hours shall be covered by steel plates.

The Contractor shall conduct his operations in such a manner as to provide reasonable access to the adjacent properties and shall have no greater length or quantity of work under construction than he can properly prosecute with a minimum of inconvenience to the public and other contractors engaged on adjacent or related work.

7-10.3 Street Closures, Detours, Barricades Add the following:

No closure of any street shall be allowed unless prior written permission is obtained from the City Engineer. If permission to close a street is granted, then the Contractor is required to notify in

writing at least five (5) working days in advance of street closures, all emergency services, and school bus services shall be notified by the contractor in writing of the locations, time, and date of the closures. In case of schedule changes, the emergency services, etc., shall be notified by telephone at least two (2) days in advance of the street closure.

7-10.4.1 Safety Orders, Add the following:

Safety Orders and Safety Control

The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and not be limited to normal working hours. Safety provisions shall conform to U.S. Department of Labor (OSHA), the California Occupational Safety and Health Act, and all other applicable Federal, State, County, and local laws, ordinances, codes, the requirements set forth below, and any regulations that may be detailed in other parts of these Contract Documents. Where any of these are in conflict, the more stringent requirements shall be followed.

No provision of the Contract Documents shall act to make the Owner, the Engineer or any other party than the Contractor responsible for safety. The Engineer shall not have authority for safety on the project. The Contractor shall indemnify, defend and hold harmless the Owner, Engineer, or other authorized representatives of the Owner, from and against any and all actions, damages, fines, suits and losses arising from the Contractor's failure to meet all safety requirements and/or provide a safe work site.

If death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to both the Engineer and the Owner. In addition, the Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the Work whether on, or adjacent to, the Site, giving full details and statements of witnesses. The Contractor shall make all reports as are, or may be, required by authority having jurisdiction, and permit all safety inspections of the work being performed under this Contract.

If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

Safety Program

The Contractor shall establish, implement, and maintain a written injury prevention program as required by Labor Code Section 6401.7. Before beginning the Work the Contractor shall prepare and submit to the Engineer a Contractor Safety Program that provides for the implementation of all the Contractor's safety responsibilities in connection with the Work at the site and the coordination of that program and its associated procedures and precautions with the safety programs, precautions and procedures of each of its subcontractors and other prime Contractors performing work at the site. The Contractor shall be solely responsible for initiating, maintaining, monitoring, coordinating, and supervising all safety programs, precautions and procedures in connection with the Work and for coordinating its programs, precautions and procedures of the subcontractors and other prime contractors performing Work at the site. The Safety Program should contain all the necessary elements for the Contractor to administer its program on site.

The Contractor's compliance with requirements for safety and/or the Engineer's review of the Contractor's Safety Program shall not relieve or decrease the liability of the Contractor for safety. The Engineer's review of the Contractor's Safety Program is only to determine if the above listed elements are included in the program.

Safety Supervisor

The Contractor shall appoint an employee as safety supervisor who is qualified and authorized to supervise and enforce compliance with the Safety Program. The Contractor shall notify the

Engineer in writing prior to the commencement of work of the name of the person who will act as the Contractor's safety supervisor and furnish the safety supervisor's resume to the Engineer.

The Contractor, will, through and with his Safety Supervisor, ensure that all of its employees and its subcontractors of any tier, fully comply with the Project Safety Policies. The Safety Supervisor shall be a full time employee of the Contractor whose responsibility shall be for supervising compliance with applicable safety requirements on the work site and for developing and implementing safety training classes for all job personnel. The Owner shall have the authority to request removal of the Contractor's Safety Supervisor if that representative is judged to be improperly or inadequately performing the duties; however, this authority shall not in any way affect the Contractor's sole responsibility for performing this work safely, nor shall it impose any obligation upon the Owner to ensure the Contractor perform its work safely.

Safety and Protection

The Contractor shall take all necessary protection to prevent damage, injury and loss to:

All employees on the Project, employees of all subcontractors, and other persons and organizations who may be affected thereby;

All the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

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

The Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss and shall erect and maintain all necessary safeguards for such safety and protection. The Contractor shall notify owners of adjacent property and of underground facilities and utility owners when prosecution of the Work may affect them and shall cooperate with them in the protection, removal, relocation and replacement of their property. All injury or loss to any property caused, directly or indirectly, in whole or in part, by the Contractor, any subcontractor, supplier or any other person or organization part, by the Contractor, any subcontractor, supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by the Contractor. The Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and the Owner has issued a notice of final completion to the Contractor.

Safety Emergencies

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer, is obligated to act to prevent threatened damage, injury or loss. The Contractor shall give the Engineer prompt written notice if the Contractor believes that any significant changes in the Work or variations from the Contract have been caused thereby.

Safety Violations

Should the Contractor fail to correct an unsafe condition, the Engineer shall immediately notify the Owner of the Contractor's failure to correct the unsafe condition. The Owner shall then notify the Contractor through the Engineer that the unsafe condition must be corrected or the work in question will be stopped until the condition is corrected to the satisfaction of the Owner. No extension of time or additional compensation will be granted as a result of any stop order so issued.

The Owner shall have the authority to require the removal from the project of the foreman and/or superintendent in responsible charge of the work where safety violations occur.

Equipment Safety Provisions

The completed Work shall include all necessary permanent safety devices, such as machinery guards and similar ordinary safety items, required by the State and Federal (OSHA) industrial

authorities and applicable local and national codes. Further, any features of the Work, including Owner-selected equipment subject to such safety regulations shall be fabricated, furnished, and installed in compliance with these requirements. All equipment furnished shall be grounded and provided guards and protection as required by safety codes, and where vapor-tight or explosion-proof electrical installation is required by safety codes, this shall be provided. Contractors and manufacturers of equipment shall be held responsible for compliance with the requirements included herein. The Contractor shall notify all equipment suppliers and subcontractors of the provisions of this paragraph.

On-Site Copies Required
The Contractor shall have at the work site copies or suitable extracts of: Construction Safety Orders, and General Industrial Safety Orders issued by the State Division of Industrial Safety.

Compliance Required
Contractor shall comply with provision of these and all other applicable laws, ordinances, and regulations, including but not limited to the Occupational Safety and Health Act of 1970 and current amendments, if any, to which particular attention is directed.

Clearance from Power Lines

To help prevent injuries and electrical service interruptions, Contractors are reminded CAL/OSHA requires tools, machinery equipment, apparatus, materials, or supplies must be kept at least 10 feet from voltage lines energized at 50,000 volts or less and even greater distances for lines in excess of 50,000 volts. In addition, the Penal Code of the State of California, Section 385, makes it a misdemeanor to violate certain clearances from high voltage lines.

Prior to starting work in which the aforementioned clearances will be impaired, it will be necessary to contact the Southern California Edison (SCE) Company Business Office nearest the proposed work location and request assistance. SCE will take appropriate action to assist in maintaining required clearances. Such action will be at Contractor's expense. Sufficient lead time to permit planning and scheduling of any necessary work will be required.

Special Hazardous Substance and Process

Contractor acknowledges that Contractor is aware of and in compliance with the provisions of the Hazard Communication Standards (California Administrative Code, Title 8, Section 4194). Contractor shall, at the request of the Owner, demonstrate that Contractor is in complete compliance with the Hazard Communication Standards.

In addition, Contractor shall, at the request of the Public Works Director/City Engineer, provide to the Owner a Material Safety Data Sheet for any product handled or used by the Contractor on Owner property or in an area where an Owner's employee is working.

7-13 LAWS TO BE OBSERVED

The Contractor shall keep fully informed of all existing and future State and Federal laws and county and municipal ordinances and regulations which in any manner affect those engaged or employed in the work, or the materials used in the work, or which in any way affect the conduct of the work, and of all such orders and decrees of bodies or tribunals having any jurisdiction or authority over the same. Contractor shall at all times observe and comply with, and shall cause all his or her agents and employees to observe and comply with, all such existing and future laws, ordinances, regulations, orders, and decrees of bodies or tribunals having any jurisdiction or authority over the work; and shall protect and indemnify the Owner, and all its officers and employees connected with the work, and including but not limited to the Public Works Director/City Engineer, against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by Contractor or Contractor's employees.

If any discrepancy or inconsistency is discovered in the Plans, Drawings, Specifications, or Contract for the work in relation to any such law, ordinance, regulation, order or decree the Contractor shall forthwith report the same to the Engineer in writing.

7-15 RECORD DRAWINGS Add the following section:

At the beginning of the project, one print of each applicable drawing will be issued by the City for use in preparing record drawings.

Actual construction conditions shall be accurately and completely recorded on the prints as the project progresses. Contractor shall make complete, current, Record Drawings available for review by the City during the time the Contractor's Application for Payment is being reviewed. Incomplete Record Drawings may delay approval of said Application. Upon completion of the work, the Contractor shall sign the record drawings and shall submit same to the City's Inspector for checking and approval prior to the Notice of Completion is filed.

SECTION 8 -- FACILITIES FOR AGENCY PERSONNEL

Facilities for Agency Personnel is not required on this project.

SECTION 9 -- MEASUREMENT AND PAYMENT

9-3 PAYMENT

9-3.1 General. Add the following at the end of the second paragraph:

Payment for cost of work to comply with the General Provisions of the Standard Specification for Public Works Construction and as modified by this Contract shall be included in the various bid items, and no additional payment will be made.

Bid prices provided on the appropriate Bid Form will remain in force as Unit Prices under the Contract Documents until the Contract has been fully performed. No cost escalation is allowed due to material price increase for the term of the project.

When an item of work is not listed in the “bid schedule” in the bid proposal, the cost of such work shall be considered to be included in the cost of the other Work that is listed. The Contractor is to provide all labor, material, and equipment necessary to complete the Project in accordance with the plans and specifications including, but not limited to the following:

a. All "Special Provisions" work required to complete the Project in a safe and orderly manner including, but without being limited to, safety measures, hoists, flagmen, clean-up, barricades, fences, temporary utilities, utility fees and charges, parking for the Contractor's and Subcontractor's personnel, and temporary facilities as may apply to this Work;

b. All insurance in accordance with the insurance requirements of the Contract;

c. Maintain and update current record drawings on-site. Upon project completion provide the Owner a legible set of record drawings, operation and maintenance manuals, warranties, and guarantees;

d. All permits required;

e. Construction schedule indicating material lead times, shop drawings, order dates, start and end dates, milestone dates. The schedule shall be updated monthly;

f. Monthly project status report; Attend weekly project meetings;

g. All engineering, testing and inspection costs for defective work, and work performed outside of the work hours set forth in Section 6-7 of the Special Provisions;

h. Repair or replace all existing improvements (public or private) damaged by the Contractor. The Contractor is responsible to provide evidence of pre-existing conditions;

i. All scheduling of utility connections turn on/off including but not limited to electrical services (for street lighting, traffic signals, and irrigation controllers) and water meters.

j. All construction survey/staking necessary to set grade for all improvements. The survey provider shall be appropriately licensed by the State of California and is subject to approval by the Owner;

k. Watchman or security service, as necessary;

l. Perimeter fencing of work zones and staging area as necessary for public safety and protection of equipment and materials;

m. Dust control, street cleaning, and protection and/or replacement of existing surfaces or properties;

n. Submittal Log of all submittals required to the Owner including but not limited to SWPPP, material, products, concrete testing data, batch plant testing data, shop drawings and traffic control and phasing plans. Said log shall be updated for each weekly project meeting.

All costs for the preceding shall be included in the other items for which bids are entered.

The City may keep any monies which would otherwise be payable at any time hereunder and apply the same, or so much as may be necessary therefore, to the payment of any expense, losses or damages, as determined by the Engineer, incurred by the City, for which the Contractor is liable under the Contract.

Other Withholds

In addition to the amount which the Owner may otherwise retain under the Contract, the Owner may withhold a sufficient amount or amounts of any payment or payments otherwise due the Contractor, as in its judgment may be necessary to cover:

a. Payments which may be past due and payable for just claims against the Contractor or any subcontractor for labor or materials furnished for the performance of this Contract.

b. Defective work not remedied.

c. Failure of the Contractor to make proper payments to its subcontractors or suppliers.

d. A reasonable doubt that the Contract can be completed for the balance remaining.

e. Damage to another Contractor or third party, or to private or City property.

f. Failure of the Contractor to keep its work progressing in accordance with its progress schedule or maintaining current Record Drawings.

g. The Owner's costs for the Contractor's failure to complete work within the allowed time.

h. Cost of insurance arranged by the Owner due to cancellation or reduction of the Contractor's insurance.

i. Failure of the Contractor to make proper submissions, as herein specified.

j. Failure to submit, revise, resubmit, or otherwise conform to the requirements herein for preparing and maintaining a construction schedule.

k. Payments due the Owner from the Contractor.

l. Provisions of law that enable or require the Owner to withhold such payments in whole or in part.

The Owner in its discretion may apply any withheld amount or amounts to the payment of valid claims. In so doing, the Owner shall be deemed the agent of the Contractor, and any payment so made by the Owner shall be considered as a payment made under the Contract by the Owner to the Contractor, and the Owner shall not be liable to the Contractor for such payment made in good faith. Such payments may be made without prior judicial determination of the claim or claims. The Owner will render to the Contractor a proper accounting of such funds disbursed in behalf of the Contractor.

Pursuant to Public Contract Code Section 22300, for monies earned by the Contractor and withheld by the Owner to ensure the performance of the Contract, the Contractor, may, at its option, choose to substitute securities meeting the requirements of said Public Contract Code Section 22300. There would be an associated administrative charge of $75 per each Contractor's Progress Invoice.

9-3.3 Delivered Materials Add the following:

Unless included in the Bid Schedule, or unless otherwise called for in Technical Provisions, no payment will be made for materials or equipment delivered but not yet incorporated in the work.

9-3.5 Final Pay Quantities. Add the following:

When the estimated quantities for a specific portion of the work are designated as a final payment quantities, said estimated quantities shall be the final quantities for which payment for such specific portion of the work will be made unless the dimensions of said portions of the work shown on the plans are revised by the Engineer. If such dimensions are revised and such revisions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the changes in the dimensions. The estimated quantities for such specified portion of the work shall be considered as approximate only, and no guarantee is made that the quantities which can be determined by computations made based on the details and dimensions shown on the plans will equal the estimated quantities. No allowance will be made in the event that the quantities based on computations do not equal the estimated quantities.

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SECTION 00 89 00
ENCROACHMENT PERMITS

PART 1 - GENERAL

1.1 Work Included

A. Obtain and comply with encroachment permits from the following agencies.

- Culver City (for work in Alley westerly of Selmaraine Drive and Bankfield Avenue)

1.2 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Encroachment Permits	Submit copies of encroachment permits

1.3 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for mobilization.

PART 2 – PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Culver City Encroachment Permit

A. A no-fee encroachment permit from Culver City will be required for work in the Alley westerly of Selmaraine Drive and Bankfield Avenue.

B. Fee for this permit will be $0.

C. City has performed a cursory review of Plans, and is ready to issue a permit pending approval of Contractor's traffic control plans, submittal of proof of insurance, and payment of permit fee.

D. Copy of Culver City General Permit/Conditional Requirement Notes are attached.

E. Contractor shall be responsible for maintaining encroachment permit in force, tracking expiration dates, and applying for permit renewals and extensions as needed.

3.2 Golden State Water Company Connection Permit

A. A Service Installation Permit from Golden State Water Company will be required for the service connection to the 6-inch cast iron pipe in Bankfield Avenue.

B. Owner will apply for service installation to the Golden State Water Company.

C. Owner will prepay the Connection fee.

D. Owner will also prepay the necessary deposit. However, any charges against this deposit will be deducted from progress payments due Contractor.

E. Golden State Water Company has not reviewed the plans.

END OF SECTION

SECTION 01 01 00
SUMMARY OF WORK AND SEQUENCE OF CONSTRUCTION

PART 1 - GENERAL

1.1 Work Covered by Contract Documents

A. The Work includes furnishing products, labor, tools, transportation, and services to:

1. Protect existing facilities in place including gas line.

2. Dewatering and excavations for wet well and vaults.

3. Construct new wet well including submersible pumps, Dri-Prime backup system, check valves, piping, valves, fittings, building, HVAC systems, flow meters, vaults, manholes, electrical equipment, conduits wires and control system, PLC, MCC/VFD, ATS, appurtenances, and landscaping.

4. Construct perimeter wall, including gates and gate operators.

B. Furnish and install complete operating engineered systems including appurtenant structural, mechanical and/or electrical mountings fittings or connections required for compliance with Manufacturer's installation requirements, for compliance with applicable building, fire, plumbing, mechanical, electrical, and energy codes and standards, and as needed to permit systems to perform all functions required by Contract Documents and described in Manufacturer's printed literature.

1.2 Project Location

A. Project is located in 5722 Bankfield Avenue, Culver City, CA 90230.

B. Project site conditions are as follows:

Ground Elevation: 24' MSL ±
Typical Temperature Range: 31°F - 105°F

1.3 Reference Standards

A. Where items of Work are not fully specified in this document, refer to the following Reference Standards in order of precedence shown.

1. Federal, State, and local regulations and permit requirements,

2. These Contract Documents,

3. Owner's published Design Criteria, Standard Drawings, and Standard Specifications

4. Published Design Criteria and Standard Drawings of public and private agencies having jurisdiction over portions of work within their service area. These include:

    a. County Public Works Standards
        i. County of Los Angeles Department of Public Works Standard Plans and Specifications (Graybook)
    b. City Standards
        i. Culver City Standard Drawings and Standard Specifications

5. Standard Specifications for Public Works Construction “Greenbook,”

B. The most recent editions and supplements to these documents adopted as of date of advertisement for bid shall govern Work covered by these Contract Documents except as expressly modified herein.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Work Sequence

A. General sequence of Work shall be as follows:

Preparation

1. Before beginning Work, coordinate with servicing electrical utility regarding electric service to site. Obtain required permits, licenses and construction easements. Call **Underground Service Alert** and utilities to obtain staking and marking of buried utilities. Submit proposed schedule of Work, insurance and bonds. Pothole as needed to supplement staking and marking. Take preconstruction photographs.

2. Verify utility locations, field dimensions, pipe types and voltage and phase of on-site electrical services. If discrepancies or conflicts are found, bring these to attention of Owner’s Representative.

3. Submit shop drawings and other submittals.

4. Begin manufacturing and shipping materials and equipment after receiving approved submittals.

5. Complete construction of wet well and 12-inch gravity sewer pipeline, 15-inch gravity sewer pipeline, and 48-inch manholes.

    a. Prepare and submit a detailed sequence of work for the wet well construction and gravity sewer pipeline and manholes. This will include a schedule of work items that details daily work progress.

    b. Submit shop drawings of the wet well and all related dewatering temporary piping and pump with alignment of dewatering pipes and any traffic control requirements for the dewatering improvements. Contractor will be responsible to obtain and maintain any permits required by local codes to dewater and all temporary improvements to protect the public R/W while dewatering operation including flood control measures to prevent erosion during dewater operation.

    c. All approved submittals, manufactured materials, pipe and equipment to complete construction of the wet well and gravity sewer pipeline and manholes shall be onsite and inspected 3 days prior to commencement of any work for the wet well and gravity sewer pipeline and manholes no exceptions.

d. A detailed sequence of work for the construction of the wet well and gravity sewer pipeline and manholes by the contractor shall be submitted a minimum of 2 weeks prior to starting any work on wet well or gravity sewer pipeline and manholes. The work sequence shall be approved by the engineer before commencing with any work of the wet well and gravity sewer pipeline and manholes.

6. Construct building footing, block building and roof. Install electrical conduits & wires, control panels, VDF/MCC, fans.

7. Construct vaults and install piping, valves and appurtenances.

8. Construct above-ground piping, valves and buried bypass according to proposed Work schedule.

9. Perform pressure testing.

10. Construct remaining building, roof, lovers, fans, doors, and related appurtenances.

11. Perform System Supplier pretest, calibrations, preliminary station testing. Connect and activate SCADA. Schedule pretest, calibrations and preliminary testing with the City's on-site representative a minimum of 5 days prior to the proposed start of work. Provide a written summary of all pretesting, instrument calibrations, and preliminary testing a minimum of 5 days prior to the scheduled work.

12. Demonstrate satisfactory installation and operation of installed work, including performing vendor and system functionality tests. A written test summary with a narrative description of station operation, summary of the test procedure and sequence of testing shall be submitted at least 2 weeks prior to scheduling the final station testing and shall be approved prior to commencing the final testing – no exceptions.

13. Construct all civil and site work and site cleanup.

Closeout

14. Provide operator training, including O&M manuals that contain engineering cut-sheets on all equipment.

15. Provide record drawings.

16. Clean up and restore construction areas.

17. Provide warranty as specified.

3.2 Normal Working Hours

A. Normal working hours shall be as shown in Special Provisions Section 6-7.

B. Exceptions to this Work schedule shall be only as accepted in writing by Owner.

C. No work shall be done outside of normal work hours and work days, except where necessary for proper care and protection of Work already performed, or except in case of emergency, and in any case only with written notice to Owner's Representative.

D. Night work may be established as regular procedure by Contractor if they first obtain written acceptance from Owner. Such notice may be revoked at any time by Owner if Contractor fails to maintain adequate nighttime force and equipment for reasonable prosecution and to justify inspection of Work.

3.3 Cooperation with Other Contractors

A. Owner may have additional work performed in this area by other Contractors. Contract requires cooperation with those contractors in the area. Any difference or conflict which may arise between Contractor and other contractors shall be adjusted and determined by Owner. Contractor shall conduct their operations as to minimize interference with work being done by other contractors. Contractor shall, at their sole expense, make good, promptly, any injury or damage to other contractors' work caused at their hands.

3.4 Contractor Use of Premises

A. The following facilities shall remain operational during construction of this project:

1. Do not shut off pipelines or power, or take action which might adversely affect Owner's use or operation of his facilities or premises without prior written authorization from Owner.

2. Install approved signs, barricades and lights necessary to ensure public safety and safety of Owners operators and personnel. Provide steel plates across ditches to enable safe access of Owner's personnel to facilities.

B. Contractor shall restrict their area of operations to avoid damage of trees and shrubs and shall not remove trees unless specifically directed by Owner. Contractor shall legally dispose of all material removed.

C. If burning is anticipated, Contractor shall obtain all necessary permits and shall give ample and proper notice to local fire warden.

D. Fences, walls, shrubs, sprinkler systems, substructures or other improvements removed or disturbed by Contractor during construction shall promptly be replaced and/or repaired at Contractor's sole expense to Owner's satisfaction.

3.5 Responsibility for Job Site Conditions

A. Contractor agrees they shall assume sole and complete responsibility for job site conditions during course of construction of Work, including safety and health of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that Contractor shall defend, indemnify and hold Owner and design consultant harmless from any and all liability except that arising from the sole negligence of Owner or design consultant.

END OF SECTION

SECTION 01 04 00
COORDINATION

PART 1 - GENERAL

1.1 Work Included

A. Licenses, permits, sales taxes, coordination with Owner, Federal, State and Local authorities, utilities, neighboring property owners, special events, design engineer, and other contractors.

1.2 Related Work

A. Section 01 31 19: Project Meetings
B. Section 01 50 00: Temporary Facilities and Controls
C. Section 31 05 50: Protecting Existing Utilities

1.3 Permits

A. Obtain, pay for, and comply with required permits, licenses, work permits and authorizations from appropriate agencies, including:

1. Licenses

   a. Before submitting bids, Contractors shall be licensed in accordance with provisions of Chapter 9, Division 3, of Business and Professions Code of State of California.

2. State and Federal permits

   Contractor shall obtain the following permits:

   a. Excavation and Dirt Moving Permit from Cal OSHA

   b. Safety Permit from California Division of Industrial Safety

3. Local permits

   Contractor shall execute Special Inspection Agreement with City's Building Safety Division, prior to commencing construction.

   Contractor shall obtain:

   a. Encroachment Permit from City of Culver City.

B. Obtain permits before starting construction.

1.4 Coordination with Owner

A. Notify Owner at least 72 hours before start of construction.

B. Submit written details and reasons for proposed deviations from Contract Documents. Do not deviate from Contract Documents until written authorization is received.

C. If Contractor fails to comply with a request of Owner, or is unable to comply with a request, and it is necessary for Owner's forces to do Work that is Contractor's responsibility, Owner will bill Contractor. Each incident requiring work by Owner's forces will be covered by a separate billing.

D. Notify Sewer Operations in writing at least 72 hours before shutdown of sewer or drainage facilities. Do not shut down utilities without prior written authorization or presence of Operations Staff.

1.5 Coordination with Golden State Water Company

A. Contractor shall provide minimum 5 working days of advance notice to Golden State Water Company prior to performing the pipeline tie-in work and shall coordinate its construction activities with Golden State Water Company staff. Do not assume water can be shut down. Do not shut down utilities without prior written authorization or presence of Golden State Water Company Staff.

B. Coordinate draining and filling of water lines, and operation of existing valves with Water Operations.

C. Coordinate with Water Operations regarding time of day system tie-ins are made.

1.6 Requests for Information (RFI's)

A. Immediately upon discovery of need for additional information or interpretation of Contract Documents, Contractor shall prepare and submit an RFI in format specified.

1. Owner's Representative will only respond to RFI's submitted by Contractor. RFI's submitted by other entities will be returned with no response.

B. Coordinate and submit RFIs in prompt manner to avoid delays in Contractor's Work or Work of subcontractors.

C. RFI's shall include detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Engineer of Record
6. Name of Owner's Representative.
7. RFI number, numbered sequentially.
8. RFI subject.
9. Specification Section number and title and related paragraphs, as appropriate.
10. Drawing number and detail references, as appropriate.

11. Field dimensions and conditions, as appropriate.

12. Contractor's suggested resolution. If Contractor's suggested resolution impacts Contract Time or Contract Sum, Contractor shall state impact in RFI.

13. Contractor's signature.

14. Attachments, including sketches, descriptions, measurements, photos, catalog data, shop drawings, coordination drawings, and other information necessary to fully describe items needing interpretation. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

D. RFI Forms shall be software-generated forms with content shown above, acceptable to Owner's Representative.

E. Attachments shall be electronic files in Adobe Acrobat PDF format.

F. Owner's Representative will review each RFI, determine action required, and respond. Allow 14 working days for Owner's response for each RFI. RFIs received by Owner's Representative after 1:00 p.m. will be considered as received the following working day.

G. The following Contractor-generated RFIs will be returned without action:

1. Requests for acceptance of submittals.

2. Requests for acceptance of substitutions where no monetary rebate is included.

3. Requests for acceptance of Contractor's means and methods.

4. Requests for coordination information already indicated in Contract Documents.

5. Requests for adjustments in Contract Time or Contract Sum.

6. Requests for interpretation of actions of Owner's Representative on submittals.

7. Incomplete RFIs or inaccurately prepared RFIs.

H. Owner's Representative's action may include request for additional information, in which case Owner's Representative's time for response will date from time of receipt of additional information.

I. Owner's Representative's action on RFIs that may result in changes to Contract Time or Contract Sum may be eligible for Contractor to submit Change Order requests.

J. If Contractor believes RFI response warrants change in Contract Time or Contract Sum, notify Owner's Representative in writing within 10 days of receipt of RFI response.

K. Prepare, maintain, and submit tabular log of RFIs organized by RFI number. Submit log weekly. Include the following:

1. Project name.

2. Name and address of Contractor.

3. Name and address of Owner's Representative.

4. RFI number including RFIs returned without action or withdrawn.

5. RFI description.

6. Date RFI was submitted.

7. Date Owner's Representative's response was received.

L. On receipt of Owner's Representative's action, update RFI log and immediately distribute RFI response to affected parties. Review response and notify Owner's Representative within 7 days if Contractor disagrees with response.

1.7 Coordination with City of Culver City

A. Contact City of Culver City Engineering Division of Public Works Department 72 hours before start of construction at the following location:

CITY OF CULVER CITY
Public Works Department
9770 Culver Blvd
Culver City, CA 90232

310/253-5602

Mate Gaspar (Engineering Services Manager)

B. Do not begin Work until Contractor's schedule, traffic control plans, haul routes, and permits have been reviewed and approved by City.

1.8 Coordination with City, County or State Traffic Engineer

A. Coordinate with City, County or State Traffic Engineer as required, to perform all portions of Work.

1.9 Coordination with Property Owners

A. Coordinate construction with property owners neighboring project limits.

1.10 Coordination with Utilities

A. Obtain service requirements from public utilities for water, sewer, gas, power, telephone, telemetering and other utility requirements. Work needed to connect to public utilities shall comply with utility service requirements. Pay service charges of utilities, including charges for trenching, piping, conduit, cables, boxes, metering, grounding and backfill.

B. Protect existing underground utilities.

C. Electrical utility companies may maintain energized aerial electrical power lines in immediate vicinity of Work. Do not consider these lines to be insulated. Construction personnel working near these lines are exposed to extreme hazard from electrical shock. Contractors, their employees, and construction personnel working on this project must be warned of danger and instructed to take adequate protective measures, including maintaining at least 10 feet clearance between lines and construction equipment and personnel. (See OSHA Std. 1926.550(A)15). As additional safety precaution, call electrical utility company to arrange, if possible, to have these lines de-energized or relocated when Work reaches their immediate vicinity. Cost of such temporary arrangements shall be borne by Contractor.

1.11 Coordination with Engineer

A. Bid phase and construction phase engineering/construction firm(s) have not been selected. Contractor will coordinate all engineer type questions with the City and/or engineering/construction firm.

B. Engineering firm responsible for preparation of Plans and Specifications is:

Psomas
3 Hutton Centre Drive, Suite 200
Santa Ana, CA 92707
(714 751-7373
(714) 545-8883 (FAX)

Contact: Harvey Gobas

1.12 Lines of Communication

A. Lines of communication between Contractor, Owner, and other parties shall be defined at Preconstruction Conference. Contractor shall adhere to direction regarding this matter given to them at that time.

1.13 Submittals

A. Supplementary progress schedules shall be submitted after Work is in progress, when requested by Owner's Representative. Schedule changes requiring increase in Owner's, Servicing Utility's or City's Engineering personnel on project shall not be put into effect until Owner, Servicing Utility, or City has made arrangements for additional personnel.

1.14 Unit Prices

A. Payment for obtaining and complying with permits during construction, including NPDES permits, building permits, encroachment permits, excavation permits, drilling permits, disposal permits, temporary easements, licenses, inspection fees, and Federal, State and local taxes will be included in prices bid for Work for which such costs are appurtenant.

B. Payment for coordinating with agencies, events and persons described will be included in prices bid for Work to which coordination is appurtenant.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 01 21 00
ALLOWANCES

PART 1 - GENERAL

1.1 Work Included

A. This section includes administrative and procedural requirements governing allowances.

B. Certain materials, equipment and fees are specified in Contract Documents by allowances. Allowances have been established in the following cases:

1. To reimburse Contractor for out of pocket expenses for utility fees and permit fees in cases where any single incidental fee exceeds $1,000.

2. Where Owner has elected to defer selection of precise materials and equipment to a later date when additional information is available for evaluation.

3. As a contingency allowance where unknown utilities are encountered, necessitating unexpected Extra Work or where other Extra Work not required by Contract Documents is required by Owner at their discretion.

C. If necessary, additional requirements will be issued by Change Order.

1.2 Related Work

A. Section 01 22 00: Unit Prices

B. Section 01 33 00: Submittal Procedures

1.3 References

A. Standard Specifications for Public Works Construction Section 3-3 Extra Work

1.4 Allowance for Out-of-Pocket Expenses for Utility Fees and Permits

A. Allowances for out-of-pocket expenses paid to utilities for utility fees, or to agencies for permits, where said fees are uncertain at time of bid shall be used to reimburse Contractor for out-of-pocket expenses in question as described in Section 01 22 00.

1.5 Allowance for Cabinetry, Desk, and Shelving

A. Allowances for cabinetry, desk, and shelving shall be used to reimburse Contractor for:

1. Materials costs for cabinetry, desk, and shelving based on Manufacturer's suggested retail list prices FOB jobsite plus applicable taxes for these items.

B. Items of Work for which materials are to be reimbursed under this allowance are listed in Section 01 22 00.

C. Only material costs will be reimbursed under this allowance. Contractor's labor, tools, equipment, overhead, profit, and other related costs for products and equipment ordered by Owner under this particular allowance (up to the maximum allowance amount) shall be considered a part of the Contract Sum. Contractor shall include compensation for costs other than material costs in the price bid for the building to which improvements are attached.

1.6 Contingency Allowance (Field Orders)

A. Contingency allowance shall be used to cover items of work unanticipated at time of bid and shall be made under Contract provisions for Extra Work.

B. In the event an unknown underground obstruction not shown on the Plans is encountered, payment for necessary additional work shall be paid for under this stipulated bid item allowance.

C. Use contingency allowance only as directed by Owner's Representative for Owner's purposes, and only following receipt of Change Orders indicating amounts to be charged against allowance.

D. Contractor's costs of labor, tools, equipment, overhead, profit, and other related costs for products and equipment ordered by Owner under contingency allowance (field orders) are not part of the Contract Sum and shall be paid for as Extra Work.

1.7 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Documentation of Expenses	For utility expense, or permit fee submit copy of cancelled check made out to appropriate utility or permitting authority.
	For interior finishes and improvements, submit documentation of Manufacturer's invoice price information and quantities ordered.
	For contingency allowance, submit documentation of costs as described under Contract provisions for Extra Work.

1.8 Unit Prices

A. Payment for work under allowances shall be as specified in Section 01 22 00.

PART 2 – PRODUCTS

(not used)

PART 3 - EXECUTION

3.1 Preparation

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure each allowance item is completely integrated and interfaced with related Work.

3.2 Contract Closeout

A. At contact closeout, all unused allowance amounts remaining shall be credited to Owner by Change Order.

END OF SECTION

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SECTION 01 22 00
UNIT PRICES

PART 1 - GENERAL

1.1 Description

A. Measurement and payment for Bid Items listed in proposal shall be based upon use of lump sum or unit price method. Extra Work or changes in Work shall be accomplished as provided in Special Provisions.

1.2 Payment

A. Payment for Unit Price Items

Payment for unit price Bid Items shall be based upon amount shown in bid schedule multiplied by total quantity measurement of item, and shall be full compensation for furnishing all supervision, planning, design, design engineering fees, labor, transportation, materials, equipment, tools, and appurtenances required for construction of item complete in place in accordance with Plans and Specifications.

B. Payment for Lump Sum Items

Payment for lump sum Bid Items shall be based upon amount shown in bid schedule and shall be full compensation for furnishing all supervision, planning, design, design engineering fees, labor, transportation, materials, equipment, tools and appurtenances required for construction of unit of Work complete in place in accordance with Plans and Specifications.

C. Work Not Listed in Bid Schedule

Costs for related Work and appurtenances which are required and/or implied by General Provisions, Technical Specifications, Special Provisions, and Plans and are not listed as separate Bid Item but are necessary to complete project shall be included in appropriate Bid Item or items within proposal.

PART 2 - MATERIALS

2.1 General (Measurement)

A. Measurement for unit price quantities shall be based upon appropriate Bid Item in proposal. Actual quantity of measurement shall be as constructed by Contractor in place in conformance with Plans and Specifications.

2.2 Linear Measurements

A. Pressure pipe, fencing, curbs, gutters, and other horizontal Work shall be measured in horizontal plane along centerline of Work, through tees, bends, valves, fittings, fence gates, and driveways, within limits of Work shown in Contract Documents.

B. Gravity sewers laid to slopes of 0.1000 or less shall be measured in horizontal plane along centerline of Work between ends as laid. Vertical pipe and pipe laid to on slopes equal to or exceeding 0.1000 shall be measured along longitudinal access between ends as laid. Linear measurement for gravity sewers and storm drains shall not include inside dimensions of manholes or structures.

C. Manholes and vaults shall be measured vertically from lowest floor or sump elevation to highest rim elevation.

2.3 Area Measurements

A. Measurement for Bid Items involving area units shall be based on horizontal-plane or vertical-plane surface areas measured in units shown in bid schedule.

B. In event of dispute, areas will be computed based on theoretical areas obtained from digital models, Autocad or Cogo prepared using best field surveys and record drawings available.

C. For convenience, Owner may use “approximate areas” for payment based on one of the following procedures:

1. Planimeter measurements using record drawings.

2. Accepted mathematical formulas for circle or polygon areas.

D. Measurements of paving or flatwork areas shall measure area enclosed by exterior perimeter of measured surface. Areas of vaults, pads, manhole covers, valve box covers, drainage features, hatches, pipe penetrations, bollards, and vents shall be included within area measured for payment when surrounded by measured surface on 3 or more sides or at least 270° of arc measured from centers of circles.

E. Measurements of wall, floor, and roof areas shall measure area enclosed by exterior perimeter of measured surface. Areas of doors, gates, windows, pipe penetrations, and shall be included within area being measured for payment when surrounded by measured surface on 3 or more sides or at least 270° of arc measured from centers of circles.

F. In absence of Owner-prepared survey and digital model, Contractor may, at their expense, retain licensed surveyor to prepare surveys and sealed calculations of theoretical areas obtained from digital models. In such case, Contractor’s surveyor’s computed volumes shall govern over any “approximate areas” but shall not supersede similar surveys and digital models prepared at Owner’s expense by licensed surveyor.

2.4 Contractor-Furnished Surveys

A. No payment will be made to Contractor for Contractor-furnished surveys other than such additional payment Contractor may be entitled to due to corrected payment quantities based on Contractor-furnished surveys.

2.5 Unit Measurements

A. Measurement for Bid Items involving units of item shall be based upon quantity of units counted as indicated in Bid Item.

2.6 Lump Sum Measurement

A. Measurement for lump sum Bid Items shall be considered as a complete project or portion of project constituting a unit. Items to be included in lump sum Bid Items shall be as specified in proposal Bid Item and/or Standard or Special Provisions.

2.7 Payment for Testing

A. Party responsible for payment for testing is identified in individual sections of Contract Documents under tests required. Where specifications are silent regarding responsible party paying for tests, costs of first tests will be paid by Owner.

B. If testing or inspection indicates failure of material or procedure to meet Contract Document requirements, Owner will back-charge Contractor for retesting and reinspection costs incurred by testing or inspection agency of Owner's choice.

C. Additional tests and inspections not specified herein but requested by Owner will be paid for by Owner, unless result of such tests and inspections are found to not comply with Contract Documents, in which case Owner will pay all costs for initial testing as well as retesting and reinspection and back-charge Contractor for retesting and reinspection.

D. Costs for additional tests or inspections required because of change in materials being provided or change of source or supply shall be paid by Contractor direct to testing laboratory.

E. Cost of testing which is required solely for convenience of Contractor in his scheduling and performance of Work shall be borne by Contractor.

F. Contractor shall pay all costs for correcting deficiencies.

2.8 Changes in Quantities Initiated by Owner

A. Owner may change Contract Documents or character and quantity of work provided total arithmetic dollar value of all changes, both additive and deductive, does not exceed 25% of Contract Price. Changes in allowance Bid items with stipulated prices will not be considered to contribute toward this total.

B. Should it become necessary to exceed this limitation, change shall be documented by written Supplemental Agreement between Contractor and Owner unless both parties agree to proceed under Change Order.

C. Changes ordered in Work items which do not substantially change character of Work from that shown in Contract Documents, will be accompanied by proportional adjustment in payment to reflect quantity changes using unit prices bid, provided Bid quantity does not change by more than 25%.

D. Where Bid quantities under any Bid item are limited to 2 or 3 integral units (*e.g.,* 2 valves) the 25% figure above shall be revised upward (to 50% or 34% respectively) to permit addition or deletion one integral unit without changing Bid price.

E. Payment for quantities in excess of 125% of quantities (or appropriate percentage for 2- or 3-unit Bid items) will be made at mutually agreed rate lower than Bid amount since Contractor's fixed costs shall be deemed to have been recovered through payment for Bid quantity at Contract unit price.

F. Payment for quantities less than 75% (or appropriate percentage for 2- or 3-unit Bid items) will only be adjusted by mutual agreement if Contractor requests so in writing. In no case will payment be less than Contractor is entitled to under original Bid prices nor more than payment due for 75% (or appropriate percentage for 2- or 3-unit Bid items) of Bid quantity at Contract Unit Price.

G. If mutual agreement cannot be reached, Owner may direct Contractor to proceed on basis of Extra Work as covered in General Provisions.

H. Should any Bid item be eliminated in its entirety, payment will be made to Contractor for actual out-of-pocket costs incurred in connection with eliminated item prior to written notification from Owner of deletion of Bid item. Where applicable, Contractor will also be reimbursed for out-of-pocket shipping costs and Manufacturer's restocking fees.

I. If materials have been ordered prior to date of written notification of deletion of Bid item and order cannot be cancelled, Contractor will be paid for actual cost of ordered item and ordered material shall become Owner's property.

J. In no case shall expenses such as bonding costs expressly covered under other Bid items be double-charged to Owner.

2.9 Reduction in Payment for Deficient Concrete Work

A. Payment for concrete failing to meet compressive strength requirements specified, but accepted at Owner's discretion, shall be reduced as follows.

B. If additional test cylinders are available, Contractor may furnish cylinders to Owner up to 42 days after placement to allow concrete to obtain additional strength which will be credited as 28-day compressive strength for payment purposes.

C. Owner may at their sole discretion accept other standard test methods proposed by Contractor to verify concrete strength.

D. If tests verify compressive strength exceeds specified 28-day compressive strength after 42 days, no penalty will be deducted.

E. If compressive strength equals or exceeds 95% of specified strength but is less than 100% of specified strength, $10 per cubic yard of concrete will be deducted.

F. If compressive strength equals or exceeds 85% of specified strength, but is less than 95% of specified strength, $15 per cubic yard of concrete will be deducted.

G. If compressive strength is below 85% of specified strength, Contractor shall remove concrete and replace at no expense to Owner.

2.10 Reduction in Payment for Deficient Water Pipelines

A. Payment for water pipelines failing to meet pressure test requirements, but accepted at Owner's discretion, shall be reduced by amount equal to Owner's current wholesale cost of water times excess leakage per hour at test pressure times 240,000 hours.

2.11 Reduction in Payment for Deficient Pump Efficiencies

A. Payment for any pump failing to meet efficiencies specified, but accepted at Owner's discretion, shall be reduced by amount equal to Owner's expected marginal power cost increase due to substandard efficiencies over 50,000 hours operation computed as follows:

1. 10,000 hours will be assumed to occur computed at point A. Substandard efficiencies at Point A will be assessed where test efficiency falls more than 3% below specified efficiency based on the difference between test efficiency and the reduced-by-3% threshold efficiency.

2. 30,000 hours will be assumed to occur computed at point B, the pump guarantee point. Substandard efficiencies at Point B shall be assessed where test efficiency falls below specified efficiency based on the difference between test efficiency and specified efficiency.

3. 10,000 hours will be assumed to occur computed at point C. Substandard efficiencies at Point A will be assessed where test efficiency falls more than 3% below specified efficiency based on the difference between test efficiency and the reduced-by-3% threshold efficiency.

4. Marginal cost of power will be estimated at $0.14 per kilowatt hour.

5. No credit will be given where pump points exceed specified or threshold efficiencies.

6. No credit will be given for other pumps which may exceed specified efficiencies.

PART 3 - EXECUTION

3.01 Scope

A. This section defines Bid Items listed in Bid schedule and describes measurement and payment provisions for each item.

3.02 Bid Item 1 – Mobilization, Demobilization & Cleanup

A. Amount bid for Mobilization/Demobilization shall not exceed 5.0% of Contractor's Bid total. Any amount bid in excess of stipulated 5.0% cap will not be paid until project completion.

B. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 1, which price shall constitute full compensation for all Work and expenditures required to mobilize, provide bonds and insurance, take preconstruction photos and videos, prepare project schedule, provide project sign, construct temporary bypass facilities, construct temporary traffic control facilities, perform required surveys, testing, site maintenance and cleanup, remove and reinstall existing site facilities as required, comply with all General and Supplementary conditions, demobilize, provide record drawings, operation and maintenance manuals, and provide cleanup of construction site complete in place, as required by Contract Documents with sole exclusion of payments to be made as defined herein for other items in Bid Schedule.

C. Work to be paid for under this item shall also include protecting existing survey monuments in place and, if Contractor's operations disturb any such monuments, hiring registered land surveyor to reestablish and reset disturbed monuments.

D. Upon completion of mobilization, 50% of amount bid for this item (or 50% of stipulated 5.0% cap, whichever is less, will be paid to Contractor. Remainder will be paid as part of final contract payment upon project completion.

3.03 Bid Item 2 – Excavation Safety Measures, Including Dewatering

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 2.

B. Work to be paid for under this item shall include the preparation and execution of the Water Control Plan for dewatering, constructing, removing and disposing of all temporary sheeting, shoring and bracing or equivalent method for protection of life and limb of workers in trenching or open excavations in accordance with requirements of:

1. Cal-OSHA Construction Safety Orders of State of California pursuant to provisions of Section 6707 of California Labor Code, and

2. Standards of Regional Water Quality Control Board regarding disposal of water and regarding protection of soils from arsenic and other pollutants which may be present in sheeting, shoring and bracing materials.

3. Standards of applicable public agencies regarding abandonment or removal of shoring products placed within their right-of-way.

C. This Work includes all excavation safety measures required to safely construct the Work.

3.04 Bid Item 3 – Traffic Control

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 3.

B. Work to be paid for under this item shall include all labor, materials and equipment for traffic control including preparation of traffic control plans, and installation and removal of barriers, temporary delineators, enclosures, and traffic control devices as required by Contract Documents and public agency permits.

3.05 Bid Items 4 – Survey Staking and Verification of Utility Locations, Field Dimensions, and Existing Electrical Work

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 4.

B. Work to be paid for under this item shall include all survey staking and verification of utility depths, locations, and field dimensions prior to ordering materials and equipment including potholing, field surveys, measurements, and electrical inspections as needed to ascertain materials and equipment ordered can be properly and legally installed within verified field conditions. Work to be paid for under this Bid Item shall include notifying Owner's Representative of any found discrepancies between conditions shown on Plans and field conditions, and appurtenant Work as required by Contract Documents.

C. Lump sum price bid for this item shall include potholing all utilities shown on plans plus one additional pothole for every 1000' or fraction thereof of pipeline or utility trench. If this number of potholes is exceeded, Contractor will be entitled to fair compensation for any additional potholing of utilities:

1. Which are not shown on plans at time of Bid and are subsequently identified in field by Underground Service Alert, surface features or walking alignment with reliable electronic pipe finder, or;

2. Which are not shown on plans in their proper location such that multiple potholes are necessary to find them.

D. Before ordering manufacture of equipment or structures described in submittals, Contractor shall verify the following under this pay item:

1. That submitted item(s) can be delivered to point of installation and will fit through applicable doors, hatches, gates and/or openings both during construction and following completion of construction.

2. That flanges or ends of pumps, valves, and piping equipment are of compatible sizes, offsets, configurations and pressure classes to mate with adjacent piping.

3. That power requirements, including voltage, phase and full-load amperage of electrical equipment and motors are consistent with power available on site.

E. If discrepancies are discovered between field conditions and dimensions shown on submittals and Contract Documents, Owner's Representative will work with Contractor to prepare such modifications to Contract Documents as required to address issues brought up.

F. If discrepancies are discovered between field conditions and dimensions shown on submittals and Contract Documents, but said discrepancies are not brought to attention of Owner's Representative by Contractor in clear and timely manner, Owner's liability shall be limited to difference in cost between Work shown in Contract Documents and Work that would be necessary had Contractor notified Owner of said discrepancy at time submittals were delivered.

3.06 Bid Item 5 – Startup and Testing

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 5.

B. Work to be paid for under this item shall include all labor, materials and equipment for start-up, testing, troubleshooting, calibration, system demonstration and presenting Work to Owner in satisfactory working condition and in accordance with warranty requirements as required by Contract Documents.

3.07 Bid Item 6 – Record Documents, O&M Manuals and Warranties

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 6.

B. Work to be paid for under this item shall include all labor, materials and equipment for operation and maintenance manuals, record drawings and warranties including but not

limited to cost of document assembly, binders, reproduction, and all appurtenant Work as required by Contract Documents.

C. Payment for operation and maintenance manuals shall be made as follows:

- 30% of lump sum Bid price will be paid after Contractor submits O&M manuals and record drawings for initial review by Owner's Representative.

- 70% of lump sum Bid price will be paid after Contractor submits final O&M manuals and record drawings incorporating or responding to comments of Owner's Representative and successfully demonstrates system operation.

3.08 Bid Item 7 – Spare Parts and Training

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 7.

B. Work to be paid for under this item shall include all labor, materials and equipment for spare parts and training listed in applicable sections of Contract Documents.

C. Payment for spare parts and training shall not be made until all specified spare parts have been delivered to Owner and training has been completed.

3.09 Bid Item 8 – Clearing and Grubbing, Site Demolition and Soil Preparation

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 8.

B. Work to be paid for under this item shall include furnishing all labor, materials, and equipment for site demolition, and soil preparation including removal of existing fencing, asphalt, trees, and landscaping where shown, localized pavement or concrete flatwork saw-cutting, removal and replacement where shown, abandoning utilities in place including disconnection from existing work and backfilling existing pipe with 2 sack cement slurry, scarifying, and sterilizing existing soil beneath concrete pads and asphalt paving, preparation and compaction of subgrade beneath new improvements in accordance with geotechnical report requirements, disposal of excess excavated material; tree cutting, disposal, root grubbing and grinding, backfill of root holes, and any appurtenant Work as required by Contract Documents.

3.10 Bid Item 9 – Site Demolition

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 9.

B. Work to be paid for under this item shall include all labor, materials and equipment for civil, mechanical and electrical demolition including removal of existing concrete, pavement, fence, monitoring wells, site or electrical items shown, salvage of materials noted, and any appurtenant Work as required by Contract Documents.

3.11 Bid Item 10 – Building Demolition

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 10.

B. Work to be paid for under this item shall include all labor, materials and equipment for building demolition including testing for hazardous materials before demolition, removal of existing concrete, masonry, steel, metal, wood, or plastic structural, mechanical or electrical items, removal and legal disposal of asbestos or other hazardous materials, salvage of materials noted, and any appurtenant Work as required by Contract Documents.

3.12 Bid Item 11 – Grading and Structural Excavation

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 11.

B. Work to be paid for under this item shall include all labor, materials and equipment for grading and structural excavation, and compliance with BMP Implementation and Erosion Control/LSWPPP requirements of local Regional Water Quality Control Board including excavation, ripping, blasting, stockpiling, haul off and disposal of excavated material, placement of suitable fill, backfill, compaction, preparation and compaction of subgrade beneath new improvements in accordance with geotechnical report requirements, scarifying and sterilizing existing soil where shown; establishment of erosion control plan and reporting procedures, placement of erosion control measures, monitoring, reporting, payment of fines due to Contractor's negligence, and any appurtenant Work as required by Contract Documents.

3.13 Bid Item 12 – Paving and Flatwork

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 12.

B. Work to be paid for under this item shall include all concrete paving and pads, concrete flatwork for site and parking spaces, including excavation, subgrade preparation and compaction, bender boards, subdrainage, subbase, base, concrete formwork, concrete reinforcement, curing, concrete slabs, sidewalks, driveway, concrete curb, gutters, ribbon drains, car stops, paving, ramps, landings, flatwork, valve rings, slurry seal, striping, expansion joints of size, type and class shown, and all appurtenant Work in accordance with Contract Documents.

3.14 Bid Item 13 – Pump Station

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 13.

B. This bid item is intended to encompass all labor, materials, and equipment needed to construct on-site wastewater conveyance structures, pipeline and appurtenances and site improvements within the perimeter wall unless covered in a separate bid item.

C. Work to be paid for under this item shall include all labor, materials, and equipment needed to construct reinforced concrete wet well, cast-in-place concrete valve vault, pre-cast concrete meter vault, cast-in-place by-pass vault, reinforced unit masonry building, onsite DIP force mains, and emergency pump back up system where shown and to dimensions shown including, but not limited to, steel reinforcing, vault bottom, compaction, falsework, formwork, concrete, anchors, embedments, special inspection, removal of forms, curing, testing, section and cover, traffic-rated hatched access lid, air vents, ladder with fall prevention system, seep rings, wall penetrations, disposal of excess excavated material, sheeting; reinforced unit masonry building where shown and to dimensions shown including, but not limited to, concrete foundation, concrete flooring, masonry block walls, roof framing, roofing, doors, louvers, vents, gutter and downspouts, finishes; plumbing system for building

and site Work including tie-in to existing water service, backflow prevention, floor drains, vents, toilet, lavatory, appurtenances, fittings, piping, and couplings, warning and detection tape, locating wire, identification labels; pump base where shown including formwork, steel reinforcing, anchors, embedded bolts for discharge head, concrete, special inspection, removal of forms, curing, finishing; wet pit submersible Sewage pumps and attached 50-hp motor, hidrostal prerostal basin, concrete encasement, pump and motor assembly, controls, piping, fittings, supports, seals, lifting assembly, cable; ductile iron pipe of size, class and type shown, trench excavation, bedding, pipe, fittings, spools, joints, couplings, bolts, nuts, flanges, gaskets, hangers, supports, brackets, saddles, outlets, backfill, surface restoration, warning and detection tape, identification labels; plug valves and check valves of size type and class shown, including valve, actuator, valve supports, gaskets and fasteners, and hand wheel, limit switches; magnetic flow meter of size shown including meter, spools, couplings, supports, signal cable, and control conduit to electrical building, tie-in with Owner's SCADA system; combination air and vacuum relief valves of size, type and class shown including connection to pipe, isolation valve, riser, couplings, fittings, air and vacuum relief valve, gaskets, fasteners, and fittings; 6" concrete-filled Schedule 80 steel removable bollards with cap, hardware for removal and replacement, painting, backfill; irrigation system including trenching, pipe, fittings, tubing, valves, emitters, sprinklers, controllers; landscaping including excavation, soil preparation, mulching, planting, ground cover, bender board, maintenance and one-year warranty of all plant materials; electrical and lighting system per NEC requirements as required to drive motors, loads, working VFD motor control center complete, automatic transfer switch as required to transfer from servicing electrical utility to standby power, and equipment shown including incidental servicing utility fees less than $1,000, variable frequency drives, soft start bypasses, contactors, electrical equipment pads, conduit, fittings connections, wiring, grounding, overcurrent protection, motor control center, starters, enclosures, panels, disconnects, meter, bus, connections, transfer switch, pigtail connection, utility outlets, lighting, testing, troubleshooting, and cleanup; yard conduit including excavation, conduit, fittings, conduit hangers, installation, junction boxes, pull boxes, pull wires, protection of existing utilities, backfill, compaction, warning and detection tape, cleanup; new instrumentation, telemetry and controls as shown and as required to provide complete operating integrated system including pressure, level, intrusion, position and temperature instruments and switches, connections, wiring, cables, grounding, interconnection with motor control center, tie-in with Owner's SCADA system, development of an I/O schedule of each input and output signal as described in the General Operation Summary; building HVAC system including fans, wall penetrations, temperature and air controls; and all other appurtenant Work as required by Contract Documents.

3.15 Bid Item 14 – Reinforced Concrete Masonry Unit Wall

A. Measurement will be based on linear footage of masonry fence wall installed, measured in horizontal plane at centerline of wall.

B. Work to be paid for under this item shall include all labor, materials, and equipment to construct reinforced concrete masonry unit wall of height shown, including excavation, soil preparation and compaction beneath footing, reinforced concrete footing, backfill, compaction above footing, reinforced masonry block wall, mortar and grouting, disposal of excess excavated material, barbed wire, and any appurtenant Work as required by Contract Documents.

3.16 Bid Item 15 – Motorized Rolling Gates

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 14.

B. Work to be paid for under this item shall include all labor, materials, and equipment to construct motorized rolling gates of size and type shown, including fabrication and installation of gate, gate posts and supports, rollers, track, hardware, motor, key operator, locks, drive mechanism, intrusion limit switch, electrical wiring, and any appurtenant Work as required by Contract Documents.

3.17 Bid Items 16 – Chain Link Fence

A. Measurement will be based on lineal footage of chain link fence installed, measured in horizontal plane.

B. Work to be paid for under this item shall include all labor, materials and equipment to construct chain link fence of height and size shown, including, concrete post foundations, galvanized steel posts, hardware, supports, chain link, and any appurtenant Work as required by Contract Documents.

3.18 Bid Item 17 – Double-Leaf Swing Vehicle Gates

A. Measurement will be based on quantity of items furnished. Two leafs shall constitute one double leaf swing vehicle gate.

B. Work to be paid for under this item shall include all labor, materials, and equipment to construct double swing vehicle gate of size shown including fabrication and installation of gates, gate posts and supports, hardware, locks, intrusion limit switch, and any appurtenant Work as required by Contract Documents.

3.19 Bid Item 18 – PVC Force Mains

A. Measurement will be based on lineal footage of pipeline installed.

B. Work to be paid for under this item shall include all labor, materials, and equipment to construct new PVC force mains and piping of size, class and type shown from by-pass vault to Bankfield Avenue, including maintenance of sewer service during force main construction, protection of existing utilities, trench excavation, bedding, piping, fittings, spools, joints, couplings, bolts, flanges, gaskets, coatings, linings, warning and detection tape, locating wire, incidental appurtenances, backfill, compaction, surface restoration, testing, cleanup, and any appurtenant Work as required by Contract Documents.

3.20 Bid Items 19 and 20 – Vitrified Clay Pipe

A. Measurement will be based on lineal footage of pipeline installed, measured as described herein for sewer pipes at centerline of pipe.

B. Gravity sewers and storm drains laid to slopes of 0.1000 or less shall be measured in horizontal plane along centerline of Work between ends as laid. Vertical pipe and pipe laid to slopes equal to or exceeding 0.1000 shall be measured along longitudinal access between ends as laid. Linear measurement for gravity sewers and storm drains shall not include inside dimensions of manholes or structures.

C. Work to be paid for under this item shall include all labor, materials and equipment to construct new sewer pipe, including protection of existing utilities, trench excavation, bedding, pipe, fittings, spools, joints, gaskets, couplings, saddles, laterals, manhole connections, backfill, surface restoration, and any appurtenant Work as required by Contract Documents.

3.21 Bid Item 21 – Precast Concrete Manholes

A. Measurement will be based on quantity of items furnished.

B. Work to be paid for under this item shall include all labor, materials, and equipment to construct precast concrete manholes of size shown including excavation, backfill, bedding, compaction, manhole base, steel reinforcement, sections, risers, rings, adjustment rings, frame and cover, wall penetrations, ladder, pipe connections adjustment of covers to grade, and any appurtenant Work as required by Contract Documents.

3.22 Bid Item 22 – Crushed Aggregate Base (CAB) Material Required for Soil Stabilization Below Wet Well

A. Measurement shall be based cubic yards of material installed as computed from load slips delivered to Owner's Representative.

B. Work to be paid for under this item shall include all labor, materials and equipment for placement of crushed aggregate base material including earthwork, subgrade preparation and compaction, as required to stabilize the ground below the wet well excavation due to high groundwater encountered during excavation. CAB shall be maximum size of ¾" and meet the requirements set forth in Technical Specification 31 05 16 (Aggregate Rock Products for Earthwork). The CAB layer shall be compacted to minimum 95% relative compaction. A maximum total depth of two feet of CAB is anticipated. All other grading and structural excavation costs shall be included within the separate bid item entitled "Structural Grading and Excavation."

3.23 Bid Item 23 – Crushed Aggregate Base (CAB) Material Required for Soil Stabilization Below 12-Inch and 15-Inch VCP

A. Measurement shall be based cubic yards of material installed as computed from load slips delivered to Owner's Representative.

B. Work to be paid for under this item shall include all labor, materials and equipment for crushed aggregate base material including earthwork, subgrade preparation and compaction, as required to stabilize the ground below the 12-Inch and 15-Inch VCP gravity sewer pipe, due to high groundwater encountered during sewer pipe trench excavation. CAB shall be maximum size of ¾" and meet the requirements set forth in Technical Specification 31 05 16 (Aggregate Rock Products for Earthwork). The CAB layer shall be compacted to minimum 95% relative compaction. A maximum total depth of two feet of CAB is anticipated. All other trenching and related excavation costs shall be included within the separate bid items entitled "Vitrified Clay Pipe."

3.24 Bid Item 24 – Temporary Trailer and Utilities

A. No measurement will be made for this item. Payment for this item will be made at lump sum price named in Bid Schedule under Item Number 23.

B. Work to be paid for under this item shall also include furnishing, setting up, and removing Contractor's operations at project site including temporary offices, utilities, staging areas, security, etc. Work shall also include furnishing any temporary construction facilities and trailers required by Contract Documents.

3.25 Stipulated Bid Item A1 – Allowance for Reimbursement for Permit Fees

A. No measurement will be made for this item.

B. Work to be paid for under this item shall include permitting fees required by public agencies in excess of $1,000 to perform Work within public agency jurisdictions as required by public agencies and Contract Documents. No reimbursement will be made for any fees less than $1,000.

C. Stipulated allowance shown on Bid Form has been set aside to reimburse Contractor for permit fees from any agency invoiced to and paid for by Contractor where any single permit fee exceeds $1,000.

D. Notwithstanding stipulated allowance, payment will be made at exact invoice amount shown by invoice, receipt, or cancelled check received from or paid to permitting agencies, less $1,000 per agency, upon submittal by Contractor of said invoices, receipts or cancelled checks. No additional allowance for expenses, overhead, or profit will be paid under this Bid Item.

E. Contractor's costs for administration, overhead and profit for permit application, payment and compliance shall be included under lump-sum Bid Item for Mobilization-Demobilization.

3.26 Stipulated Bid Item A2 – Allowance for Reimbursement for SCE Power Service and Transformer

A. No measurement will be made for this item.

B. Work to be paid for under this item shall include servicing electrical utility fees in excess of $1,000. No reimbursement will be made for any fees less than $1,000.

C. Stipulated allowance shown on Bid Form has been set aside to reimburse Contractor for electrical utility service charges and fees for power service and transformers invoiced to and paid for by Contractor where any single fee at any single address exceeds $1,000. Payment under this item shall include full compensation for all invoices billed by servicing electrical utility to Contractor for Work by servicing electrical utility to provide power to site up to stub-up from transformer for meter.

D. Notwithstanding stipulated allowance, payment will be made at exact invoice amount shown on invoice, receipt, or cancelled check received from or paid to servicing electrical utility, less $1,000, upon submittal by Contractor of said invoices, receipts or cancelled checks. No additional allowance for expenses, overhead, or profit will be paid under this Bid Item.

E. Contractor's costs for administration, overhead and profit for working with servicing electrical utility shall be paid under lump-sum Bid Item for Mobilization-Demobilization.

3.27 Stipulated Bid Item A3 – Allowance for Cabinetry, Desk, Shelving, and Other Related Miscellaneous Items Including Tuff Shed

A. No measurement will be made for this item.

B. Stipulated lump sum price of $50,000 has been established as allowance for Owner to purchase interior finish cabinets, a desk, shelves, finishes, and miscellaneous items acceptable to Owner for specified items listed below. Reimbursement shall be at Manufacturer's invoice price FOB jobsite, including sales tax, freight and delivery. Stipulated lump sum price is set aside solely to provide an allowance for fair reimbursement to

Contractor for purchase price of certain materials whose quality, quantity, and type is best negotiated directly between Owner and Contractor with direct reimbursement to Contractor for purchase price.

C. Reimbursement for upgrades shall be difference in Manufacturer's invoice price FOB jobsite, including sales tax, freight, and delivery for upgraded versus specified item.

D. Cost of labor, tools, and equipment to install materials, and cost of Contractor's markup, overhead, and profit shall be included in other Bid Items for building construction and will not be paid out of this Bid Item allowance.

E. Owner reserves right to supply materials directly to Contractor in-lieu of paying Contractor to order from third parties.

F. In event Owner orders materials under this Bid Item allowance exceeding stipulated allowance amount, any additional Work will be paid for under allowance for Field Orders below. Items at top of list in paragraph immediately below will be paid for under this allowance until allowance has been exhausted, after which remaining items will be paid for under allowance for Extra Work (which may include labor, tools, equipment, markup, overhead and profit.)

G. The following Work is expressly **included** and will be reimbursed under this Bid Item:

1. Wood, composite, or steel finish cabinetry in electrical room and bathroom.
2. Wood, composite, or steel desk in electrical room.
3. Modular wood, composite, or steel adjustable shelves in electrical room and bathroom.
4. Fiberglass tuff shed in southeast corner of the site.

H. The following materials are **excluded** from payment under this Bid Item and shall be included in other Bid Items:

1. Building construction, including all concrete, masonry and steel Work, thermal and moisture protection, roofing, doors, hatches, and windows.
2. Painting and coating with exception of factory-applied finishes applied to cabinets, workbenches, shelving, and shop equipment.
3. Work outside main building envelope, including site Work, piping work, Work on outbuildings, and Work above roof line, below floor surfaces, or within or outside walls.
4. Work inside electrical room, electrical metering closet, equipment room and pump room.
5. Plumbing Work of any nature covered by California Plumbing Code, including hot and cold water, drain, waste, vent and compressed air piping, valves, fixtures and appurtenances.
6. Mechanical Work of any nature covered by California Mechanical Code including ducts and ventilation equipment.
7. Electrical Work of any nature covered by California Electrical Code with exception of wiring extensions required to relocate outlets from walls covered by cabinets or machinery to accessible locations.
8. Seismic anchorage.

3.28 Stipulated Bid Item A4 – Allowance for Field Orders

A. No measurement will be made for this item.

B. Stipulated allowance shown in Bid Form has been set aside as allowance for Owner to reimburse Contractor for field orders.

C. Payment for necessary construction as directed by FIELD ORDER will be made per criteria outlined in “Standard Specifications for Public Works Construction (Greenbook) Section 3-3 “Extra Work,” which price shall be constitute full compensation for this item.

D. Should an unknown underground obstruction not shown on Plans be encountered, payment for necessary additional Work shall be paid for under this stipulated Bid Item allowance.

E. Contractor’s hourly charge rate for labor, tools, and equipment shall not exceed published Caltrans rates for similar labor, tools, and equipment.

END OF SECTION

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SECTION 01 24 00
COST-REDUCTION INCENTIVE PROPOSALS

PART 1 - GENERAL

1.1 Work Included

A. This section includes submittal and administration of cost-reduction incentive proposals (CRIP's).

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 63 00: Product Substitution Procedures

1.4 Quality Assurance

A. Owner's acceptance of cost-reduction incentive proposals shall not excuse Contractor from any warranty or performance requirements other than those expressly written in proposal.

B. Cost-reduction incentive proposals shall not violate any codes or regulations.

1.5 Submittals

A. Formal cost-reduction incentive proposals may be submitted by Contractor at any time from bid opening through preconstruction meeting.

B. Proposals shall be in writing and identify:

   a. What changes are proposed to Contract Documents.
   b. Supporting submittal data for alternate materials or equipment proposed.
   c. Any extensions or reductions to warranties if proposal is accepted.
   d. If any reengineering is required and who will pay for it.
   e. Savings Contractor offers Owner if proposal is accepted.

C. If Owner believes savings offered will not cover his review costs, Owner reserves right to reject proposal without further review.

D. Cost-reduction incentive proposals will be reviewed by Owner and engineer of record. A decision will be returned within 2 weeks of submittal.

E. Owner reserves right to reject cost-reduction incentive proposals based on Owner's perceived interests, and Owner's decision shall be final.

F. Upon approval of cost-reduction incentive proposal net cost-reduction will be split between the City and the Contractor 50/50.

G. Any Contractor labor or expense involved in preparing cost-reduction incentive proposals shall be at Contractor's sole risk and no compensation will be made therefor.

H. Any Owner labor or expense involved in reviewing and evaluating cost-reduction incentive proposals will be absorbed by Owner.

1.6 Acceptance of Cost-Reduction Incentive Proposals

A. Owner will acknowledge acceptance of cost-reduction incentive proposals through a formal change order.

1.7 Unit Prices

A. Work provided under this section shall be considered voluntary on Contractor's part, and no compensation will be provided to Contractor to submit cost-reduction incentive proposals.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Manufacturers not listed as acceptable manufacturers may be accepted by Owner if savings offered are sufficient.

2.2 Materials

A. Materials substitutions may be accepted by Owner if savings offered are sufficient.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.1 Scope

A. Requirements for preconstruction meeting, progress meetings, specially-called meetings and post-construction meeting.

B. Owner's Representative will schedule and conduct meetings and conferences at Work site unless otherwise indicated.

1.2 Contractor's Responsibilities

A. Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.

B. For all meetings other than those required by Contract Documents or Owner's Representative, Contractor shall record minutes, including significant proceedings and decisions for each meeting. Reproduce and distribute copies of minutes within 5 days after each meeting. Provide copies to Owner's Representative, all other participants in meeting, and all other parties affected by decisions made at meeting.

1.3 Pre-Construction Meeting

A. Before issuance of Notice to Proceed, preconstruction meeting will be held at time and location designated by Owner's Representative.

B. Meeting shall be attended by Owner's Representative, Engineer of Record, Representatives from affected cities, agencies and utilities, Contractor and his superintendent, all major subcontractors and other persons designated by Owner.

C. Agenda for preconstruction meeting shall include:

1. Scheduling items

    a. Tentative construction schedule

    b. Phasing.

    c. Critical work sequencing and long-lead items.

    d. Procedures for schedule revisions

2. Designation of key personnel and their duties.

    a. Designation of persons authorized to sign documents for Owner and Contractor, with examples of signature of each.

    b. List of names, addresses and telephone numbers of those persons authorized to act for Contractor in emergencies

    c. Safety procedures including designation of Contractor's safety officer.

3. Lines of communications.
    a. Procedures for processing field decisions and Change Orders.
    b. RFI procedures
    c. Submittal procedures
    d. Testing and inspection procedures.
    e. Payment application and processing procedures.
    f. Change Order procedures
4. Distribution of Contract Documents.
5. Preparation of record drawings.
6. Use of premises,
    a. Parking availability.
    b. Office, work, and storage areas.
    c. Equipment deliveries and priorities.
    d. Work restrictions.
    e. Working hours.
    f. Owner's occupancy requirements.
    g. Responsibility for temporary facilities and controls including barricades, utilities, sanitary facilities, signs and other facilities required.
    h. Procedures for moisture and mold control.
    i. Procedures for disruptions and shutdowns.
    j. Construction waste management and recycling.
7. First aid.
8. Security.
9. Progress cleaning and housekeeping.
10. Construction permit requirements, procedures and posting.
11. Establishment of schedule for progress meetings.
12. Other administrative items as appropriate.

1.4 Progress Meetings

A. Progress meetings shall be held at dates and times scheduled at preconstruction meeting unless changes are agreed to by all parties and appropriate notification of such changes has been given.

B. Meetings shall be attended by Owner's Representative and Contractor's superintendent. When requested by Owner's Representative or Contractor; subcontractors, and Owner's consultants shall also attend.

C. Agenda for these meetings shall include:

1. Review progress of construction since previous meeting.

2. Discuss field observations, problems and conflicts.

3. Identify problems which impede planned progress and develop corrective measures as required to regain projected schedule. Revise construction schedule if necessary.

4. Plan progress during next construction period.

5. Coordinate progress of subcontractors.

6. Review changes proposed by Owner for their effect on construction schedule and completion time.

7. Review Contractor's record drawings.

1.5 Special Meetings

A. Upon appropriate notice to other parties, special meetings may be called by Owner's Representative or Contractor, at times agreed to by all parties involved.

1.6 Post-Construction Conference

A. Post-construction conference shall be held after system demonstration but before final inspection of Work to discuss and resolve all unsettled matters.

B. Prior to post-construction conference, bonds and insurance to remain in force, and other documents required to be submitted by Contractor will be reviewed and deficiencies identified if any.

C. Agenda shall include:

1. Preparation of record documents.

2. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.

3. Submittal of written warranties.

4. Requirements for submitting operations and maintenance data.

5. Requirements for delivery of spare parts.

6. Requirements for demonstration and training.

7. Preparation of Contractor's punch list

8. Contractor’s schedule for addressing punch list items.

9. Procedures for processing Applications for Payment at Substantial Completion and for final payment.

10. Responsibility for removing temporary facilities and controls.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 Work Included

A. Contractor's scheduling of Work using computerized Critical Path Method (CPM) scheduling to satisfy Contract schedule and project status reporting requirements.

B. All times and durations specified and schedules prepared by Contractor shall be in working days.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 73 00: Execution

1.3 Quality Assurance

A. Prior to submittal deadline shown in Paragraph 1.6A below, submit name and qualifications of person responsible for preparing, maintaining, updating and revising schedules. This person shall have authority to act on Contractor's behalf and have at least 5 years verifiable experience preparing and updating construction schedules for projects of similar type, size, and complexity. Scheduler shall be proficient in use of software used. If Contractor has no employee with required scheduling experience and expertise, as determined by Owner, Contractor shall retain qualified CPM consultant who regularly performs these services and who in Owner's opinion possesses qualifications required to perform Project CPM scheduling. Owner reserves right to remove scheduler from Project if schedules submitted do not comply with requirements of this section.

B. Qualifications of scheduler shall be verified with references of not less than 3 previous projects of similar type, size, and complexity on which Contractor's Construction Scheduler has used CPM scheduling using scheduling software. Construction Scheduler shall attend all meetings pertaining to scheduling and progress of Work.

C. Owner's acceptance of Contractor's CPM scheduling person is prerequisite to issuance of Notice to Proceed.

1.4 References

A. AGC publication "Use of CPM in Construction"

1.5 Submittals

A. Provide one licensed copy of scheduling software used to Owner registered in Owner's name. Software copy shall become Owner's property.

B. Submit 4 copies of each submittal listed below plus electronic copy on compact disk or thumb drive in accordance with deadlines shown.

SUBMITTAL	PARAGRAPH REFERENCE	SUBMITTAL DEADLINE
Name and Qualifications of Contractor's Scheduler	1.4A	No later than 7 calendar days after Contract Award
Preliminary Progress Schedule to	3.2	No later than 14 calendar days after receipt of notice

SUBMITTAL	PARAGRAPH REFERENCE	SUBMITTAL DEADLINE
Include 60-day Plan of Operation and Project Overview Bar Chart		to proceed.
Revised Preliminary Progress Schedule	3.2	No later than 7 calendar days after receipt of Owner review comments.
Original Baseline Critical Path Method (CPM) Schedule	3.4A	No later than 14 calendar days after submittal of Revised Preliminary Progress Schedule
Original Baseline Critical Path Method (CPM) Meeting	3.4C	No later than 10 calendar days after submittal of Original Baseline CMP Schedule
Revised Baseline CPM Schedule	3.4D	No later than 10 calendar days after Original Baseline CPM Schedule Meeting
Updates and Periodic CPM Schedule Submittals	3.4E	Monthly

C. In addition to submittals listed above, Owner may require recovery schedule, Time Impact Evaluation, and mitigation plan when appropriate.

D. Procedures for submission, review and acceptance of all schedule submittals shall conform to Section 01 33 00 and applicable sections of General Conditions.

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers of scheduling software products include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Scheduling Software	Microsoft Project	Redmond, WA
	Oracle Primavera 6	Santa Clara, CA
	Accepted equal	

B. Scheduling system shall be capable of handling, processing, printing and plotting data to satisfy all requirements of this Section.

PART 3 - EXECUTION

3.1 Progress of Work

A. It is expressly understood and agreed time of beginning, progress rate, and time of completion of Work are of the essence of this Contract. Execute work with such progress as required to prevent any delay to completion of Contract, Contract milestones, and to other contractors working on other contracts at site.

B. By preparing and submitting Construction Schedule, Contractor represents they can and intend to execute contracted Work, including activities of subcontractors, equipment vendors and suppliers, submittals and resubmittals within specified times and constraints and bid covers all costs associated with execution of Work in accordance with Construction Schedule.

3.2 Preliminary Progress Schedule Submittal

A. Prior to deadline shown in Part 1, submit 4 hard copies and one electronic copy of cost-loaded Preliminary Progress Schedule package which shall serve as Contractor's Plan of Operation for initial 60 working day period of Contract Time and to identify the manner in which Contractor intends to complete all work within the Contract Time. Submit (1) 60-day Plan of Operation bar chart, and (2) project overview bar chart type plan for all work as indicated below.

B. During initial 60 working days of Contract Time, conduct Contract operations in accordance with 60-day bar chart Plan of Operation. Bar chart prepared and submitted shall show dates for accomplishment of Contractor's early activities including:

1. Mobilization
2. Permits
3. Submittals needed for early material and equipment procurement, including specified Owner’s review period
4. Submittals needed for long lead equipment procurement, including specified Owner’s review period
5. CPM submittals
6. Initial site work, and
7. Other submittals and all other activities required and planned for execution in first 60 working days.

C. Information shall provide sufficient durations for administration, fabrication, and transportation to produce realistic delivery dates for procurement items.

D. Project Overview Bar Chart shall show major components of project work and sequence relations between major components and subdivisions of major components. Overview bar chart shall show relationships and time frames in which components of Work will be completed and placed into service to meet project milestones. Include sufficient detail for identification of subdivisions of major components into such activities as

1. Excavation
2. Foundation subgrade preparation
3. Foundation concrete
4. Completion of structural concrete
5. Utility work
6. Mechanical work
7. Electrical work
8. Instrumentation and control work
9. Other important work for each major facility within project scope.

E. Show approximate durations and start dates for each work item subdivision representing Contractor's best estimate for Work the summary activity represents. Total duration of summary activities shall equal Contract Time. Accurately plot each major component and subdivision component on time scale sheets not to exceed 24-inches by 36-inches in size. Use no more than 4 sheets to represent this overview information.

F. Owner will review Preliminary Progress Schedule and provide comments at meeting with Contractor within 10 calendar days after submittal to Owner. Owner's review and comment on schedules will be limited to Contract conformance with sequencing and milestone requirements stated in other sections of Contract Documents. Make corrections to schedules needed to comply with Contract requirements and adjust schedules to incorporate missing information requested by Owner. Revisions needed as result of Owner review and meeting with Contractor shall be resubmitted for review to Owner prior to deadline shown in Part 1.

G. Preliminary Progress Schedule will be used temporarily to record and monitor Work progress until Baseline Schedule, specified hereinafter, has been developed and accepted by Owner. Incorporate recorded data on Preliminary Progress Schedule into Baseline Schedule during first schedule update.

3.3 Schedule Methodology

A. Scheduling method shall present CPM activity and node Precedence Diagram Network (PDN) showing critical path.

B. Submit Work Breakdown Structure to Owner for acceptance. Include associated alphanumeric coding structure to implement work breakdown structure, and activity identification system for labeling all work activities.

C. Designate code fields as follows:

1. First code field shall designate Bid Item.

2. Second code field shall identify activity as one of the following types:

    a. Submittal,
    b. Review/Acceptance
    c. Procurement/Fabrication,
    d. Delivery,
    e. Construction/Installation,
    f. Start-up, or
    g. Change order

3. Third field shall identify applicable Contract Document section under which activity is described.

4. Fourth code field shall identify who is responsible to perform activity (i.e., Contractor, subcontractor(s), supplier, etc.).

5. Fifth code field shall identify area being worked in or facility, if appropriate.

6. Sixth code field shall identify construction phase or project element (if phasing of work or project elements are identified in Contract).

7. Include all Change Orders and Notices of Non-Compliance as separate code fields.

3.4 CPM Schedule Submittals

A. Original Baseline CPM Schedule Submittal: Prior to deadline shown in Part 1, submit hard copy of Original Baseline CPM Network Schedule and Computerized Schedule Report tabulations. Also submit compact disk or thumb drive containing all of schedule submittal information and data. Submit new disk with updated information with each change or submission of CPM schedule. Disk shall contain data compatible with scheduling software to generate network diagrams and schedule reports identical to hard copies submitted. This submittal shall have already been reviewed and accepted by Contractor's Project Manager, Project Superintendent, and Project Estimator prior to submission. CPM Schedule shall be time-scaled network diagram of "I-j" activity-on-arrow or precedence type. Network Diagram shall describe activities to be accomplished and their logical relationships and show Critical Path.

B. Computerized Schedule Report tabulations shall include:

1. Report of activities sorted by Activity Number

2. Report of activities sorted by Early Start date

3. Report of activities sorted by Total Float.

4. Report of activities sorted by Responsibility Code. Responsibility Codes shall be established for Contractor, Owner, subcontractors, suppliers, etc. Identify these codes in Network Diagram.

5. A successor-predecessor report which shall identify successor and predecessor activities for each activity and ties between schedule activities

C. Original Baseline CPM Schedule Review Meeting: Within time stipulated above, meet with Owner to review Original Baseline CPM Schedule submittal. Contractor’s Project Manager, Project Superintendent, and Project Scheduler shall be in attendance. Owner's review will be limited to submittal's conformance to Contract requirements. However, review may also include:

1. Clarifications of design intent, process, and startup requirements.

2. Directions to include activities and information missing from submittal.

3. Requests to Contractor to clarify schedule.

D. Revised Baseline CPM Schedule: Within submittal time shown in Part 1, revise Original Baseline CPM Schedule submittal to address all review comments from Original Baseline CPM Schedule Meeting and resubmit network diagrams and reports for Owner's review. Owner, within 14 days from receipt of Revised Baseline CPM Schedule will either (1) accept schedule as submitted, or (2) advise Contractor in writing to review any part or parts of schedule which either do not meet Contract requirements or are unsatisfactory for Owner to monitor project's progress and status or evaluate monthly payment requests by Contractor. Owner may accept schedule with conditions that first monthly CPM schedule update be revised to correct deficiencies identified. When schedule is accepted, it shall be considered as "Original Baseline CPM Construction Schedule" until an updated schedule has been submitted. Owner reserves right to require Contractor to adjust, add to, or clarify any portion of schedule which may later be discovered to be insufficient for monitoring of Work. No additional compensation will be provided for such adjustments, additions or clarifications.

E. Acceptance of Contractor's schedule by Owner will be based solely upon schedule's compliance with Contract requirements. By way of Contractor assigning activity durations

and proposing sequence of Work, Contractor agrees to use sufficient and necessary management and other resources to perform work in accordance with schedule. Upon submittal of schedule update, updated schedule shall be considered "current" project schedule.

F. Submission of Contractor's progress schedule to Owner shall not relieve Contractor of Contractor's total responsibility for scheduling, sequencing, and pursuing Work to comply with requirements of Contract Documents, including adverse effects such as delays resulting from ill-timed work.

G. Monthly Updates and Periodic CPM Schedule Submittals: Following acceptance of Contractor's Original Baseline CPM Schedule, monitor progress of Work and adjust schedule continuously to reflect actual progress and any changes in planned future activities. Submit complete schedule updates in accordance with General Conditions Article 6, including all information requested in original schedule submittal and as specified herein. Each update shall continue to show all work activities including those already completed. These completed activities shall accurately reflect record drawing information by indicating when work was actually started and completed.

H. Neither submission nor updating of Contractor's original schedule submittal nor submission, updating, change or revision of any other report, curve, schedule or narrative submitted to Owner by Contractor under this Contract, nor Owner's review or acceptance of any such report, curve, schedule or narrative shall have effect of amending or modifying, in any way, Contract completion date or milestone dates or of modifying or limiting, in any way, Contractor's obligations under this Contract. Only a signed, fully executed change order can modify these contractual obligations.

I. Monthly schedule update submittal will be reviewed with Contractor during a monthly construction schedule review meeting held on 20th Work Day of each month. The goal of these meetings is to enable Contractor and Owner to initiate appropriate remedial actions to minimize any known or foreseen delay in completion of Work and to determine amount of Work completed since last month's schedule update. Status of Work will be determined by percent complete of each activity shown in Network Diagram. These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. As a minimum, Contractor's Project Manager and General Superintendent shall attend these meetings. Submit within 7 working days after monthly progress meeting revised CPM Network Diagram, the revised CPM computerized tabulations as noted herein, revised successor/predecessor report, Project Status Reports as defined in Paragraph 3.8 and Contractor's Application for Payment. Within 5 working days of receipt of above noted revised submittals, Owner will either accept or reject monthly schedule update submittal. If accepted, percent complete shown in monthly update will be basis for Application for Payment to be submitted by Contractor. If rejected, correct and resubmit update before Application for Payment for update period can be processed.

J. Schedule Revisions: Highlight or otherwise identify all changes to Network Diagram Schedule Logic or activity durations made from previous schedule. Modify any portions of CPM schedule which become infeasible because of activities behind schedule or for any other valid reason.

3.5 Change Orders

A. Upon acceptance of a change order, or upon receipt by Contractor of authorization to proceed with additional work, change shall be reflected in next submittal of CPM schedule by Contractor. Use sub-network in schedule depicting changed work and its effect on other activities. This sub-network shall be tied to main network with appropriate logic, so true analysis of Critical Path can be made.

3.6 CPM Standards

A. CPM, as required by this Section, shall be as outlined in Association of General Contractors (AGC) publication, "" except either "I-j" arrow diagrams or precedence diagramming format may be used. In case of conflicts between Contract Documents and AGC Document, Contract Documents shall govern.

B. Include in construction schedules graphic network diagram and computerized construction schedule reports as described in Paragraph 3.4.

C. CPM network shall be in form of pure logic diagram or, if directed or accepted by Owner, a time scaled "I-j" activity-on-arrow or precedence type diagram and may be divided into a number of separate sheets with suitable match lines relating interface points among sheets. Individual sheets shall not exceed 36-inch by 60-inch (maximum 2 sheets).

D. Except for a pure logic diagram, show all construction activities and procurement activities in time-scaled format. Show calendar time line along entire sheet length. Plot each activity arrow or node to accurately represent beginning and completion dates of each activity along calendar time line. Show activities using symbols clearly distinguishing between critical path activities, non-critical activities and free float for each non-critical activity. Identify all activity items by their respective Activity Number, Responsibility Code, Work Duration, and their Dollar Value. All non-critical path activities shall show their total float time in scale form using dotted line or other graphical means.

E. Compute duration estimate for each activity in working days considering scope of activity work and resources planned for activity. Except for certain non-labor activities, such as concrete curing or delivery of materials, activity duration shall not exceed 10 working days nor be less than one working day unless otherwise accepted by Owner.

F. Float time shall be total float defined as the number of working days each non-critical path activity may be delayed before it and its succeeding activities fall on critical path. If a non-critical path activity is delayed beyond its float period, that activity then becomes part of critical path and controls project end date. Thus, delays of non-critical path activities beyond their float times will delay Project completion.

G. Neither Owner nor Contractor owns float time. The Project owns all float time. Liability for delay of Project completion date rests with party causing delay to Project completion date. For example, if Party A uses some, but not all of float time and Party B later uses remainder of float time as well as additional time beyond float time, Party B shall be liable for costs associated with time that represents delay to project's completion date. Party A would not be responsible for any costs since it did not consume all of float time and additional float time remained, therefore, Project's completion date was unaffected.

H. Include 10 lost days on CPM schedule's critical path for inclement weather.

3.7 Schedule Reports (Format)

A. Schedule Reports: Prepare Schedule Reports based on Construction Schedule to include following minimum data for each activity:

1. Activity Numbers and Responsibility Codes

2. Contract Number

3. Estimated Activity Duration

4. Activity Description
5. Activity's Percent Completion
6. Early Start Date (Calendar Dated)
7. Early Finish Date (Calendar Dated)
8. Late Start Date (Calendar Dated)
9. Late Finish Date (Calendar Dated)
10. Status (Whether Critical)
11. Total Float for Each Activity
12. Free Float for Each Activity
13. Cost Value for Each Activity

B. Project Information: Preface each Schedule Report with the following summary data:

1. Project Name
2. Contractor.
3. Contract No
4. Type of Tabulation
5. Project Duration
6. Contract Completion Date (revised to reflect time extensions)
7. Commencement Date Stated in Notice to Proceed
8. Data Date and Plot Date of Network Diagram
9. If update, new schedule completion date

3.8 Project Status Reporting

A. In addition to submittal requirements for CPM scheduling, submit monthly project status reports (Overview Bar Chart and written narrative report) in conjunction with revised CPM Schedules as specified in Paragraph 3.6. Status reporting shall be in form specified below.

B. Prepare and submit monthly Overview Bar Chart schedule of major project components. Overview bar chart schedule shall summarize current CPM schedule (original and as updated and adjusted throughout construction period). It shall contain no more than 2 sheets which shall not exceed 36-inch by 60-inch. Represent major project components as time bars subdivided into various types of Work including demolition, excavation and earthwork, yard piping, concrete construction, mechanical, electrical and instrumentation installations. Major components shall include each new structure by area designation, sitework, modifications to existing structures, tie-ins to existing facilities and plant startups.

C. Accurately time scale plot each major component and subdivision consistent with project overview bar chart specified above. It shall represent same status indicated by early start and finish activity information contained in latest update of CPM schedule. In addition, indicate percent completion for each major component and subdivision. Make initial submittal of overview bar chart schedule at time revised Original Baseline CPM Schedule is submitted to Owner within submittal deadline shown in Part 1. Amend overview schedule to include any additional detail required by Owner. Include any additional information requested by Owner at any time during construction of Work.

D. Submit monthly written narrative reports. Written status reports shall include:

1. Status of major project components (Percent Complete, amount of time ahead or behind schedule) and an explanation of how project will be brought back on schedule if delays have occurred.

2. Progress made on critical activities indicated on CPM schedule.

3. Explanations for any lack of work on critical path activities planned to be performed during last month

4. Explanations for any schedule changes, including changes to logic or to activity durations.

5. A list of critical activities scheduled to be performed in next two month period.

6. Status of major material and equipment procurement.

7. Value of materials and equipment properly stored at site, but not yet incorporated into Work-in-place.

8. Any delays encountered during reporting period.

9. An assessment of inclement weather delays and impacts to progress of Work.

E. Contractor may include any other information pertinent to status of project. Include additional status information requested by Owner.

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SECTION 01 32 33
CONSTRUCTION PHOTOGRAPHIC AND VIDEO DOCUMENTATION

PART 1 - GENERAL

1.1 Work Included

A. Administrative and procedural requirements for:

1. Preconstruction photographs.

2. Periodic construction photographs.

3. Final completion construction photographs.

4. Preconstruction video recordings.

5. Periodic construction video recordings.

B. Submit preconstruction photographs or videos to Owner's Representative before Work is performed which has potential to disturb or modify public or private property not owned by Owner.

C. Failure by Contractor to submit preconstruction photographs or videos may be taken by Owner as evidence subsequent claims by property owners for damage to their property can be rightfully attributed to Contractor's actions.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 73 00: Execution
E. Section 01 77 00: Closeout Procedures

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 Submittals

A. The following minimum photographic or video documentation shall be required.

1. One submittal of preconstruction photographs and videos taken before start of Work.

2. One submittal of periodic construction photographs or videos taken every month Contractor is on site.

3. One submittal of final completion construction photographs or videos.

B. Owner's Representative may require any one of the following combinations of photographic or video documentation.

1. Key plan plus digital photographs plus construction photographic paper prints.

2. Key plan plus digital photographs plus video recordings and transcripts.

3. Key plan plus construction photographic paper prints plus video recordings and transcripts.

C. Submittals shall meet the following requirements.

SUBMITTAL	DESCRIPTION
Key Plan	Key plan of Project site with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation. Submit key plan with each digital or construction photograph submittal.
Digital Photographs	Submit image files within 3 days of taking photographs. Use digital camera with minimum sensor resolution of 8 megapixels. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file. Identification: Provide the following information with each image description in file metadata tag: Name of Project. Name and contact information of photographer. Name of Owner and Owner's Representative. Name of Contractor. Date photograph was taken. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction. Unique sequential identifier keyed to accompanying key plan.
Construction Photograph Paper Prints	On Owner's request, submit 2 prints of each photographic view within 7 working days of taking photographs. Format: 8"x10" smooth-surface matte prints on single-weight, commercial-grade photographic paper; enclosed back to back in clear plastic sleeves punched for standard 3-ring binder. Identification: On back of each print, provide applied label or rubber-stamped impression with the following information: Name of Project. Name and contact information of photographer. Name of Owner and Owner's Representative. Name of Contractor. Date photograph was taken if not date stamped by camera. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction. Unique sequential identifier keyed to accompanying key plan.
Video Recordings (required on projects valued >$1 million)	Submit video recordings within 7 days of recording. Submit video recordings in digital video disc format acceptable to Owner's Representative. With each submittal, provide the following information: Project Name. Name and contact information of photographer. Name of Owner and Owner's Representative. Name of Contractor. Date video recording was recorded. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction. Weather conditions at time of recording.
Video Recording Transcript (required on projects valued >$1 million)	Prepared on 8-1/2"x11" paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include cover sheet with same label information as corresponding video recording. Include name of Project and date of video recording on each page.

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

B. Base number of construction photographs on average of 30 photographs per week over duration of Work

C. For projects valued in excess of $1 million, base number of videos on one preconstruction video, one post construction video and one additional video per month over Work duration.

PART 2 - PRODUCTS

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Digital images shall be in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

C. Digital video recordings shall be high-resolution, digital video disc in format acceptable to Owner's Representative.

PART 3 - EXECUTION

3.1 Preparation

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

3.2 Photography

A. Engage qualified photographer to take construction photographs.

B. Take photographs using maximum range of depth of field. Photographs shall be in focus and clearly show Work. Photographs with blurry or out-of-focus areas will not be accepted.

C. Maintain key plan with each set of construction photographs that identifies each photographic location.

D. Submit digital images exactly as originally recorded in digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Include date and time in file name for each image.

2. Maintain one set of images accessible in field office at Project site, available at all times for reference. Identify images in same manner as those submitted to Owner's Representative.

3.3 Construction Video Recordings

A. Engage qualified videographer to record construction video recordings.

B. Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and actual temperature reading at Project site.

C. Describe scenes on video recording by audio narration by microphone while video recording is in progress. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.

1. Confirm date and time at beginning and end of recording.

2. Begin each video narration with name of Project, Contractor's name, videographer's name, and Project location.

D. Provide printed transcript of narration. Display images and running time captured from video recording opposite corresponding narration segment.

3.4 Preconstruction Photographs

A. Before commencement of excavation and/or demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Owner's Representative.

B. Photographs shall be of sufficient quality and thoroughness to fully document preexisting damage or wear to photographed property for which Contractor or Owner might be asked to compensate property owner were it not for photographic evidence of preexisting damage. Where existing cracks in concrete, masonry or other materials are wider than thickness of a dime, include dime or similar visual standard in photo or video for reference.

C. Flag excavation areas and construction limits before taking construction photographs.

D. Take 20 photographs to show existing conditions adjacent to property before starting Work.

E. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

F. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

3.5 Preconstruction Videos

A. Before starting excavation and/or demolition, record video recording of Project site and surrounding properties from different vantage points, as directed by Owner's Representative.

B. Videos shall be of sufficient quality and thoroughness to fully document preexisting damage or wear to video-recorded property for which Contractor or Owner might be asked to compensate property owner were it not for video evidence of preexisting damage. Where existing cracks in concrete, masonry or other materials are wider than thickness of a dime, include a dime or similar visual standard in photo or video for reference.

C. Flag excavation areas and construction limits before recording construction video recordings.

D. Show existing conditions adjacent to Project site before starting Work.

E. Show existing buildings either on or adjoining Project site to accurately record physical conditions at start of excavation and/or demolition.

F. Show protection efforts by Contractor.

3.6 Periodic Construction Photographs

A. Periodic Construction Photographs: Take 30 photographs weekly, with timing each month adjusted to coincide with cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

B. Take photographs of all Work to be covered or buried prior to covering or burying. Photographs shall show all subgrade, geotextiles, conduit, utilities, steel reinforcement, fasteners, embedments, bare concrete surfaces, decking, framing, insulation, piping, ductwork, wiring or other work subsequently covered.

C. Where structural members are fabricated off site, provide photographic documentation of fabrication in sufficient detail and quantity to show all work not visible at time of delivery to jobsite.

D. Where on-site events may result in construction damage or losses, take photographs as needed to document damage or losses.

E. From time to time, Owner's Representative will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show status of construction and progress since last photographs were taken.

3.7 Periodic Construction Videos

A. Record video recording monthly, coinciding with cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last video recording. Minimum recording time shall be 30 minutes.

3.8 Final Completion Construction Photographs

A. Take 30 color photographs after date of Substantial Completion for submission as project record documents. Owner's Representative will inform photographer of desired vantage points.

B. Do not include date stamp on final completion construction photographs.

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 Work Included

A. General procedures and requirements for submittals, initial submittal, submittals required on Owner's request, progress reports, Shop Drawings, product data and samples, notification of affected residences and businesses, and submittal forms.

1.2 Related Work

A. Section 01 32 33: Construction Photographic and Video Documentation
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution

1.3 References

A. ANSI AWS A2.4 Standard Symbols for Welding, Brazing and Nondestructive Examination

1.4 Electronic (Digital) Submittals

A. Submit digital copy of **each** submittal using one of following methods chosen by Owner:

1. Email: Send submittal as pdf attachment to Owner and Owner's Representative.

2. Data tracking System (DTS): Upload digital file to server maintained by Owner's Representative.

3. CD: Burn a CD containing one or more submittals and furnish copy of CD to Owner and Owner's Representative.

B. Multiple hard copies of submittals will not be accepted in lieu of digital submittal unless otherwise authorized or directed by Owner's Representative.

C. One digital copy of stamped submittal with cover letter will be returned to Contractor by email or DTS as appropriate.

D. Contractor shall verify emails sent with large attachments have been successfully received by Owner and Owner's Representative. Files in excess of 5 MB in size shall not be sent as attachments to emails due to size restrictions associated with users' email systems.

E. Number submittals using numbering system as directed by Owner's Representative.

F. Shop Drawing Transmittal Form. Use form included at end of this section unless otherwise directed by Owner. Submit separate form for each submittal and assign a submittal number. Form shall be first page of each digital submittal. Submittals without completed Contractor's Transmittal Form as first page will be returned without review and stamped "REJECTED/RESUBMIT AS SPECIFIED."

G. Stock or standard drawings will not be accepted for review unless full identification and supplementary information is shown thereon in ink or typewritten form.

H. Exceptions and departures from Contract Documents shall be clearly noted, along with brief justification for each exception or departure.

1.5 Paper Submittals

A. Submit paper submittals for:

1. Electrical submittals
2. Reinforcing steel schedules larger than 11”x17” original format
3. Steel pipe lay diagrams larger than 11”x17” original format
4. Original drawings larger than 11”x17” size

B. Submit 6 copies of submittals unless otherwise stated.

C. Fold paper submittals to approximately 9”x12”.

D. Three copies will be returned to Contractor.

E. Number submittals using numbering system as directed by Owner’s Representative.

F. Shop Drawing Transmittal Form. Use form included at end of this section unless otherwise directed by Owner. Submit separate form for each submittal number. Submittals without completed Contractor's Transmittal Form attached to each copy of each submittal listed in Schedule of Submittals will be returned without review and stamped "REJECTED/RESUBMIT AS SPECIFIED."

G. Stock or standard drawings will not be accepted for review unless full identification and supplementary information is shown thereon in ink or typewritten form.

H. Exceptions and departures from Contract Documents shall be clearly noted, along with brief justification for each exception or departure.

1.6 Owner’s Review of Submittals

A. Owner’s review or acceptance of submittals shall only constitute acceptance of the following:

1. Portions of submittal in compliance with Contract Documents.

2. Exceptions or departures expressly noted on Contractor’s submittal as “exceptions” or “departures” and accepted in writing by Owner.

3. Exceptions or departures Owner or their Representative may by chance discover and acknowledge and accept in writing in Owner’s response to said submittal.

B. If any submittal’s exception or departure from Contract Documents is neither noted by Contractor on their submittal nor acknowledged and expressly accepted by Owner, Contract shall remain unchanged. Owner’s failure to discover all exceptions and departures in submittals whether intentional or unintentional on Contractor’s part shall not relieve Contractor of any Contract responsibilities.

C. Review of submittals will proceed as follows:

1. Submit specified quantity of complete submittals together with Contractor's submittal forms to Owner's Representative for review. At Owner's discretion, Owner may review submittals prior to, parallel with, or after Owner's Representative has reviewed submittals.

2. Submittals will be stamped "ACCEPTED", "ACCEPTED AS NOTED", "REVISE AS NOTED/RESUBMIT", "REJECTED/RESUBMIT AS SPECIFIED," "NO ACTION REQUIRED," or "SUBMITTAL NOT REQUESTED, RETURNED WITHOUT REVIEW." Three copies with letter of transmittal will be returned to Contractor.

3. If drawing or data is returned stamped "ACCEPTED", "ACCEPTED AS NOTED", "NO ACTION REQUIRED," or "SUBMITTAL NOT REQUESTED, RETURNED WITHOUT REVIEW." No further resubmittals will be required for that item.

4. If drawing or data is stamped "REVISE AS NOTED/RESUBMIT," or "REJECTED/RESUBMIT AS SPECIFIED," make necessary corrections and resubmit documents as required in Instruction 1. Contractor's submittal form transmitting revised documents shall show that documents comprise a resubmittal. Revisions and re-submittals shall be numbered as Revision #1, Revision #2, or as appropriate.

5. If changes other than those noted by Owner are made on submittal before resubmittal, note such changes on resubmittal.

6. Revise and resubmit submittals as required, until confirmation of compliance is obtained.

D. Costs incurred by Owner for original submittal and first re-submittal will be paid by Owner. Costs incurred by Owner for second and subsequent re-submittals will be deducted from payment due Contractor.

E. Allow not less than 31 calendar days for review and response to submittals. Review may be delayed if contingent on receipt of other submittals. Upon timely written request by Contractor, Owner's Representative will make reasonable efforts to shorten review periods which may fall on Contractor's critical path.

F. Correct and resubmit rejected submittals within 14 calendar days.

G. Do not order products or begin work described in required submittals until such submittals have been reviewed and returned by Owner stamped "ACCEPTED" or "ACCEPTED AS NOTED". Contractor's acceptance of delivery of products prior to receipt of Owner's Representative's satisfactory return of applicable submittals shall be at Contractor's risk.

H. Review of submittals by Owner's Representative shall extend solely to general type and layout of Work and shall not be construed as relieving Contractor of full responsibility for adequacy and accuracy of submitted designs and details shown in submittals.

1.7 Initial Submittal

A. Submit the following within 72 hours after bid opening.

1. Names and addresses of Manufacturers furnishing products valued greater than either 4 percent of contract value or $40,000, whichever is less. State locations of shops at which manufacture will take place. State whether products are already designed or in production. Include brief description of products proposed, including sizes and catalog numbers.

2. Letter addressed to Owner's Representative identifying Contractor's superintendent, safety officer, and traffic control coordinator, including emergency telephone numbers and signature authorization, and listing names, addresses and telephones for subcontractors.

3. Proposed Construction Schedule.

1.8 Submittals on Owner's Request - Supplemental Information

A. Detailed construction schedule updates shall be submitted, with monthly pay requests to describe scheduling of elements of construction requiring Owner's or Contractor's coordination with public, or other private parties or public agencies.

B. Supplemental information will be requested for "accepted equals" and may be requested when there is a question a Manufacturer's product conforms to Contract Documents. Owner reserves right to require submittal of supplemental information as described herein before acceptance of product.

C. Certification of compliance with listed reference standards shall be submitted by Manufacturers on Owner's request. Failure of Owner to request certification of compliance shall not serve as waiver of Contractor's duty to comply with reference standards.

D. Transcripts of results of acceptance tests performed at point of manufacture of products furnished shall be submitted by Manufacturers on Owner's request.

E. Samples shall be submitted on Owner's request.

F. Names and addresses of nearest local service representatives maintaining technical service personnel and complete inventory of spare parts and accessories shall be submitted on Owner's request.

G. List of 3 installations in which products comparable in size, capacity and rating with those required in Contract Documents are now in regular operation shall be submitted on Owner's request. Include listing of size capacity or rating of each installation. Include name and telephone number of at least one reference responsible for operations at each installation whom Owner's Representative may contact.

1.9 Progress Reports

A. Daily log shall be submitted by Contractor's superintendent on one-page form provided by Owner. These logs shall be detailed with activities that took place during each day. Submit logs daily to Owner's Representative by end of following workday.

B. Schedule updates shall be submitted with monthly pay requests. If Work falls behind schedule, monthly pay requests shall include revised schedules to demonstrate how Contractor intends to bring work back on schedule.

C. Record drawings, consisting of one set of full size annotated blue-line plans and other drawings forming a part of contract, showing installed locations of improvements and all changes made during construction shall be available to Owner for inspection throughout project. Record all deviations from Contract Documents, including accepted change orders, using additional sketches or ink revisions, immediately after installing each portion of Work. Show locations of underground piping, conduit, sensor lines, valves, capped ends, branch fittings, pull boxes and Work. Keep one current record copy of Contract Documents, addenda, supplementary drawings, working drawings, change orders and clarifications at site and in good order. Report changes and deviations promptly to Owner's Representative.

D. Partial payment requests may be withheld if daily logs, schedule updates or record drawings are damaged, lost or not kept current to satisfaction of Owner's Representative.

1.10 Contractor's Notice of Pending Delay Claim

A. In event a delay claim is foreseen by Contractor, Contractor shall immediately notify Owner in writing. Following said notice, Contractor shall have no more than 7 calendar days to furnish follow-up information as required by Owner to allow Owner to act judiciously to minimize losses. As a minimum, said information shall consist of a letter identifying and substantiating cost of expected claim per day of delay accompanied by schedule showing any available float and delay's impact on overall schedule.

1.11 Shop Drawings and Product Data

A. Shop Drawings shall be defined as job-specific drawings showing details of manufactured or assembled products.

B. Shop Drawings shall be prepared to scale wherever possible and shall include project name on shop drawing.

C. Except where preparation of a submittal is contingent upon acceptance of a prior submittal, Contractor shall make every reasonable effort to combine all submittals relating to same class or portion of Work into one package, regardless of variety of trades or types of equipment required to construct that portion of Work. *e.g.* all above ground piping, fittings, valves, actuators, pipe stands, couplings, flow meters and appurtenances shall be submitted as one package for review.

1. Packages shall clearly reference specification sections and specified submittal requirements therein, showing where in submitted literature each submittal requirement is satisfied.

2. Packages clearly incomplete will be returned without review.

3. To facilitate approval of critical path items or to facilitate Contractor's communication with multiple suppliers and subcontractors, packages may contain several submittals from several suppliers so long as all relevant submittals are contained in package.

4. Where expedited review of one submittal item within package is desired to facilitate critical path items, notify Owner's Representative in writing to request expedited review of said item. Contractor's request for expedited review of a portion of a submittal package shall be taken as full acceptance of responsibility by Contractor for any subsequent field modifications or substitutions later necessary to remedy any conflict between expedited submittals and other submittals or to remedy any conflict between expedited submittals and Contract Documents not brought to Owner's attention at time of submittal.

D. Catalog Data shall be defined as Manufacturer's pre-printed drawings which need not include project name. However, where multiple products or options are shown in same catalog cut, product or option being furnished shall be clearly delineated as specified below.

E. All submittals shall show US units. For submittals prepared in foreign countries where Manufacturer's literature is printed solely in metric units, Contractor may make hand annotations to convert to US units as long as annotations are legible. Submittals not bearing US units will be returned without review.

F. Submittals bearing text in languages other than English will be returned without review.

G. Shop Drawings for piping shall include:

1. Key or index showing locations of spools and fittings.

2. Order of installation. Each spool shall receive a unique mark number. No other spool or fitting, even on separate pipelines or casings included in Contract, shall have same mark number. Sequential order of mark numbers shall correspond to a logical order of installation for each pipeline.

3. Laying lengths, dimensions, clearances and tolerances for all spools and fittings.

4. Clearly legible drawing showing each pipe fitting and/or spool in plan view and in profile.

5. Station and invert elevation of all grade changes and changes in horizontal alignment

6. Slopes of pipe not vertical or horizontal.

7. Horizontal and vertical alignment data for all curves, bends, tees and outlets.

8. Couplings and end types of all pipe, spools, fittings, outlets and adjacent valves or pipeline equipment.

9. Proposed pipeline linings and coatings including thicknesses.

10. How connections will be made between Work under this contract and existing work or work under other contracts.

11. Pipe and valve support sizes and locations including anchor bolt sizes and embedments.

12. Relationship of piping to other Work.

H. Shop Drawings for valves, pumps or pipeline equipment shall include:

1. Laying lengths and dimensions, clearances, tolerances and end types.

2. Weight and type of valves, pumps or equipment.

3. Valve and pump port sizes and tolerances.

4. Dimensions and orientation of actuators and pilot systems. Locations of actuator stops.

5. Proposed linings and coatings.

6. Performance characteristics.

7. Parts and materials lists and ratings and details of appurtenances to be furnished, along with references to appropriate ASTM, Federal Specifications and other reference standards and grades.

8. Piping and conduit attachments and sizes.

I. Shop Drawings for structural and architectural items shall include:

1. Lengths, widths, thickness, embedment, dimensions and tolerances of structural members or architectural items.

2. Detailing of openings and wall penetrations including doors, windows, hatches, louvers, vents, pipes and all floor, slab, wall and door penetrations.

3. Connection details including applicable sizes, diameters, thickness, spacing, embedment and edge distances of bolts, anchors, rivets, nails, screws, spikes, connection plates, holdowns, joints, sleepers and other fasteners and fastening systems.

4. Welding details using standard ANSI/AWS 2.4 symbols and showing type, electrode, length, spacing and thickness of welds.

5. Materials listing and properties, including types, strengths and finishes of concrete, masonry, metals, wood, plastics and other construction materials.

J. Shop Drawings for equipment shall include:

1. Dimensions, clearances and floor space requirements.

2. Weight and type of equipment.

3. Location where product will be installed.

4. Anchor bolt sizes and embedments.

5. Finishes and coatings.

6. Performance characteristics.

7. Parts and materials lists and ratings and details of appurtenances to be furnished, along with references to appropriate ASTM, Federal Specifications and other reference standards and grades.

8. Piping and conduit attachments and sizes.

K. In addition to above requirements for Shop Drawings for equipment, Shop Drawings for electrically powered or controlled equipment shall include:

1. Elevations showing arrangements and positions of all panel components including nameplates.

2. Electrical diagrams as needed to show wiring circuit schematics, single line diagrams, voltage wire numbers and identified interlocks and terminals.

3. Logic diagrams for programmable controllers or relays if used.

4. Nameplate data showing nameplate material, height of letters, number of lines, inscriptions and dimensions.

L. Shop Drawings for replacement items shall include field measurements needed to verify fit in existing spaces.

M. Catalog Data shall clearly indicate applicable items when several products are covered on one page. Using black ink, indicate on submitted catalog data, specification section or plan reference being satisfied.

N. Installation Instructions or Application Instructions shall be defined as Manufacturer's printed instructions including warranty requirements, clearances required and proper field procedures to deliver, handle, install and prepare product for use. In absence of Manufacturer's published literature, ASTM, AWWA or trade standards for installation will usually be accepted. If no instructions are submitted for installing or applying item of Work, Owner reserves right to stop work on subject item at any time, and to retain experts of Owner’s choosing to prepare appropriate instructions to control Contractor’s work. Installation Instructions shall include recommended bolt torques for assembly and installation of bolted items.

O. Operation and Maintenance Instructions shall be defined as Manufacturer's printed instructions for correct operation and maintenance procedures for product, along with data which must accompany manual as directed by current regulations of government agency. Include operating instructions for each piece of equipment. Describe equipment function, operating characteristics, limiting conditions, operating instructions, startup procedures, normal and emergency conditions, regulation and control, and shutdown. Include preventative maintenance instructions. List warranty requirements. Explain and illustrate preventative maintenance tasks. Include lubrication charts, lists of acceptable lubricants, trouble shooting instructions, and lists of required maintenance tools and equipment. List recommended spare parts, their costs, and ordering information for one Manufacturer who can supply these parts. Index instructions for easy reference. Include information for installed equipment only.

P. Manufacturer's Statement of Responsibility shall be copy of form attached, signed by authorized factory representative for Manufacturer whose product is being furnished.

Q. Certificate of compliance shall certify materials or procedures have been sampled, tested and found to comply with applicable reference standards, and shall be accepted by Owner prior to shipping items described therein.

R. Engineering calculations shall be clearly legible, shall follow recognized engineering principles and shall be sufficiently detailed to permit ready check of procedures used. Where published tables or charts are included in calculations, clearly show design or load variables used to make selection, highlighting applicable columns or rows in tables and highlighting intersecting variables on chart axes. Engineering calculations shall demonstrate compliance with current state and local codes, applicable standards, and contract requirements. Calculations shall be sealed by registered engineer licensed in State of California. Calculations or drawings bearing seals with expired expiration dates will not be accepted.

S. Foundry or test record transcripts shall fully describe required tests in accordance with specified test standards, shall certify that factory quality control, testing and inspection requirements have been successfully completed and shall be accepted by Owner prior to shipping items described therein.

T. Statements of Qualifications for optional maintenance contracts from Manufacturers or suppliers of products shall fully describe Manufacturer's qualifications, experience, pricing, and recommended maintenance schedule. Contractor's submittal of Manufacturer's qualifications for optional maintenance contracts shall not be construed as placing maintenance service contracts within scope of this contract, except Contractor may be obligated to pay for maintenance contract if:

    1. Contract Documents expressly state Contractor shall bear this responsibility and expense under warranty or other express obligations, or

    2. Acceptance of a Manufacturer as an accepted equal is predicated in writing on Contractor's furnishing operation and maintenance services for stipulated period as part of warranty requirement.

U. Furnish the following submittals

SUBMITTAL	DESCRIPTION
Preconstruction Photographs or Videos	Preconstruction photographs or videos shall be submitted to Owner before Work is performed which has potential to disturb or modify public or private property not owned by Owner. Photographs shall be of sufficient quality and thoroughness to fully document preexisting damage or wear to photographed property for which Contractor or Owner might be asked to compensate property owner were it not for photographic evidence of preexisting damage. Where existing cracks in concrete, masonry or other materials are wider than thickness of a dime, include dime or similar visual standard in photo or video for reference. Failure by Contractor to submit preconstruction photographs or videos, may be taken by owner as evidence that subsequent claims by property owners for damage to their property can be rightfully attributed to Contractor's actions.
	See Section 01 32 33.
Schedule for Lubrication and Run-in Procedures	Submit 2 weeks before beginning procedures.
Manufacturer's Written Acceptance of Installation (where "Manufacturer's Statement of Responsibility" is required)	Written acceptance of installation of products shall be certified and submitted by authorized factory representative. This written acceptance shall state factory authorized representative has inspected installation, alignment, lubrication and operation of furnished equipment and found it to fully comply with specified design and warranty requirements and be ready for safe operation.
Warranty	Unless otherwise stated, furnish one-year warranty from date of final acceptance.

V. Owner's Representative's review of submittals shall be limited to review of products to be incorporated in Work and to remain in place upon project completion.

1. Contractor shall have sole responsibility at all times for construction means, methods and jobsite safety.

2. Contractor shall retain services of California-licensed civil, structural or traffic engineer, as appropriate, to design and prepare plans for necessary safety equipment required by OSHA, Cal OSHA and other state and local regulatory authorities during construction, and to prepare summary documents for Contractor's use for accomplishing said work including, but not limited to sheeting, shoring, trench plating, excavation protection, falsework, formwork, scaffolding, barricading, pedestrian safety and traffic control.

3. Originals of summary documents, signed and sealed by engineer of record who prepared them, shall be submitted solely as proof this requirement has been fulfilled.

4. Since Contractor has sole responsibility for means, methods and jobsite safety, review of said documents will be limited to verifying preparing engineer's registration is current and that engineer of record has no active complaints filed against them with California Board for Professional Engineers and Land Surveyors.

W. Use of contract drawing reproductions for shop drawings is subject to rejection.

1.12 Samples

A. Furnish samples, finished as specified, and as intended to be used on or in Work. Send samples to Owner's Representative, carriage prepaid.

B. Submit samples at least 21 days before date by which Owner's approval is required. Allow 14 days for review and return of samples.

C. Submit 2 of each sample, except for field samples. Attach completed Contractor's submittal form to sample. List items being transmitted, stating proposed use and location, product, color, trade name, lot, style, and model as appropriate.

D. Resubmit samples until acceptable. One of each sample will be returned to Contractor upon acceptance.

E. Samples of finishes shall be 8" x 10" and shall be of minimum thickness consistent with sample presentation. In lieu thereof, submit actual full-size item.

F. Samples of value may be returned to Contractor for use in Work after review, analysis, comparison, and/or testing as may be required by Owner's Representative.

G. Furnish one sample of accepted products, colors, or textures to Owner's Representative for final record. Show identification previously described including, if finish sample, Manufacturer, mix proportion, name of color, building, Contractor, subcontractor, and surfaces to which applied on back of sample.

1.13 Notification of Affected Residences and Businesses

A. Written notification, with Contractor's 24-hour emergency phone number, shall be provided to residences and businesses fronting project on either side of alley. Notify these parties 72 hours in advance of construction which will affect these properties. Door-hangers or other means of notification shall be submitted to and accepted in advance by Owner's Representative.

1.14 Unit Prices

A. Payment for submittals and re-submittals, will be included in price bid for those items of Work for which submittals are required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SHOP DRAWING TRANSMITTAL FORM

FROM: _____ DATE: _____

PROJECT NAME: _____

TO: Psomas
3 Hutton Center Drive Suite 200
Santa Ana, CA 92707

PROJECT NO.: _____

OWNER: _____

ATTN: _____
Construction Manager

SUBMITTAL NO.: _____ THIS IS AN ORIGINAL SUBMITTAL _____ THIS IS A REVISION OF SUBMITTAL NO.: _____

SUBJECT OF SUBMITTAL: _____

SPECIFICATION SECTION(S): _____

PLAN SHEET NUMBER(S): _____

CONTRACTOR'S CERTIFICATION: Check & Complete either (A) or (B) below:

(A) We have reviewed in detail and certify the material, equipment or construction procedure(s) contained in this submittal meet all requirements specified in or shown on Contract Documents, with no exceptions.

(B) We have reviewed in detail and certify the material, equipment or construction procedure(s) contained in this submittal meet all requirements specified in or shown on Contract Documents, except for the following deviations:

_____

_____

_____

CONTRACTOR'S AUTHORIZED SIGNATURE:

_____

MANUFACTURER'S STATEMENT OF RESPONSIBILITY

Project Name:
_____

Specification Section Number: _____

Item:
_____

Serial
Numbers:_____

Owner:
_____

Contractor:
_____

Supplier:
_____

1. **We have reviewed applicable sections of the Contract Documents** describing requirements for our product, including Sections entitled "Submittal Procedures," "Quality Requirements," "Product Requirements," "Starting and Adjusting," " Closeout Procedures," "Operating and Maintenance Data," "Demonstration and Training," "Basic Civil Engineering Requirements," and "Painting and Coating."

2. **Before shipping, we promise to review Contractor's submittals from other Manufacturers** who will supply products that interface with our product, and may affect our product's performance. In addition we promise to request and review data concerning quality of water, soils or any other materials which may contact or adversely impact performance of our product.

3. **Should we have cause to believe our product is, for any reason, incompatible** with an interfacing product or material, we will inform Owner of our concern before shipping our product. In such case, we will not ship our product until our concerns have been satisfactorily resolved.

4. **We further understand that Owner reserves right to request a factory-authorized representative's written acceptance of installation, application and/or erection of our product** as described in Section of Contract Documents entitled "Starting and Adjusting", before paying Contractor for our product.

_____
Authorized Factory Representative

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SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 Work Included

A. Inspection and testing laboratory qualifications, duties and responsibilities.

B. Contractor's quality control requirements.

C. Owner's inspection and testing.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 75 00: Starting and Adjusting

1.3 Reference Standards

A. ASTM E329 Agencies Engaged in Construction Inspection, Testing, or Special Inspection

1.4 Quality Assurance

A. Work shall conform to Federal, State and local building codes, electrical codes, fire codes, mechanical codes, energy codes, green building standards codes, and plumbing codes, and to Occupational Safety and Health Act (OSHA) Regulations. Nothing in Contract Documents shall be interpreted as permission or direction to violate any governing code or ordinance.

B. Where reference is made to third-party standards such as ANSI, AWWA or ASTM specifications, or any standard or code adopted or promulgated by a public agency, it shall mean latest edition thereof formally adopted and published at time of advertisement for bids.

C. “Tying” or “Bundling” of manufactured equipment into packages to thwart competition shall be considered in non-compliance with Contract Documents. Owner is under no obligation to accept any Manufacturer based on such “bundling” arrangements, and may elect to reject any bundled Manufacturer solely on basis such bundling in Owner’s opinion represents an unfair business practice.

D. Manufacturer’s production facilities shall be open for inspection by Owner or Owner’s Representative at all times during production of products furnished under this contract.

1. Notify Owner’s Representative in writing of time and place of shop tests no later than 14 calendar days before they begin. Complete manufacturing operations, checks, adjustments and tests before factory inspection.

2. Notify Owner’s Representative promptly if scheduled test or inspection must be cancelled or rescheduled. Owner will back-charge Contractor for costs incurred by Owner due to Contractor’s failure to notify Owner’s Representative of scheduling, rescheduling or cancellation of tests and inspections in a prompt and timely manner.

3. Factory-witnessed tests, where required, shall be completed no sooner than 14 calendar days after written notification is delivered to Owner. Owner will pay travel expenses for Owner's personnel to and from laboratory performance test location within 50 miles of Work for first test only. Should test results indicate, in opinion of Owner's Representative, that tested equipment fails to meet specified requirements, Owner's Representative will notify Contractor of performance test failure. Contractor shall thereupon notify Manufacturer to reschedule testing and notify Owner of time of retest. Manufacturer shall thereupon at no expense to Owner, make modifications and perform tests as required to demonstrate compliance with Specifications. Additional costs for job specific travel and subsistence shall be reimbursed to Owner by Contractor.

E. Furnish samples required for testing. Cost of material samples to be tested shall be paid by Contractor in all cases. Cost of testing, sampling and laboratory services shall be paid for by Owner or Contractor as shown.

F. Testing by independent testing agencies shall proceed as follows:

1. Testing Agencies shall comply with ASTM E329 and have 5 years minimum experience in appropriate area of specialty and shall be listed on "Roster of Approved Testing Agencies" for either City of Los Angeles, or City of San Diego, or shall be accepted by Owner.

2. Where required by these specifications, or where tests occur more than 50 miles from Work, Contractor shall hire Owner-accepted independent laboratory to perform testing and certify results. Provide labor, products, tools, instruments, water, and power as directed for sampling for required tests.

3. Samples for testing shall be representative of final work product. Samples treated differently from final work product will not yield valid test results.

4. Tests of products shall follow commonly recognized standards of national technical organizations, and specified sampling and testing methods.

5. Contractor shall pay for quality assurance testing unless otherwise shown.

6. Retest costs or other testing costs invoiced to Owner and specified to be paid by Contractor may be deducted from Contractor's next progress payment in lieu of Contractor's direct payment of invoice.

7. Owner may test representative samples of each type and size of product furnished using independent testing agency. Failure of samples to pass tests will be deemed sufficient cause to reject entire lot delivered.

G. Testing by Owner shall proceed as follows:

1. Notify Owner's Representative in writing at least 14 calendar days before Owner testing of materials is required. Written notice shall include name of supplier along with contact information, address and telephone number for source of material.

H. Employ only competent workers on Work. Any person employed found to be incompetent, intemperate, troublesome, disorderly, or otherwise objectionable or who fails to perform Work properly, acceptably and in accordance with Manufacturers' installation and warranty requirements, shall be immediately removed from Work by Contractor and not reemployed on Work.

1. Welders shall be AWS certified for type of work they are performing.

2. Fabricators shall have 5 years minimum experience in appropriate area of specialty and shall be listed on "Roster of Licensed Fabricators" for either City of Los Angeles, or City of San Diego, or shall be accepted by Owner.

3. Deputy Inspectors shall comply with ASTM E329 and have 5 years minimum experience in appropriate area of specialty and shall be listed on "Roster of Approved Testing Agencies" for either City of Los Angeles, or City of San Diego, or shall be accepted by Owner.

I. Upon completion of Contract, Work shall be finished, tested and ready for operation. Work shall fulfill its intended purpose as described in Contract Documents, in submittals, and in Manufacturer's literature.

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Certificates of Compliance	Furnish on Owner's Request
Transcripts of Acceptance Test Results	Furnish on Owner's Request as needed to verify quality of manufactured products
Manufacturer's Statement of Responsibility	Furnish where required in Contract Documents.

B. Furnish samples required for testing. Cost of material samples to be tested shall be paid by Contractor in all cases. Cost of testing, sampling and laboratory services shall be paid for by Owner or Contractor as shown.

1.6 Contractor's Quality Control

A. Arrange work to be readily accessible and easy to operate and maintain where detail drawings are not included in Contract Documents, supplementary drawings or shop drawings and submittals.

B. Combinations of manufactured equipment shall be fully compatible and work safely and successfully as a unit. Furnish necessary mountings, couplings and appurtenances with each unit.

C. Relocations or adjustment of existing facilities noted in Contract Documents shall be done as needed. If existing items are lost or damaged during construction, replace with new items of equal or better quality.

1.7 Project Conditions

A. Ascertain suitability of native soil for backfill before submitting bid. If native soil is found to be unsuitable, provide suitable material for meeting compaction requirements at no additional cost to Owner.

B. Items furnished shall be capable of fulfilling their intended purpose in environment in which they are installed. Allow for local temperature extremes, climactic conditions and corrosive environments where necessary to ensure proper functioning of furnished products.

1.8 Unit Prices

A. Payment for Contractor-provided testing required in Contract Documents will be included in price bid for items of work for which Contractor-provided testing is specified.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Inspection

A. Products and Work shall be subject to field and factory inspection and testing in accordance with standards required and defined in Contract Documents. Waiver by Owner of their right to inspect shall not relieve Contractor of duties to comply with Contract Documents.

B. Contractor shall provide and pay for independent inspection, deputy inspection and testing services required by Contract Documents.

C. Owner will provide certain inspection and testing duties not required of Contractor under Contract Documents. Performance of these tests and costs will be borne by Owner; except, Contractor shall pay cost of any failing test.

D. Inspection will be provided by Owner's Representative. Inspection shall not be considered as direct control of individual workman and his work. Inspections, tests, or approvals by Owner's Representative or others shall not relieve Contractor from their duty to perform Work in accordance with Contract Documents.

E. Inspection and testing fees imposed by public agencies other than Owner shall be paid for by Contractor. If Contract Documents, permits, laws, ordinances, rules, regulations or orders of public authorities having jurisdiction require Work to be inspected, tested, or accepted by someone other than Contractor, give Owner's Representative timely notice of readiness. Submit required certificates of inspection, testing or approval to Owner's Representative.

F. Maintain access to Work for Owner and Owner's Representatives. Permit authorized representatives and agents of Federal or State agencies to inspect work, products, and other relevant data and records. Provide safe and proper facilities to access and observe Work and to inspect or perform tests.

G. Owner’s Representative will inspect products after delivery and throughout construction process. Products will be subject to rejection at any time on account of failure to meet Contract Documents even though samples may have been accepted as satisfactory at place of manufacture.

H. Before backfilling, request inspection by Owner’s Representative to verify proper installation of buried work.

I. Before finishing, request inspection by Owner's Representative to verify no surfaces to receive product have defects or errors which could result in poor or potentially defective application or cause latent defects in workmanship.

J. If Work is covered contrary to written instructions or work is covered before Contractor requests and receives inspection, uncover it at Contractor's expense, if requested by Owner's Representative. Replace at Contractor's expense.

K. If Owner's Representative considers it advisable covered Work be reinspected or tested by others, at Owner's Representative's written request, uncover Work in question, furnishing necessary labor, products, and tools. If Work is found defective, Contractor shall pay for uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, Work is not found defective, Contractor will be allowed an increase in Contract Price or an extension of Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction, and a Change Order will be issued.

3.2 Field Quality Control

A. Frequency of sampling and testing shall be as shown, and shall be performed at such other times as necessary to document contract compliance.

B. Notify Owner's Representative and regulating authorities 3 days before field tests.

C. Perform field tests in presence of Owner's Representative who will record results.

D. Pipework, valves, fittings, conduit, and appurtenances shall have no visible leaks at design pressures. Joints shall be watertight.

E. Buried pipework and conduit shall provide clear and unobstructed pathway free from obstructions due to pipe or conduit deflection and free from interior debris. Where Owner has reason to suspect presence of such obstructions, Owner's Representative reserves right to require mandrel testing to demonstrate compliance before subsequent work such as paving, before charging or commissioning of piping, or before installation of wire within conduit.

F. Remove rejected work from jobsite. Work rejected by Owner's Representative for failure to comply with Contract Documents, shall be removed within 10 calendar days after Written Notice of rejection, whether incorporated in Work or not, unless repairs have been made to Owner's satisfaction.

G. Promptly replace and reexecute removed Work in accordance with Contract Documents and without expense to Owner. Contractor shall bear cost of making good Work of other Contractors destroyed or damaged by such removal or replacement.

H. Removal and replacement work shall be at Contractor's expense. If Contractor does not act to remove rejected Work within 10 calendar days after receipt of Written Notice, Owner may remove such Work and store products at Contractor's expense.

I. Repair, correct or replace work failing tests or inspection. Repeat tests at Contractor's expense, until results satisfy specifications.

J. Repair damage to work that is not cause for rejection.

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SECTION 01 42 13
ABBREVIATIONS AND ACRONYMS

PART 1 - GENERAL

1.1 Work Included

A. This section lists abbreviations and defines them for use in these Contract Documents.

1.2 References

A. Publications listed below form part of this specification to extent referenced and are referred to in text by the basic designation only. Reference shall be made to the latest edition of said standards at time of bid.
   1. CSI TD-2-4 - Construction Specifications Institute Abbreviations
   2. SSPWC - Standard Specifications for Public Works Construction "Greenbook"

1.3 Application

.

A. When references are made in these specifications to standards, specifications, or other published data of various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only.

B. If an abbreviation is not listed below refer to CSI TD-2-4

C. Where use of Standard Specifications for Public Works Construction "Greenbook" is made, refer to SSPWC for use and description of abbreviations.

D. Interpretation of abbreviations shall consider context or discipline in which they are used. For example:

   1. FF means "finish floor" when referring to a floor slab.
   2. FF means "flat face" when referring to a pipe flange.

E. Refer discrepancies to Owner's Representative for interpretation.

1.4 List of Abbreviations

A Ampere / Area / Architectural Sheet
AA Aluminum Association
AASHTO American Association of State Highway and Transportation Officials
AB Anchor Bolt / Aggregate Base
ABAN Abandoned
ABC Asphalt Base Course
ABS Acrylonitrile Butadiene Styrene
AC Acre / Asphalt Concrete / Alternating Current
ACI American Concrete Institute
ACP Asbestos-Cement Pipe
ACU Access Door
ADA Americans with Disabilities Act of 1990 (Public Law 101-336, 104 Sat. 1990,42 USC 12101-12213 (as amended))
AE Architect-Engineer
AFF Above Finished Floor
AGG Aggregate
AI The Asphalt Institute

AIA American Institute of Architects
AISC American Institute of Steel Construction, Inc.
AISI American Iron and Steel Institute
AL Aluminum
AMB Ambient
AMP Ampere
ANG Angle
ANSI American National Standards Institute
APA American Plywood Association
APC Air Placed Concrete
API American Petroleum Institute
APWA American Public Works Association
ARCH Architecture / Architectural
ARAM Asphalt Rubber and Aggregate Membrane
ARHM Asphalt Rubber Hot Mix
ARV Air-Release Valve
ARVV Air-Release and Vacuum Valve
ASCE American Society of Civil Engineers
ASHRAE American Society of Heating, Refrigeration and Air-Conditioning Engineers
ASME American Society of Mechanical Engineers
ANSI American National Standards Institute
ASPH Asphalt
AREA American Railway Engineering Association
ASSY Assembly
ASTM American Society for Testing and Materials
ATS Automatic Transfer Switch
AVE Avenue
AVG Average
AWG American Wire Gage
AWPA American Wood Preservers Society
AWS American Welding Society
AWWA American Water Works Association

BB Back-to-Back
BC Beginning of Curve / Back of Curb / Bare Copper
BEG Begin
BETW Between
BF Blind Flange
BHP Brake Horsepower
BK Back / Brake
BKR Breaker
BL Building
BLK Block
BLVD Boulevard
BM Bench Mark / Beam
BMP Best Management Practice
BO Blowoff
BOP Bottom of Pipe
BOT Bottom
BP Baseplate
BRG Bearing
BRNZ Bronze
BTN Button
BTU British Thermal Unit
BUR CBL Buried Cable

BFV Butterfly Valve
BVC Begin Vertical Curve
BW Block Wall

C Conduit / Celsius / Civil Drawings / Copper
CAB Crushed Aggregate Base
CAP Capacity / Corrugated Aluminum Pipe
CAPA Corrugated Aluminum Pipe Arch
CB Catch Basin / Circuit Breaker
CBC California Building Code
CBR California Bearing Ratio
CC Cooling Coil / AWWA C800 Table 7 Pipe Thread Taper
CCFRPM Centrifugally Cast Fiberglass Reinforced Plastic Mortar
C-C Center-to-Center
CCB Concrete Block
CCR California Code of Regulations
CCTV Closed Circuit TV
CD Cross Drain / Condensate Drain / Ceiling Diffuser
CEC California Electrical Code
CEM Cement
CEnC California Energy Code
CF Cubic Feet / Curb Face
CFC California Fire Code
CFH Cubic Feet Per Hour
CFM Cubic Feet Per Minute
CFS Cubic Feet Per Second
CG Construction Grade
C&G Curb and Gutter
CHDPE Corrugated High Density Polyethylene
CHG Change
CHKD PL Checkered Plate
CI Cast Iron
CIP Cast-in-Place / Cast-Iron Pipe
CIPCP Cast-in-Place Concrete Pipe
CIPP Cured in Place Pipe
CISP Cast Iron Soil Pipe
CISPI Cast-Iron Soil Pipe Institute
CJ Construction Joint
CL Centerline / Class / Clearance / Chlorine
CLR Clear
CLSM Controlled Low-Strength Material
CMB Crushed Miscellaneous Base
CMC California Mechanical Code
CMLCSP Cement-Mortar Lined & Coated Steel Pipe
CMLSP Cement-Mortar Lined Steel Pipe
CMP Corrugated Metal Pipe
CMPA Corrugated Metal Pipe Arch
CMU Concrete Masonry Unit
CO Cleanout / Conduit Only
COL Column
COMM Communication
COMP Composite
COMPL Complete
CONC Concrete
CONN Connection
CONST Construct or Construction

CONT Continuous
CONTR Contractor
COORD Coordinate / Coordinated
COP Copper
COR Corner
CORP Corporation
CP Cathodic Protection
CPC California Plumbing Code
CPLG Coupling
CPVC Chlorinated Polyvinyl Chloride
CQS Cationic Quick Setting
CRM Crumb-Rubber Modifier
CRS Cationic Rapid Setting
CRSI Concrete Reinforcing Steel Institute
CRUMAC Crumb-Rubber-Modified Asphalt Concrete
CRUMAC-GG Crumb-Rubber-Modified Asphalt Concrete Gap-Graded
CS Commercial Standard, US Department of Commerce
CSP Corrugated Steel Pipe
CSS Cationic Slow Setting
CT California Test / Center Top / Current Transformer
CTG Coating
CTR Center
CULV Culvert
CU YD, CY Cubic Yard
CYL Cylinder

D Degree of Curvature
DB Direct Buried / Decibel
DBL Double
DC Direct Current
DEPT Department
DET Detail / Detour
DG Decomposed Granite
DI Drop Inlet
DIA Diameter
DIAG Diagonal
DIM Dimension
DIMJ Ductile-Iron Mechanical Joint
DIP Ductile-Iron Pipe
DIPRA Ductile-Iron Pipe Research Association
DISCH Discharge
DIST Distance
DMH Drop Manhole
DN Down
DR Drain / Door
DSL Diesel
DWG Drawing
DWY Driveway

E East / Electrical Drawings
EA Each
EC End of Curve
ECC Eccentric
ED External Distance
EE Each End
EF Each Face / Exhaust Fan

EFF Efficiency
EFL Effluent
EGL Energy Grade Line
EIA Electronics Industries Alliance
EL Elevation / Each Layer
E/L Easement Line
ELEC Electric
ELP Elliptical
ENC Encasement or Encased
ENCL Enclosure
ENG Engine
ENGR Engineer
EOS Equivalent Opening Size
EP Edge of Pavement / Explosion Proof
EPA Environmental Protection Agency (Federal)
EQ Equation
EQL Equal
ESMT Easement
EST Estimate or Estimated
ETC And so Forth
ETL Electrical Testing Laboratories
EVC End Vertical Curve
EW Each Way
EXC Excavate or Excavation
EXP Expansion
EXST Existing
EXT Exterior / Extension

F Fahrenheit / Floor
FAB Fabricate
FAT Functional Acceptance Test (site)
FBRBD Fiberboard
FC Foot-Candle
FCC Federal Communications Commission
FCO Floor Cleanout
FCV Flow Control Valve
FD Floor Drain
FDN Foundation
FDT Factory Demonstration Test.
FE Flanged End / Fence
Fed Spec Federal Specification
FF Finished Floor / Flat Face
FG Finished Grade
FH Fire Hydrant
F&I Furnish and Install
FIG Figure
FIP Female Iron Pipe Thread
FIPT Female Iron Pipe Thread
FIT Fitting
FL Floor / Flow Line
FLG Flange
FM Force Main / Factory Mutual
FMH Flexible Metal Hose
FNSH Finish
FNTP Female National Pipe Thread Taper
FOC Face of Concrete

FPC Flexible Pipe Coupling
FPM Feet Per Minute
FPS Feet Per Second
FS Finished Surface / Floor Sink / Federal Specifications
FSTNR Fastener
FT Feet
FTG Footing
FUT Future

G Gas / General Drawings / Gram
GA Gage
GAL Gallon
GALV Galvanized
GB Grade Break
GDR Guard Rail
GR Grooved End
GENL General
GFI Ground Fault Interrupter
GG Gap-Graded
GM Gas Main
GND Ground
GPD Gallons Per Day
GPM Gallons Per Minute
GR Grade
GRI Geosynthetic Research Institute
GSKT Gasket
GUI Graphical User Interface.
GUT Gutter
GV Gate Valve

H Humidistat / Horizontal
HARN Harness
HB Hose Bib
HC House Connection
HD Heavy Duty
HDPE High-Density Polyethylene
HGL Hydraulic Grade Line
HGT Height
HI Hydraulic Institute
HMI Human-Machine-Interface. (Software providing graphical user interface to control system
HMWPE High-Molecular Weight Polyethylene
HORIZ Horizontal
HP Horsepower / High Pressure
HPT High Point
HR Hour / Handrail
HRWRA High-Range Water-Reducing Admixture
HS High Strength
HV Hose Valve
HVAC Heating, Ventilating, and Air Conditioning
HW Headwall / Hot Water
HWL High Water Level
HWY Highway
HYDR Hydraulic
HZ Hertz (cycles per second)

I Intersection Angle / Instrumentation Drawings
ICBO International Conference of Building Officials
ICC International Code Council
ID Inside Diameter
IE Invert Elevation
IEEE Institute of Electrical and Electronics Engineers
IMSA International Municipal Signal Association
IN Inches
INCL Include
INL Inlet
INSUL Insulating
INSTL Install or Installation
INT Interior
INTR Intersection
INV Invert
I/O Inlet / Outlet
IP Iron Pipe / Internet Protocol
IPS Iron Pipe Size
IPT Iron Pipe Thread
IRR Irrigation
ISA Instrument Society of America
ITE Institute of Traffic Engineers

JB Junction Box
JCT Junction
JN Join
JT Joint

KG Kilogram
KM Kilometer
KIPS Thousands of Pounds
KPA Kilopascal
KV Kilovolt
KW Kilowatt
KWH Kilowatt-Hour
KWHM Kilowatt-Hour Meter

L Length of Curve / Long / Landscaping Drawings
LATL Lateral
LB Pound
LCL Local
LF Linear Foot
LNDSCP Landscaping
LOCN Location
LP Light Pole
LPG Liquified Petroleum Gas
LPT Low Point
LR Long Radius
LS Lift Station / Lump Sum
LT Left / Light
LWC Lightweight Concrete
LWIC Lightweight Insulating Concrete
LWL Low Water Level

M Mechanical Drawings / Meter
MATL Material

MAX Maximum
MB Machine Bolt / Megabyte / Millibars
MC Medium Curing / Metal Channel
MCM Thousand Circular Mils
ME Machined End
MECH Mechanical
MFR Manufacturer
MG Million Gallons / Milligram
MGD Million Gallons Per Day
MH Manhole
MHZ Megahertz
MI Malleable Iron / Mile
MIL Military Specifications
MIL- Military Specification (leading symbol)
MIN Minimum
MIP Male Iron Pipe Thread
MISC Miscellaneous
MJ Mechanical Joint
MM Millimeter
MNTP Male National Pipe Thread Taper
MO Motor Operator / Motor Operated / Masonry Opening
MOD Modification
MON Monument
MOT Motor
MOV Motor Operated Valve
MSDS Material Safety Data Sheet
MSL Mean Sea Level
MTD Mounted
MUTCS Manual on Uniform Traffic Control Devices

N North / Neutral / Nitrogen
N/A Not Applicable
NACE National Association of Corrosion Engineers
NBS National Bureau of Standards
N & C Nail and Cap
NC Normally Closed
NCV Normally Closed Valve
NE Northeast
NEC National Electrical Code
NEMA National Electrical Manufacturers Association
NFC National Fire Code
NFPA National Fire Protection Association
NIC Not in Contract
NIP Nipple
NO Number / Normally Open
NOM Nominal
NPT National Pipe Thread Taper
NRS Non-Rising Stem
NSF National Sanitation Foundation
NTS Not to Scale
NW Northwest
NWL Normal Water Level

OA Overall / Outside Air
OC On Center / Overcurrent
OD Outside Diameter

OE Or Equal
OF Outside Face
OFCI Owner-Furnished Contractor-Installed
OFCR Owner-Furnished Contractor-Relocated
O/ I PLC Inputs and Outputs.
OPER Operator
OPNG Opening
OPP Opposite
OSHA Occupational Safety and Health Administration, U.S. Department of Labor
OS&Y Outside Screw and Yoke
O TO O Out to Out
OUTL Outlet
OVFL Overflow
OVHD Overhead
O&M Operations and Maintenance.

P Pole
PARA Paragraph
PAV Pressure-Aging Vessel
PB Push Button / Pull Box
PC Point of Curvature / Programmable Controller
PCA Portland Cement Association
PCC Point of Compound Curvature / Portland Cement Concrete
PCS Process Control System
PE Plain End / Polyethylene / Professional Engineer
PEN Penetration
PG Performance Graded / Pressure Gage
PI Point of Intersection
PJTN Projection
PKWY Parkway
PL Plate / Property Line
PLATF Platform
PLC Programmable Logic Controller.
PLF Pounds Per Lineal Foot
PLI Pounds per Lineal Inch
PM Parcel Map
PMB Processed Miscellaneous Base
PNL Panel
PO Push-On
POB Point of Beginning
POC Point of Connection
PE Polyethylene
POR Portion
PP Power Pole / Polypropylene
PPB Parts Per Billion
PPI Plastic Pipe Institute
PPM Parts Per Million
PR Pair
PRC Point of Reverse Curve
PRCB Precast Reinforced Concrete Box
PRESS Pressure
PRL Parallel
PRPSD Proposed
PRVC Point of Reverse Vertical Curve
PSI Pounds Per Square Inch
PSIG Pounds Per Square Inch Gage

PSF Pounds Per Square Foot
PT Point of Tangency
PV Plug Valve
PVC Polyvinyl Chloride / Point of Vertical Curvature
PVI Point of Vertical Intersect
PVMT Pavement
PWR Power
P&ID Process and Instrumentation Diagram.

Q Flow Rate
QTY Quantity

R Radius / Resistance Value / Right
RA Reclaimed Aggregates
RAC Recycled Asphalt Concrete
RAF Return Air Fan
RAP Reclaimed Asphalt Pavement
RAT Reliability Acceptance Test
RC Rapid Curing / Reinforced Concrete
RCP Reinforced Concrete Pipe
RCPA Reinforced Concrete Pipe Arch
RCPCC Reclaimed Plastic Portland-Cement Concrete
RD Road
RDC Reduce
RDCR Reducer
RDWY Roadway
REF Reference
REINF Reinforce or Reinforced
RELOC Relocate
REQD Required
RES Reservoir
REV Revise / Revision
RF Raised Face
RH Relative Humidity
RJ Restrained Joint
RND Round
RM Record Map
ROS Record of Survey
RPM Revolutions Per Minute
RS Road Survey / Rising Stem
RSD Regional Standard Drawings
RST Reinforcing Steel
RT Right
RTFO Rolling Thin-Film Oven
RUS Retail Utilities Service
RW Recycled Water
R/W Right-of-Way
RWGV Resilient-Wedge Gate Valve
S Hveem Stability / South
SA Sweetwater Authority
SAE Society of Automotive Engineers
SAN Sanitary
SAPP Structural Aluminum Plate Pipe
SAPPA Structural Aluminum Plate Pipe Arch
SC Seal Coat / Slow Curing
SCADA Supervisory Control and Data Acquisition

SCFM Standard Cubic Feet Per Minute
SCH Schedule
SCM Supplementary Cementitious Material
SCRN Screen
SD Storm Drain
SDG Siding
SDR Standard thermoplastic pipe dimension ratio (ratio of pipe OD to minimum wall thickness)
SE Sand Equivalent / Southeast
SECT Section
SF Square Feet
SG Specific Gravity
SGL Single
SH Sheet / Sheeting / Shielded / Structural Sheet
SHT Sheet
SI International System of Units (Metric)
SIM Similar
SKWK Sidewalk
SLC Service Lateral Connection
SLP Slope
SLV Sleeve
SM Sheet Metal
SOL Solenoid
SOV Solenoid-Operated Valve
SP Space / Steel Pipe / Static Pressure / Spare / Stand Pipe
SPCG Spacing
SPEC Specification
SPLC Splice
SPRT Support
SQ Square
SS Sanitary Sewer / Slow Setting
SSPC Steel Structures Painting Council
SSPP Structural Steel Plate Pipe
SSPPA Structural Steel Plate Pipe Arch
SSPWC Standard Specifications for Public Works Construction
SS Stainless Steel
ST Street
STA Station
STBY Standby
STD Standard
STK Stake
STL Steel
STR Straight
STRL Structural
STRUCT Structure
STS Storm Sewer
SURF Surface
SW Southwest
SWG Swing
SYMM Symmetrical
SWPPP Storm Water Pollution Prevention Plan
SYS System

T Ton / Tangent Length of Curve
TAN Tangent
T/B Top of Beam

TB Top of Bank / Terminal Board
T&B Top and Bottom
TBG Tubing
TBM Temporary Bench Mark
TC Top of Curb
TCP Traffic Control Plan
TDH Total Dynamic Head
TDS Total Dissolved Solids
TEL Telephone
TEMP Temperature / Temporary
THB Thrust Block
THD Thread or Threaded
THH Thrust Harness
THK Thick
TO Turnout
T/O Top of
TOC Top of Concrete / Top of Curb
TOP Top of Pipe
TOS Top of Slab
TOT Total
TP Telephone Pole
TRD Thread
TRA Tie Rod Assembly
TRMAC Tire-Rubber-Modified Asphalt Concrete
TS Tube Sheet
TTC Temporary Traffic Control
TYP Typical

UD Underdrain
UG Underground
UL Underwriters Laboratories, Inc.
ULT Ultimate
UON Unless Otherwise Noted
UPS Uninterruptible Power Supply.
US United States
USC United States Code
UTC Underground Telephone Cable
UTIL Utilities

V Vent / Valve / Volt / Vertical
VAC Vacuum / Volts Alternating Current
VAI Virtual PLC analog input
VAO Virtual PLC analog output
VC Vertical Curve
VCP Vitrified Clay Pipe
VDC Volts Direct Current
VDI Virtual PLC discrete input
VDO Virtual PLC discrete output
VEL Velocity
VERT Vertical
VFD Variable Frequency Drive
VOL Volume
VPC Vertical Point of Curve
VPI Vertical Point of Intersection
VPT Vertical Point of Tangency
VTCSH Vehicle Traffic Control Signal Heads

W West / Watt / Wide / Water / Wire
W/ With
WADG Water Agencies' Design Guide
WAS Water Agencies' Standards
WASC Water Agencies' Standards Committee
WATCH Work Area Traffic Control Handbook
WE Weld End
WG Water Gage
WL Waterline
WLD Welded
WM Water Meter
W/O Without
WOG Water Oil Gas
WP Waterproof / Working Point
WSE Water Surface Elevation
WSP Water Stop
WT Weight
WTAT Wet Track Abrasion Test
WTR Water
WWF Welded Wire Fabric
WWM Woven Wire Mesh
WWR Welded Wire Reinforcement

X by

YCO Yard Cleanout
YD Yard
YP Yield Point
YR Year
YS Yield Strength

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 Work Included

A. Mobilization, storage yard, temporary utilities, construction aids, barriers and enclosures, security, parking areas, traffic regulation, and temporary controls

B. See Section 01 52 13 for field office requirements.

C. See Section 01 55 26 for traffic control and restriping requirements.

D. See Section 01 57 23 for temporary storm water pollution control requirements.

E. See Section 01 74 00 for cleaning and waste management requirements.

1.2 Related Work

A. Section 01 04 00: Coordination
B. Section 01 33 00: Submittal Procedures
C. Section 01 52 13: Field Offices
D. Section 01 56 26: Traffic Control and Restriping Requirements
E. Section 01 57 23: Temporary Storm Water Pollution Control
F. Section 01 74 00: Cleaning and Waste Management
G. Section 01 77 00: Closeout Procedures

1.3 Submittals

A. Furnish the following submittals:

SUBMITTAL	DESCRIPTION
Storage Yard	Description of Contractor's proposed methods for dust and noise control in storage areas
	Property owner's written approval of storage yard along with City or County Planning Department permit for use of property used as storage yard for project.
Construction Facilities Plan	Layout, equipment, materials and procedures proposed for construction of temporary power, telephone, lighting, heating, water, sanitation, field offices and sheds, storm water management, security, dewatering, etc.
Designation of "Project Safety Official"	Submit name and phone number to Owner's Representative at preconstruction meeting.
Designation of "Competent Person"	Submit name and phone number to Owner's Representative at preconstruction meeting.
Injury and Illness Prevention Program	Description of Contractor's procedures and requirements for safety and hygiene.
Excavation and Shoring Working Drawings (Shoring Plan)	Detailed plan showing design of shoring, bracing, sloping, or other provisions for worker protection from hazard of caving ground during excavation of any trench, pit, or excavation ≥ 5' deep. If shoring plan varies from shoring system standards, plan shall be prepared by structural or civil engineer registered in California. Shoring plan shall accommodate existing underground utilities.
California Division of Industrial Safety Excavation Permit	Submit copy of excavation permit from State Division of Industrial Safety prior to start of excavation.

SUBMITTAL	DESCRIPTION
Confined Space Entry Program (CSEP)	Submit CSEP meeting requirements of California Code of Regulations Title 8, Sections 5156, 5157, and 5158 addressing confined space procedures including: • Training of personnel • Purging and cleaning space of materials and residue • Potential isolation and control of energy and material inflow • Controlled access to spaces • Atmospheric testing of spaces • Ventilation of spaces • Special hazards consideration • Personnel protective equipment • Rescue plan provisions. Include names and daytime telephone numbers of Contractor's personnel including each Subcontractor's personnel assigned to Work having CSEP responsibilities, their CSEP training, and their specific assignment and responsibility in carrying out the CSEP.
Traffic Control Plans	See Section 01 55 26

1.4 Mobilization

A. Obtain temporary easements, which Contractor may require for construction activities outside of existing easements and/or rights-of-way secured by Owner, at Contractor's expense.

B. Remove obstructions in right-of -way before starting construction. Where private property, such as parked cars, must be removed prior to construction, notify respective property owners 72 hours in advance of right-of-way clearing to allow them to remove their property.

1.5 Temporary Dry Utilities

A. Purchase or generate on-site power for Work where existing outlets are not available.

B. Install temporary lighting when Work is performed at night or under deficient daylight conditions to ensure correct performance, to facilitate inspection, and to meet or exceed OSHA and Cal OSHA mandated lighting levels.

C. Construction telephone shall be available at site at all times Work is in progress. Cellular phones are acceptable.

1.6 Temporary Wet Utilities

A. Do not draw water from any fire hydrant, except to extinguish fire, without obtaining written permission from applicable water utility and abiding by conditions set forth by water utility

B. Construction water shall be furnished at Contractor's expense.

C. Connect to water utilities using meters and backflow preventers furnished by water utility.

D. Provide piping, valves and appurtenances needed to deliver construction water where needed for compaction, testing, concrete, dust control and other Work.

E. Construction water shall be clean and free from objectionable deleterious amounts of acids, alkalies, salts, or organic materials. If water is taken through fire hydrants, use one 2½" connection for construction water. Reserve remaining outlets for fire department use.

F. Provide abundant supply of safe drinking water on jobsite at all times.

G. Contractor shall post orders against drinking any water in Work vicinity known to be unsafe

H. Provide suitable and conveniently located toilets, sanitation, and hand washing facilities for workers, and comply with rules and regulations of State Board of Health and/or other bodies having jurisdiction. Leave Contractor-provided toilets and sanitation facilities at site until final inspection has been made.

I. Do not use public sanitation facilities without written permission.

J. Toilets shall be cleaned at least once per week until project completion.

K. Do not interrupt water service or wastewater conveyance and disposal without prior written permission from Owner.

1.7 Safety

A. Contractor shall have full authority over and shall bear full responsibility for jobsite safety and for safeguarding their employees from injury or illness due to construction-related activities.

B. Contractor shall provide safety measures as necessary to protect public and workers within, or in vicinity of Work site. Contractor shall ensure their operations do not create safety hazards. Contractor shall certify they are experienced and qualified to anticipate and meet safety and health requirements of Work and shall require their personnel to observe proper safety and hygienic precautions.

C. Provide safety equipment, material, and assistance to Owner's personnel to facilitate safe and proper inspection of all Work phases.

D. Contractor shall designate in writing a "Project Safety Official," who shall be at Work site at all times Work is in progress and who shall be thoroughly familiar with Contractor's Injury and Illness Prevention Program (IIPP) and Code of Safe Practices (CSP) Project Safety Official shall be available at all times to abate any potential safety hazards and shall have authority and responsibility to shut down an unsafe operation, if necessary.

E. Contractor shall have copies or suitable extracts of Construction Safety Orders and General Industry Safety Orders issued by California State Division of Industrial Safety at Work site

F. Contractor's excavation safety procedures shall address the following:

1. Prior to beginning any excavation ≥ 5' deep, Contractor shall submit to Owner's Representative name of "Competent Person" as defined in California Code of Regulations Title 8, Section 1504.

2. Competent person shall be at Work site as required by Cal OSHA.

3. Do not begin excavating any trench ≥ 5' deep, prior to acceptance of Excavation and Shoring Working Drawings required above under Submittals, and Contractor submitting excavation permit from California State Division of Industrial Safety.

4. If Contractor fails to submit shoring plan or fails to comply with accepted shoring plan, Contractor shall suspend work at affected location(s). Such suspended work shall not be basis of claim for Extra Work, and Contractor shall receive no additional compensation or Contract time.

G. Contractor's explosive handling safety procedures shall address the following:

1. Explosives may only be used in undeveloped areas and only when authorized in writing by Owner's Representative.

2. Handle use and store explosives in accordance with applicable regulations.

3. Notify Owner 72 hours in advance of blasting.

4. Notify jurisdictional law enforcement agency 24 hours in advance of blasting.

5. Notify jurisdictional fire department 24 hours in advance of blasting.

6. Include blasting activities and schedule milestones in Contractor's construction schedule.

7. Owner's acceptance of use of explosives shall not relieve Contractor from liability for claims caused by blasting.

H. Contractor's hazardous substance safety procedures shall address the following:

1. Work may expose Contractor's employees to hazardous materials underground and from nearby facilities. Hazardous materials may include asbestos, lead, mercury, petroleum products, propane gas, natural gas, diesel fuel, gasoline, combustion exhaust products, sewer gas, treatment chemicals, wastewater, and other chemicals.

I. Where asbestos is being removed or cut, requirements of California Code of Regulations Title 8 Division 1, Chapter 4, Subchapter 4 and Subchapter 7 shall be implemented.

J. Contractor shall be solely responsible for storage, use, handling, and application of all hazardous materials encountered or provided as part of Work.

K. Confined space safety procedures shall address the following:

1. Entry into permit-required confined spaces as defined in California Code of Regulations Title 8, Section 5157 may be required as part of Work. Manholes, tanks, vaults, pipelines, excavations, or other enclosed or partially-enclosed spaces shall be considered permit-required confined spaces until pre-entry procedures demonstrate otherwise.

2. Prior to start of Work, submit CSEP as described above under "Submittals."

3. Copy of permit shall be available at all times for review by Contractor and Owner's Representative at Work site.

4. Before performing work in permit-required confined spaces, Contractor shall implement, administer, and maintain Confined Space Entry Program (CSEP) in accordance with California Code of Regulations Title 8, §5156, 5157, and 5158.

L. No attempt is made to set out in detail means or methods necessary to satisfy requirements for worker and public safety. Recognition of requirements set forth by law is made to assist Contractor in identifying necessary costs during bid preparation.

M. Provide scaffolding, rigging, hoisting, and services needed to safely deliver, support, move and install Work. Remove same from premises when Work is complete.

1.8 Construction Aids

A. Comply with OSHA requirements and applicable laws, ordinances, rules, regulations, and orders pertaining to construction machinery and equipment, hoists, cranes, scaffolding, staging, materials handling facilities, tools, appliances and other construction aids.

B. Obtain safety bulletins and printed safety instructions from Manufacturers regarding proper operation of their equipment and installation of their products. Obtain MSDS sheets from chemical manufacturers. Provide copies on-site in a conspicuous location for worker reference.

C. Provide railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.

D. Design temporary supports with adequate safety factor to assure adequate load bearing capability.
   1. When requested, submit design calculations by professional engineer registered in State of California before applying loads.

   2. Submitted design calculations are for information and record purposes only.

E. Prepare and implement accident prevention and safety program to include, but not be limited to:
   1. Exercise precautions throughout construction for protection of persons and property.

   2. Observe safety provisions of applicable laws and regulations.

   3. Observe safety provisions recommended by applicable Manufacturers of products, chemicals, and construction equipment.

   4. Post safety provisions in a conspicuous and logical location accessible to workers on-site for reference.

   5. Guard machinery and equipment, and eliminate other hazards.

   6. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.

   7. Before commencing construction Work, take necessary action to comply with provisions for safety and accident prevention.

F. Adequately identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers. Devices shall conform to minimum requirements of OSHA and State agency which administers OSHA regulations where Project is located.

G. Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.

H. On multi-level structures, provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where Project is located.

1.9 Access Roads and Parking Areas

A. Construct and maintain access or haul roads required for project, and personnel movement into and within construction and excavation areas, subject to prior approval by Owner. Access facilities shall provide for surface drainage. Install and remove earth ramps as

needed to protect concrete and asphalt curbs. Areas used for temporary access, haul roads and access from public roads shall be graded and restored to original. Grade conditions to Owner's satisfaction.

B. Treat access roads and parking areas as needed to control dust and prevent tracking of mud onto paved streets.

1.10 Temporary Controls

A. Dust control operations shall prevent construction dust from harming or annoying persons living in or occupying buildings near Work.

8. Use water or dust preventative to control dust.

9. Cover or wet loads of excavated material, rubbish leaving site, or material being imported to prevent blowing dust.

10. Employ dust control measures to Owner’s satisfaction throughout project duration.

B. Noise control shall be done to comply with local noise ordinances and OSHA regulations for acceptable noise exposure.

1. Schedule Work to comply with noise ordinances.

2. Install sound barriers if needed to comply with noise ordinances and Contract Documents.

3. If noise at doorstep of any private residence exceeds allowable noise specified, Owner may require Contractor to pay each affected household $200 per day to cover expenses of alternative lodging.

4. Do not operate noise-generating construction equipment except during normal working hours unless written permission is obtained from Owner’s Representative.

C. Fire danger shall be minimized at and near construction site. Protect surrounding private property from fire damage resulting from construction operations.

D. Storm water management operations shall be conducted and maintained as needed to prevent runoff or seepage from entering excavations and to control erosion in conformance with Federal, State and local regulations.

E. Operation of portable screens and crushers will not be allowed on or adjacent to Work site.

1.11 Traffic Regulation

A. Contractor shall implement whatever traffic control measures may be required to facilitate Work of this contract, at no additional cost to Owner.

1.12 Unit Prices

A. Payment for mobilization, demobilization, including payment for construction, modification, maintenance, removal and restoration associated with access, and storage facilities, will be included in price bid for major Work items for which mobilization and demobilization are required.

B. Payment for construction surveying and staking will be included in price bid for items of Work for which alignment or limits must be staked.

C. Payment for shoring and bracing will be included in price bid in bid item for shoring and bracing.

D. Payment for Contractor's safety procedures, compliance with provisions of safety orders, and OSHA and Cal OSHA regulations will be included in prices bid for items of appurtenant Work.

E. Payment for verification of field dimensions and utility locations will be included in price bid for items of Work which may require relocation or refitting if field dimensions differ from those shown on plans.

F. Payment for water furnished by Contractor for construction use will be included in price bid for items to which it is appurtenant. Payment under these items will include full compensation for furnishing labor, products, tools and equipment and doing work necessary to develop sufficient water supply and furnishing necessary equipment for applying water as specified.

G. Payment for sanitary facilities will be included in price bid for "Mobilization/Demobilization."

H. Payment for power furnished by Contractor for construction use will be included in price bid for items to which it is appurtenant. Payment under these items will include full compensation for furnishing labor, products, tools, and equipment and doing work necessary to obtain and distribute power for construction purposes.

I. Payment for dust control, including dust palliatives and water supply and application will be included in price bid for Work items for which dust control during construction is required.

J. Payment for costs arising from fire or prevention of fire will be included in price bid for items of work for which fire protection during construction is needed.

K. Payment for noise control facilities will be included in price bid for items of work where noise control facilities are required during construction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

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SECTION 01 52 13
FIELD OFFICES

PART 1 - GENERAL

1.1 Work Included

A. Temporary field office and accessory equipment for Owner.

1.2 Related Work

A. Section 01 04 00: Coordination
B. Section 01 33 00: Submittal Procedures
C. Section 01 50 00: Temporary Facilities and Controls

1.3 Building Construction

A. Provide trailer or, with Owner's consent, construct or rent separate field office building for Owner. Field office and appurtenances or accessories shall remain Contractor's property until project completion. Remove field office from site after completion of project.

B. Building shall be watertight. Field office characteristics shall be as specified below in Table 1. Provide 8-foot-minimum ceiling height. Provide offices, workroom, and restroom as specified. Portable toilet may be provided if no sewer connection is available.

C. If multiple rooms are required per Table 1:

1. Provide floor-to-ceiling walls to separate rooms. Do not use temporary partitions.
2. Provide inter-connecting doors.
3. Provide floor tiles in each room.

D. Provide windows in building, with at least one window for each room. Provide 2 entrance doors to building, one at each end. Provide cylinder lock and key on each door. Provide 6 sets of keys to Owner.

E. Insulate walls and ceiling.

F. Provide electricity.

G. Provide janitorial service.

H. Pay costs for all utilities including installation costs and monthly charges.

1.4 Accessory Equipment

A. Electrical Outlets and Lighting

1. Provide warm white fluorescent light fixtures to evenly illuminate the rooms to a minimum of 50 foot-candles and an average of 70 foot-candles measure at desk height. Provide a minimum 60-watt light fixture in the lavatory facility. Provide light switch in each room.

2. Provide two duplex 120-volt outlets in each room (one only in restroom).

1.5 Unit Prices

A. Payment for field office, including cost of building (or trailer), utilities, services and removal, will be included in lump sum price bid for “Temporary Trailer and Utilities.”

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

TABLE 1: REQUIRED FIELD OFFICE CHARACTERISTICS

Standard Specification
Class "B" Field Office

Office square footage	250 sf minimum
Window area	22 sf minimum
Number of office rooms	2
Air conditioning	not required
Telephone service	not required
Desk 1 required	
Dimensions	3' x 6'
Drawers and locks	required
Table	1 required
Dimensions	3' x '5'/4' x 8'
Chairs	4 required
Type	cushioned office swivel chair
Drafting tables	1 required
Dimensions	4' x 6'
Equipment	drafting machine and parallel bar
Drafting stools	1 required
Type	cushioned
Plan rack	1 required
Metal stick files	6 required
Filing cabinet	1 required
Dimensions	18" wide x 30" deep x 52" high
Drawers	4
Locks	required
Bookcase	1 required
Dimensions	12" deep x 48" long x 60" high
Adjustable shelves	5 required
Wastebaskets	1 required
	Office equipment copy machine
	wall-mounted markerboard (4' x 4') and
	3 markers each in red, green, blue and black
	bottled water service with hot and cold water

Sanitary Facilities

Chemical Toilet	required adjacent to the office
Shower	not required
Wash basin and mirror	required

Fixtures	towel rack medicine cabinet toilet paper dispenser soap dispenser paper towel cabinet
Exhaust fan	required

END OF SECTION

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SECTION 01 55 26
TRAFFIC CONTROL AND RE-STRIPING

PART 1 - GENERAL

1.1 Work Included

A. Requirements for furnishing, constructing, maintaining, and removing detours, road closures, lights, striping, dots, signs, barricades, fences, flares, miscellaneous traffic devices, flagmen, drainage facilities, paving, and such other items and services necessary to:

1. Provide for adequate traffic detour routing and signing to maintain a smooth and safe flow of traffic through and around Work areas

2. Safeguard public from hazard and inconvenience.

3. Comply with ordinances, directives, and regulations of authorities with jurisdiction over public roads in which Work takes place and over which detoured traffic is routed by Contractor.

B. Upon completion of Work, replace all striping, reflectors, dots, or other traffic control materials to original condition or as specified.

1.2 Related Work

A. Section 01 04 00: Coordination
B. Section 01 33 00: Submittal Procedures
C. Section 01 40 00: Quality Requirements
D. Section 01 61 00: Product Requirements
E. Section 01 65 00: Product Delivery Requirements
F. Section 01 66 00: Product Storage and Handling Requirements
G. Section 01 73 00: Execution Requirements

1.3 References

A. Caltrans Standard Specifications Section 12-3.01.

B. Caltrans Manual of Traffic Controls

C. Manual of Uniform Traffic Control Devices (MUTCD)

D. State of California, Department of Public Works "Manual of Warning Signs, Lights, and Devices for Use in Performance of Work Upon Highways"

E. Work Area Traffic Control Handbook (WATCH Manual)

1.4 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Traffic Control Plans (TCP)	Required 30 days before beginning of construction.
	Sheets shall show title, phase identification, name of firm preparing TCP, name and stamp of registered traffic or civil engineer, acceptance block for

SUBMITTAL	DESCRIPTION
Traffic Control Plans (TCP) (cont.)	each jurisdictional agency, north arrow, sheet number, and number of sheets comprising TCP. Include general notes and symbol definitions when appropriate. Provide adequate dimensioning to allow for proper field installation.
	Prepare TCP on 1"=40' scale on common-size sheets, either 11"x17" or 24"x36" as dictated by length of Work.
	Include names and cell phone numbers of parties responsible for maintenance of traffic control devices.
	Submit to respective authority or authorities having jurisdiction over public right of way in which construction occurs.
	Do not start construction until traffic control plans are accepted in writing by agencies having jurisdiction.

1.5 Permanent Traffic Controls

A. All existing permanent traffic control signs, barricades and devices shall remain in effective operation unless substitute operation is arranged for and approved by appropriate jurisdication as portion of vehicular traffic control above, except inductive traffic loops, and magnetometer traffic detectors.

B. Replace inductive traffic loops damaged or removed during construction in kind, from nearest pullbox, in accordance with appropriate provisions of Section 86 "Signals and Lighting" of Caltrans Specifications (except measurement and payment), and existing record drawings for each intersection involved. Obtain copies of these record drawings from offices of respective authorities.

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 – MATERIALS

2.1 Acceptable Manufacturers

A. Acceptable manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Temporary Reflective Raised Pavement Markers	Apex Universal 2SCSM-1W or 2SCSM-1Y	Santa Fe Springs, CA
	Flex-O-Lite Div Lukens Company	Saint Louis, MO
	Accepted equal	
Portable Changeable Message Signs (PCMS)	Solar Tech Model MB2	Contact BC Rentals at (714) 279-6868 for information
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Temporary Reflective Raised Pavement Markers	Dimensions	24' maximum spacing 4" wide 24" long
	Color	Match color of lane line or centerline markers replace.

C. Construction signing used for handling traffic and public convenience shall conform to most current edition of State of California, Department of Transportation "Manual of Warning Signs, Lights, and Devices for Use in Performance of Work Upon Highways" and most current edition of "Work Area Traffic Control Handbook."

D. Signs shall be illuminated or reflectorized when they are used during hours of darkness. Cones, pylons, barricades or posts used to divert traffic shall be provided with flashers or other satisfactory illumination if in place during hours of darkness.

E. Striping shall conform to State of California, Department of Transportation, "Traffic Manual", latest edition.

PART 3 – EXECUTION

3.1 Preparation

A. After award of contract, Contractor shall submit to appropriate jurisdiction their proposed schedule for closure based on Traffic Control Plan and comply with requirements specified herein. This submittal shall be made sufficiently in advance of any rerouting or diversion of traffic by Contractor to allow for review of Contractor's proposed traffic control by appropriate jurisdiction(s).

B. Allow passage of public transportation coaches through construction area at all times. Notify appropriate public transit agency at least 48 hours prior to construction affecting bus stop zones to allow said transit agency to temporarily abandon and relocate bus stop zones within construction area.

C. At least one 4'-wide pedestrian walkway shall be maintained and safely delineated along each public street at all times during Work.

D. Street closure schedules shall be submitted 10 days prior to closing affected street.

E. Before start of Work, provide fire and police departments within whose jurisdiction project lies with construction schedule showing expected start date, sequence of work, and timing for each phase of construction, completion date, and name and telephone number of 2 responsible persons who may be contacted at any hour in event of a condition requiring immediate correction.

F. Inform affected property owners 48 hours prior to blocking driveways with any pipe installation or other work. After working hours, backfill trenches and restore access to all driveways. If requested by Owner's Representative during working hours, provide access over trench from any driveway previously blocked.

G. Notify appropriate jurisdiction at least 10 working days in advance of closing or partially closing any street or alley and comply with jurisdictional requirements. In addition, notify appropriate police or sheriff's department and fire department at least 2 working days in advance of such closing.

H. Do not close cross streets or intersecting streets without approval of authority with jurisdiction over public roads in which Work takes place and over which detoured traffic is routed by Contractor.

I. All existing permanent traffic control signs, barricades, and devices shall remain in operation unless a substitute operation is arranged for and approved by respective authority as a portion of vehicular traffic control above, except inductive traffic loops, and magnetometer traffic detectors.

J. Prior to start of each workday, perform all necessary Work incidental to and commensurate with proper signing, detouring, barricading, etc. heretofore and hereinafter specified, and required for that day's Work. No construction Work shall be permitted until such signing and detouring operations are in place.

K. Immediately notify above parties upon completion of construction work and opening or reopening of any street or alley.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install traffic control devices at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. Caltrans Standard Specifications Section 12-3.01.
4. Caltrans Manual of Traffic Controls
5. Manual of Uniform Traffic Control Devices
6. Work Area Traffic Control Handbook
7. Other applicable code requirements

B. If permanent pavement markings cannot be restored by end of work shift in which they are obliterated, provide temporary markings prior to leaving Work site on all streets except any street closed to through traffic. Temporary markings shall be as follows:

1. Temporary lane lines and/or centerlines shall consist of day/night reflectorized raised pavement markers.
2. Right edge lines shall not be simulated with dashes or pavement markers; however, portable delineators, guide markers, etc., may be used where it is considered desirable to enhance the edge of traveled way due to curvilinear alignment or narrowing pavement and shall be used when directed by Owner's Representative.

3. Post locations where no-passing zone centerline delineation has been obliterated with sign package consisting of a W20-1 "ROAD WORK AHEAD" and SC13 "DO NOT PASS".

4. Where Work causes obliteration of pavement markers and/or delineation, place temporary pavement markers/delineation prior to opening traveled way to traffic. All pavement markers/delineation, including but not limited to lane lines, centerlines, directional arrows, pavement legends, etc, shall be provided at all times for traveled ways open to traffic.

5. Clean surfaces on which temporary pavement delineation is to be applied. Remove all dirt and loose material, leaving surface dry when pavement delineation is applied. Do not apply temporary pavement markers/delineation over existing pavement delineation or other temporary pavement delineation.

6. Maintain temporary pavement markers/delineation until replaced with permanent pavement markers/delineation. Remove temporary pavement delineation when 1) it conflicts with permanent pavement delineation; 2) a new traffic pattern is established or 3) as determined by Owner's Representative.

7. Apply temporary reflective raised pavement markers to pavement surface with adhesive in accordance with manufacturer's instructions. Do not use epoxy adhesive to apply temporary reflective raised pavement markers in areas where pavement will not be removed.

8. Maintain all temporary pavement markings and signs until permanent pavement markings are restored.

9. Temporary lane line or centerline delineation consisting of temporary reflective raised pavement markers may be used on lanes opened to public traffic for maximum of 14 days. Prior to end of 14 days, place planned permanent pavement delineation, except permanent pavement markers. If planned permanent pavement delineation, exclusive of permanent pavement markers, is not placed within 14 days, Contractor shall provide, at their expense, additional temporary pavement delineation as directed by Owner or agency having jurisdiction. Additional temporary pavement delineation provided shall be equivalent to pattern specified for permanent traffic lines.

C. Temporary "No Parking" signs shall be placed as follows:

1. Post "Temporary No Parking" signs at least 48 hours in advance of first date of work and required enforcement. If work is to begin on either a Monday or Tuesday, post signs on preceding Friday.

2. Each sign must include text indicating beginning and end dates and hours in effect. "Tow-Away" and "No Parking" must appear on each sign face.

3. If it is required to temporarily restrict parking 24 hours/day then "Tow-Away" and "No Parking Any Time" must appear on each sign face.

4. Mount signs on either 1" x 2" x 3' high wood stakes, Type II barricades, or 39"-high delineators.

5. Place signs at approximately 100’ intervals on affected side(s) of street. Do not post signs on trees, traffic signal poles, utility poles, street lights, or any other street furniture.

6. Signs shall be professionally made of moisture-resistant, heavy duty cardboard or other approved material.

7. Maintain all signs and keep free of graffiti. Replace signs that become illegible or are removed within 24 hours.

8. Contractor shall only be permitted to restrict parking for minimum time necessary to complete on-going work. Remove and repost "Temporary No Parking" signs when work will be delayed more than 5 consecutive days, or if Work must go beyond end date shown on signs, or otherwise directed by Owner’s Representative.

9. Contractor shall notify applicable police or sheriff’s department, for review and enforcement. Parking restriction cannot be enforced until Police or Sheriff are notified and signs have been in place 48 hours.

10. Maintain signs through day of work. Remove all signs on or within one calendar day of Work completion within restricted parking area.

11. If a street scheduled for slurry or cape sealing was missed, Contractor shall immediately remove all “No Parking” signs and notify all residents and others previously notified, with printed notices, that due to unforeseen circumstances, Contractor was not able to seal street as previously notified, that street will be rescheduled in 1 to 2 weeks, and that they will be re-notified. Prior to start of each day’s work, Contractor shall have adequate supply of approved letters of notification to residents for missed streets available on Work site.

D. Street closures, detours and barricades shall be placed or occur as follows:

1. Provide notifications of public agencies required above.

2. Install, maintain, and remove all temporary delineators, barricades, lights, warning signs and other devices necessary to control traffic as specified in Contract Documents and approved Traffic Control Plans.

3. Materials for a temporary facility may be provided from new or used materials. If used materials are provided, they shall be sound, in good condition and otherwise meet requirements of new materials. All traffic control devices shall be free of graffiti, and Contractor shall immediately clean and/or replace any device to Owner’s satisfaction.

4. Where streets in which improvements are being constructed are specified hereinafter to be closed to through traffic, such closures shall apply only to portions of such streets where construction is actually in progress.

E. Protect open excavations and trenches as follows:

1. Provide temporary railing (Type K) per Caltrans Standard Plan T3, 5’-high chain link fences, or equivalent protection, to completely enclose all open excavations over 3' in depth.

2. Fencing may be removed during working hours to extent necessary to provide access and working room, in which case Contractor shall provide equivalent security, to Owner's satisfaction during said periods. Any excavation not secured to Owner's satisfaction shall be completely backfilled prior to end of each day's construction activities.

3. When backfilling operations of an excavation in traveled way, whether transverse or longitudinal cannot be completed within a work day, steel plate bridging with a non-skid surface and shoring may be required to preserve unobstructed traffic flow. In such cases, the following conditions shall apply:

4. Steel plate used for bridging shall extend at least 12" beyond trench edges.

5. Steel plate bridging shall be installed to operate with minimum noise.

6. Trench shall be adequately shored to support bridging and traffic loads.

7. Temporary paving with cold asphalt concrete shall be used to feather plate edges where posted speed limits are 45 mph or less

8. Bridging shall be secured against displacement by using adjustable cleats, shims, or other devices.

9. Where posted speed limits exceed 45 mph, pavement shall be cold planed to depth equal to plate thickness and width and length equal to plate dimensions.

10. Where posted speed limits are 45 mph or less, attach approach plate(s) and ending plate (if longitudinal placement) to roadway by a minimum of 2 dowels pre-drilled into corners of plate and drilled 2" into pavement. Butt subsequent plates to each other. Fine grade asphalt concrete shall be compacted to form ramps, maximum slope of 8.5% with at least 12" taper to cover all steel plate edges. When steel plates are removed, backfill dowel holes in pavement with either graded fines of asphalt concrete mix, concrete slurry or equivalent slurry satisfactory to appropriate jurisdiction responsible for road maintenance.

11. Contractor shall maintain steel plates, shoring and asphalt concrete ramps.

12. Plate thicknesses shall be as follows: (A-36 grade steel, designed for HS20-44 truck loading).

TRENCH WIDTH	MINIMUM PLATE THICKNESS
0–10"	½"
10" –1'-11"	¾"
1'-11" – 2'-7"	7/8"
2'-7"– 3'-5"	1"
3'-5"– 5'-3"	1 ¼"
5'-3" and wider	Submit structural design prepared by California registered civil engineer

13. Steel plates shall be non-skid.

14. Advance signs shall be required for steel plates within traveled ways (Type P per WATCH Manual or "Rough Road" sign (W33) per Caltrans requirements).

F. Provide signs as required herein and by accepted Traffic Control Plans.

G. Prior to start of each work day, perform all necessary work incidental to and commensurate with proper signing, detouring, barricading, etc., required for that particular day's schedule of operations. Do not begin construction until such signing and detouring operations have been completed.

H. At project completion, replace original striping pattern, unless directed otherwise by Owner's Representative.

I. Striping shall conform to State of California, Department of Transportation, "Traffic Manual."

J. All signs and barricades shall be illuminated or reflectorized when used after sunset. Provide all delineators, cones, barricades or posts used to divert traffic with flashers or other satisfactory illumination if in place during darkness.

K. Maintain 24-hour emergency service to remove, install, relocate, and maintain warning devices and furnish Owner's Representative and Police Department with names and telephone numbers of 3 persons responsible for this emergency service. If these persons do not promptly respond when notified by Owner's Representative, Owner's Representative reserves right to call other forces to accomplish such required emergency service, and Contractor will be held responsible for any costs incurred by Owner.

END OF SECTION

SECTION 01 57 23
TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 Work Included

A. Storm Water Pollution Prevention Plans and pollution prevention during construction.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 74 00: Cleaning and Waste Management

1.3 References

A. California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook for Construction

1.4 Submittals

A. Furnish the following submittals

SUBMITTAL	DESCRIPTION
Storm Water Pollution Prevention Plan (SWPPP)	See Paragraph 1.5 below
Spill Prevention, Control, and Countermeasure Plan (SPCCP)	See Paragraph 1.6 below

1.5 Pollution Prevention and Storm Water Pollution Prevention Plan (SWPPP)

A. Comply with current California State Water Control Board (SWRCB) General Construction Activity NPDES Stormwater Permit (General Construction Permit) for all construction disturbing one acre or more of land (including all staging areas, access routes, material storage yards, etc.) Where more than an acre is disturbed, this permit includes a requirement to develop a Stormwater Pollution Prevention Plan (SWPPP) and Monitoring Plan (MP) which will outline site-specific Best Management Practices (BMPs) to prevent impairment to surface water quality from construction site discharges to surface waters

B. No SWPPP is available. Contractor shall manage operations so no more than 0.999 acres are disturbed by Contractor's operations.

C. Pay all fines associated with failure to comply with Storm Water Pollution Prevention Plan (SWPPP) requirements of applicable Regional Water Quality Control Board, except where such fines are assessed due to sole negligence of Owner.

D. Where a SWPPP has been prepared for project, comply fully with all requirements of SWPPP governing Contractor's operations and record keeping requirements.

E. Where no SWPPP is available:

1. Exercise every reasonable precaution to protect channels, gutters, storm drains, and bodies of water from pollution using best management practices (BMPs) listed in California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook for Construction.

2. Water pollution control Work shall consist of Work necessary to construct facilities required to protect Work area from damage from erosion or impounding of water, prevent erosion and discharge of sediments, and control and abate water pollution.

3. Such work shall include, but not be limited to constructing rock bag berms, desilting basins, drains, fiber rolls and mats, and concrete washout areas.

F. Prohibit rain runoff or other water from entering pipe trenches and infiltrating to ground water by redirecting surface flows with berms, temporary drains, or other suitable measures. Pump water out of trenches as necessary to control water in excavations.

G. Construct silt fence around disturbed soil areas. Take all measures necessary to prevent erosion and transport of sediment into waterways in accordance with SWPPP. Stockpile excavated material within construction staging area. Cover stockpiles with plastic sheets to prevent erosion.

H. In absence of published SWPPP where disturbing more than 0.999 acres by construction operations is unavoidable, Contractor shall retain certified SWPPP preparer accepted in writing by Owner's Representative to prepare SWPPP for approval by Owner and applicable local agency and Regional Quality Control Board.

1.6 Watershed Protection

A. Enforce strict on-site handling rules to keep construction and maintenance materials out of receiving waters.

1. Store all reserve fuel supplies only within confines of designated construction staging area.

2. Refuel equipment only within designated construction staging area.

3. Regularly inspect all construction vehicles for leaks.

B. For Work on sewers or sewage equipment outside wastewater plants, prepare Spill Prevention, Control, and Countermeasure Plan (SPCCP). Plan shall include measures to be taken in event of an accidental wastewater spill.

C. Clearly mark and stake construction and staging areas shown on Plans. Do not use heavy equipment outside this area. Design construction staging areas to contain contaminants such as oil, grease, and fuel products, so they do not drain towards receiving waters or storm drain inlets. If heavy-construction equipment is stored overnight adjacent to a potential receiving water, place drip pans beneath machinery engine block and hydraulic systems.

1.7 Unit Prices

A. Cost for compliance with SWPPP requirements shall be included in bid item "Grading and Structural Excavation" and no additional compensation will be granted.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 Work Included

A. Basic requirements for all products used in Work.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 63 00: Product Substitution Procedures
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 01 73 33: Mechanical Identification
I. Section 01 77 00: Closeout Procedures
J. Section 26 05 00: Common Work Results for Electrical
K. Section 26 05 53: Identification for Electrical Systems
L. Section 33 05 31: Pipeline Joint Materials
M. Section 33 05 39: Manual Valve Operators
N. Section 33 71 73: Electrical Utility Services
O. Section 40 90 10: Common Work Results for Instrumentation and Control

1.3 Quality Assurance

A. Piping systems and elements shall comply with ASME Codes, and appropriate ASTM, API, AWWA, or NFPA standards.

B. Products requiring electrical connection shall be listed and classified by Underwriters Laboratories, Inc. as suitable for purpose shown.

C. Wiring terminations shall match branch circuit conductor quantities, sizes, and materials shown. Enclose terminal lugs in terminal box sized to NFPA 70.

D. If furnished products differ from those shown and require changes to enclosures, mounting and support structures, power and control circuitry or other Work to accommodate furnished product, provide changes required at no additional cost to Owner and of same quality as shown.

1.4 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Products of listed acceptable Manufacturers shall meet specifications notwithstanding the fact Manufacturer is "listed". Owner reserves right to reject submittals and products from "acceptable Manufacturers" if they fail to demonstrate compliance with specifications.

B. Similar items on project shall be products of same Manufacturer.

C. Equipment furnished shall operate through its full operating range powered by amperages specified or shown on Plans. Equipment requiring larger amperage than specified or shown is unacceptable absent written statement from Owner electrical infrastructure and switchgear can support increased amperage.

D. Where plans and specifications are silent regarding specific acceptable Manufacturers, acceptable Manufacturers shall meet minimum requirements outlined in Section 01 63 00 for “accepted equals.”

2.2 Materials

A. Products shall be new and of current design and manufacture, free from defects and imperfection that might impede serviceability of product for its intended purpose.

B. Products and workmanship shall match Contractor's submittals as reviewed by Owner's Representative.

C. Products or Work for which no technical specifications are set forth shall be of best grade in quality and workmanship obtainable in market from firms of established good reputation, or, if not ordinarily stocked, shall conform to usual standards for first class products of kind required, considering intended use. Work shall be in full conformity and harmony with intent to secure best standard of products and construction.

D. Materials and materials sources shall be accepted by Owner at least 3 days before use of materials in Work.

E. Dissimilar metals, when used in conjunction with each other shall have suitable insulation provided between adjoining surfaces to eliminate direct contact and resultant current.

F. Insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators, bushings, washers, or other accepted materials.

G. All-thread or close nipples are prohibited.

H. Mating ends of pipe shall match.

I. Mating ends of valves, meters and couplings shall match ends of adjacent pipe.

J. Minimum working pressure of valves, couplings and fittings shall equal or exceed class of pipe to which they are attached or 150 psi, whichever is higher.

K. Castings shall be sound, clean, free from porosity, cold shots, blisters, holes and defects of any nature that would render them unacceptable. No plugging, filling, brazing or welding of defects will be allowed.

L. Connections and mountings required to install products shall comply with connections and mountings shown in Contract Documents and Submittals on location-specific basis. Do not assume acceptance of connections or mountings at one location constitutes acceptance of same at all locations.

M. Comply with federal, state and local regulations governing VOC content, lead content, percentage solids by volume, and other paint and solvent properties.

N. Corresponding parts of identical products shall be interchangeable.

O. Materials for complete paint or sealant system, including primer, finish coats, thinners, cleaners and drying agents, and other additives shall be end products of one Manufacturer to ensure product compatibility and unit responsibility.

P. Design and fabrication of products shall ensure products withstand stresses and loads which may occur during testing, installation, start-up, and normal operation.

Q. Products shall be capable of fulfilling their intended purpose in environment in which they are installed. Allow for local temperature extremes, climactic conditions and corrosive environments where necessary to ensure proper functioning of furnished products.

R. Electrical equipment shall be built to NEMA and UL standards for NEC Article 505 Classification specified.

2.3 Equipment

A. Stainless steel inscribed nameplates shall be securely fastened in conspicuous locations for mechanical equipment having moving parts. Show Manufacturer's name, year of manufacture, serial number, principal rating data and equipment item number. Nameplates shall be in English and use American measuring units.

B. Valves shall be marked to show name of Manufacturer, year of manufacture, size of valve, maximum working pressure, and arrow to show direction of flow.

C. Valves shall close drip tight at rated pressures.

D. Valves shall be satisfactory for applications involving valve operation after long periods of inactivity.

E. Motors shall meet, as minimum requirements, published standards, rules and regulations of NEMA, ANSI and IEEE as to application, manufacture and tests. Motor windings shall be insulated and braced for full voltage operation.

F. Motors shall develop sufficient torque for required service throughout acceleration range at voltage 10 percent less than motor nameplate rating. Motors shall develop sufficient torque when started using reduced voltage starters.

G. Provide grounding lugs inside conduit boxes for motor frame grounding.

H. Provide grounding rods as required for grounding magnetic meters and other electrical equipment requiring grounding for proper operation.

I. Grease fittings shall be standard button-head type. Grease fittings shall be serviceable by a single type of grease gun. Extend fittings as necessary to provide easy access, or as directed by Owner's Representative.

J. Furnish special tools, wrenches and appliances needed to adjust, operate, maintain or repair mechanical equipment supplied.

PART 3 - EXECUTION

3.1 Installation

A. Furnish mounts, guides, bearing plates, flanges, anchor and attachment bolts and screws, saddles, supports, pads and skids necessary to securely mount products and equipment.

B. Tighten bolts to Manufacturers' specifications using torque wrenches. Unless otherwise directed, use lubricant such as Copperkote or blue Teflon when making up bolts.

C. Manufacturer's instructions and warranty requirements for installation, application, connection, erection, maintenance, operating, cleaning and conditioning of products shall be strictly followed.

D. Contractor shall require Manufacturers to furnish factory-authorized technical representative to visit site as needed to provide technical support in resolving field problems associated with Manufacturer’s product.

END OF SECTION

SECTION 01 63 00
PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 Scope

A. Acceptable manufacturers, accepted alternates, and procedures for seeking product substitutions.

1.2 Related Work

A. Section 01 24 00: Cost Reduction Incentive Proposals
B. Section 01 33 00: Submittal Procedures
C. Section 01 64 50: System Integrators

1.3 General Requirements

A. Pursuant to California Public Contract Code §3400, Deadline for receipt of Substitution Requests shall expire at 5:00 P.M. Pacific Standard Time, 35 calendar days after award of contract.

B. Where products are specified solely by reference standard, any product meeting standards referenced may be used. Information on such products shall be submitted in accordance with requirements of Section 01 33 00.

C. Where products or processes are specified by trade, patent or proprietary name, said specification, unless marked "no exceptions", shall be deemed to be followed by the words "or equal accepted in writing by Owner's Representative." In such case substitution of similar products as "accepted equals" will be considered under this section.

D. Where more than one proprietary name is specified, Contractor may provide any one of products specified or submit a request for an "or equal" substitution consistent with paragraph C above.

E. Only one manufacturer shall be used for each specific application throughout Work notwithstanding that similar materials or equipment of 2 or more manufacturers or producers may be specified for same application.

F. Substitution Request Procedure Before Bid Opening - Submit written request on enclosed form for proposed substitutions to Owner's Representative prior to deadline for receipt of substitution requests. Submit proposed substitutions relating to a particular subcontract or trade in one package. If Owner accepts any proposed substitutions, such acceptance will be set forth by addendum. No substitution will be considered after deadline for receipt of substitution requests has expired unless accompanied by an offer of savings to Owner.

G. Substitution Request Procedure After Bid Opening – Owner will only consider substitutions after bid opening if accompanied by an offer of savings to Owner in excess of $1,000. Submit written request on enclosed form to Owner's Representative. Submit proposed substitutions relating to a particular subcontract or trade in one package. If Owner accepts any proposed substitutions, such acceptance will be set forth by change order.

H. Contractor's Responsibility for Construction Modifications - Drawings have been detailed in compliance with dimensions and International Code Council (ICC) Evaluation Report data for products specified. If proposed substitute product is accepted by Owner's Representative, Contractor shall assume both responsibility for construction modifications and additional costs required by reason of this acceptance. If substitution decreases Contractor's cost, potential savings to Owner may be submitted to Owner's Representative for consideration.

I. No time extension will be allowed for substitution of materials.

1.4 Standardization of Equipment and Certain Materials

A. Systems of Like Manufacture - To ensure standardization and uniformity in all parts of Work and to provide Owner with inter-changeability capabilities, simplified spare parts inventory, and standardized maintenance programs and Manufacturers' services, where products are specified in groups to be furnished by one manufacturer, no substitution will be considered not similarly furnished by one manufacturer. Where Contractor proposes to use system of equipment other than that shown in Contract Documents, substitution shall be proposed as complete system.

B. Material items exempt from standardization include structural steel, reinforcing steel, fasteners and bolting materials, building insulation, sheet metal, materials specified only by reference to recognized standard, and items hidden from view where inter-changeability, color, and texture is no significant factor for standardization.

C. Contractor shall inform their suppliers and subcontractors of these requirements, and shall provide necessary coordination to accomplish standardization specified.

D. Pursuant to California Public Contract Code §3400(b), Owner reserves right to reject product substitutions (1) on the basis of maintenance of economies of scale available to Owner through standardizing of manufacturers and minimizing spare parts inventories, or (2) if Owner has provided in Invitation for Bids that the product is necessary to (i) field test or experiment to determine the product's suitability for future use, (ii) match other products in use on a completed public improvement or one in the course of completion, (iii) obtain a necessary item only available from one source, or (iv) respond to an emergency declared in accordance with requirements of California Public Contract Code §3400(c)(4).

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Substitution Request Form	Submit Substitution Request on form furnished below.
Contractor's Certification of Performance and Assumption of Liability	Submit Certificate of Performance certifying proposed substitution is equal to or better in all respects to product specified and proposed substitution will, in all respects perform function for which it is intended.
Certificate of Compliance	Required as needed to substantiate Product Substitutions
Dimensional Data:	Required for Product Substitutions
Material Samples	Required as needed to substantiate Product Substitutions
Manufacturer's Statement of Responsibility	Required at Owner's discretion for Product Substitutions. See form at rear of Section 01 33 00.
Foundry or Test Record Transcripts	Required as needed to substantiate Product Substitutions
Material List and Ratings	Required as needed to substantiate Product Substitutions
Names and Addresses of Nearest Local Manufacturer's Representatives	Required for Product Substitutions (Use allotted space on attached Substitution Request Form)

SUBMITTAL	DESCRIPTION
List of 3 Local Product Installations	Names and contact information for three installations within 150-mile radius of project completed in prior 3 years. Required for Product Substitutions (Use allotted space on attached Substitution Request Form)
Manufacturer's Service Contract Statement of Qualifications	Required for installations of products which include optional maintenance service contracts.
Warranty	Furnish warranty equal to or better than warranty required for specified product.

B. Burden of proof of equality of substituted item shall be on Contractor. Acceptance of such substitutions is entirely at Owner's discretion.

C. List of Accepted Substitutions - Owner will issue to bidders by addendum a list setting forth accepted substitutions. No products proposed for substitution, shall be ordered before being accepted in writing by Owner's Representative.

D. Products accepted as "accepted equals" shall, in Owner's opinion, meet the following requirements:

1. Products shall be of equal quality, substance and function to those listed.

2. Architectural finishes and colors of accepted equals shall, in Owner's opinion be compatible with existing finishes and colors.

3. Products shall be standard products of a reputable manufacturer having regularly been engaged for 5 years in manufacture of products furnished.

4. Products shall have a reputation for assuring long-lasting trouble-free service.

5. Factory-authorized, factory-trained and competent service personnel and stocked service parts shall be available within a 150-mile radius of Work.

6. Manufacturer shall be capable of certifying compliance with listed reference standards.

E. System integrators accepted as "accepted equals" shall, in Owner's opinion, meet the following requirements:

1. System integrator, including key personnel assigned to project shall have regularly been engaged for 5 years in system integration of products furnished.

2. Work provided by system integrator on prior projects shall have a reputation for delivering long-lasting trouble-free service.

3. Key personnel proposed for work on project shall be factory-trained and competent full-time employees of system integrator, and shall reside within a 150-mile radius of Work.

4. System integrator shall maintain inventory of stocked service parts available within a 150-mile radius of Work.

5. System integrator shall be capable of certifying compliance with listed reference standards.

F. If, in Owner's opinion, proposed substitution is not equal to or better in every material respect to specified product, or was not submitted for acceptance in manner outlined above, Contractor shall furnish products specified.

G. Contractor shall inform all other trades, vendors, and subcontractors of effects of substitutions on their Work or products. Failure to so notify shall not relieve Contractor of their duty to make payments arising from alterations in specified products or methods needed to complete Work in acceptable manner.

1.6 Contractor's Responsibility for Cost of Substitution Reviews

A. Contractor shall pay all costs incurred by Owner's Representative and Owner to review Requests for Substitutions.

1.7 Responsibility for Spare Part Inventories

A. Provide spare parts inventory for 2 years' typical maintenance. See technical specifications for further information for specific equipment items.

1.8 Bid Shopping and Reverse Auctions

A. Substitutions for products and services of Manufacturers, system integrators, or subcontractors listed at time of bid and/or in Contractor's initial Submittal will only be permitted under one or more of the following circumstances:

1. Where Contractor offers a credit to Owner sufficient in Owner's opinion to justify accepting substitution by Change Order.

2. Where Contractor-listed manufacturer, system integrator or subcontractor has gone out of business.

3. Where Contractor-listed manufacturer, system integrator or subcontractor has, in Owner's opinion, failed to perform or no longer possesses both capability and willingness to perform to standard required by Contract Documents.

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4. Where Contractor-listed manufacturer, supplier or subcontractor increases price quoted to Contractor above that quoted at time of bid, and Contractor submits evidence of this acceptable to Owner.

5. With respect to subcontractors listed at time of bid, substitution is for a circumstance permitted by California Public Code Section 4107.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SUBSTITUTION REQUEST FORM

TO: _____
Owner

_____
Address

_____
City/State/ZIP

PROJECT NAME: _____

FROM CONTRACTOR:_____

We hereby submit for consideration the following product substitution of specified item for above project:

DRAWING OR SECTION NO.	**SHEET NUMBER OR PARAGRAPH**	**SPECIFIED ITEM**
_____	_____	_____

PROPOSED SUBSTITUTION:_____

Attach complete dimensional information and technical data needed to substantiate product substitution, including ICBO reports and laboratory tests, if applicable.

Include complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Where product substitutions are proposed at multiple locations, submit copies of plans showing in red each location where product substitution is proposed.

Submit with request all necessary samples and substantiating data to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance. Differences in quality of materials and construction shall be indicated.

Submit Manufacturer’s Statement of Responsibility.

SUBSTITUTION REQUEST FORM

Fill in Blanks Below:

A. Does the substitution affect dimensions shown on Drawings?

Yes ___ No ___ If yes, attach copy of plans and clearly indicate changes.

B. Will the undersigned pay for changes to building design, including engineering, detailing and review costs caused by requested substitution? Yes ___ No ___

C. What effect does substitution have on other trades?

1._____

2. _____

3. _____

D. What effect does substitution have on applicable code requirements?

1._____

2. _____

3. _____

E. What is the ICC Approval Number? _____

F. Differences between proposed substitution and specified item:

1._____

2. _____

3. _____

G. List three installations where product is in use:

1._____

2. _____

3. _____

H. Address of Authorized Manufacturer's Representative:

_____
Representative

_____
Address

_____
City/State/ZIP

I. Manufacturer's guarantees of proposed and specified items are:

Same ___ Different ___ (Explain) _____

J. Owner's share of cost savings if substitution is accepted $_____

SUBSTITUTION REQUEST FORM

CONTRACTOR'S CERTIFICATION OF PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

I certify the proposed substitution is equal to or better in all respects to the product specified and that the proposed substitution will, in all respects perform the function for which it is intended.

Submitted By:

_____
Signature Title

_____
Firm

_____
Address

_____
Telephone Date

For use by Design Engineer:
__ Accepted
__ Accepted as Noted
__ Not Accepted
__ Received Too Late

By _____

Date _____

Remarks _____

_____

_____

_____

_____

_____

_____

_____

Concurrence By:

_____
Owner

Signature must be by person having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in retraction of acceptance.

END OF SECTION

SECTION 01 64 00
INSTALLATION OF OWNER-FURNISHED PRODUCTS

PART 1 - GENERAL

1.1 Work Included

A. Delivery, storage, handling, installation and startup of Owner-furnished products.

B. Owner furnished products for this job include the following:

1.2 Related Work

A. Section 01 65 00: Product Delivery Requirements
B. Section 01 66 00: Product Storage and Handling Requirements
C. Section 01 73 00: Execution
D. Section 01 73 24: Seismic Restraint
E. Section 01 73 33: Mechanical Identification

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Handle, store and install owner-furnished products in accordance with Manufacturer's printed instructions and warranty requirements for storage, handling and installation of Manufacturer's products.

1.5 Submittals

A. Copies of shop drawings and other submittals will be forwarded to Contractor by Manufacturer. Review shop drawings and verify adequate space is provided for installation of Owner-furnished items. In event adequate space or utility connections are not available, immediately notify Owner's Representative in writing so appropriate arrangements may be made.

B. Contractor shall request, review and comply with Manufacturer's written instructions and warranty requirements for handling, storing and installing Manufacturer's products. In the event compliance with said instructions is not feasible, Contractor shall notify Owner's Representative in writing of any exceptions taken to said installation instructions and Owner will take appropriate action.

1.6 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of products shall be strictly followed.

C. Coordinate with Manufacturer and Owner as required to receive, inspect and properly store Owner-furnished products.

D. Upon receipt of Owner-furnished items, thoroughly inspect and inventory delivered item preparing full listing of any noticeable defects or flaws. Submit photograph or videotape evidence of said defects to Owner's Representative.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - MATERIALS

2.1 Materials

A. Furnish incidental bolts, nuts, screws, fasteners, anchors, couplings, supports, pipe couplings, junction boxes, electrical connections, grout and other work required to properly mount, set, level and connect owner furnished items to other facilities being constructed as part of this Contract.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install Owner-furnished items. Field conditions which limit Contractor's ability to properly install said items shall be brought to attention of Owner's Representative at earliest possible moment. Make minor changes in dimensions and alignments as needed to accommodate dimensions of Owner-furnished items as shown in shop drawings.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Install owner-furnished products at locations shown on plans according to Manufacturer's installation and warranty requirements. Manufacturer's requirements for installation, application, connection, erection, maintenance, operating, cleaning, conditioning, and startup of products shall be strictly followed.

C. Install owner-furnished products to tolerances recommended by Manufacturer. Unless otherwise shown, install equipment true, plumb, and level, using precision gauges and levels.

D. Refer variances between Manufacturer's installation instructions and Contract Documents to Owner's Representative.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Finished Installation	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Manufacturer of Owner-furnished products will perform field inspection of installed facility prior to completion of Work. Any exceptions to installation will be brought to Owner's attention by Manufacturer at time of Manufacturer's field inspection so Owner and Contractor may take appropriate remedial actions.

C. Contractor shall make modifications to installation as requested by Manufacturer to remedy any conditions identified by Manufacturer which might void Manufacturer's warranty.

END OF SECTION

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SECTION 01 64 50
SYSTEM INTEGRATORS

PART 1 - GENERAL

1.1 Work Included

A. Owner has elected to require use of System Integrators for the following systems.

1. SCADA systems.

B. This section covers Owner and Contractor responsibilities surrounding use of System Integrators.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 63 00: Product Substitution Procedures
E. Section 01 65 00: Product Delivery Requirements
F. Section 01 66 00: Product Storage and Handling Requirements
G. Section 01 73 00: Execution

1.3 "Sole-Source" System Integrators

A. The following shall apply where Owner has listed one "sole-source" System Integrator.

1. Contractor shall contact sole-source System Integrators before bid and ascertain to their satisfaction what is and is not included in scope of services being offered by system integrator for fee quoted.

2. Work required to complete contract but not expressly listed in quotation from system integrator shall be accomplished by Contractor at no additional charge.

3. In the event System Integrator "sole-sourced" by Owner fails to perform to Owner's satisfaction, Owner's claim against Contractor for System Integrator's failure shall be limited to fee quoted by "sole-source" System Integrator.

1.4 Submittals

A. In the event a bidder desires to use a System Integrator not listed in this section, Contractor shall follow procedures outlined in Section 01 63 00 and shall provide complete submittal package described therein prior to deadline for receipt of Substitution Requests.

1.5 System Integrator's Service Contract and Warranty

A. A 3-year parts-and-labor non-prorated warranty from System Integrator is required, extending from date of Owner's final acceptance. Warranty need not exceed 5 years from date of shipping of System Integrator-furnished products.

B. System Integrator's warranty shall include warranty and support of all components and subcomponents furnished and installed by the System Integrator or under their supervision.

C. Failure of System Integrator to install equipment properly or according to Manufacturer's installation requirements shall not void System Integrator's warranty responsibilities.

D. System Integrator shall have right of inspection of any work by others which interfaces with their work, and shall notify Owner of any observed defective work prior to project completion which may impact the serviceability of the disinfection system. Failure to notify Owner of improper work shall nullify subsequent claims by System Integrator that defective workmanship is not covered by System Integrator's warranty.

E. Warranty shall cover parts, labor and prompt service for repair of defects, performance failure or damage due to normal wear and tear, or due to any cause other than acts of God, Owner's failure to perform minimum maintenance as set forth in O&M instructions furnished with warranty, or intentional or active and extreme abuse of product.

F. Warranties shall cover Owner's full cost of restoring non-functional components to their full function as described in Contract Documents and in Manufacturer's published literature. Prorated warranties will not be accepted. Replacement of damaged parts with old or recycled parts will not be accepted.

1.6 Unit Prices

A. Any allowance for Contractor's overhead and profit expenses over and above fee paid to System Integrators shall be included in lump sum price bid for "Mobilization, Demobilization & Cleanup".

PART 2 - PRODUCTS

2.1 Acceptable System Integrators

A. Acceptable System Integrators include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
SCADA Systems	US Cubed	
	Accepted equal	

PART 3 – EXECUTION (not used)

END OF SECTION

SECTION 01 65 00
PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 Work Included

A. Transportation and delivery of products.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 66 00: Product Storage and Handling Requirements

1.3 References

A. ANSI/NSF 60 Drinking Water Treatment Chemicals – Health Effects
B. ANSI/NSF 61 Drinking Water System Components – Health Effects

1.4 Delivery

A. Do not ship any item until Owner has accepted all applicable submittals.

B. Before shipping materials and/or equipment, Contractor shall also be responsible for verifying field dimensions, utility locations and electrical compatibility for items of Work which may require relocation, refitting, or different electrical motors and wiring if field dimensions differ from those shown on Plans.

C. Should Contractor discovers a conflict during surveying, staking, verification of field dimensions, verification of utility locations or verification of electrical compatibility, they shall bring this matter to Owner's attention as soon as conflict is discovered and before materials or equipment are shipped. Owner will make adjustments to Contract requirements needed to accommodate field conditions, and will pay reasonable costs for upgrades or modifications required to be made at place of manufacture prior to shipping to accommodate conflicts discovered.

D. Owner will not pay costs of shipping and returning items to place of manufacture unless:

1. Owner has acted to prevent Contractor from completing surveys, staking, verification of field dimensions, verification of utility locations or verification of electrical compatibility, and Contractor has notified Owner of this fact in writing before shipping equipment, or

2. Changes required are direct result of buried utility conflicts where said utilities were neither shown on Plans in their approximate location, nor located by Underground Service Alert, nor evident from surface features.

E. Ship and deliver products to jobsite as follows:

1. Do not ship, accept delivery of or store items on site for which applicable submittals have not been accepted.

2. Before shipping, operate valves, motors, pumps, actuators, and mechanical equipment at factory to ensure products are complete and in working condition.

3. Only products of accepted Manufacturers shall be delivered to or stored at site.

4. Deliver products to jobsite in Manufacturer's original, unbroken, unopened, labeled packaging containers or bundles. Tag or label packages containers or bundles as needed to identify contents and name of equipment of which contents form a part.

5. Deliver large multi-component assemblies in sections facilitating field handling and installation.

6. Oil-lubricated gearing, bearings, and other lubricated components shall be shipped with oil soluble protective coating as described in warranty requirements or recommended by Manufacturer. For parts contacting potable water, coating shall be NSF-approved. Coating shall provide protection for one year after final acceptance.

1.4 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

B. Material delivered to Contractor shall not be paid until such material is installed and accepted.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Warranty Requirements

A. Manufacturer’s instructions and warranty requirements for delivery of products shall be strictly followed.

END OF SECTION

SECTION 01 66 00
PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 Work Included

A. Handling, storage and protection of products.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements

1.3 References

A. ANSI/NSF 60 Drinking Water Treatment Chemicals – Health Effects
B. ANSI/NSF 61 Drinking Water System Components – Health Effects

1.4 Storage and Handling

A. Store products at jobsite as follows:

1. Contractor shall be responsible for damage or loss to products until Final Acceptance.

2. Store materials per Manufacturer's recommendations, and in protected area at temperature between 35°F and 110°F.

3. Store products so as to preserve their quality and fitness for Work. Locate stored products and equipment to be incorporated in Work to facilitate prompt inspection.

4. Protect products against moisture, weather, temperature extremes, dust, debris, tampering, theft, vandalism, ultraviolet radiation, or damage from improper handling, storage, or exposure.

5. Protect exposed metals from rust and corrosion, even for items which may be sandblasted or otherwise cleaned before painting. Any corrosion in evidence prior to final acceptance shall be removed, or product shall be removed or replaced.

6. Store items not designed for outdoor exposure off-ground and under cover.

7. Store aggregate in well-drained area to minimize change in moisture content. Prevent contamination by other materials.

8. Store cementitious materials in weather-tight spaces. Keep free from moisture.

9. Store fasteners and connectors in original unopened containers until used.

10. Cover stored materials with tarpaulin or other covering to prevent soiling or exposure to weather. Fasten coverings to prevent removal by wind

11. Cover plastic and similar brittle items to protect from sun exposure and temperature extremes.

12. Store flammable products to conform with City, County, State, and Federal safety codes for storage of flammable materials.

13. Cover, plug, or cap pipe ends, valve ends, and equipment openings with rubber, plastic, or canvas to prevent intrusion or contamination.

14. Stringing of pipe along right of way shall be done in manner that will not interfere with free passage of vehicles.

15. Do not store pipe on roadway or parkway of residential streets for more than 10 days, or on business streets for more than 3 days.

16. Store items in accordance with requirements of project Storm Water Pollution Prevention Plan (SWPPP), if applicable. If a SWPPP has not been prepared for project, store items in accordance with appropriate best management practices (BMP's) listed in California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook for Construction latest edition. Comply with all City, County, State and Federal pollution prevention laws and permits.

17. Notify Owner in writing if delivered or stored product is damaged. Exterior surfaces of delivered items shall be in perfect unblemished condition. Do not repair damaged products without prior written approval.

B. Handle products as follows:

1. Handle products with care, using proper equipment according to Manufacturer's recommendations. Lift large heavy items only at points designated by Manufacturer. Do not drop, drag, bump, bend or handle products in manner that causes abrasions, bruises, cracks, mars, scars, scratches, or other damage. Use padded slings and hooks for lifting as needed to prevent damage. Improper handling shall be cause to reject mishandled products.

2. Coated pipe, valves and other products shall be lifted, lowered or suspended using rubber or canvas belt slings or pneumatic-tired cradles. Sling width shall equal or exceed pipe or product diameter. Do not handle coated products using ropes, hooks, chains, calipers or cables. Store such materials on padded skids.

3. Inspect each product item for damage, defects, completeness and correct operation before installing.

4. Before installation, swab joints and interiors of piping materials to remove foreign matter and contaminants.

5. Clean and protect machined surfaces and shafting from corrosion using proper type and amount of coating as described in Manufacturer's warranty requirements to assure protection to one year after final acceptance.

6. Maintain records for Owner's review of deliveries to show Contractor's order number, purchase order number, and equipment number. Include labeling or shipping tag in records.

1.4 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant and no additional compensation will be granted.

B. There will be no payment for just handling and storage.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Warranty Requirements

A. Manufacturer's instructions and warranty requirements for storage and handling of products shall be strictly followed.

END OF SECTION

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SECTION 01 73 00
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 Work Included

A. Examination of site before bidding, preparation for construction, and execution of Work

1.2 Related Work

A. Section 01 32 33: Construction Photographic and Video Documentation
B. Section 01 33 00: Submittal Procedures
C. Section 01 40 00: Quality Requirements
D. Section 01 61 00: Common Product Requirements
E. Section 01 65 00: Product Delivery Requirements
F. Section 01 66 00: Product Storage and Handling Requirements
G. Section 01 73 24: Seismic Restraint
H. Section 01 73 33: Mechanical Identification
I. Section 01 74 00: Cleaning and Waste Management
J. Section 01 75 00: Starting and Adjusting
K. Section 01 77 00: Closeout Procedures
L. Section 01 78 36: Project Warranties
M. Section 01 78 39: Project Record Drawings
N. Section 01 78 43: Spare Parts
O. Section 01 79 00: Demonstration and Training
P. Section 26 05 00: Common Work Results for Electrical
Q. Section 26 05 53: Identification for Electrical Systems
R. Section 31 05 50: Protecting Existing Utilities
S. Section 33 71 73: Electrical Utility Services
T. Section 40 90 10: Common Work Results for Instrumentation and Control

1.3 Project/Site Conditions

A. Review existing soils reports to ascertain suitability of native soil for backfill before submitting bid. If native soil is found to be unsuitable, provide suitable material for meeting compaction requirements at no additional cost to Owner.

B. Items furnished shall be designed to fulfill their intended purpose in environment in which they are installed. Allow for local temperature extremes, climactic conditions and corrosive environments where necessary to ensure proper functioning of furnished products.

C. The action of beginning installation, application or erection of any product shall be deemed sufficient evidence that both Contractor and installer accept existing field conditions as acceptable for installation, application or erection of that product, except where written notice is given of Contractor or installer's concerns before starting applicable work.

1.4 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid for which such Work is appurtenant. No additional payment will be made for Work in this Section.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Preparation

A. See Section 01 32 33 for preconstruction and construction photographic and video documentation requirements. Damage not documented as preexisting before start of construction will be attributed to Contractor's activities in absence of conclusive evidence to contrary.

B. Carefully lay out work in advance to minimize cutting, channeling, chasing or drilling of structural pads or elements. Cuts, channeling, drilling, or welding required to accommodate mechanical or electrical equipment shall be reviewed in advance with Owner's Representative. Do not begin such work until notified by Owner's Representative. Repair damage to structures, piping equipment or finishes using skilled workers of appropriate trades.

C. Relocations or adjustment of existing facilities needed to facilitate construction must be accepted in writing by Owner's Representative and subsequently relocated or adjusted by Contractor as directed. If existing items are lost or damaged during construction, replace with new items of equal or better quality.

D. Make field measurements needed to fabricate and install Work before ordering or beginning work. Make minor changes in alignments and dimensions as needed to remedy or avoid utilities and structural conflicts.

E. Material safety data sheets (MSDS) shall be available and maintained at project site.

3.2 Installation / Application / Erection

A. Maintain complete set of Contract Documents including shop drawings at jobsite field office or superintendent's truck at all times.

B. Install products in accordance with shop drawings and submittals.

C. Install products according to Manufacturer's installation and warranty requirements. Manufacturer's requirements for installation, application, connection, erection, maintenance, operating, cleaning, conditioning and startup of products shall be strictly followed.

D. Products shall be installed by Contractor at location shown on Plans and submittals.

E. Install products to tolerances recommended by Manufacturer. Unless otherwise shown, install equipment true and level, using precision gauges and levels.

F. Refer variances between Manufacturer's installation instructions and Contract Documents to Owner's Representative.

G. Construct walls, floors, and flatwork plumb, straight, level, square and true. Acceptable deviations from plumb or level shall not exceed ¼" in any 32" section. Flatwork shall not deviate from plan elevation by more than ¾" at any location.

H. Welds, unless otherwise shown, shall be continuous, watertight, and conforming to Structural Welding Code of American Welding Society. Welds shall be free of sharp points or edges.

I. Before welding, abutting joints shall be free of strain.

J. Exposed surfaces shall be finished in appearance. Grind smooth exposed welds. Round or chamfer corners of exposed structural shapes for personnel protection.

K. Roofing systems shall be leak free, demonstrated by a 1-hour hose test.

L. Prime and paint exposed surfaces of ferrous products, piping, and conduit except for stainless steel or galvanized or sherardized surfaces or unless otherwise shown. Clean painted surfaces and touch up bare or marred spots with finish to match factory finish.

M. Paint and coat in workmanlike manner to produce an even film of uniform thickness. Pay attention to edges, angles, flanges, corners, crevices, and joints to insure they have been thoroughly cleaned and they receive specified thickness of paint or coating. Finished surfaces shall be free from runs, drops, ridges, waves, shiners, laps, brush marks, and variations in color, texture and finish. Hiding shall be so complete that addition of another coat would not increase hiding. Apply coats so as to produce film of uniform thickness.

N. Do not force-fit or spring pipe, conduit or equipment into place. Corrective measures for cases of poor alignment shall be accepted in advance by Owner's Representative.

O. Deflections at joints shall fall within Manufacturers' published tolerance limits.

P. Mitered piping joints are not permitted.

Q. Pipe bends shall conform to ASME B31.3 and be free from wrinkles, creases or corrugations.

R. Water pipe bends shall use accepted AWWA fittings.

S. Cut pipe threads with sharp dies and make up joints with accepted thread sealing compound. Threads to be seal-welded shall be made up dry. Do not use Teflon sealers.

T. Epoxy coated pipe, valves and fittings shall be fabricated and installed without cutting, notching or welding.

U. Install valves and equipment so as to be easy to operate and service. Where geometry of manufactured valves and equipment and field conditions make it difficult or impossible for average worker to operate or service an installed item, notify Owner’s Representative of conflict before installing item.

V. Unless otherwise shown, encase buried valves and ductile iron pipe in two layers of 8-mil polyethylene wrap in accordance with AWWA C105.

W. Repair damage to Work that is not cause for rejection.

X. Repair, correct or replace Work failing tests or inspection. Repeat tests until results satisfy specifications. Repair damages resulting from tests.

END OF SECTION

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SECTION 01 73 24
SEISMIC RESTRAINT

PART 1 - GENERAL

1.1 Work Included

A. Seismic restraint systems for mechanical and electrical equipment.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 61 00: Common Product Requirements
C. Section 01 73 00: Execution
D. Section 05 50 00: Metal Fabrications
E. Section 09 90 00: Painting and Coating
F. Section 33 05 38: Hangers and Supports

1.3 System Description

A. Furnish and install complete seismic restraint systems, including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building, mechanical, and electrical codes and standards.

1.4 References

A. ASCE 7 Minimum Design Loads for Buildings and Other Structures Chapter 13 and Chapter 15
B. California Building Code (CBC) Chapter 16
C. MSS SP127 Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
D. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per structural shop drawing requirements.
Catalog Data	Required for pre-manufactured systems per catalog data requirements.
Engineering Calculations	Required for seismic anchorage systems per engineering calculations requirements.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data and engineering calculations.

C. Under California Building Code and ASCE 7 Section13.1.4, engineering calculations are not required for:

1. Seismic restraint of components weighing 20 pounds or less.

2. Seismic restraint of components mounted 4 feet or less above floor level weighing 400 pounds or less.

3. Seismic restraint of piping, utility or distribution systems weighing 5 pounds per lineal foot or less.

D. For wall and slab-mounted equipment, requirement for engineering calculations will be waived if Contractor submits unsealed calculations demonstrating to Owner's satisfaction that either

1. Bolting strength in shear for floor-mounted equipment exceeds weight of equipment. (For bolt strengths in shear, see CBC Table 1911.2 or ICBO data for concrete anchors)

2. Bolting strength in shear for wall-mounted equipment exceeds twice weight of equipment. (For Bolt strengths in shear, see CBC Table 1911.2 or ICBO data for concrete anchors)

E. Calculations required for seismic restraint of nonstructural components shall be sealed by California-licensed civil or structural engineer and shall follow ASCE 7 Section 13.3 where:

1. I_p shall be assumed to be 1.5 unless otherwise shown on Structural Plans.

2. S_{DS} shall be as shown on Structural Plans or Geotechnical Report. If not shown, use S_{DS} equal to 1.0.

3. a_p and R_p shall be as shown in ASCE 7 Table 13.5-1 or Table 13.6-1 as appropriate.

4. Under ASCE 7, Section 13.4.2, anchors in concrete and masonry shall be designed for 1.3 times calculated force F_p

5. Where earthquake lateral design loads for nonstructural components are shown on Plans for Contractor's convenience, typically as a multiple of wet weight (W) of furnished item shown on Sheet S1, either this conservative Plan value may be used, or a more exact value based on exact elevation of furnished item may be used and substantiated by calculation.

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Refer to Section Section 01 61 00 and Section 05 50 00 for basic requirements for products and materials.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install seismic restraint systems before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install seismic restraint systems as required by code and at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, mechanical and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

END OF SECTION

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SECTION 01 73 33
MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 Work Included

A. Materials, and installation of mechanical identification on above-ground pipes, ducts, valves and equipment, for hazardous materials warnings, and for miscellaneous services.

B. Manhole covers and utility castings shall be marked and identified per Section 05 56 00.

C. Buried pipes and equipment shall be marked and identified per Section 33 05 26.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 05 56 00: Metal Castings
I. Section 09 90 00: Painting and Coating
J. Section 10 14 00: Signage
K. Section 26 05 00: Common Work Results for Electrical
L. Section 26 05 53: Identification for Electrical System
M. Section 33 05 26: Utility Identification
N. Section 33 71 73: Electrical Utility Services

1.3 System Description

A. Furnish and install mechanical identification on pipe including appurtenant structural and mechanical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASME/ANSI A13.1 Scheme for Identification of Piping Systems
B. ANSI Z535.1 Safety Color Code

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per architectural shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.

SUBMITTAL	DESCRIPTION
Material Samples	Required, showing materials, colors and label sizes and letter sizes to be furnished
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of mechanical identification on pipes shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Labels for Exterior Piping	Calpico, Inc. Self-Adhesive Pipe Markers	South San Francisco, CA
	Seton Name Plate Corporation Pipe Markers	Branford, CT
	W.H. Brady B-946	Milwaukee, WI
	Accepted equal	
Labels for Valves	Seton Name Plate Corp. Series SVT	Branford, CT
	W.H. Brady B-60	Milwaukee, WI
	Accepted equal	
Labels for Mechanical Equipment	Seton Name Plate Corp. Style 2065	Branford, CT
	W.H. Brady B-120 Fiber-Shield	Milwaukee, WI
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Lettering shall conform to OSHA requirements on all signage and labels.

C. Mechanical identification on pipes shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Labels for Piping Exterior	Weather and Ultraviolet-Resistant Acrylic Plastic	
Labels for Piping Inside Buildings	Vinyl Cloth	
Labels for Valves	Aluminum or 1/16" Fiberglass Tags	Aluminum tags shall have black-filled letters
Labels for Mechanical Equipment	Aluminum, Brass, or ⅛" -thick Fiberglass Tags	Aluminum tags shall have black-filled letters

D. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Labels for Piping	Label Color	Conform to ANSI A13.1 and Z553.1 See below
	Text	Show full piping system name with no abbreviations
	Text Size	Conform to ANSI A13.1 and Z553.1
	Flow Arrows	Provide flow-directional arrows next to each label
	Design	Pre-printed semi rigid, color-coded, snap-on type pipe markers may be provided. Label shall cover 360º (minimum).
Labels for Valves	Tag Requirement	Tag each valve larger than 1"
	Tag Size	2"x2" square identification tag
	Text	Show valve tag number and full name or designation shown on Plans
Labels for Mechanical Equipment	Tag Requirement	Show tag number and equipment name
	Tag Size	½" by 4"
Labels for Instruments and Gauges	Tag Requirement	Show tag number and name of instrument
	Tag Size	1½" by 4"
Manhole Lids	See Section 05 56 00	

E. Except where otherwise directed by Owner, color scheme for piping shall follow 10-States standards and be as follows: (4000-series colors reference numbers are Sherwin Williams color chips)

PIPING SERVICE	PIPE COLOR	BANDS	LABEL COLOR	LEGEND
WASTEWATER PIPING (ABOVE GROUND/VAULTS)				
Sanitary Sewage	4025 Anchor Gray		Gray	White Text
Non-Potable Water	4086 Safety Blue	4032 Black	Safety Green	White Text
Potable Water	4086 Safety Blue		Safety Green	White Text
OTHER LINES				
Other Pipelines	4019 Flint Gray		Conform to ANSI A13.1 and Z553.1	
BURIED UTILITIES (IDENTIFICATION TAPE COLOR)				
Potable Water	Light Blue		Safety Blue	White Text "Caution - Potable Water Line"
Sewage	Light Green		Safety Green	White Text "Caution - Sewer"
Cable TV and other Communications			Safety Orange	White Text "Caution Cable TV"
Telephone			Safety Orange	White Text "Caution Telephone"
Electrical	Encase in Red Concrete		Safety Red	White Text "Caution Electrical"

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install mechanical identification on pipes before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install mechanical identification at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, mechanical and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. In addition to locations shown on Plans and Submittals, provide label and flow arrow at each connection to pumps or other mechanical equipment, at wall boundaries, at tees and crosses, and at 20' centers on straight piping runs. Provide full-band pipe markers, extending 360° around pipe at each location.

F. Attach labels to valve or piece of equipment with Type 304 or 316 stainless-steel chains or wires. Attach label to valve by tying tag wire or chain around operating shaft or nut.

G. Attach signs directly to equipment or on adjacent wall as directed by Owner's Representative.

H. Install mechanical identification on pipes and equipment true, plumb, and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Mechanical Identification	Installation and Level	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 01 74 00
CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 Work Included

A. Cleaning during construction, final cleaning on completion of Work and disposal of waste.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 57 23: Temporary Storm Water Pollution Control
C. Section 02 41 13: Selective Site Demolition

1.3 Submittals

A. Furnish the following submittals

SUBMITTAL	DESCRIPTION
Dust Control Plan (SWPPP)	See Paragraph 1.4 below

1.4 Air Pollution Control

A. Comply with all laws, ordinances, rules, regulations, and orders pertaining to air pollution.

B. Do not discharge smoke, dust, equipment exhaust, or any other air contaminants into atmosphere in quantities sufficient to violate Federal, State, AQMD or local regulations.

C. Maintain equipment engines in proper tune and operate construction equipment so as to minimize exhaust emissions. Do not discharge air pollutants (dust, smoke, or other air contaminants) into atmosphere in such quantities to violate regulations of any legally constituted authority.

D. Phase and schedule polluting construction activities to avoid emission peaks.

E. Do not allow fugitive dust to be visible beyond City facilities' property lines.

1. Employ dust control measures to Owner's satisfaction throughout project duration to prevent construction dust from harming or annoying persons living in or occupying buildings near Work.

2. Use reasonable and typical watering and dust preventative techniques to reduce fugitive dust emissions. Furnish all labor, equipment, and means required (including watering or soil binders), and carry out effective measures wherever and as often as needed to prevent Contractor's operations from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals; or causing a nuisance as determined by Owner.

3. Wet all unpaved demolition and construction areas as necessary during excavation and construction.

4. Use temporary dust covers to reduce dust emissions and meet SCAQMD Rule 403.

5. Cover or wet loads of excavated material or rubbish leaving site or of material being imported to prevent blowing dust.

6. Spread soil binders on site, unpaved roads, and parking areas when needed to control dust and wind-blown particles from causing a nuisance or violating air quality standards.

7. Submit dust control plan and obtain Owner's acceptance before beginning work off paved roads or any activity that might stir up dust.

F. Pursuant to Title 13 of California Code, §2449(d)(3), Contractor shall ensure all self-propelled diesel-fueled vehicles on jobsite, 25-hp and up and not designed for on-road driving, limit idling to no more than 5 consecutive minutes, with the following exceptions:

1. Idling when queuing;

2. Idling to verify vehicle is in safe operating condition;

3. Idling for testing, servicing, repairing, or diagnostic purposes;

4. Idling necessary to accomplish work for which vehicle was designed (such as operating a crane)

5. Idling required to bring machine system to operating temperature; and

6. Idling necessary to ensure safe operation of vehicle.

G. Contractor shall be responsible for promptly paying any fines assessed for noncompliance with Title 13 idling limitations for any equipment owned or rented by Contractor or his subcontractors.

H. Portable engine-driven equipment shall comply with air quality regulations pertaining to portable engines with rated horsepower of 50-bhp or greater and other applicable portable equipment. This includes the following requirements:

1. Engines or other applicable portable equipment shall have SCAQMD permit or be registered with CARB.

2. Engines furnished shall satisfy applicable emissions standards, as set forth in Title 13 of California Code of Regulations (Article 5, §2450-2466) and Title 40 of Code of Federal Regulations, Part 89.

3. Engines shall be equipped with a non-resettable elapsed-operating-time meter. Submit activity reports to regulators as required.

4. If portable engines and other portable equipment permitted with SCAQMD are to be located on Owner's property for more than 12 consecutive months, provide Owner with all information necessary for Owner to revise their Title V operating permit. This information shall include, but is not limited to, detailed equipment description, specifications, emissions information, dispersion modeling, permits, registrations, monitoring records, and source tests reports required by permit for subject equipment. Submit this information to Owner prior to the end of 6th month equipment is located at Owner's facilities. If Contractor fails to provide specified information in specified time frame, Contractor shall bear all fees, costs, and penalties including, but not limited to, filing fees, attorney fees, fees associated to acquire necessary offsets, fees for excessive emissions, etc. associated with City obtaining necessary variances from SCAQMD.

I. Provide responsible personnel in direct control of all vehicle and equipment fueling operations at all times to prevent fuel spills. All fueling must be continually monitored at all times and shall comply with SCAQMD Rule 461, Gasoline Transfer and Dispensing.

J. Per SCAQMD Rule 401 – Visible Emissions, no visible emissions from any engine shall be as dark as or darker than No. 1 in the Ringleman Chart for a period or periods aggregating more than 3 minutes per hour.

K. Maintain usage records of volatile organic compound (VOC) materials according to SCAQMD Rule 109 and pay annual fees according to Rule 301. Usage records shall contain:

1. Manufacturer's Name
2. Product Name/Number
3. Quantity (in gallons)
4. VOC Content (in lb/gal)
5. SCAQMD Rule Number or California Code section

1.5 Cleaning During Construction

L. Maintain areas impacted by Work, including adjacent properties, and public and on-site access roads. Keep these areas free from construction waste, mud, debris and rubbish.

M. Treat access roads and parking areas as needed to control dust and prevent tracking of mud onto paved streets.

1. Minimize spillage on haul routes.
2. Clean public access roads to site. Remove material falling from haul trucks and clean spill areas.
3. Wet down dry materials and rubbish on site.
4. Under no circumstances shall vehicles leaving Work site track mud onto public right-of-way.
5. Sweep streets daily using self-loading rear-broom motor sweeper with vacuum and spray nozzles to remove any mud or waste tracked from Work site to public streets. If streets are kept clean, Owner's Representative may accept less frequent cleaning.

N. Dispose of rubbish, surplus, and waste materials occurring at Work site offsite per local, state, and federal codes, ordinances, and antipollution laws governing locations and methods of disposal.

1. Provide containers for collecting and disposing of waste materials.
2. Do not stockpile rubbish or debris. Store worksite rubbish and debris in roll-off, enclosed containers prior to disposal.
3. Do not burn or bury rubbish and waste materials on project site.

4. Do not dispose of volatile wastes, such as mineral spirits, oil or paint thinner, in storm or sanitary drains.

5. Do not dispose of wastes into streams or waterways.

6. Dispose of asbestos as required by law.

7. Establish regular intervals of collection and disposal of materials and waste.

O. Obtain written permission from property owner prior to disposing of surplus materials, waste products or debris on private property.

P. Use only cleaning materials recommended by Manufacturer of surface to be cleaned.

Q. If Contractor fails to keep Work site free from rubbish and debris, Owner's Representative may suspend Work until condition is corrected.

1.6 Containment of Hazardous Materials

A. Provide methods, means and facilities required to prevent contamination of soil, water or atmosphere by discharge of noxious substances from construction operations.

B. Provide equipment and personnel required to perform emergency measures required to contain any spillages and to remove contaminated soils or liquids.

C. Excavate and dispose of any contaminated earth off-site and replace with suitable compacted fill and topsoil.

D. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances near rivers, drainages, or in sanitary or storm sewers.

E. Provide systems for control of atmospheric pollutants. Prevent toxic concentrations of chemicals. Prevent harmful dispersal of pollutants into the atmosphere.

F. Contractor's equipment used during construction shall conform to all current federal, state and local laws, ordinances, regulations and standards.

G. Provide adequate protection of site to prevent leaks and spills of fuel, oil, solvents, grease and other chemicals onto ground or pavement. Place plastic sheeting with berms beneath drill rig, compressor, pump rigs, test engines, welding machines and fuel/oil storage areas. Place absorbent material on plastic sheeting, remove when saturated, and replace with fresh absorbent material. Closely monitor fueling and equipment servicing to prevent leaks and spills. Store absorbent material in dry condition on-site for clean-up of any spills.

1.7 Disposal of Hazardous Wastes

A. Within framework of Federal and State Laws and as prescribed therein, dispose of all materials categorized as hazardous waste by virtue of ruling of Federal, State or County Regional Environmental Control Agencies.

B. Employ qualified testing laboratory to test for hazardous and toxic components in accordance with California Administrative Code of Environmental Health, Title 22 Division 4.

C. Test results shall include testing laboratory's determination as to whether or not materials to be disposed of conform to limits set forth in Title 22 for both Soluble Threshold Limit Concentrations (STLC) and Total Threshold Limit Concentration (TTLC) values.

D. Remove, transport and dispose of products or materials deemed hazardous in strict accordance with Title 22, including items scheduled for demolition as well as paint, spent abrasives, solvents, cleaning compounds and contaminated soils. Provide written notification of intent to dispose of waste to State of California Department of Public Health Services whether sold to recycling firm or consigned to hazardous waste hauler.

E. Obtain from consignee a receipt for disposition of these materials, and provide certified copy to Owner showing amounts and destination or end use.

1.8 Final Cleaning

A. Restore construction areas to preconstruction conditions after completing of Work and immediately before final inspection.

B. Restore lines and grades of areas used for earthwork storage.

C. Clean, sweep, and wash Work and equipment including finishes.

D. Remove grease, dust, dirt, stains, labels, fingerprints, and foreign materials from sight-exposed interior and exterior finished surfaces. Polish surfaces so designated.

E. Repair, patch, and touch up marred surfaces to specified finish to match adjacent surfaces.

F. Broom-clean paved surfaces.

G. Rake-clean other surfaces of grounds.

H. Remove from Owner's property temporary structures and materials, equipment and appurtenances not required as part of, or appurtenant to, completed Work.

I. After Work is complete, remove from site loose concrete, lumber, wire, aggregate or rock piles, reinforcing, rubbish, debris and materials not incorporated in Work. Remove excess pointing mortar materials and other debris within pipes.

1.9 Unit Prices

A. Payment for cleaning, waste management, and disposal will be included in items of Work to which cleaning, waste management, and disposal is appurtenant.

B. Cost for processing and disposing of hazardous wastes shall be included in bid items set forth in these documents, and no additional compensation will be granted.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 01 75 00
STARTING AND ADJUSTING

PART 1 - GENERAL

1.1 Work Included

A. Testing, adjusting, and balancing of systems, Manufacturers' approvals of installation, and systems demonstrations.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 73 00: Execution
D. Section 01 77 00: Closeout Procedures
E. Section 01 78 23: Operation and Maintenance Data
F. Section 01 79 00: Demonstration and Training
G. Section 03 08 50: Leakage Testing of Hydraulic Structures
H. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
I. Section 33 08 31: Leakage and Infiltration Testing of Gravity Sewer Pipelines
J. Section 33 13 00: Disinfecting of Water Utility Distribution

1.3 Submittals

A. Furnish the following submittals before startup or system demonstration.

SUBMITTAL	DESCRIPTION
Manufacturer's Written Approval of Installation (where "Manufacturer's Statement of Responsibility" is required)	Written approval of installation of products shall be certified and submitted by Manufacturers factory-authorized representative. This written approval shall affirm factory-authorized representative has inspected installation, alignment, lubrication and operation of furnished equipment and found it to fully comply with specified design and warranty requirements and be ready for safe operation.

1.4 Unit Prices

A. Payment for startup, including materials, equipment, devices, labor, travel costs, expenses, and maintenance items, required in Contract Documents will be included in price bid for items of work for which systems demonstration and startup is specified.

B. Payment for services of Manufacturer's representatives will be included in price bid for their products or items to which their products are appurtenant. No additional payment will be made for services or expenses needed for testing, startup, or demonstration if duration of services needed to provide complete working system exceeds those expected or exceeds durations stated in writing in correspondence from Manufacturer to Owner, Contractor or other party.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Preparation

A. Pre-startup checkout and functional testing shall be conducted upon completion of Work.

B. Operate and test all mechanical and electrical Work to satisfaction of Owner. Tests shall demonstrate Work has been properly assembled, aligned, adjusted, wired and connected. Any changes, adjustments or replacements of equipment which due to errors or omissions on part of Contractor shall be done at Contractor's sole expense.

C. Test equipment at rated speeds for required performance, instrumentation control, and automatic operation.

D. Water used during tests shall be at Contractor's expense.

E. Clean foreign material from new Work.

F. To extent possible, turn rotating equipment, operate valves and gates, and check for binding or interference.

G. Check incoming electric power for voltage amplitude and voltage balance. Check motor driven equipment for correct rotation. Check power draw of equipment.

H. Verify safety equipment is in place.

I. Debugging, tuneup and adjustments shall be done as needed.

J. Lubricate mechanical equipment per Manufacturer's instructions using oils and greases of type and viscosity recommended by Manufacturer. Furnish lubricants with flushing oils. Following flushing, fill oil lubrication system with "run-in" oil. Run in equipment at no-load condition for 2 hours. Drain and flush equipment again with flushing oil and refill with lubricant. All equipment shall be properly lubricated and furnished with a one-year supply of all necessary lubricants.

K. Manufacturer's factory-authorized representative shall check all equipment for lubrication, alignment, rotation, and vibration, and shall notify Contractor and Owner of anything in installation which might nullify Manufacturer's warranty.

L. Upon request by Owner, during performance test, furnish services of factory-authorized Manufacturer's representative to inspect and approve, in writing, installation and lubrication of mechanical equipment furnished by that Manufacturer, to place it into operation, to assist in necessary adjustments and tests and to instruct operating personnel in equipment operation and maintenance.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 Work Included

A. Specific administrative procedures, closeout submittals, and forms to be used at substantial completion and final completion of Work.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 74 00: Cleaning and Waste Management
D. Section 01 75 00: Starting and Adjusting
E. Section 01 78 23: Operating and Maintenance Data
F. Section 01 78 36: Product Warranties
G. Section 01 78 39: Project Record Documents
H. Section 01 78 43: Spare Parts
I. Section 01 79 00: Demonstration and Training

1.3 Quality Assurance

A. Upon completion of Contract, Work shall be finished, tested, and ready for operation. Work shall fulfill its intended purpose as described in Contract Documents, in submittals, and in Manufacturer's literature.

B. Where connections or disruptions have been made to existing work, repair, reactivate, refill and recharge components, restoring them to preconstruction conditions. Follow procedures of authorities having Ownership or jurisdiction for Work involving existing utilities and services.

1.4 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Monument Survey	Show record locations of monuments or benchmarks disturbed and reset by Contractor. Monument survey, if required shall be sealed by surveyor licensed to practice in California.
Record Drawings	See Section 01 78 39.
O&M Manuals	See Section 01 78 23.
Warranties	See Section 01 78 36.
Spare Parts	See Section 01 78 43.

1.5 Unit Prices

A. Payment for monument survey required in Contract Documents will be included in price bid for items of work for which monument survey is required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Field Quality Control

A. Following system demonstration, Contractor shall schedule and attend final inspection and walkthrough with Owner's Representative. At walkthrough, Owner's Representative will review Owner-prepared punch list of items requiring correction with Contractor and present punch list to Contractor within 72 hours of meeting. Contractor shall address punch list items promptly.

B. Should Contractor elect to protest a punch list item rather than address it to Owner's satisfaction, Owner reserves right to withhold payment in an amount sufficient to hire a third party to perform unfinished work until such time as dispute between Owner and Contractor is resolved in Contractor's favor.

C. Eleven month warranty inspection shall be conducted prior to release of bonds. Any work failing to comply with specifications or performance standards stated in Manufacturers submittals or printed promotional literature will at that time be tagged as defective and scheduled for repair. Repair all defective work in strict accordance with Contract Documents and to satisfaction of Owner's Representative.

1. Owner will establish inspection date and will notify Contractor at least 30 days in advance.

2. Warranty Inspection Report will be prepared by Owner's Representative and delivered to Contractor. It will set forth number and type of failures observed and names of persons making inspection.

3. Repairs shall proceed promptly. Upon completion of inspection and receipt of Inspection Report, Owner will establish a date for Contractor to proceed with remedial Work. Delay on part of Contractor to proceed with remedial work on schedule shall constitute breach of this Contract. In such case, Owner may proceed to have defects remedied as outlined in Contract Documents.

4. Costs of warranty inspection and repair shall be borne by Contractor, who shall include an appropriate amount for testing and repair in his bid. No additional allowance will be paid by Owner for Warranty Inspection and repairs.

3.2 Adjusting and Cleaning

A. Valve box cover elevations are not shown on Plans. Determine and set cover elevations in field so finished rim elevations are flush with finished pavement where directed by Owner's Representative.

3.3 Extra Stock/Spare Parts

A. Special tools and Manufacturer's standard spare parts, if required by Contract Documents or for normal operation and maintenance during first year of operation, shall be supplied with the Work. Tools shall be packaged in a steel case, clearly and indelibly marked on exterior to indicate equipment for which tools are intended.

B. Spare parts shall be delivered in Manufacturer's original containers labeled to completely describe contents and equipment for which it is furnished.

C. Provide to Owner a list of all spare and replacement parts with individual prices and location where they are available. Prices shall remain in effect for not less than one year after final acceptance.

END OF SECTION

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SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 Work Included

A. Operation and maintenance manual.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 75 00: Starting and Adjusting
C. Section 01 78 36: Project Warranties
D. Section 01 79 00: Demonstration and Training

1.3 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Operation and Maintenance Manual	Furnish as described below.
Equipment Data Sheets	Submit for equipment furnished under each specification section. Include data sheets in Operation and Maintenance Manual. Use attached form and follow format of attached sample Data Sheet to summarize equipment furnished, nameplate data, and equipment Manufacturer's maintenance instructions and recommendations.

1.4 Operation and Maintenance Manual

A. Prepare and submit 4 copies of Operation and Maintenance Manual containing information itemized and requested in Contract Documents. Deliver 3 copies in D-ring binders tabbed and indexed by specification sections. Include table of contents. Label binders with project name. Fourth electronic copy shall be scanned onto CD Rom disc or flash drive and delivered to Owner in labeled plastic case.

B. Each section of Operation and Maintenance Manual shall include the following submittals (where required by contract documents) returned and stamped “accepted:”

1. List of equipment furnished for project with name, address, and telephone number of each vendor
2. List of serial numbers of equipment furnished
3. Equipment data sheet describing function of equipment
4. Tabulation of motor nameplate horsepower, nameplate current, field-measured current, overload relay setting, and catalog number for poly-phase motors
4. Catalog data
5. Shop drawings for mechanical, electrical, and instrument equipment in final form
6. Installation or application instructions
7. Operation and maintenance instructions
8. Parts list

9. List of fuses, lamps, seals, and other expendable equipment and devices. Specify size, type, and ordering description. List name, address, e-mail address, fax number, and telephone number of vendor.

C. Provide manuals for each piece of equipment including individual components and subsystems of complete assemblies. Line out non-applicable text and illustrations. Manual section on operation shall describe functions and limitations of each component and its relationship to system of which it is part. Where several models, options, or styles are described, manual shall identify items actually provided.

D. Provide the following in each manual:

1. Manufacturer's identification, including order number, model, and serial number.

2. Paper prints or reviewed shop drawings and diagrams of all systems.

3. Certified equipment drawings or reviewed shop drawing data clearly marked for equipment furnished.

4. Complete operating and maintenance instructions for each and every item of equipment, setting forth in detail and step-by-step the procedure for starting, stopping, operating, and maintaining entire system as installed. Include schedule of recommended maintenance intervals.

5. Complete parts list of replaceable parts, their part numbers, and name and address of their nearest vendor.

6. Any special emergency operating instruction and list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of system.

7. Copy of Manufacturer's equipment guarantees and warranties.

E. Brochures shall be loose leaf with durable plastic or fiberboard covers. Each sheet shall be reinforced to prevent tearing from continued use, and each brochure shall have the following information clearly printed on its cover:

1. Project name, name of Owner, and address.

2. Name and address of Owner's Representative.

3. Name and addresses of contractors and subcontractors and department to contact.

4. Telephone number of contractors, including night and emergency numbers.

5. Major equipment vendors' names and telephone numbers.

F. Before requesting payment for 80% completion point for total contract, submit two of 6 required copies of Operation and Maintenance Manual containing copies of material available at that time.

G. Within 30 days after review and approval by Owner of 2-copy submittal, submit remaining 3 hard copies and one electronic copy of Operation and Maintenance Manual.

H. Operation and maintenance manuals specified herein are in addition to any operation, maintenance, or installation instructions required by Contractor to install, test, and start up equipment.

1.5 Unit Prices

A. Payment for operation and maintenance manuals required in Contract Documents will be included in price bid for items of Work for which sections of Operation and Maintenance Manuals are required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

EQUIPMENT MAINTENANCE DATA SHEET

PREVENTATIVE MAINTENANCE PROGRAM	EQUIPMENT RECORD NUMBER		
EQUIPMENT DESCRIPTION	**ELECTRICAL OR MECHANICAL DATA**		
Name:	Nameplate Horsepower:		
Serial No.:	Model:		
Vendor:	Catalog Number (polyphase motors):		
Vendor Address:	Type:		
	Manufacturer:		
Vendor Rep:	Voltage:	Measured Current:	Nameplate Current:
Phone:	Phase:	Overload Relay Setting:	rpm:

MAINTENANCE AND LUBRICATION WORK TO BE DONE	Frequency*

SPARE PARTS LIST		FUSES/LAMPS/SEALS		
Quantity	Part & Part Number	Qty	Size	Type & Ordering Description

WARRANTY AND OPERATING REQUIREMENTS AND REFERENCE

*D - Daily; W - Weekly; B - Biweekly; M - Monthly; Q - Quarterly; S - Semiannually; A - Annually

SAMPLE

EQUIPMENT MAINTENANCE DATA SHEET

PREVENTATIVE MAINTENANCE PROGRAM	EQUIPMENT RECORD NUMBER		
EQUIPMENT DESCRIPTION	**ELECTRICAL OR MECHANICAL DATA**		
Name: Influent Pump No. 1 Tag No.: P01-1	Nameplate Horsepower: 15 HP		
Serial No.: 123456ABC	Model: 140T Frame Serial No. 987654ZY Class F Insulation w/ Space Heater		
Vendor: ABC Pump Co.	Catalog Number (polyphase motors): M36999b		
Vendor Address: 1234 Richter Avenue Gotham City, NY 12345	Type:		
	Manufacturer: DEF Motors, Inc.		
Vendor Rep: XYZ Equipment, Inc.	Voltage: 460	Measured Current: 18 amps	Nameplate Current: 20 amps
Phone: 949-752-0505	Phase: 3	Overload Relay Setting: 25 amps	rpm: 1,800

MAINTENANCE AND LUBRICATION WORK TO BE DONE	Frequency*
1. Operate valves and check such things as a) bearing temperature, b) changes in running sound, c) suction and discharge gage readings, d) pump discharge rate, and e) general condition of drive equipment.	D
2. Check packing.	D
3. Check pumping unit for any dust, dirt or debris.	W
4. Lubricate bearing frame and motor bearings (consult manufacturer's instructions for type of grease or oil).	Q
5.Disassemble and change or repair the following: a) impeller, b) shafts, c) shaft sleeve, d) rotary seals, and e) sleeve bearings.	A

SPARE PARTS LIST		FUSES/LAMPS/SEALS		
Quantity	Part & Part Number	Qty	Size	Type & Ordering Description

WARRANTY AND OPERATING REQUIREMENTS AND REFERENCE

For manufacturer's instructions regarding installation, operation, maintenance and troubleshooting of this equipment, see Volume ____, Section ____.

*D - Daily; W - Weekly; B - Biweekly; M - Monthly; Q - Quarterly; S - Semiannually; A – Annually

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SECTION 01 78 36
PRODUCT WARRANTIES

PART 1 - GENERAL

1.1 Work Included

A. Warranties are required for all Work furnished under this contract.

B. Manufacturer's warranties shall not relieve Contractor of liability required under Contract Documents. Such warranties only shall supplement Contractor's responsibility.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 75 00: Starting and Adjusting
D. Section 01 77 00: Closeout Procedures

1.3 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Warranty	For equipment bearing manufacturer's warranty in excess of one year, furnish copy of warranty to Owner with Owner named as beneficiary.

1.4 One-Year Product Warranties

A. Warranties shall cover improper assembly or erection, defective workmanship and products, and incorrect or inadequate operation.

B. One-year warranty shall be furnished for all Work and manufactured items unless otherwise stated. Warranty shall cover parts, labor, and prompt service for repair of defects, performance failure or damage due to normal wear and tear or due to any cause other than acts of God, or intentional or active and extreme abuse of product. Warranty period shall extend one year beyond final acceptance of completed contract by Owner.

C. In addition to Manufacturer's standard warranty, furnish services of factory-authorized and factory-trained service technician to promptly provide repair service for mechanical equipment for specified warranty period. This service shall be provided at no cost to Owner and shall include cost of all replacement parts and labor required during that period.

1.5 Inspection of Installation by Manufacturer

A. Should Manufacturer or supplier of any product have reason to suspect said Manufacturer’s product has not been installed in accordance with Manufacturer’s warranty requirements, Manufacturer shall have right to send their factory authorized representative to inspect facility.

B. Should Manufacturer’s factory-authorized representative elect to inspect installation, said Manufacturer shall promptly notify Owner in writing of any observed deficiencies in installation procedures which might affect required warranty.

C. Should Manufacturer elect to forego inspection of installation of their products, said Manufacturer shall be precluded from claiming faulty installation by others as relief from honoring furnished warranties.

1.6 Eleven-Month Anniversary Warranty Inspection

A. Warranty inspection shall be conducted during 11th month following completion of Work.

B. Locations found in warranty inspection where paving, coating, or paint has peeled, bubbled, or cracked, and locations where rusting is evident will be considered a system failure. Repair defective work identified during warranty inspection by removing deteriorating paving, coating or paint system, cleaning surface, and repaving, recoating, or repainting with same system. Electrically test repaired painted areas. If area of failure exceeds 25% of total paved, coated or painted surface for pavement, coating or paint system on any structure or surface, remove and recoat entire paving, coating or paint system per original specification.

C. Other failed products found in warranty inspection shall be repaired per warranty requirements.

D. Owner shall establish date for warranty inspection and shall notify Contractor at least 30 days in advance. If notification of inspection date does not occur within 12 months after final acceptance, the first anniversary inspection shall be considered to be waived.

1.7 Three-Year Product Warranties and Other Extended Warranties

A. Three-year minimum warranty shall be furnished for:

1. Manhole linings

2. Pumps

3. Other motorized equipment using motors 2-hp or larger

4. Air-conditioning and refrigeration systems

B. Three-year warranty shall be 3-year parts-and-labor non-prorated warranty extending from date of Owner's final acceptance. Warranty need not exceed 5 years from date of shipping.

C. Where System Integrators or unit manufacturers are required to furnish skid-mount or packaged air conditioning systems requiring 3-year or extended warranties, every component of system furnished shall be covered under extended warranty, not withstanding clauses in other sections which may stipulate a lesser warranty for certain components.

D. Ten-year minimum warranty shall be furnished for:

1. Wet well coatings and liners

2. Roofing

E. Ten-year warranty shall be 10-year parts-and-labor non-prorated warranty extending from date of Owner's final acceptance. Warranty need not exceed 12 years from date of shipping.

F. Extended warranty shall cover parts, labor and prompt service for repair of defects, performance failure or damage due to normal wear and tear, or due to any cause other than acts of God, Owner's failure to perform minimum maintenance as set forth in O&M instructions furnished with warranty, or intentional or active and extreme abuse of product. Warranty period shall extend the stipulated number of years beyond final acceptance of completed contract by Owner.

G. Extended warranties shall cover Owner's full cost of restoring non-functional components to their full function as described in Contract Documents and in Manufacturer's published literature. Prorated warranties will not be accepted. Replacement of damaged parts with old or recycled parts will not be accepted.

H. Should Manufacturer refuse to provide full extended warranty, Contractor may be required to purchase extended warranty or negotiate with Owner a fair value for a shorter warranty period.

1.8 General Warranty Clauses

A. Where sections of specifications stipulate longer warranty period than stipulated in this section, the longest and most stringent warranty requirement shall apply.

B. Warranty period shall begin on the earliest of the following 2 milestones:

1. Date of formal notification of completion or

2. 30 calendar days after both substantial completion and Owner taking over beneficial use of project.

C. Warranties shall cover:

1. Parts

2. Labor

3. Diagnostics

4. Servicing

5. Removal or Installation Charges

6. Setup and Reconfiguration of System with Replacement Parts

7. Shipping

D. Where a part is replaced during warranty period, warranty for replaced part and shipping shall be extended to not less than one year following date of replacement. Warranty for labor shall be unchanged.

E. Following notification of Contractor of a warranty issue, Contractor or their agent shall have 2 weeks to inspect and 30 days to remedy defective work. Failure to perform within this stipulated period will result in damages being assessed against Contractor and responsible parties retroactive to date of discovery.

1.9 Unit Prices

A. Payment for warranties required in Contract Documents will be included in price bid for items of work for which warranties are required.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - SCOPE

1.1 General Requirements

A. Contractor shall keep one accurate, legible set of Record Drawings at site and available for review by Owner's Representative in Contractor's field office or in superintendent's truck throughout project.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 79 00: Demonstration and Training

1.3 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Record Drawings	Required as described below
PLC Programming CD Rom Discs	Required as described below
Programmers for Instruments and Devices	Required as described below

1.4 Detailed Requirements

A. Record drawings shall be on one set of full-size project blackline prints of Contract Drawings and other drawings forming part of contract, showing installed locations of improvements and all changes made during construction.

B. Record drawings shall show locations by key dimensions, depths, elevations of all underground piping, conduit, sensor lines, valves, capped ends, branch fittings, pull boxes, and Work.

C. Show all Record Drawing changes in contrasting color to original.

D. In showing changes in Work, or added Work, use same legends used on Contract Drawings. Show locations and elevations to same level of accuracy as original Contract Documents. Tie dimensions to permanent point with 2-point tie-down system.

E. Report changes and deviations promptly to Owner's Representative.

F. Record drawings shall incorporate addenda, supplementary drawings, working drawings, change orders and clarifications.

G. Record drawings shall incorporate survey notes, field notes and system demonstration logs.

H. Maintain Record Drawings on an up-to-date basis with all entries reviewed by Owner's Representative. Bring record drawings to all progress meetings.

I. Protect Record Drawings from damage or loss.

J. Record Drawings shall clearly show all discrepancies between Contract Documents and installed Work.

K. Record information on how to maintain and/or service concealed Work.

L. Concealed shall mean construction installed underground or in area which cannot be readily inspected by use of access panels, inspection plates or other removable features.

M. Record finalized hydraulic and electrical equipment control settings in appropriate tables and spaces provided on Record Drawings.

N. In addition to paper record drawings, provide PDF copy of record drawings on CD ROM disc or flash drive delivered to Owner in labeled plastic case.

O. Provide 2 copies of PLC programming CD ROM discs delivered to Owner in labeled plastic jewelcases.

1.5 Unit Prices

A. Payment for record drawings required in Contract Documents will be included in price bid for items of work for which record drawings are required.

B. Progress payment requests may be withheld if daily logs, schedule updates or Record Drawings are damaged, lost or not kept current to satisfaction of Owner's Representative.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 General

A. During progress payment request meetings, present current record drawing documents for review prior to submittal of progress payment request.

B. Deliver marked record set of Record Drawings to Owner prior to final acceptance of Work. Owner will use these Record Drawings to modify original mylars to create reproducible Record Drawings.

END OF SECTION

SECTION 01 78 43
SPARE PARTS

PART 1 - GENERAL

1.1 Work Included

A. Delivery packaging and quality of spare parts

1.2 Related Work

A. Section 01 75 00: Starting and Adjusting
B. Section 01 78 23: Operation and Maintenance Data
C. Section 01 79 00: Demonstration and Training

1.5 Unit Prices

A. Payment for spare parts required in Contract Documents will be included in price bid for items of work for which spare parts are is specified.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 Extra Stock/Spare Parts

A. Spare parts required shall be delivered in Manufacturer's original containers labeled to completely describe contents and equipment for which it is furnished.

B. At completion of system demonstration, refill or recharge all operating fluids, including but not limited to fuel, and oil.

C. For any device requiring hardware to program, provide one programmer apparatus for each device at each site.

D. In addition to spare parts listed in respective technical specifications that follow, provide the following spare parts in lockable toolbox:

ITEM	DESCRIPTION	EQUIPMENT TYPE	QUANTITY
Spare Parts Equipment Storage Container	Storage Box	Storage Box	1 unit
Each Pilot-Operated Control Valve	Diaphragm and Rubber Kit	Mechanical	1 kit
Motor Control Center Light Bulbs	One-Year Supply of Fuses and Panel Lights	Electrical	10% of units
Each Chart Recorder	One-Year Supply of Charts and Pens	Instrumentation	52 charts
PLC Software	Software Reload Diskettes	Instrumentation	2 sets of CD's
Quantum PLC Controller	Additional PLC Controller	Instrumentation	1 extra unit

END OF SECTION

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SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 Work Included

A. System Demonstration and training of Owner's personnel

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 75 00: Starting and Adjusting
C. Section 01 78 23: Operation and Maintenance Data
D. Section 01 78 43: Spare Parts
E. Section 40 90 10: Common Work Results for Instrumentation and Control

1.3 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
System Demonstration Plan	• Submit within 30 days following pre-construction meeting. • Outline each test procedure proposed for final testing. • Describe each system to be tested, functional test methods, test materials, test instruments and recorders, and results to be recorded. • Include continuous 72-hour demonstration of operation of entire installed system. Shorter demonstration period may be authorized by Owner's Representative if external constraints make 72-hour test impractical. • Demonstrate operation of all instruments, set points, alarms, telemetry, software, safety interlocks and back-up operation modes. • Incorporate Manufacturer's start-up and demonstration procedures. Owner may modify proposed procedures as deemed necessary to demonstrate system operation. • Operate all new equipment through entire no-load to full-load range.
Control System Demonstration Plan	Submit per Section 40 90 10
System Demonstration Log	Submit for final operations test period.
Control Software	Submit current copy of all control software.
Training Outline	Submit for instruction program for Owner's personnel

1.5 Unit Prices

A. Payment for system demonstration including materials, equipment, devices, labor, travel costs, expenses, and maintenance items, required in Contract Documents shall be included in price bid for items of work for which systems demonstration and startup is specified.

B. Payment for costs and expenses of representatives of material and equipment suppliers and subcontractors shall be included in price bid for items of work for which systems demonstration and startup is specified.

C. Payment for operation and maintenance training required in Contract Documents shall be included in price bid for items of work for which operation and maintenance training is required.

D. If it is necessary for any of Owner's inspectors or Owner's Representatives to be present for retests or reinspections of installed facilities, Contractor shall pay all costs on per-diem rate as established between Owner and Owner's Representative or inspector. Said amounts will be deducted from final payments to Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 System Demonstration

A. System demonstration shall conform to accepted demonstration plan

B. Notify Owner's Representative of time and place of system demonstrations at least 7 calendar days before they begin.

C. Arrange for representatives of equipment suppliers and subcontractors to be present as required to successfully demonstrate installed system.

D. Furnish and install any temporary valves, fittings, bulkheads, taps or other items necessary for system demonstration.

E. Prior to formal system demonstration, provide test runs as needed and verify all parts are in place and in working order. Owner's costs for delays during system demonstration due to Contractor's failure to pretest system and verify all products are in place and functional will be back-charged to Contractor.

F. Perform systems demonstrations in presence of Owner's Representative who will record results. Start up and operate individual subsystems, pieces of equipment, instruments, etc.

G. Defects and malfunctions disclosed during testing and system demonstration shall be corrected immediately. Work failing to perform its intended function, and which cannot be repaired, shall be replaced with new equipment.

3.2 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Finished Installation	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	System Demonstration	Demonstrate compliance to Contract Documents and Manufacturer's printed literature using accepted system demonstration plan described above	One 72-hour demonstration without interruption. (If test is interrupted, clock restarts at zero for 72-hour demonstration)	Contractor (Owner will pay for test water)	Contractor
	Control System Demonstration	Section 40 90 10	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Correct all deficiencies found during system demonstration, including malfunctions of equipment or control systems, leakage, excessive vibration and excessive noise.

C. Following testing, remove all bulkheads and temporary equipment. Dispose of test water according to local regulations and NPDES requirements.

3.3 Training of Owner's Personnel

A. After functional testing is complete, conduct training and instruction program on system operation for Owner-designated personnel. Furnish services of qualified factory-trained instructors from applicable equipment Manufacturers. Include instruction covering overview of system, basic operation theory, routine preventative maintenance and repair, safety procedures, and "hands-on" operation of equipment. If not otherwise specified, base duration of program on complexity of equipment involved. Obtain Owner's approval of instruction adequacy before terminating program. Consult Owner to schedule instruction.

B. For electrically powered equipment include training on operator interfaces, switchboards, and MCC's, including operation, setup, maintenance and trouble-shooting of solid-state starters, variable frequency drives, power monitoring and Ethernet and Devicenet communications.

C. As part of training, provide attendees with names, contact persons, telephone numbers and addresses of authorized service centers within 100-mile radius of jobsite for equipment on which training is taking place.

D. System demonstration testing, final operation testing, and instruction of Owner's personnel may be performed simultaneously, subject to prior approval of extent of consolidation.

E. The following training is required:

ITEM	LOCATION	CLASSROOM TRAINING DURATION	FIELD TRAINING DURATION	APPROXIMATE NUMBER OF ATTTENDEES
System Overview	On-site	2 hours	2 hours	3-10 people
Building Maintenance including HVAC, Plumbing and Lighting	On-site	2 hours	2 hours	3-10 people
Instruments and Controls	On-site	2 hours	2 hours	3-10 people
Pilot-Operated Control Valves	On-site	2 hours	2 hours	3-10 people
Pumping System	On-site	4 hours	4 hours	3-10 people
Electrical System	On-site	4 hours	4 hours	3-10 people

END OF SECTION

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SECTION 02 41 13
SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 Work Included

A. Site, mechanical and electrical demolition outside building envelope.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 74 00: Cleaning and Waste Management
H. Section 02 41 14: Paving Removal and Resurfacing
I. Section 02 41 15: Utility Line Removal and Abandonment
J. Section 02 41 16: Structure Demolition
K. Section 26 05 00: Common Work Results for Electrical
L. Section 26 05 53: Identification for Electrical Systems
M. Section 31 23 00: Excavation and Fill
N. Section 33 71 73: Electrical Utility Services

1.3 System Description

A. Remove the following items.

1. Site items including:
    a. Wrought-iron rolling gate
    b. Chain link fence
    c. Landscape tree and bushes along streetscape and immediately outside building
2. Items shown on Plans for demolition including asphalt, fencing, concrete and masonry work, piping, valves, monitoring wells, and electrical work.
3. Items listed for removal in Section 02 41 16 including Redwood Tow Building.

B. Abandon the following items in place:

1. Items shown on plans for abandonment in place
2. Items listed for abandonment in place in Section 02 41 16.

C. Legally dispose of Items not designated for salvage.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods needed for proper performance of Work of this section.

1.5 References

A. California Building Code (CBC)

B. California Fire Code (CFC)
C. California Green Building Code (CGBC)
D. California Mechanical Code (CMC)
E. California Plumbing Code (CPC)
F. NFPA 70 National Electric Code (NEC)

1.6 Hazardous Materials Survey

A. A limited hazardous materials survey has been completed for this project and appended to the Contract Specifications, "Phase I Environmental Site Assessment Summary."

B. Under EPA Regulations and South Coast AQMD Rule 1403, if >100 square feet of material containing over 1% asbestos, must be disturbed during construction, a California Occupational Safety Health Administration (CAL-OSHA)-certified site surveillance technician and or certified asbestos consultant (CAC) is required to:

   a. Conduct visual and/or bulk surveys of property prior to demolition and to prepare a hazardous material survey outlining appropriate remediation measures.

   b. Prepare hazardous material survey, reporting testing results and recommending appropriate remediation measures.

C. In addition, per Cal-OSHA and EPA requirements, if lead, or other hazardous material must be disturbed during construction, DPH Certified Inspector must:

   a. Conduct visual and/or bulk surveys of property prior to demolition and to prepare a hazardous material survey outlining appropriate remediation measures.

   b. Prepare a hazardous material survey, reporting testing results and recommending appropriate remediation measures.

D. Contractor shall hire remediation firm separate from hazardous materials consulting firm to perform appropriate remediation measures. For asbestos concentrations exceeding 0.1%, or other hazardous material concentrations exceeding 1%, remediation work shall be done by personnel OSHA-certified and trained in use of OSHA-required PPE and respirators.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 – PRODUCTS

2.1 Acceptable Consulting and Remediation Firms

A. Acceptable hazardous material consulting firms include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Hazardous Materials Consulting Firms	A-Tech Consulting, Inc. (714) 434-6360	Orange, CA
	Citadel, Inc.	Glendale, CA
	Patriot Environmental Services, Inc.	Wilmington, CA
	Accepted equal	

B. Acceptable remediation firms include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Hazardous Materials Removal and Disposal	Advanced Cleanup Technologies, Inc.	Carson, CA
	Ocean Blue Environmental	Long Beach, CA
	Patriot Environmental Services, Inc.	Wilmington, CA
	PSC Industrial Outsourcing	Long Beach, CA
	Specialized Environmental (562) 698 9222	Anaheim, CA
	Accepted equal	

2.2 Acceptable Manufacturers

C. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Asbestos Encapsulation Compound	Certane 1000 Post Removal Encapsulant.	Eden Prairie, MN
	Accepted equal	

PART 3 - EXECUTION

3.1 Preparation

A. Shut off or disconnect utilities affecting demolition work. Schedule shutdowns with Owner, and notify Owner 3 days in advance of any shutdown required to perform Work.

B. Owner will open/close valves on piping and electrical disconnects required for shutdowns.

3.2 Demolition

A. Refer to Section 01 73 00 for basic execution requirements.

B. Demolish items as shown on Plans.

C. Nonstructural items not shown on Plans for demolition but interfering with (or damaged by) installation of new items, may, at Contractor's option, and pending acceptance by Owner's Representative, be temporarily demolished and replaced following installation of new items subject to the following:

1. Items to be demolished may not be on a structural load path and may not include roofing, decking, trusses, beams, columns, bearing walls, shear diaphragms, connections, or foundations.

2. Non-structural and non-essential items including railings, ladders, supports, piping, conduit, wiring, boxes, lighting fixtures, and other interferences may be removed and shall be replaced with new and similar material pending written permission in advance from Owner.

D. The following demolition standards shall be followed:

1. Applicable EPA, OSHA and Cal OSHA regulations

2. Other applicable building, fire, plumbing, mechanical and electrical code requirements

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. Asbestos shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA and other regulatory agencies. Procedures shall include but not be limited to:

1. Adhere to California Code of Regulations, Title 8, §1529, including construction safety orders regulating dusts, fumes, mists, vapors, and gases associated with asbestos.

2. Asbestos removal shall be performed by trained and registered personnel.

3. Within vaults, deactivate all HVAC systems prior to asbestos removal. Close and temporarily seal registers.

4. Control measures may include wet methods, encapsulation, or removal with HEPA-filter-equipped vacuums into labeled polyethylene bags.

5. See Section 02 41 15 for procedures for removing asbestos-cement pipe. Remove asbestos pipe in whole pipe pieces where possible. At Contractor's option, buried asbestos pipe outside any foundation footprints may be hot-tapped or snap-cut in wetted condition per Section 02 41 15. Do not sawcut asbestos.

6. Demolition shall comply with SCAQMD Rule 1403. Asbestos-related work conducted during demolition shall be performed by a California-licensed asbestos-abatement contractor under supervision of a California State Certified Asbestos Consultant.

7. Remove and dispose of asbestos-containing construction materials (ACCM's) in compliance with notification, monitoring, and asbestos-removal procedures stipulated in SCAQMD Rule 1403 to reduce asbestos-related health risks.

8. Throughout Work, maintain all records of compliance with Rule 1403 for Owner inspection upon request, including:

    a. Evidence of notification of SCAQMD pursuant to Rule 1403,

    b. Contact information for Asbestos-Abatement Contractor,

    c. Contact information for Asbestos Consultant,

    d. Receipts or other evidence of legal off-site disposal of all ACCM's.

9. Air monitoring relating to asbestos removal work shall be performed by or under direct supervision of a California State Certified Asbestos Consultant as required by law.

10. Properly manifest all scrap ACP and prepare for transport, complying with State and local criteria. Deliver scrap material to landfill permitted for disposal of asbestos containing materials.

G. Lead-based paint (LBP) shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA, South Coast Air Quality Management District (SCAQMD), and other regulatory agencies. Procedures shall include but not be limited to the following:

1. Lead-based paint removal shall be performed by trained and registered personnel.

2. Notification to California Department of Public Health (DCPH) shall be completed through filing of an Abatement of Lead Hazards Notification CDPH Form 8551.

3. Removal of LBP's shall be completed by Certified Lead Supervisor or Certified Lead Works as defined by §35008 and §35009 of the LBP Regulations respectively.

4. Work shall conform to procedures specified In Chapter 12 Abatement in "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing" published by the United States Department of Housing and Urban Development in June 1995.

5. Encapsulate any deteriorating lead paint prior to removal.

6. Lead paint that is intact and not delaminating may be disposed of as construction material as long as it is attached to its original substrate.

7. Non-encapsulated paint chips and debris shall be wet-sanded or scraped, collected and disposed of in accordance with local, state and federal regulations.

8. If any paints containing Lead or Chromium must be disturbed or made airborne during Work by activities such as abrasive blasting, welding, cutting or torch burning, provide worker protection in accordance with OSHA Lead in Construction Standard and other applicable regulations.

9. Containment of LBP shall prevent contamination of non-work areas with lead-contaminated dust, lead-contaminated soil, or lead-based paint debris.

10. Removal of LBP materials shall be conducted in accordance with an Abatement Plan prepared by a Certified Lead Supervisor, Certified Lead Project Monitor, or Certified Lead Project Designer. Abatement plan shall encompass all requirements specified in §35100(4)(A) of the LBP Regulations.

11. Throughout Work, Certified Lead Supervisor shall maintain all records of compliance with LBP regulations for Owner inspection upon request, including:

    a. Evidence of notification of CDPH,

    b. Maintenance of Abatement Plan shall be retained on-site throughout demolition activities for Owner review upon request,

12. All demolition activities shall be subject to inspection by CDPH or Owner to verify compliance with requirements of LBP regulations and Abatement Plan.

13. Following completion of abatement activities, retain services of a Certified Lead Inspector/Assessor or Certified Lead Project Monitor to conduct clearance inspection in accordance with Title 17 of California Code of Regulations Division 1 Chapter 8 §35000a and §36000(c)(3).

14. Submit copy of results of clearance inspection to Owner and to City Planning Division upon completion of abatement and inspection activities.

15. Legally dispose of all paint removed during progress of demolition and Work. When paint debris is found to contain >5 ppm lead or hexavalent chromium when tested in accordance with Waste Extraction Test (WET) method of California Code of Regulations, Title 22, it shall be disposed of as hazardous waste.

H. Mercury shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA and other regulatory agencies. Dispose of intact units in accordance with local, state and federal regulations.

I. Polychlorinated biphenyls (PCB's) shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA and other regulatory agencies. Dispose of intact units in accordance with local, state and federal regulations.

J. Following remediation, demolition shall occur as follows:

1. Facilities scheduled for demolition shall be removed, salvaged and disposed of as shown in Contract Documents. Remove and dispose of all portions of items scheduled for demolition which interfere with project construction.

2. Backfill and compact site areas disturbed by demolition work with earth or gravel backfill in accordance with Section 31 23 00.

3. Protect work not intended to be removed or salvaged. If in opinion of Owner's Representative a demolition method used may endanger or damage parts of structure or affect satisfactory operation of facilities, promptly change method upon receipt of notification from Owner's Representative.

4. No blasting will be permitted.

5. All equipment, material and piping, scheduled for demolition and not required to be salvaged to Owner shall become Contractor's property and shall be removed from project site and disposed of legally.

6. Do not reuse material salvaged from demolition work on this project except where permitted by Contract Documents.

K. Patching shall occur as follows:

1. Patching shall include restoration of surface or item to condition as near as practicable to match existing adjoining surfaces unless otherwise directed.

2. Where patching involves cleaning, painting, special coating, wall covering or other applied finish, clean and refinish entire surface plane, wall or ceiling unless complete refinishing of entire space is required elsewhere.

L. Each load for landfill disposal shall be accompanied by manifest verifying hazardous materials were legally disposed of to absolve Owner of responsibility. Return completed copy of manifest to Owner after disposal.

END OF SECTION

SECTION 02 41 14
PAVING REMOVAL AND RESURFACING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, removal and replacement of paved surfaces disturbed by construction.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 09 90 00: Painting and Coating
I. Section 31 23 00: Excavation and Fill
J. Section 32 13 13: Concrete Paving

1.3 Quality Assurance

A. Resurfacing of existing pavement and surfaces disturbed in connection with construction of project improvements and appurtenances, shall conform to provisions of applicable permits issued by agencies having jurisdiction over work within their right-of-way.

1.4 References

A. Asphalt Institute MS-4 The Asphalt Handbook
B. Orange County Environmental Management Agency Standard Plans
C. SSPWC Standard Specifications for Public Works Construction (Greenbook)

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Certificate of Compliance	Submit report from testing laboratory certifying that aggregate material is asbestos-free and conforms to specified gradations or characteristics.
Delivery Tickets	Required for all asphalt and concrete used. Deliver submittal to jobsite inspector.

B. Refer to Section 01 33 00 for definition of requirements for certificates of compliance.

1.6 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of asphalt materials shall be strictly followed.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Removal and resurfacing products shall conform to the following specifications:

ITEM	MATERIAL	SPECIFICATION
Subgrade Preparation	Suitable material	Section 31 23 00
Soil Sterilant	Herbicide	Section 31 23 00
Base	Aggregate Base	Section 32 13 13
Prime Coat	Liquid Asphalt	Section 32 13 13
Asphalt Paving Materials	Asphalt	Section 32 13 13
Seal	Slurry Seal	Section 32 13 13
Concrete Paving Materials	Portland Cement Concrete	Section 03 30 00

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install pavement before beginning work. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Photograph and measure locations of all pavement markings to allow replacement upon completion of paving operations.

3.2 Pavement Removal

A. Remove pavement or road surfacing within limits of construction excavations prior to excavation operations of any nature. Remove surplus material and dispose of as specified.

B. Prior to removal of existing surfacing, make pavement cuts for pipelines at limits of excavations as shown or required by permit. Pavement cuts for trenches shall be neat and straight along both sides of trench and shall parallel pipe alignment to provide unfractured level pavement joints for bonding existing surfacing to new pavement replacement. Make pavement cuts for pipelines at least 12 inches outside trench face to provide benched surface of undisturbed base on which new pavement will be placed to match existing pavement.

C. Where large irregular surfaces are removed, trim or cut paving parallel or perpendicular to roadway centerlines. Cut edges shall have clean, solid vertical faces free from loose material.

D. For trenches 5 feet deep or less, tunnel under existing curbs, gutters, sidewalks and concrete flatwork.

E. Cutting of concrete flatwork shall be done only by permission granted in excavation or encroachment permit.

F. Portland cement concrete pavement, including cross gutters, curbs and gutters, sidewalks, driveways, and other concrete surfaces shall be saw cut to minimum depth of 1½ -inches prior to removal.

G. Sawcut concrete pavement at edge of trench or excavation. Sawcut concrete curbs, gutters and sidewalks to the nearest score marks or construction joints beyond damaged portion as may be required in each case by authority having jurisdiction.

H. Pneumatic tools may be used to cut concrete pavement only with written permission of Owner's Representative. In such event, a subsequent saw cut shall be made after backfilling, and additional concrete pavement shall be removed and disposed of by Contractor prior to resurfacing.

I. Do not demolish Portland cement concrete using impact equipment such as stomper attachments on backhoes and excavators, wrecking balls, or other means of demolition that may result in vibration and ground shaking unless prior written consent is secured from Owner's Representative at least 3 working days before start of demolition.

J. Asphalt concrete surfaces shall be initially cut by means of sawcutting or other accepted equipment prior to removal of surfacing. Pavement saw-cutting will be required within rights-of-way of county roads and highways, or as required by permits or local governing bodies.

3.3 Temporary Paving

A. Replace pavement removed by trenching operations with minimum 2 inches of temporary asphalt paving mix after compaction is accepted by Owner's Representative or within 3 days after pipe installation, whichever comes first.

B. Place temporary pavement on cross streets and all accesses on same day that excavation is made.

C. Maintain temporary pavement so a smooth traversable surface is available at all times for vehicular traffic, free from ruts, depressions, holes, or loose gravel.

D. Inspect temporary paving at no greater than 12-hour intervals, 7 days per week during periods of measurable precipitation. Repair and/or replace temporary asphalt paving as needed on discovery of damage.

E. Cost for installing, maintaining and removing temporary paving shall be included in contract unit prices for Work, and no extra compensation will be made to Contractor.

3.4 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install asphalt concrete resurfacing at locations shown on Plans and Submittals and approved by Owner's Representative.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building and plumbing code requirements

4. Standard Specifications for Public Works Construction

5. Asphalt Institute MS-4 The Asphalt Handbook

D. Refer variances between the above documents and Contract Documents to Owner's Representative.

E. Installation shall proceed as follows:

1. After trench is backfilled and passes compaction testing, sawcut paving to minimum depth of 1½ inches not less than 12 inches outside limits of excavation or previous pavement cut, whichever limits are greater. Remove additional surfacing and dispose of prior to resurfacing.

2. Restore surface to original grade and crown section in all areas where surface is removed, broken, or damaged by equipment, or where ground has caved or settled due to the installation of the Work.

3. Restore subgrades, base materials, and paved surfaces above trenches or damaged sections with subgrades, base materials and paved surfaces equal to or better than those found prior to Contractor beginning Work.

4. Unless otherwise shown on Contract Documents or permits, thickness of finished asphalt concrete course shall be one inch greater than asphalt thickness prior to construction.

5. Remove existing surfacing before resurfacing.

6. Work shall match appearance of existing improvements.

7. Where large irregular surfaces are to be resurfaced, cut and remove existing surfacing as provided herein.

8. Apply asphaltic emulsion to vertical faces of all asphalt concrete pavement against which pavement replacement materials are to be placed.

9. When ready for acceptance, thoroughly compact completed surface true to grade and cross section.

10. Lap trench section at least 12-inches on each side and hand rake so that lapped section will feather-in smoothly with existing pavement. Resulting edge of contact between new and existing pavement on each side shall parallel the existing trench and be a straight and neat join line.

F. Portland cement resurfacing shall be installed according to requirements of the Standard Specifications for Public Works Construction. Installation shall proceed as follows:

1. Replace Portland cement concrete sidewalks, curbs, gutters and driveways to nearest scoreline or over sufficient width to replace any portions of concrete damaged, fragmented, cracked, or otherwise disturbed due to construction operations.

2. Where new PCC pavement contacts existing PCC pavement, dowel and epoxy #4 smooth bars, 16 inches in length, spaced at 18 inches on-center, located vertically in center of the PCC pavement. Drill 8¾-inch-long hole in exposed edge of existing PCC pavement just large enough to accept #4 smooth bar and epoxy bar into place in existing PCC prior to placing new concrete. Install expansion joint material as required by local governing body, agency, or association having jurisdiction over public and private streets.

3. Construct cold joints between sections of new PCC pavement using either #4 deformed bars spaced at 18 inches on-center, located vertically in center of PCC pavement, or by forming keyway at cold joints. Thoroughly vibrate PCC into adjoining keyway during placement of each pavement section.

G. Minimum paving course thicknesses are shown below under field quality control.

H. Following pavement replacement and sealing, replace all pavement markings in kind.

3.5 Field Quality Control

A. Field testing shall include the following for asphalt paving:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Asphalt Concrete Paving	Minimum thickness	Thickness of section removed plus one inch	As directed	Owner	Contractor
Aggregate Base	Minimum thickness	Thickness to equal thickness of section removed and shall extend at least 4-inches beneath asphalt	As directed	Owner	Contractor
Finish Grade	Finish surface	No deviations from existing grade in excess of ⅛-inch in 10 feet	As directed	Owner	Contractor
		No ruts, depressions or irregularities in excess of ⅜-inch deep	As directed	Owner	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Permit Requirements	1 test	Owner	Contractor

B. Field testing shall include the following for Portland cement concrete paving:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Portland Cement Concrete	Minimum thickness	Thickness to equal thickness of section removed (4-inch minimum)	As directed	Owner	Contractor
Aggregate Base	Minimum thickness	Thickness to equal thickness of section removed and shall extend at least 8-inches beneath PCC	As directed	Owner	Contractor
Finish Grade Finish Grade	Finish surface	No deviations from existing grade in excess of ⅛-inch in 10 feet	As directed	Owner	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
(cont.)		No ruts, depressions or irregularities in excess of ⅜-inch deep	As directed	Owner	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Permit Requirements	1 test	Owner	Contractor

C. Contractor shall furnish and place permanent resurfacing within 7 days after order to do so by Owner.

END OF SECTION

SECTION 02 41 15
UTILITY LINE REMOVAL OR ABANDONMENT

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and Work required to abandon or remove existing pipes, conduit and buried structures.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 73 00: Execution
E. Section 01 74 00: Cleaning and Waste Management
F. Section 02 41 13: Selective Site Demolition
G. Section 26 05 00: Common Work Results for Electrical
H. Section 26 05 53: Identification for Electrical Systems
I. Section 31 05 50: Protecting Existing Utilities
J. Section 33 05 31: Pipeline Joint Materials
K. Section 33 71 73: Electrical Utility Services

1.4 Quality Assurance

A. Use adequate number of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Building Code (CBC)
B. California Fire Code (CFC)
C. California Mechanical Code (CMC)
D. California Plumbing Code (CPC)
E. NFPA 70 National Electric Code (NEC)
F. Standard Specifications for Public Works Construction (Greenbook) Section 306-5
G. 29 CFR 1926.1101 OSHA Construction Industry Standard for Occupational Exposure to Asbestos Subpart Z, Asbestos

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Asbestos Encapsulation Compound	Certane 1000 Post Removal Encapsulant.	Eden Prairie, MN
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to abandon or remove pipes, conduits, and structures and rejoin with new pipe or conduit before disturbing existing improvements.

B. Examine areas and conditions under which Work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

C. Before snap cutting asbestos-cement pipe, the following items shall be on-hand:

1. Snap-cutting equipment of appropriate size
2. Water source and means of application sufficient to maintain continuously wetted cutting area
3. Waste disposal bags
4. OSHA-required safety equipment including, but not limited to disposable coveralls, full-face air-supplied respirators, rubber boots, hard hats, eye protection, and gloves.

3.2 Field Procedures

A. Refer to Section 01 73 00 for basic execution requirements.

B. Abandon or remove pipes, conduits and structures at locations and as shown on Plans and Submittals.

C. The following standards shall be followed:

1. Applicable OSHA and Cal OSHA regulations
2. Published requirements of owners of facilities to be abandoned or removed
3. California Building Code
4. Other applicable building, fire, plumbing, mechanical and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Where expressly called out on Plans, or in specifications or pay items, backfill pipes, conduits and structures to be abandoned by filling with 2-sack cement slurry.

F. When other buried piping, conduits or structures have been or are to be abandoned and interfere with construction, remove interfering portion and securely seal open portions as follows:

1. Where greater internal dimension of conduit is 48” or less, seal with one of the following methods:

    a. a minimum 6” thick concrete wall or plug
    b. a minimum 8” thick wall of brick and mortar
    c. a blind flange bolted to an available existing flange
    d. a manufactured cast-iron, ductile-iron or PVC cap
    e. filling pipe with 2-sack slurry

2. For larger openings, seal as shown on Plans.

3. For catch basin connector pipes, inlet opening to mainline pipe shall also be sealed.

4. Where pipes, conduits, sanitary sewers, or storm drains are to be abandoned within specified limits, abandon or remove all connected structures and appurtenances within said limits.

5. Where catch basins, manholes, vaults, valves, or other structures are to be abandoned, remove upper portion to at least 12” below street subgrade. Seal conduits connecting to structure as provided herein. Perforate or break bottom of concrete or watertight structures to prevent entrapment of water. Backfill with suitable material compacted to 90%, except in layers where stricter compaction requirements are specified or shown.

6. Where catch basins, manholes, vaults, valves, or other structures are to be removed, remove to full depth of structure, including foundation. Backfill with suitable material compacted to 90%, except in layers where stricter compaction requirements are specified or shown.

7. Salvage cover sets, gratings, and other steel components (except reinforcing bars) of removed and abandoned structures. Contact respective owners, and, if required, deliver and load salvaged materials to owner’s truck at Work site. Otherwise, such material shall become Contractor’s property and shall be legally disposed of outside Work site.

3.3 Disposal of Removed Pipe Material

A. Dispose of removed pipe segments as unsuitable material in accordance with requirements of state and federal law.

B. Dispose of or protect asbestos-cement utilities in accordance with OSHA Construction Industry Standard for Occupational Exposure to Asbestos Subpart Z, 29CFR 1926.1101 Asbestos.

3.4 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Trench Backfill	Compaction	ASTM D1557	1 test	Owner	Contractor
Cement-Sand Slurry Backfill	Slump (6" maximum)	ASTM C143	1 each batch	Owner	Contractor
Connection to Existing Water Line	Verification of Proper Connection	Make cut in presence of Owner's Representative and present coupon to Owner's Representative Coupon shall match full valve nominal size.	1 each connection	Contractor	Contractor

END OF SECTION

SECTION 02 41 16
STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 Work Included

A. Building, mechanical, and electrical demolition inside or attached to building envelope or roof.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 02 41 13: Selective Site Demolition
H. Section 02 41 15: Utility Line Removal and Abandonment
I. Section 26 05 00: Common Work Results for Electrical
J. Section 26 05 53: Identification for Electrical Systems
K. Section 33 71 73: Electrical Utility Services

1.3 System Description

A. Remove the following items.

1. Existing towing company building
2. Electrical items where shown
3. Other items shown on Plans for demolition including concrete and masonry work, piping, valves, and electrical work.
4. Items listed for removal in Section 02 41 13.

B. Abandon the following items in place:

1. Other items shown on plans for abandonment in place
2. Items listed for abandonment in place in Section 02 41 13.

C. Legally dispose of Items not designated for salvage.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Building Code (CBC)
B. California Fire Code (CFC)
C. California Green Building Code (CGBC)
D. California Mechanical Code (CMC)
E. California Plumbing Code (CPC)
F. NFPA 70 National Electric Code (NEC)

1.6 Hazardous Materials Survey

A. A limited hazardous materials survey has been completed for this project and appended to the Contract Specifications, "Phase I Environmental Site Assessment Summary."

B. Under EPA Regulations and South Coast AQMD Rule 1403, if >100 square feet of material containing over 1% asbestos, must be disturbed during construction, a California Occupational Safety Health Administration (CAL-OSHA)-certified site surveillance technician and or certified asbestos consultant (CAC) is required to:

   a. Conduct visual and/or bulk surveys of property prior to demolition and to prepare a hazardous material survey outlining appropriate remediation measures.

   b. Prepare hazardous material survey, reporting testing results and recommending appropriate remediation measures.

C. In addition, per Cal-OSHA and EPA requirements, if lead, or other hazardous material must be disturbed during construction, DPH Certified Inspector must:

   a. Conduct visual and/or bulk surveys of property prior to demolition and to prepare a hazardous material survey outlining appropriate remediation measures.

   b. Prepare a hazardous material survey, reporting testing results and recommending appropriate remediation measures.

D. Contractor shall hire remediation firm separate from hazardous materials consulting firm to perform appropriate remediation measures. For asbestos concentrations exceeding 0.1%, or other hazardous material concentrations exceeding 1%, remediation work shall be done by personnel OSHA-certified and trained in use of OSHA-required PPE and respirators.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 – PRODUCTS

2.1 Acceptable Consulting and Remediation Firms

A. Acceptable hazardous material consulting firms include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Hazardous Materials Consulting Firms	A-Tech Consulting, Inc. (714) 434-6360	Orange, CA
	Citadel, Inc.	Glendale, CA
	Patriot Environmental Services, Inc.	Wilmington, CA
	Accepted equal	

B. Acceptable remediation firms include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Hazardous Materials Removal and Disposal	Advanced Cleanup Technologies, Inc.	Carson, CA
	Ocean Blue Environmental	Long Beach, CA
	Patriot Environmental Services, Inc.	Wilmington, CA
	PSC Industrial Outsourcing	Long Beach, CA
	Specialized Environmental (562) 698 9222	Anaheim, CA
	Accepted equal	

PART 3 - EXECUTION

3.1 Preparation

A. Shut off or disconnect utilities affecting demolition work. Schedule shutdowns with Owner, and notify Owner 3 days in advance of any shutdown required to perform Work.

B. Owner will open/close valves on piping and electrical disconnects required for shutdowns.

3.2 Demolition

A. Refer to Section 01 73 00 for basic execution requirements.

B. Demolish items as shown on Plans.

C. Nonstructural items not shown on Plans for demolition but interfering with (or damaged by) installation of other new items, may, at Contractor's option, and pending acceptance by Owner's Representative, be temporarily demolished and replaced following installation of new items subject to the following:

1. Items to be demolished may not be on a structural load path and may not include roofing, decking, trusses, beams, columns, bearing walls, shear diaphragms, connections, or foundations.

2. Non-structural and non-essential items including railings, ladders, supports, piping, conduit, wiring, boxes, lighting fixtures, and other interferences may be removed and shall be replaced with new and similar material pending written permission in advance from Owner.

D. Demolish items as shown on Plans.

E. The following demolition standards shall be followed:

1. Applicable EPA, OSHA and Cal OSHA regulations

2. Other applicable building, fire, plumbing, mechanical and electrical code requirements

F. Refer variances between above documents and Contract Documents to Owner's Representative.

G. Asbestos shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA and other regulatory agencies. Procedures shall include but not be limited to:

1. Adhere to California Code of Regulations, Title 8, §1529, including construction safety orders regulating dusts, fumes, mists, vapors, and gases associated with asbestos.

2. Asbestos removal shall be performed by trained and registered personnel.

3. Deactivate all HVAC systems prior to asbestos removal. Close and temporarily seal registers.

4. Control measures may include wet methods, encapsulation, or removal with HEPA-filter-equipped vacuums into labeled polyethylene bags.

5. Remove asbestos pipe in whole pipe pieces without cutting or sawing, except for snap-cutting as described in Section 02 41 15.

6. Demolition shall comply with SCAQMD Rule 1403. Asbestos-related work conducted during demolition shall be performed by a California-licensed asbestos-abatement contractor under supervision of a California State Certified Asbestos Consultant.

7. Remove and dispose of asbestos-containing construction materials (ACCM's) in compliance with notification, monitoring, and asbestos-removal procedures stipulated in SCAQMD Rule 1403 to reduce asbestos-related health risks.

8. Throughout Work, maintain all records of compliance with Rule 1403 for Owner inspection upon request, including:

    a. Evidence of notification of SCAQMD pursuant to Rule 1403,

    b. Contact information for Asbestos-Abatement Contractor,

    c. Contact information for Asbestos Consultant,

    d. Receipts or other evidence of legal off-site disposal of all ACCM's.

9. Air monitoring relating to asbestos removal work shall be performed by or under direct supervision of a California State Certified Asbestos Consultant as required by law.

10. Properly manifest all scrap ACP and prepare for transport, complying with State and local criteria. Deliver scrap material to landfill permitted for disposal of asbestos containing materials.

H. Freon 12 shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA and other regulatory agencies. A certified technician shall evacuate gas prior to disposal of air conditioning units.

I. Lead-based paint (LBP) shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA, South Coast Air Quality Management District (SCAQMD), and other regulatory agencies. Procedures shall include but not be limited to the following:

1. Lead-based paint removal shall be performed by trained and registered personnel.

2. Notification to California Department of Public Health (DCPH) shall be completed through filing of an Abatement of Lead Hazards Notification CDPH Form 8551.

3. Removal of LBP's shall be completed by Certified Lead Supervisor or Certified Lead Works as defined by §35008 and §35009 of the LBP Regulations respectively.

4. Work shall conform to procedures specified In Chapter 12 Abatement in "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing" published by the United States Department of Housing and Urban Development in June 1995.

5. Encapsulate any deteriorating lead paint prior to removal.

6. Lead paint that is intact and not delaminating may be disposed of as construction material as long as it is attached to its original substrate.

7. Non-encapsulated paint chips and debris shall be wet-sanded or scraped, collected and disposed of in accordance with local, state and federal regulations.

8. If any paints containing Lead or Chromium must be disturbed or made airborne during Work by activities such as abrasive blasting, welding, cutting or torch burning, provide worker protection in accordance with OSHA Lead in Construction Standard and other applicable regulations.

9. Containment of LBP shall prevent contamination of non-work areas with lead-contaminated dust, lead-contaminated soil, or lead-based paint debris.

10. Removal of LBP materials shall be conducted in accordance with an Abatement Plan prepared by a Certified Lead Supervisor, Certified Lead Project Monitor, or Certified Lead Project Designer. Abatement plan shall encompass all requirements specified in §35100(4)(A) of the LBP Regulations.

11. Throughout Work, Certified Lead Supervisor shall maintain all records of compliance with LBP regulations for Owner inspection upon request, including:

    a. Evidence of notification of CDPH,

    b. Maintenance of Abatement Plan shall be retained on-site throughout demolition activities for Owner review upon request,

12. All demolition activities shall be subject to inspection by CDPH or Owner to verify compliance with requirements of LBP regulations and Abatement Plan.

13. Following completion of abatement activities, retain services of a Certified Lead Inspector/Assessor or Certified Lead Project Monitor to conduct clearance inspection in accordance with Title 17 of California Code of Regulations Division 1 Chapter 8 §35000a and §36000(c)(3).

14. Submit copy of results of clearance inspection to Owner and to City Planning Division upon completion of abatement and inspection activities.

15. Legally dispose of all paint removed during progress of demolition and Work. When paint debris is found to contain >5 ppm lead or hexavalent chromium when tested in accordance with Waste Extraction Test (WET) method of California Code of Regulations, Title 22, it shall be disposed of as hazardous waste.

J. Mercury shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA and other regulatory agencies. Dispose of intact units in accordance with local, state and federal regulations.

K. Polychlorinated biphenyls (PCB's) shall be remediated according to guidelines set up by EPA, OSHA, Cal OSHA and other regulatory agencies. Dispose of intact units in accordance with local, state and federal regulations.

L. Following remediation, demolition shall occur as follows:

    1. Facilities scheduled for demolition shall be removed, salvaged and disposed of as shown in Contract Documents. Remove and dispose of all portions of items scheduled for demolition which interfere with project construction.

2. Backfill and compact site areas disturbed by demolition work with earth or gravel backfill in accordance with Section 31 23 00.

3. Protect work not intended to be removed or salvaged. If in opinion of Owner's Representative a demolition method used may endanger or damage parts of structure or affect satisfactory operation of facilities, promptly change method upon receipt of notification from Owner's Representative.

4. No blasting will be permitted.

5. All equipment, material and piping, scheduled for demolition and not required to be salvaged to Owner shall become Contractor's property and shall be removed from project site and disposed of legally.

6. Do not reuse material salvaged from demolition work on this project except where permitted by Contract Documents.

M. Patching shall occur as follows:

1. Patching shall include restoration of surface or item to condition as near as practicable to match existing adjoining surfaces unless otherwise directed.

2. Where patching involves cleaning, painting, special coating, wall covering or other applied finish, clean and refinish entire surface plane, wall or ceiling unless complete refinishing of entire space is required elsewhere.

END OF SECTION

SECTION 03 01 31
WATERPROOFING SUBSURFACE CONCRETE STRUCTURE INTERIORS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of waterproofing systems for concrete structures.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution

1.3 System Description

A. Furnish and apply complete operating system to waterproofing interior of concrete structure without excavation to expose exterior surface.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Applicators of waterproofing systems shall be factory-authorized and trained by Manufacturer of waterproofing system.

1.5 References

A. California Building Code (CBC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Applicator Certification	Submit letter from waterproofing system Manufacturer proposed applicator is factory-authorized and trained and Manufacturer will honor warranty of Work performed by applicator.
Catalog Data	Required per catalog data requirements.
Application Instructions	Required per installation or application instruction requirements.
Warranty	Furnish 10-year warranty from date of final acceptance on polyurea waterproofing systems.

B. Refer to Section 01 33 00 for definition of requirements for catalog data and application instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of waterproofing products shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Polyurethane Injection Foam	SealBoss 1752 NSF Foam (for exposure to potable water)	Santa Ana, CA
	Accepted equal	
Epoxy Primer for Polyurea Coating Systems	Freedom Chemical Corporation FreedomTuff 6100MT	Hawaiian Gardens, CA
	Accepted equal	
Polyurea Coating Systems	Freedom Chemical Corporation FreedomTuff 2202	Hawaiian Gardens, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

PART 3 - EXECUTION

3.1 Preparation

A. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

B. Prepare concrete surfaces to receive coatings as follows:

1. Examine surfaces for form tie holes and structural defects including honeycombing, rock pockets, faulty construction joints, and cracks.

2. Remove dirt, laitance, and other foreign matter.

3. Repair surface defects per waterproofing system Manufacturer's recommendations using materials recommended by manufacturer.

4. To provide absorbent surface, wash and lightly sandblast, water-blast or acid-etch surface to provide 3-mil profile.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Other applicable building, fire, and plumbing code requirements

C. Refer variances between above documents and Contract Documents to Owner's Representative.

D. Install polyurea waterproofing system as follows:

1. Prepare interior surface as described above.

2. Inject cracks wide enough to stick a dime in with polyurethane injection foam following Manufacturer's application instructions.

3. Prime prepared interior surface with epoxy primer.

4. Spray primed surface with 80-100-mil polyurea coating.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Waterproofing System	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Provide services of factory-authorized representative on-site to provide:

1. Installation assistance, inspection and startup of complete waterproofing system.

2. Field testing.

END OF SECTION

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SECTION 03 08 50
LEAKAGE TESTING OF HYDRAULIC STRUCTURES

PART 1 - GENERAL

1.1 Work Included

A. This section includes testing of reinforced concrete hydraulic structures for leakage.

1.2 Related Work

A. Section 01 61 00: Common Product Requirements
B. Section 03 30 00: Cast-in-Place Concrete
C. Section 09 90 00: Painting and Coating

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. AWWA D110 Prestressed Concrete Water Tanks

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

PART 3 - EXECUTION

3.1 Preparation

A. Do not start leak testing or cleaning of surfaces until concrete has cured and joint sealants have set at least 14 days.

B. Do not hydrostatically test walls to be restrained or laterally supported by slabs until slab concrete has obtained specified 28-day compressive strength.

C. Prior to testing, thoroughly wash surface with water to remove surface laitance and loose mater from walls and slabs.

D. Remove wash water and debris from structures by means other than washing through plant piping.

E. Conduct testing before backfill is placed against walls and after all concrete has attained specific compressive strength.

3.2 Field Quality Control

A. Leakage testing for other structures shall proceed as follows:

1. Fill hydraulic structures to be subjected to leakage testing with potable water to maximum operating liquid level line.

2. For structures with adjacent bays, fill all bays simultaneously. Empty adjacent bays alternately.

3. Repair any running leaks which appear during filling before continuing test procedures.

4. After structure has been kept full for 48 hours, it will be assumed for testing purposes concrete moisture absorption is complete.

5. After structure has been kept full for 48 hours, close all gates and valves to structure and measure change in water surface each 24 hours for a 72-hour period.

6. During test period, examine exposed portion of structure and mark visible leaks or damp spots. Repair visible leaks or damp spots after dewatering.

7. If drop in water surface over 72-hour period exceeds 0.15% (3/20th of 1%) of contained volume, leakage shall be considered excessive.

8. Determination of surface moisture evaporation shall be aided with a 24”-deep, white-colored, watertight container of not less than 10 square feet surface area exposure. Position container to experience sunlight, shade and environmental conditions similar to structure tested. Subtract evaporation loss from measured water loss in basin to compute leakage.

9. If leakage is excessive, drain structure, repair leaks and damp spots, and repeat leakage test. Continue testing until drop in water surface in a 24-hour period meets test requirements.

10. Inspect manholes and telltale vaults of any underdrain system beneath floors for evidence of floor slab leaks. If leakage is indicated, locate and repair.

11. Seed floor of each hydraulic structure with one bag of cement per 1000-square-foot surface area. Seeding shall take place after test filling has reached 18” in depth. Detect leaks in construction and expansion joints with aid of diver. Stir cement deposits on floor. Observe cement deposits flowing toward leaks and repair where defect is located.

12. Repair flowing leaks whether leakage exceeds allowable leakage or not.

13. Repairs and additional filling and testing shall be made by Contractor at no additional cost to Owner.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, erection and removal of concrete formwork including formwork, bracing, shoring, supports, falsework, and all appurtenant work.

B. Setting of embedded bolts, anchors, pipe sleeves, conduit sleeves, conduit and similar work under direction of respective trades.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 31 23 00: Excavation and Fill
H. Section 03 20 00: Concrete Reinforcing
I. Section 03 30 00: Cast-in-Place Concrete
J. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install concrete formwork including appurtenant structural, or mechanical mountings or connections required for compliance with applicable building codes and standards.

B. Forms, shoring and falsework shall:

1. Confine concrete ingredients including water, sand and cement while placing concrete,

2. Confine concrete to required lines, grades and construction tolerances.

3. Provide safe working environment in accordance with OSHA regulations.

4. Support all dead loads and live loads plus superimposed construction loads including equipment, stored materials, personnel, impact loads form falling concrete or other materials, foundation pressures repetitive stress loads from vibrating concrete, and all other vertical and lateral loads during construction.

5. Be of sufficient number and area to allow construction to proceed on schedule.

6. Upon removal, leave concrete with nontoxic, clean, dry surface, free from ridges, fins, offsets, deflection marks, or similar defects. Surface shall be in condition that can be finished by Contractor as required by Contract Documents.

C. It shall be Contractor's responsibility to design, construct and maintain safe forms, shoring and falsework at all times in accordance with applicable OSHA regulations.

D. If adequate foundation for shores cannot be secured, provide truss supports.

E. Forms, shoring and falsework failing to provide all above functions shall be removed from jobsite immediately at no additional cost to Owner.

F. Cap protruding reinforcement bars for worker protection in accordance with applicable safety codes.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Design of structures shown on drawings includes no allowance for imposed construction loads. Provide forms, shoring and falsework adequate for dead loads and live loads plus imposed loads during construction.

C. Formwork shall comply with ACI 347, except as exceeded by requirements of other regulatory agencies or as otherwise shown.

D. Tolerances of formwork shall comply with ACI 117. Failure of finished concrete work to meet specified tolerances shall be remedied at Contractor's expense.

1.5 References

A. ACI 117 Standard Tolerances for Concrete Construction and Materials
B. ACI 318 Building Code Requirements for Reinforced Concrete
C. ACI 347 Recommended Practice for Concrete Formwork
D. California Building Code (CBC)
E. California Division of Occupational Health and Safety Construction Safety Orders
F. PS1 U.S. Product Standard Code for Concrete Forms, Class 1
G. PS20 American Softwood Lumber Standard

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for construction and expansion joints placement and for sequence of forming and concrete placing operations per structural shop drawing requirements.
	Required for falsework, formwork, and vertical shoring per structural shop drawing requirements.
	Required for embedments, conduit, piping and other wall penetrations per structural Shop Drawing requirements.
Catalog Data	Required for form ties, taper tie plugs (if used), form gaskets related work per catalog data requirements.
Engineering Calculations	Required for falsework, formwork and vertical shoring per engineering calculations requirements. Calculations shall include statement from preparing engineer certifying falsework, formwork and vertical shoring design meets or exceeds design requirements of Cal OSHA Construction Safety Orders including Article 29 §1717, "Falsework and Vertical Shoring."

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, and engineering calculations.

C. Maintain at least one copy of accepted shop drawings on site throughout concrete placing operations.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of concrete formwork shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Form Ties	Burke Company (Penta-Tie System)	San Mateo, CA
	Dywidag Systems International	Munich. GE
	Richmond Screw Anchor Company (Snap Tys)	Fort Worth, TX
	Accepted equal	
Reusable and Wash-off Forms for Site Concrete	Labrado – wash off	
	L.M. Scofield (Lascolite) - reusable	
	Accepted equal	
Form Coatings	Grace Construction Matierials (Formfilm)	
	Sika Chemical Corporation (Antisot)	Lyndhurst, NJ
	Sonneborn Building Products, Inc. (Form-Saver)	
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Unless expressly accepted by Owner's Representative, all lumber brought onto jobsite for use as forms, shoring, or bracing shall be new material of grade shown on accepted shop drawings. Form surfaces shall be smooth.

C. Form materials that remain or leave residues on or in concrete must be classified as acceptable for potable water use by Environmental Protection Agency within 30 days of application or use. Concrete formwork containing arsenic or other toxic materials shall be removed from jobsite and disposed of off-site.

D. Formwork shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Wall Forms	Steel	Design per ACI 347 Provide rubber grommets where ties pass through forms to prevent loss of cement paste.
	Plywood panel	PS1 Class 1 edge-sealed Douglas Fir or Southern Yellow Pine plywood 5/8" minimum thickness with stud spacing close enough to prevent deflection marks.
	Floor gasket	1" to 1½" diameter polyethylene rod gasket to seal bottom of wall forms resting on floor slabs or footings to prevent loss of fines and paste during concrete placing and vibration.
All Other Forms	Steel Panels or Tongue-and-Groove Lumber	ACI 347 Provide rubber grommets where ties pass through steel forms to prevent loss of cement paste.
	Plywood	ACI 347, PS1 Class 1 edge-sealed Douglas Fir or Southern Yellow Pine plywood ⅝" minimum thickness Stud spacing close enough to prevent deflection marks.
Lumber for Falsework	Douglas Fir or Southern Yellow Pine	PS 20 Construction Grade or better
Plywood Forms for Surfaces to be Painted	Plywood	Medium Density Overlaid Plywood, MDO Ext. Grade
Form Ties	Plastic	Plastic removable cone type with integral water stops. Do not use wire form ties. Do not use snap ties which cause spalling of concrete upon form stripping or tie removal.

E. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Forms and Falsework Strength Design	Design Load	Design for total dead load plus live load of 50 psf.
	Minimum Vertical Design Load	100 psf.
		Design of structures shown on drawings includes no allowance for imposed construction loads. Provide forms, shoring and falsework adequate for dead loads and live loads plus all imposed vertical and lateral loads during construction.
Chamfers and Fillets	Chamfers	Provide ¾" chamfer on exterior corners except where otherwise shown.
	Fillets	Do not provide fillets on reentrant corners except where shown.
Form Ties – Water Retaining Structures or Structures in Contact with Groundwater	Maximum Diameter of Removable Cone	1½"
	Holes	Form ties shall leave holes of regular shape for reaming.
	Design	Provide with plastic cone or other means of forming conical hole to ensure form tie may be broken off back of concrete face.
	Removable Taper Ties	May be used if accepted by Owner's Representative. Insert preformed neoprene or polyurethane tapered plug (sized to seat at wall center) in hole left by taper tie removal.
Form Coating	Acceptable Materials	Non-grainraising, nonstaining resin or polymer type coating
	Unacceptable Materials	Coatings leaving residual matter on concrete surface. Coatings adversely affecting concrete bonding to paint, plaster, mortar, protective coatings, waterproofing or other applied materials. Coatings containing mineral oils, paraffins, waxes or other nondrying ingredients.

ITEM	DESCRIPTION	
Form Coating (continued)	Unacceptable Materials against Surfaces Contacting Potable Water	Any toxic or partially toxic materials
Form Joint Sealers	Design	Resilient foam rubber strips, non-hardening plastic type caulking compound free of oil.
	Alternate Design	Waterproof pressure sensitive plastic tape of minimum 8-mil thickness and 2" width.
	Form Tie Hole Filling	Use rubber plugs, plastic caulking compound or equal

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install concrete formwork before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Install plumb and string lines before placing concrete and maintain throughout concrete placement.

C. Set pipe stubs, wall sleeves, anchor bolts and other embedded work in forms where required before placing concrete. Use templates to maintain anchor bolts in position during concrete placing.

D. Embedded items shall be subject to the following constraints.

1. Locate embedded items so as not to reduce strength of construction.

2. No embedded item (parallel to surface) shall have an outside diameter greater than ⅓ of slab or wall thickness.

3. Embedded items parallel to surface shall be placed between top or interior reinforcing steel and bottom or exterior reinforcing steel.

4. Embedded items shall not be spaced closer than 3 diameters on center. Diameter shall be taken as largest outside diameter of embedded item.

5. Embedded items shall be supported independently from reinforcing steel in manner preventing metallic contact and electrolytic deterioration.

6. Walls or slabs 4½" or less in thickness shall have no embedded items (parallel to surface) other than conduit.

7. For corrosion protection, place embedded metallic items so at least 2" clearance is provided between any embedded metallic item and any part of concrete reinforcement. Do not secure embedded items in place by wiring or welding to reinforcement.

8. Supplemental reinforcing shall be placed around openings as required.

E. Thoroughly clean forms and embedments before placing concrete.

1. Remove any encrusted dirt, concrete, mortar or grout from forms or embedments.

2. Treat form surfaces with lubricant acceptable to Owner's Representative at least 2 weeks before using forms.

3. Remove any excess lubricant before placing concrete.

4. Take care to keep lubricant off surfaces of steel reinforcement and embedded items.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install concrete formwork at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install concrete formwork to tolerances recommended by Manufacturer and as described below to meet tolerances shown under "Field Quality Control." Unless otherwise shown, install concrete formwork true, plumb and level using precision gauges and levels.

F. Form all vertical surfaces except where concrete placement against earth is shown.

G. For members of comparatively limited height, where character of ground is such it can be trimmed to required lines and stand securely without caving or sloughing throughout concrete placement, Owner's Representative may permit placing concrete against earth at Contractor's risk. Should ground fail during concrete placement for any reason, including weather, or other natural or manmade causes, Contractor shall remove concrete in areas of earth failure and reconstruct with forms and new concrete at Contractor's sole expense.

H. Where concrete is permitted to be placed against trimmed ground in lieu of forms, add at least 1" thickness of additional concrete to face of concrete being formed against earth.

I. Where taper ties are approved for use, larger end of taper tie shall be on wet side of walls in structures retaining water or groundwater

J. Secure gaskets at bottom of wall forms before placing concrete.

K. Provide adequate cleanout holes at bottom of each lift of forms.

L. Provide form windows where concrete cannot be placed from top of wall in manner that meets contract document requirements.

M. Quantity and dimensions of cleanout holes and form windows shall be subject to approval by Owner's Representative.

N. Concrete construction joints shall only be made where shown on Contract Documents and accepted shop drawings or approved in writing by Owner's Representative. When second lift is placed on hardened concrete, Contractor shall take care to ensure quantities, locations, and tightness of form ties prevents unsatisfactory effects on finished concrete.

3.3 Field Quality Control

A. Monitor plumb and string line positions continually throughout concrete placement and correct deficiencies immediately.

B. Special inspection and field testing required by Chapter 17 of CBC (Table 1704.4) shall be completed by an ICC-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Concrete Formwork	Shape, Location and Dimensions of Item Being Formed	ACI 318 6.1.1, and paragraph C below	Periodic per CBC Table 1704.4	Owner	Contractor to reimburse Owner for costs of first deputy inspector if re-inspection is required

C. Additional field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Formwork and Finished Concrete	Tolerance of Finished Concrete Work	As described below and ACI 117 Manometer survey may be required for horizontal slabs to demonstrate compliance	Inspection at Owner's discretion (may occur after concrete is in place)	Owner	Owner

D. Tolerances of finished concrete shall be as follows:

ITEM	TOLERANCE
Variation of Constructed Linear Outline from Established Position in Plan	¼" maximum in 10' ½" maximum in 20' or more
Variation from Level or from Grades Shown	¼" maximum in 10' ½" maximum in 20' ¾" maximum over entire structure
Variation from Plumb	¼" maximum in 10' ½" maximum in 20' or more
Variation in Thickness of Slabs and Walls	Minus ¼" Plus ½"
Variation in Locations and Sizes of Slabs and Wall Openings	±¼"

3.4 Adjusting and Cleaning

A. Remove forms being careful not to damage concrete. Contractor shall remedy damage from improper or premature form removal at his sole expense.

1. No heavy loading on green concrete will be permitted.

2. Forms supporting non-load bearing vertical members including walls and columns shall remain in place for at least 2 days.

3. Forms supporting roof slabs and above-ground floor slabs shall remain in place for at least 14 days and until test cylinders for supported item show all tested concrete has attained 90% of specified 28-day compressive strength,

4. In addition, forms supporting roof slabs and above-ground floor slabs shall remain in place and until test cylinders for slabs, panels, walls, columns, and supporting members adjacent to that item show all tested concrete has attained 90% of specified 28-day compressive strength,

5. Time required to reach 90% of specified 28-day compressive strength shall be established by Owner's Representative based on test cylinders taken for this purpose.

6. Forms for all items of work not specifically mentioned herein shall remain in place for time periods determined by Owner's Representative.

7. Immediately after removing forms, wet concrete surfaces and keep surface moist until curing procedures begin.

8. Do not apply construction, equipment or permanent loads on columns, supported slabs or supported beams until all concrete in load path to foundation has attained 28-day design compressive strength.

B. Form tie removal shall proceed as follows:

1. No form-tying device or part thereof other than metal shall be left embedded in concrete.

2. Do not remove ties in such manner as to leave hole extending through interior of concrete members.

3. Where metal rods extend through concrete to support or strengthen forms, rods shall remain embedded and shall terminate at least 1" back from formed face or faces of concrete,

4. Where taper ties are removed, ream holes left by removal of form tie cones with suitably toothed reamers. Finished surface of holes shall be clean and roughened for bond before being filled with mortar.

5. A precast neoprene or polyurethane tapered plug shall be placed at wall centerline. Hole shall then be completely filled with non-shrink or regular cement grout for above grade walls that are dry on both sides.

6. Exposed faces of walls and ceilings, and floors shall have outer 2" of exposed face filled with cement grout matching color and texture of surrounding wall surface.

C. Forms may be reused only if in good condition and only if acceptable to Owner's Representative.

1. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces.

2. Fill residual tie rod holes with metal caps or other methods accepted by Owner's Representative.

3. Thoroughly clean form before reuse.

END OF SECTION

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SECTION 03 15 00
CONCRETE ACCESSORIES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of waterstops and construction joints.

B. Refer to Section 05 50 00 for cast-in-concrete and retrofitted anchor bolts.

C. Refer to Section 33 05 37 for concrete accessories around pipe penetrations.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 74 00: Cleaning and Waste Management
H. Section 03 08 50: Leakage Testing of Hydraulic Structures
I. Section 03 10 00: Concrete Forming
J. Section 03 20 00: Concrete Reinforcing
K. Section 05 50 00: Metal Fabrications
L. Section 07 92 00: Joint Sealants
M. Section 33 05 37: Wall Pipes, Seep Rings and Penetrations

1.3 System Description

A. Furnish and install concrete accessories where shown, including waterstop and construction joint materials.

B. Finished water-containing structures shall pass leakage testing requirements described in Section 03 08 50.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Building Code (CBC)

1.6 Submittals

A. Furnish the following submittals:

SUBMITTAL	DESCRIPTION
Catalog Data	Required for waterstops and other accessories per catalog data requirements.
Installation Instructions	Required for accessories per installation instruction requirements.
Certificate of Compliance	At least 24 hours before placing concrete, submit certification from each trade having embedded items in concrete to be placed stating embedded items for each trade are properly located, placed and braced.
Warranty	Furnish one-year warranty from date of final acceptance

B. In addition to requirements of ACI, refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of concrete accessories shall be strictly followed.

C. Storage of materials shall conform to requirements of ACI 301.

D. Store materials to prevent damage by moisture or breakage.

E. Do not use aluminum embedments in concrete.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Detectable Warning Surfaces on Curbs, Curb Access Ramps, and at Sidewalks near Driveway Entrances	ADA Solutions, Inc.	North Billerica, MA
	Accepted equal	
Joint Filler	DFC "Denver Foam"	
	Sonneborn Building Producte, Inc. "Sonofoam"	
	Accepted equal	
Waterstops	Greenstreak Inc.	St Louis, MO
	Vinylex Corp.	Knoxville, TN
	Accepted equal	
Waterstops for Chemical Containment	J.P Specialties, Inc.	Lake Elsinore, CA
	Accepted equal	
Waterstops for Retrofit	J.P Specialties, Inc.	Lake Elsinore, CA
	Accepted equal	
Waterstops, Stainless Steel	J.P Specialties, Inc.	Lake Elsinore, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Concrete accessories shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Detectable Warning Surfaces on Curbs and Curb Access Ramps	Dimensions	Raised truncated domes with nominal 0.9" base diameter, nominal 0.2" height and nominal 2.35" center-to-center spacing
	Color	Gray
Joint Filler - Preformed		ASTM D1751 Nonextruding resilient bituminous type
Joint Sealer - Elastomeric		See Section 07 92 00.
Joint Sealer - Mastic	Asphalts or similar materials blended with lubricants or plasticizers	No evaporating solvents or volatile oils or lubricants permitted Shall tenaciously adhere to concrete surfaces Shall remain permanently resilient and pliable Shall not be affected by continuous presence of water Shall in no way contaminate potable water Shall effectively seal joints from moisture infiltration even when joints are subject to expansion or contraction movements

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Waterstops	Corners	Provide shop-made corner fittings. Do not splice corners in field.

D. All materials furnished for Work must be classified by Environmental Protection Agency as acceptable for potable water use within 30 days of application.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install concrete accessories before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Before placing concrete within forms, each trade having embedded items, including water stops within forms and affected by pour shall certify all items are properly located, placed and braced.

C. Construction joints shown on Contract Documents and accepted shop drawings may be made as shown with provision of keys or other locking shapes to secure proper union with subsequent work.

D. Before placing concrete, verify location of embedded items with affected trades. Accuracy of placement of embedded items is Contractor's responsibility.

3.2 Installation/Application

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install concrete accessories at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. California Building Code Chapter 19 "Concrete"
4. Other applicable building code requirements
5. ACI 301 Structural Concrete for Buildings Chapter 8.
6. ACI 318 Building Code Requirements for Reinforced Concrete

D. Refer variances between above documents and Contract Documents to Owner's Representative.

3.3 Field Quality Control

A. Field testing of concrete accessories shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Water-Bearing Concrete Structures	Waterstop and Joint Effectiveness	Section 03 08 50	As directed	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of steel reinforcement in concrete and masonry, including reinforcing bar, couplers, concrete inserts, wires, clips, supports, chairs, spacers, epoxy embedment, and other embedded accessories.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 10 00: Concrete Forming
H. Section 03 30 00: Cast-in-Place Concrete
I. Section 04 29 00: Engineered Unit Masonry
J. Section 09 90 00: Painting and Coating
K. Section 33 05 16: Precast Concrete Utility Structures

1.3 System Description

A. Furnish and install complete steel reinforcement including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Steel Reinforcement	Material Properties	ASTM A615	As required by Owner	Owner	Contractor
Steel Reinforcement Welding	Compliance with AWS D1.4	AWS D1.4	As required by Owner	Owner	Contractor
	Radiographic testing	AWS D1.4	As required by Owner	Owner	Contractor

1.5 References

A. ACI 117 Standard Tolerances for Concrete Construction Materials
B. ACI 315 Details and Detailing of Structural Reinforcement
C. ACI 318 Building Code Requirements for Reinforced Concrete
D. ACI 350 Environmental Engineering Concrete Structures

E. ASTM A82 Steel Wire, Plain, for Concrete Reinforcement
F. ASTM A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
G. ASTM A706 Low-Alloy Steel Deformed Bars for Concrete Reinforcement
H. ASTM C1116 Fiber-Reinforced Concrete
I. ASTM D3963 Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.
J. AWS D1.4 Structural Welding Code – Reinforcing Steel
K. California Building Code (CBC)
L. CRSI MSP Concrete Reinforcing Steel Institute Manual of Standard Practice
M. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 201-2 "Reinforcement for Concrete"

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
CBC Chapter 17 Special Inspection Required Contractor Statement of Responsibility	As required in CBC Section 1706
Shop Drawings	Shop bending diagrams, placing lists and drawings of reinforcing steel required per structural shop drawing requirements. Comply with ACI 315.
	Show actual bar lengths to nearest inch measured to intersection of tangent extensions of outside bar surface. Bar placement diagrams shall clearly show dimensions of each bar splice. Show location of any coupler used with details of how they are installed in formwork.
	Show locations of construction and expansion joints. Show locations of all embedded items including anchor bolts, wall sleeves, conduit and piping which may conflict with steel reinforcing
Catalog Data	Required for mechanical couplers with ICBO test reports per catalog data requirements.
Installation Instructions	Submit written welding procedure for each type of rebar weld for each size of bar intended to be spliced by welding. (A mere statement that AWS procedures will be followed is unacceptable.)
Test Record Transcripts	For each load of steel reinforcement delivered, submit mill certificates and Manufacturer's certification of chemical and physical properties of steel as needed to verify steel materials. Also, submit information needed to determine carbon equivalent of any steel to be welded in accordance with AWS D1.4 and per test record transcript requirements.
Material Samples	Required from each heat of reinforcing steel upon Owner's Representative's request. Sample quantities required if requested shall conform to SSPWC Section 201-2.4 Required for each type of welded splice upon Owner's Representative's request.
Welder Qualification Certificates	Required as specified in AWS D1.4 for all welders performing welding of steel reinforcement. Also submit certifications of procedure qualifications for each welding procedure used.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, test record transcripts, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. CRSI recommendations included in Manual of Standard Practice for delivery, storage and handling of steel reinforcement shall be strictly followed.

C. Bundle reinforcement and tag with suitable identification to facilitate sorting, placing and transport.

D. Bars with kinks or bends not shown on shop drawings shall be removed from site.

E. Bars with rust, scale, oil or any other coating that would reduce or destroy bond between concrete and steel shall be removed from site.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 – PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Dowel System (alternate to slip dowels)	Greenstreak (Speed Dowel)	St Louis, MO
	Accepted equal	
Mechanical Bar Couplers	Dayton Superior (Dowel Bar Splicer System)	Dayton, OH
	Erico Products, Inc. (Lenton Form Saver)	Solon, OH
	Richmond Screw Anchor Company (Dowel Bar Splicer System)	Fort Worth. TX
	Accepted equal	
Epoxy Grout Systems for Rebar Dowels into Existing Concrete	Edoco “BurkEpoxy NS”	Kansas City, KS
	Master Builders Inc. “Concresive Paste LPL”	Cleveland, OH
	Pecora Corporation “Dynapoxy EP430 Fast”	Harleysville, PA
	Sika Corporation “Sikadur 31 Hi-Mod Gel” (vertical or overhead applications)	Lyndhurst, NJ
	Sika Concrete Restoration Systems SikaDur 32, Hi-Mod LPL	Lyndhurst, NJ
	Simpson Strong Tie Co.	Dublin, CA
	Accepted equal	
Rebar Supports	Dayton Superior	Dayton, OH
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Materials which remain or leave residues on or within concrete shall be classified as acceptable for potable water use by Environmental Protection Agency within 30 days of application or use.

C. Steel reinforcement shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Steel Bar Reinforcement	Steel	ASTM A615 Grade 60 Billet Steel Deformed Bars
Steel Bar Reinforcement - Welded	Low Alloy Steel	ASTM A706 Grade 60 Deformed Bars
Tie Wire	Annealed Steel	14 gauge minimum
Fiber Reinforcement	Steel Fiber	ASTM C1116 Type I
	Glass Fiber	ASTM C1116 Type II
	Polypropylene or Other Synthetic Fibers	ASTM C1116 Type III

A. Bar supports, chairs or dobies shall comply with CRSI Manual of Standard Practice Chapter 3 and shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Concrete Blocks (Dobies) (Do not use in slabs or walls less than 6" thick, or where architectural finish is to be applied.)	Concrete	Minimum 28-day compressive strength f'_c equal to that of concrete but not less than 4000 psi. Embed wire ties in concrete block bar supports.
Plastic Bar Supports (Do not use on grade)	Plastic	CRSI Class 1 gray

B. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION
Mechanical Couplers	Provide where shown on approved shop drawings. Couplers shall develop 125% of yield strength of reinforcement being spliced. Do not reduce bar cross section to accommodate couplers. Threaded couplers require use of next larger size of reinforcing. Supply all components needed for complete splice.
Welded Splices	Provide where shown on approved shop drawings. Splices shall develop 125% of yield strength of reinforcement being spliced. Provide all materials required to meet AWS D1.4.
Bending and Forming Bars	Conform to ACI 315 and ACI 318. Fabricate to tolerances shown in ACI 117. Reinforcing for masonry shall be shop fabricated, ready for installation by masons.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install steel reinforcement before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish, accurately position and install steel reinforcement at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Building Code Chapter 19 "Concrete" Section 1907 "Modifications to Reinforcement" and Section 1908 "Modifications to ACI 318"

4. Other applicable building code requirements

5. ACI 315 Details and Detailing of Structural Reinforcement

6. ACI 318 Building Code Requirements for Reinforced Concrete

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Minimum cover for non-pre-stressed steel reinforcement per ACI 318 shall be as follows:

LOCATION	BAR SIZE	MINIMUM COVER
Concrete Cast Against and Permanently Exposed to Earth	#4- #18	3.0"
Formed Concrete Exposed to Earth or Weather	#3-#5	1.5"
	#6-#18	2.0"
Formed Concrete Not Exposed to Weather or Earth: Beams	#4- #18	1.5"
Formed Concrete Not Exposed to Weather or Earth: Slabs or Walls	#3-#11	0.75"
	#14-#18	1.5"

F. Minimum spacing between parallel bars per ACI 318 shall be 1.0" or 1 bar diameter, whichever is greater.

G. Installation of steel reinforcement bars shall proceed as follows:

1. Install steel reinforcement to tolerances shown in ACI 117 and Section 7.5 of ACI 318.

2. Do not straighten or re-bend reinforcing steel in manner that will damage material. Do not use bars with bends not shown on Plans. Bends shall be cold-bent. Do not use heat.

3. Reinforcing shall be supported and wired together to prevent displacement using annealed iron wire ties or suitable clips at intersections. Use concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent displacement of steel during concrete placement.

4. Where concrete is placed against earth, use supporting concrete dobies in sufficient numbers to support bars without settlement, but in no case shall support be continuous. Tie reinforcing steel to dobies with wire ties embedded in blocks.

5. Where concrete is placed over formwork, furnish concrete, metal, plastic or other acceptable bar chairs and spacers.

6. Bend tie wires away from forms to provide specified concrete cover.

7. Accessories used to support reinforcing bars shall be placed and spaced such that deflections of supports due to weight of supported bars is within tolerances specified by ACI 117 and ACI 318.

8. Where additional bars are provided by Contractor for any reason, they shall be provided at no additional cost to Owner unless Owner's preapproval is evidenced by written change order issued prior to placing steel reinforcement.

9. Bars may be moved as necessary to avoid conflicts with other reinforcement steel, conduits or embedded items. If bars are moved by more than one bar diameter or enough to exceed specified tolerances, secure approval from Owner's Representative before placing concrete.

10. Provide additional reinforcing bars around sleeves and openings as shown on Drawings.

H. Splices shall be made as follows:

1. Splicing shall meet requirements of ACI 318 and applicable building codes unless noted otherwise on drawings.

2. Splicing of vertical bars in concrete is not permitted, except at indicated or approved horizontal construction joints or as detailed on plans or shop drawings.

3. Splicing of horizontal bars in concrete is not permitted, except as detailed on plans or shop drawings.

4. Use of mechanical couplers is not permitted, except as detailed on plans or shop drawings.

5. Welding of reinforcing bars is not permitted, except as detailed on plans or shop drawings.

I. Dowelling and epoxying of rebar into hardened concrete shall proceed as follows:

1. Hole diameter shall be as recommended by epoxy Manufacturer but shall be at least ¼" greater in diameter than outer surface of reinforcing bar deformations.

2. Depth of hole shall be as recommended by epoxy Manufacturer, but shall not be less than 12 bar diameters, unless noted otherwise or unless required to prevent penetration through opposite surface of existing concrete member.

3. Drill hole using methods that do not interfere with proper bonding of epoxy.

4. Field locate reinforcement in existing concrete before drilling using pachometer or other approved locator device. Adjust location of holes to be drilled to avoid drilling through or nicking any existing reinforcing bars.

5. Use compressed air to remove all dust and loose material from freshly drilled holes.

6. Inject epoxy into hole through tube placed at bottom of hole. Withdraw tube as epoxy is placed but keep injection tip immersed to prevent air pockets from forming.

7. Fill hole to a depth that ensures excess material will be expelled from hole during dowel placement.

8. Twist dowels during insertion into partially filled hole to guarantee full wetting of bar surface with epoxy. Insert bar slowly to prevent air pockets from forming.

3.3 Field Quality Control

A. Special inspection requirements for masonry rebar are itemized in Section 04 29 00.

B. Special inspection and field testing required by Chapter 17 of CBC (Table 1704.3 and 1704.4) shall be completed by an ICBO-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Steel Reinforcement	Size Grade and Type	Compliance with Contract Documents	Periodic per CBC Table 1704.3	Owner	Contractor to reimburse Owner for costs of first deputy inspector if re-inspection is required
	Verification of Weldability (for Steel Other than ASTM A706)	AWS D1.4, & ACI 318 Sec 3.5.2	Periodic special inspection per CBC Table 1704.3		
	Welding	AWS D1.4 & ACI 318 Sec 3.5.2 Also inspect for proper dimensions and absence of cracks, undercutting, surface holes or slag inclusions	Periodic per CBC Table 1704.3		
	Placement	ACI 318 Sec 3.5, & 7.1-7.7 & CBC 1913.4	Periodic per CBC Table 1704.3		
	Epoxy Embedded Dowels	Epoxy Manufacturer's Requirements	All dowels		

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of concrete for buried and above-ground cast-in-place structures, flatwork and paving.

B. Refer to Section 03 10 00 for concrete forming.

C. Refer to Section 03 15 00 for concrete accessories, including waterstops, construction joints, and cast-in-concrete anchors.

D. Refer to Section 03 20 00 for concrete reinforcing.

E. Floor hardener shall be applied to entire concrete slab around pump cans.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 74 00: Cleaning and Waste Management
H. Section 03 08 50: Leakage Testing of Hydraulic Structures
I. Section 03 10 00: Concrete Forming
J. Section 03 15 00: Concrete Accessories
K. Section 03 20 00: Concrete Reinforcing
L. Section 03 60 00: Grout
M. Section 05 12 00: Structural Steel Framing
N. Section 07 92 00: Joint Sealants
O. Section 09 90 00: Painting and Coating
P. Section 31 13 13: Concrete Paving
Q. Section 31 23 00: Excavation and Fill
R. Section 33 05 16: Precast Concrete Utility Structures
S. Section 33 39 13: Manholes and Structures

1.3 System Description

A. Furnish and install complete concrete structural system including appurtenant structural, mechanical and/or electrical mountings, embedments or connections required for compliance with Manufacturer's installation requirements of other trades and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Installers of floor surface hardeners shall have minimum of 3 years specialized experience in application of dry shake surface hardeners.

C. Manufacturer of waterproofing additive shall be ISO 9001 registered and have a minimum of 10 years specialized experience in manufacturing the waterproofing additive. Manufacturer must be capable of providing field service representation during construction phase.

D. Proportion mixes either by laboratory trial batch or field experience methods, using specified materials acceptable for each type of concrete required, and complying with ACI 211.1.

E. Factory (batch plant) testing of aggregate shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Aggregate	Ratio of Silica Released to Reduction in Alkalinity	ASTM C33	As directed	Owner	Contractor
	Loss with Sodium Sulfate	ASTM C33	As directed	Owner	Contractor
	Sieve Analysis	ASTM C136	1 each trial batch	Owner	Contractor
Coarse Aggregate	Abrasion Loss	ASTM C33	As directed	Owner	Contractor
Fine Aggregate	Sand Equivalent	ASTM D2419	As directed	Owner	Contractor
	Organic Impurities	ASTM C40	As directed	Owner	Contractor
	Color of Supernatant on Washing	ASTM C33	As directed	Owner	Contractor

F. Plant testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Concrete	Certification of Mix Design	ACI 301 certified by independent testing laboratory	1 per mix	Contractor	Contractor
Ready-Mix Concrete Materials	Materials Inspection	See Paragraph 2.2 below	As directed	Owner	Owner

1.5 References

A. ACI 117 Standard Tolerances for Concrete Construction Materials
B. ACI 211.1 Selecting Proportions for Normal, Heavyweight, and Mass Concrete
C. ACI 214 Evaluation of Strength Test Results for Concrete
D. ACI 301 Structural Concrete for Buildings
E. ACI 304 Measuring, Mixing, Transporting, and Placing Concrete
F. ACI 305 Hot Weather Concreting
G. ACI 309 Consolidation of Concrete
H. ACI 315 Details and Detailing of Concrete Reinforcement
I. ACI 318 Building Code Requirements for Reinforced Concrete
J. ACI 350 Environmental Engineering Concrete Structures

K. ASTM A820 Steel Fibers for Fiber-Reinforced Concrete
L. ASTM C31 Making and Curing Concrete Test Specimens in Field
M. ASTM C33 Concrete Aggregates
N. ASTM C39 Compressive Strength of Cylindrical Concrete Specimens
O. ASTM C40 Organic Impurities in Fine Aggregates for Concrete
P. ASTM C42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
Q. ASTM C78 Flexural Strength of Concrete Using Simple Beam with Third Point Loading
R. ASTM C88 Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
S. ASTM C94 Ready-Mixed Concrete
T. ASTM C117 Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
U. ASTM C136 Sieve Analysis of Fine and Coarse Aggregates
V. ASTM C138 Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
W. ASTM C143 Slump of Hydraulic Cement Concrete
X. ASTM C150 Portland Cement
Y. ASTM C156 Water Retention by Concrete Curing Materials
Z. ASTM C157 Length Change of Hardened Hydraulic Cement Mortar and Concrete
AA. ASTM C172 Sampling Freshly Mixed Concrete
BB. ASTM C173 Air Content of Freshly Mixed Concrete by Volumetric Method
CC. ASTM C191 Time of Setting of Hydraulic Cement by Vicat Needle
DD. ASTM C192 Making and Curing Concrete Test Specimens in Laboratory
EE. ASTM C231 Air Content of Freshly Mixed Concrete by Pressure Method
FF. ASTM C266 Time of Setting of Hydraulic Cement Paste by Gillmore Needlesw
GG. ASTM C289 Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
HH. ASTM C309 Liquid Membrane-Forming Compounds for Curing Concrete
II. ASTM C494 Chemical Admixtures for Concrete
JJ. ASTM C881 Epoxy-Resin-Base Bonding Systems for Concrete
KK. ASTM C932 Surface-Applied Bonding Compounds for Exterior Plastering
LL. ASTM C1017 Chemical Admixtures for Use in Producing Flowing Concrete
MM. ASTM C1077 Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
NN. ASTM C1116 Fiber-Reinforced Concrete
OO. ASTM C1157 Performance Specification for Hydraulic Cement
PP. ASTM C1240 Silica Fume Used in Cementitious Mixtures
QQ. ASTM D1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
RR. ASTM D2419 Sand Equivalent Value of Soils and Fine Aggregate
SS. ASTM E119 Fire Tests of Building Construction and Materials
TT. California Building Code (CBC)
UU. California Green Building Standards Code (CALGreen Code)
VV. Caltrans Standard Specifications – Section 90 Portland Cement Concrete
WW. California Test Method 214 Soundness of Aggregates
XX. California Test Method 227 Cleanness Value
YY. California Test Method 229 Durability
ZZ. California Test Method 515 Relative Mortar Strength of Portland Cement Concrete Sand
AAA. California Test Method 530 Effect of Water-Reducing and Set-Retarding Admixtures on Drying Shrinkage of Concrete
BBB. Fed Spec UU-B-790A Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellent and Fire Resistant
CCC. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 201 “Concrete, Mortar, and Related Materials
DDD. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 303 “Concrete and Masonry Construction.”

1.6 Submittals

A. Furnish the following submittals in accordance with ACI 301 and California Building Code.

SUBMITTAL	DESCRIPTION
CBC Chapter 17 Special Inspection Required Contractor Statement of Responsibility	As required in CBC Section 1704
Shop Drawings	Required per structural shop drawing requirements. In addition to requirements listed under steel reinforcement, show construction joints and placement schedule.
Catalog Data	Required for admixtures and curing compounds per catalog data requirements.
Installation Instructions	Required for admixtures per installation instruction requirements.
	Submit materials and methods for curing per installation instruction requirements.
Certificate of Compliance	Submit certification from independent testing laboratory mix design complies with these specifications.
	Submit mill test certification including fineness for each shipment of cement per ACI 301.
	Submit aggregate gradation and certification per ACI 301.
	Submit admixture certification including chloride ion content per ACI 301.
	For cementitious materials, admixtures and curing compounds used in walls, floor, roof, columns, and interior concrete appurtenances of potable water storage tanks. Submit certification of compliance with NSF 61 requirements
	At least 24 hours before placing concrete, submit certification from each trade having embedded items in concrete to be placed stating embedded items for each trade are properly located, placed and braced and equipment pads are properly sized.
Engineering Calculations (Mix Design)	Required for concrete mix design per engineering calculations requirements sealed by California-licensed Civil Engineer.
	In addition to original mix design, provide new mix design if change in brand or type of cement or change in source or gradation of aggregates is permitted or if defective concrete occurs.
Brand and Type of Cement/Source of Aggregate	Submit brand and type of cement and source of aggregates to allow sampling and testing by Owner's Representative.
Welder Qualification Certificates	Required for all welders performing reinforcement welding
Product Samples	Provide mock-up for all architectural finishes and all colored or textured concrete.
Delivery Tickets	Required for ready-mix concrete as needed to document delivery quantities. In accordance with ASTM C94 Sections 16.1 and 16.2, each ticket shall show • Name of ready-mix batch plant, • Serial number of ticket, • State certified equipment used in preparing mix, • Truck number. • Name of purchaser & name & location of job • Mix number, • Quantities by weight of cement, sand, each class of aggregate, admixtures and water added in batching plant, • Type and brand of cement & admixtures, • Source & identification of aggregates, • Amount of water allowed to be added at site for specified mix, • Total yield in cubic yards, • Date & time of day to nearest minute corresponding to time batch was dispatched, time batch left plant, time batch arrived on site, time unloading began and time unloading was completed. • Reading of revolution counter at first addition of water

SUBMITTAL	DESCRIPTION
Delivery Tickets (cont.)	Certificates shall be from public weighmaster. Owner's Representative will not accept concrete in absence of certificate.
Waterproofing Additive	Provide complete test reports from approved independent testing laboratories certifying that waterproofing system conforms to performance characteristics and testing requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. In addition to requirements of ACI, refer to Section 01 33 00 for definition of requirements for Shop Drawings, Catalog Data, Installation Instructions, Certificates of Compliance, Engineering Calculations, Test Record Transcripts, and Material Samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of concrete admixtures and curing compounds shall be strictly followed.

C. Storage of materials shall conform to requirements of ACI 301 or SSPWC.

D. Store materials to prevent damage by moisture or breakage.

E. Store sacked cement in manner permitting access for inspection and sampling.

F. Use cement in sequence of receipt of shipments.

G. Coarse aggregate with maximum size greater than ¾" shall be prepared, stored, and handled in 2 or more size groups. When aggregates are proportioned for each batch of concrete, the 2 size groups shall be combined.

H. Do not use any aluminum materials for handling concrete.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Admixtures – Set Retarding (Use when air temperature exceeds 80°F)	Grace Concrete Products "Daratard"	Cambridge, MA
	Master Builders Inc. "Pozzolith 300R"	Cleveland, OH
	Sika Corporation "Plastocrete"	Lyndhurst, NJ
	Accepted equal	
Admixtures – Set Retarding (Use when air temperature exceeds 80°F), – NSF 61-certified for structures holding potable water	Grace Concrete Products "Daratard 17"	Cambridge, MA
	Euclid Chemical Company "Eucon Retarder"	Cleveland, OH
	Accepted equal	
Admixtures – Water	Grace Concrete Products "WRDA 79"	Cambridge, MA

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Reducing (Normal Range) Admixtures – Water Reducing (Normal Range) (cont.)	Master Builders Inc. “Pozzolith 322-N”	Cleveland, OH
	Sika Corporation “Plastocrete 161”	Lyndhurst, NJ
	Accepted equal	
Admixtures – Water Reducing (High Range)	Grace Concrete Products “WRDA 19 or Duracem 100”	Cambridge, MA
	Master Builders Inc. “Rheobuild 716 or Rheobuild 1000”	Cleveland, OH
	Sika Corporation “Sikament FF or Sikament 86”	Lyndhurst, NJ
	Accepted equal	
Bonding Agent (Hardened Concrete to Fresh Concrete)	Edoco “BurkEpoxy MV”	Kansas City, KS
	Concresive Div BASF 1001 LPL	Freeport, TX
	Epoxtile 2391	
	Euco Epoxy 463	
	Master Builders Inc. “Concresive Liquid LPL”	Cleveland, OH
	Pecora Corporation “Dynapoxy EP420”	Harleysville, PA
	Sika Corporation “Sikadur 32 Hi-Mod” or “Sikadur 32 Hi-Mod (LPL)” Epoxy Adhesive	Lyndhurst, NJ
	Accepted equal	
Epoxy Bonding Adhesive for Rebar	Edoco “BurkEpoxy NS”	Kansas City, KS
	Master Builders Inc. “Concresive Paste LPL”	Cleveland, OH
	Pecora Corporation “Dynapoxy EP430 Fast”	Harleysville, PA
	Sika Corporation “Sikadur 31 Hi-Mod Gel” (vertical or overhead applications)	Lyndhurst, NJ
	Sika Concrete Restoration Systems SikaDur 32, Hi-Mod LPL	Lyndhurst, NJ
	Simpson Strong Tie Co.	Dublin, CA
	Accepted equal	
Curing Compounds (Water-Based Resin Type) Use where air quality regulations prohibit use of solvent based compounds	Edoco “Aqua Resincure”	Kansas City, KS
	Euclid Chemical Company “Super Rez Seal”	Cleveland, OH
	Master Builders Inc. “MB429”	Cleveland, OH
	Accepted equal	
Dampproofing Agent	Euclid Chemical Company	Cleveland, OH
	W. R. Meadows Inc. “Sealmastic”	Hampshire, IL
	Sonneborn Div. Chemrex Inc. “Hydrocide 600”	Shakopee, MN
	Accepted equal	
Evaporation Retardant for Curing	Euclid Chemical Company “Eucobarl”	Cleveland, OH
	Master Builders Inc. (Confilm)	Cleveland, OH
	Accepted equal	
Floor Hardener (Surface-Applied)	Euclid Chemical Company “Diamon-Plate”	Cleveland, OH
	Master Builders Inc. “Lumiplate”	Cleveland, OH
	Accepted equal	
Crystalline Waterproofing Additive (Batch Mixed)	Xypex Admix C-500/C-500 NF	Richmond, BC, Canada
	Accepted equal	

B. Use only one brand of cement.

C. All admixtures shall be compatible and by one Manufacturer capable of providing qualified field service representation.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Concrete structural systems shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Cement	Standard Brand Portland Cement	ASTM C150 Type V Modified Low Alkali/Sulfate Resisting Also meet Table 2 optional requirements At least 85% of cement by weight shall pass 325 screen.
Water	Clean, Clear Potable Water	TDS<1000 mg/l
Coarse Aggregate	Specification	Meet ASTM C33 requirements Gravel, crushed gravel, crushed rock or combination From pits acceptable to Owner's Representative
	Cleanness Value per California Test Method 227	75 minimum
	Percentage Wear per ASTM C131	Abrasion loss < 10.5% after 100 revolutions
		Abrasion loss < 42% after 500 revolutions
	Specific Gravity per ASTM C127	2.58 minimum
	Ratio of Silica Released to Reduction in Alkalinity	1.0 maximum
Fine Aggregate	Specification	Meet ASTM C33 requirements Nonreactive clean, hard durable washed material From pits acceptable to Owner's Representative
	Organic Impurities per ASTM C40	Satisfactory Resultant color of testing solution shall not be darker than ASTM C40 standard
	Mortar Strength Relative to Ottawa Sand per California Test Method 515	100% minimum
	Sand Equivalent	>75% average for 3 samples >70% for any one sample
	Percent Clay, Silt, Loam per ASTM C117	<3%
	Soundness per California Test Method 214	<10% Soundness requirement will be waived if durability index D_i>60 per California Test Method 229.
		Ratio of silica released to reduction in alkalinity <1.0 Lightweight sand not permitted
Surface-Applied Bonding Agent	Surface-Applied Bonding Compound	ASTM C932
Epoxy Bonding Agent	Epoxy Resin	ASTM C881
Curing Blankets	Polyethylene Sheet	White 10-mil nominal PE thickness Loss of moisture per ASTM C156<0.055 grams/cm^2
	Polyethylene-Coated Burlap	White opaque polyethylene film impregnated or extruded onto one side of burlap 4-mil nominal PE thickness Burlap weight 9oz/sy or greater Loss of moisture per ASTM C156<0.055 grams/cm^2
	Polyethylene-Coated Waterproof Paper Sheeting	White polyethylene sheeting 2- mil nominal PE thickness Permanently bond to waterproof paper per Fed Spec UU-B-790A Loss of moisture per ASTM C156<0.055 grams/cm^2

ITEM	MATERIAL	SPECIFICATION
Curing Compounds		ASTM C309 White pigmented, resin based Do not use sodium silicate compounds. Meet requirements of floor hardener Manufacturer where applicable NSF 61-certified for potable water tanks where finished concrete will contact potable water.
Curing Mats	Heavy Shag Rugs, Carpets or Cotton Mats Quilted at 4" on center	Minimum dry weight of 12 oz/sy
Grout for Smooth Concrete Finish		1 part Portland cement (½ gray & ½ white Portland cement) White Portland cement to be Atlas white or equal. 1 part fine sand passing No. 16 sieve Calcium chloride (add amount equal to 5% of cement by volume.) Sufficient water to provide consistency of thick paint.
Ready-Mix Concrete		ASTM C94
Repair Mortar	Two-Component Cement Based Product	Low shrinkage. Designed for repairing damaged concrete surfaces. Use medium slump repair mortar on horizontal surfaces. Use non-sag low-slump repair mortar on vertical or overhead surfaces. NSF 61-certified for potable water tanks where finished mortar will contact potable water.

C. Concrete aggregate will be designated by letter per Standard Specifications for Public Works (Greenbook) Section 201 and shall conform to the following gradations:

PERCENTAGE PASSING SIEVES BY WEIGHT					
SIEVE SIZE	**GRADING A** (For concrete street paving not integral with curb)	**GRADING B** (For concrete channel and box inverts)	**GRADING C** (For Class AA, A, A2 or B concrete not used for paving or channel or box inverts. May be used for Class C Concrete)	**GRADING D** (May be used for Class B extruded curbs and gutters or for gunite)	**GRADING E** (For trench backfill, slurry and masonry grout May be used for Class C concrete.)
2"	100%	100%			
1½"	95-100%	95-100%	100%		
1"	64-80%	80-96%	95-100%		
¾"	55-71%	64-80%	77-93%	100%	100%
⅜"	37-53%	40-52%	50-70%	92-100%	90-100%
No. 4	32-42%	35-46%	39-51%	42-60%	60-80%
No. 8	25-35%	28-38%	31-41%	33-47%	50-70%
No. 16	18-28%	21-31%	22-32%	22-38%	33-53%
No. 30	10-18%	10-20%	12-22%	17-25%	19-35%
No. 50	3-9%	3-10%	3-15%	6-15%	5-15%
No 100	0-4%	0-4%	0-5%	1-6%	2-7%
No. 200	0-2%	0-2%	0-2%	0-3%	0-4%

D. Concrete mix shall be designed to meet properties and proportions specified. In general, mix shall be designed to minimize shrinkage, surface flaws, honeycombing and rock pockets around steel reinforcing. Limiting parameters specified are not intended to be a mix design. Additional cement or water reducing agent may be required to achieve workability demanded by Contractor's methods and aggregates. Contractor is responsible for any costs associated with furnishing concrete with required workability, density and strength.

E. Admixtures shall consist of the following materials:

ITEM	MATERIAL	SPECIFICATION
Admixtures	General Requirements	Do not use to reduce cement requirement Shall be free from thiocyanates Chloride ion <0.05% NSF 61-certified for potable water tanks where finished concrete will contact potable water.
Fly Ash and other SCM's		Not permitted
Plasticizing Agents		ASTM C1017
Set Retarding Agents (Use when air temperature exceeds 80°F)		ASTM C494 Type B
Water Reducing Agents (High Range)		ASTM C494 Type F or G Only one water-reducing admixture shall be used
Water Reducing Agents (Normal Range)		ASTM C494 Type A Only one water-reducing admixture shall be used
Water Reducing and Set Accelerating Agents		ASTM C494 Type E Only one water-reducing admixture shall be used
Water Reducing and Set Retarding Agents		ASTM C494 Type D Only one water-reducing admixture shall be used
Crystalline Waterproofing Concrete Admixtures		ASTM E329

F. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Class A "Structural" Concrete Greenbook 750-CSE-P (Use for foundations, footings, and slabs on grade)	f'_c	5,000 psi per ASTM C39
	Cement Content	750 lbs of cementitious material 80% cement & 20% Class F fly ash 600 lb cement per cubic yard minimum but ≤750 lb cement per cubic yard
	Maximum Water/Cement Ratio	0.40 by weight
	Aggregate	SSPWC Greenbook Grading C
	Maximum Aggregate Size	1½"
	Slump	4" maximum per ASTM C143
	Water Reducing Admixture	Required
	Maximum Transit Time	60 minutes (250 revolutions maximum)
Class A "Structural" Concrete Greenbook 750-CSE-P (Use for underground vaults and wet well).	f'_c	5,000 psi per ASTM C39
	Cement Content	750 lbs of cementitious material 80% cement & 20% Class F fly ash 600 lb cement per cubic yard minimum but ≤750 lb cement per cubic yard
	Maximum Water/Cement Ratio	0.40 by weight
	Aggregate	SSPWC Greenbook Grading C
	Maximum Aggregate Size	1½"
	Slump	4" maximum per ASTM C143
	Water Reducing Admixture	Required
	Waterproofing Admixture	Required
	Maximum Transit Time	60 minutes (250 revolutions maximum)
Class A2 "Structural – No Special Inspection" Concrete Greenbook 750-CSE-P (Use for pads and minor structures where Owner elects to waive CBC Special Inspection requirements.)	f'_c	5,000 psi per ASTM C39
	Cement Content	750 lb cement per cubic yard minimum but ≤750 lb cement per cubic yard
	Maximum Water/Cement Ratio	0.40 by weight
	Aggregate	SSPWC Greenbook Grading C
	Maximum Aggregate Size	1½"
	Slump	4" maximum per ASTM C143
	Water Reducing Admixture	Optional
	Maximum Transit Time	60 minutes (250 revolutions maximum)

ITEM	DESCRIPTION	
Class B "Site Paving" Concrete (Use for curbs, gutters, sidewalks, and non-vehicular paving.) Greenbook 560-B-3250	f'_c	3250 psi per ASTM C39
	Cement Content	560 lb cement per cubic yard minimum but ≤560 lb cement per cubic yard
	Maximum Water/Cement Ratio	0.55 by weight
	Aggregate	SSPWC Greenbook Grading B
	Maximum Aggregate Size	2"
	Slump	4" maximum per ASTM C143
	Water Reducing Admixture	Optional
	Maximum Transit Time	90 minutes
Class C "Utility" Concrete (Use for encasement, thrust blocks, fence and guardrail posts, and mass concrete.) Greenbook 560-C-3250	f'_c	3250 psi per ASTM C39
	Cement Content	560 lb cement per cubic yard minimum but ≤560 lb cement per cubic yard
	Maximum Water/Cement Ratio	0.55 by weight
	Aggregate	SSPWC Greenbook Grading C
	Maximum Aggregate Size	1½"
	Slump	3-6" per ASTM C143
	Water Reducing Admixture	Optional
	Maximum Transit Time	90 minutes
Class D "Slurry Backfill" Concrete (Use for trench backfill.) Greenbook 94-E-100	f'_c	100 psi per ASTM C39
	Cement Content	94 lb cement per cubic yard
	Maximum Water/Cement Ratio	0.60 by weight
	Aggregate	¾"
	Maximum Aggregate Size	SSPWC Greenbook Grading E
	Slump	6" maximum per ASTM C143
	Water Reducing Admixture	Optional
	Maximum Transit Time	120 minutes
Fiber-Reinforced Concrete (Provide in Class A, A2 and B concrete mixes to limit microcracking and shrinkage cracks)	Synthetic Fibers	ASTM C1116 Add 0.1% by volume.
	Steel Fibers	ASTM A820 Add 0.1% by volume.
Additional Requirements for Concrete to which Floor Hardener is to Be Applied	Slump	<4", except where ambient temperatures are below 65°F, use slump < 3".
	Air Content	<3%
	Other Requirements	Do not use set-accelerating admixtures containing calcium chloride.
		Do not use admixtures that increase bleeding.
Floor Hardener	Manufacture	Premeasured, premixed and prepackaged at factory
	Application Rate	1.8-2.5 lb per square foot.
	Evaporation Retarder	Monomolecular film evaporation retarder recommended by floor-hardener Manufacturer to maintain moisture during early curing

G. With addition of high range water reducer, slump shall be 7" +/- 2".

H. All materials furnished for Work shall comply with requirements of Sections 201, 203, and 204 of ACI 301 as applicable.

I. Cement shall be clean and free from contaminants. Do not use cement reclaimed from cleaning bags or leaking containers. Do not use lumpy cement.

J. All materials furnished for Work must be classified by Environmental Protection Agency as acceptable for potable water use within 30 days of application.

2.3 Mixes

A. Proportioning shall meet requirements of ACI 301 Chapter 3 “Proportioning.”

B. Quantity of water shall be just sufficient to produce workable batches of concrete which can be worked into place without segregation or other flaws and compacted using vibratory methods to provide desired density, impermeability, and smoothness of surface. Adjust water quantity added if needed to adjust for variations in moisture content of aggregate while providing uniform consistency between batches. Determine consistency of batches by slump testing as described below.

C. Mixing shall meet requirements of ACI 301 Chapter 7 “Mixing.”

D. Apply admixtures according to Manufacturer’s installation and warranty requirements.

E. Set controlling and water reducing admixtures shall be applied as follows:

1. Use or addition of admixtures shall be at Contractor’s option to increase workability and shall result in no increase in cost to Owner.

2. Use or addition of admixtures shall be subject to approval by Owner’s Representative.

3. Concrete containing admixture shall be first placed at location determined by Owner’s Representative.

4. High range water reducing admixtures shall be added to concrete on site after all other ingredients have been mixed and initial slump has been verified. Do not use more than 14 ounces of water reducer per sack of cement. Water reducer shall be considered as part of mixing water when calculating water cement ratio.

5. If high-range water reducer is added to concrete on site, it may be used in conjunction with same water reducer added at batch plant. Concrete shall have slump of 3” ±½” before adding high range water reducing admixture at job site.

6. High-range water-reducing admixture shall be accurately measured and pressure injected into mixer as single dose by experienced technician. Standby system shall be provided and tested before each day’s operation of job site system.

7. Mix concrete at mixing speed for at least 30 mixer revolutions after adding high-range water reducer.

F. Retampering of partially hardened concrete or mortar will not be permitted.

G. Trial batch testing shall proceed as follows:

1. Before placing any concrete, testing laboratory designated by Owner’s Representative shall prepare trial batch of each class of “structural” or “premium” concrete based on preliminary concrete mixes submitted by Contractor and using aggregates, cement and admixtures proposed.

2. During trial batch, testing laboratory may adjust aggregate proportions to obtain required properties. Such adjustments shall be considered refinements to mix design and shall not justify extra compensation to Contractor.

3. All concrete shall meet specified requirements whether aggregate proportions are from Contractor's preliminary mix design, or whether proportions have been adjusted during trial batch process.

4. Trial batch materials shall be sufficient to yield 3 drying shrinkage and 10 compression test specimens from each batch.

5. Test 5 cylinders at 7 days to establish 7-day average compressive strength.

6. Test remaining 5 cylinders no more than 28 days after molding.

7. Required average compressive strengths shall be as follows:

SPECIFIED COMPRESSIVE STRENGTH (f'_c)	28-DAY LABORATORY TRIAL BATCH COMPRESSIVE STRENGTH MINIMUM TEST RESULTS		28-DAY FIELD TEST COMPRESSIVE STRENGTH MINIMUM TEST RESULTS
	5-CYLINDER AVERAGE	ANY SINGLE TEST	5-CYLINDER AVERAGE
$0 < f'_c < 3000$ psi	f'_c +1000 psi	f'_c	f'_c + 600psi
3000 psi ≤ f'_c < 5000 psi	f'_c +1200 psi	f'_c	f'_c + 600psi

8. Perform shrinkage tests on the design mix for "premium" concrete used as part of a hydraulic structure. The tests shall conform to ASTM C157 as modified by ASTM C596. Use concrete specimens. Do not use mortar specimens. The maximum concrete shrinkage, as measure at 21 days or 28 days of air storage shall not exceed 0.036 or 0.042 percent respectively.

9. Concrete mix for underground vaults with a crystalline waterproofing system shall be tested in accordance with the following standards and conditions, and the testing results shall meet or exceed the performance requirements as specified herein.

    a. Testing shall be performed by an accredited independent laboratory meeting the requirements of ASTM E 329 for certification of testing laboratories. Testing laboratory shall obtain all control and treated concrete samples.
    b. Crystallizing capability of waterproofing system shall be evidenced by independent SEM (Scanning Electron Microscope) photographs showing crystalline formations within the concrete matrix.
    c. Independent testing for permeability shall be performed according to a U.S. Army Corps of Engineers CRD-C48 (Mod.) "Permeability of Concrete". Concrete samples shall be pressure tested to 150 psi (350 foot head of water) or 1.05 MPa (106 m head of water). After 5 days the untreated samples shall leak and the treated samples shall exhibit no measurable leakage.
    d. Independent testing shall be performed to determine "Sulfuric Acid Resistance of Concrete Specimens". Treated concrete samples dosed at 3% shall be tested against untreated control samples. All samples shall be immersed in 7% sulfuric acid and weighed daily until a control sample reaches a mass loss of 50%. On final weighing the percentage mass loss of the treated samples shall be significantly lower than the control samples.
    e. Independent testing shall be performed to determine "Sulfate Resistance of Concrete Specimens" treated with integral crystalline admixture. Treated and untreated samples shall be immersed in a concentrated sulfate solution for at least 4 months. On final weighing the percentage mass loss of the treated samples shall be significantly lower than the control samples.

f. Concrete samples containing the crystalline waterproofing additive shall be tested against an untreated control sample of the same mix. At 28 days, the treated samples shall exhibit equal or increased compressive strength over the control sample.

10. Do not place “structural” or “premium” concrete until mix design has been qualified under test criteria above. Should source of materials or established procedures change, Owner may require new trial batch testing.

11. Field trial batches may be placed in Work at designated locations accepted by Owner’s Representative where concrete of lower quality is required. For payment purposes, concrete so placed will be considered to be type of concrete specified at that location.

H. Measure cement and aggregate for mixing concrete using direct weighing equipment accessible to Owner’s Representative.

I. Tolerances of measurement equipment shall be as follows:

1. Cement: Use weighing equipment accurate to ±1% of total weight
2. Aggregate: Use weighing equipment accurate to ±3% of total weight
3. Admixtures: Use weighing equipment accurate to ±3% of total weight
4. Water: Use metering equipment accurate to ±3% of total volume

J. Water feed control mechanism shall be capable of being locked in position to deliver constant flow of water to each batch of concrete. Use positive quick-acting valve for cut-off in water line to mixer. Operating mechanism shall not allow leakage to occur when valves are closed.

K. Ready mixed concrete shall meet ASTM C94 and requirements below.

1. Materials used in ready-mixed concrete shall be subject to continuous inspection at batching plant by Owner’s Representative.

2. Transport and deliver all ready-mixed concrete to site using agitating equipment. Do not use non-agitating equipment or combination truck and trailer equipment to transport or deliver ready-mixed concrete.

3. Deliver ready-mixed concrete to site and complete discharge within “maximum travel time” specified above after addition of cement to aggregates. Also, deliver mixed concrete to site and complete discharge before drum has been revolved specified maximum number of revolutions.

4. Truck mixers shall have electrically actuated counters to record number of revolutions of drum or blades. Counter shall be resettable recording type, and shall be mounted in driver’s cab. Counters shall be actuated at time of starting mixers at mixing speeds.

5. Completely empty mixer of any previously mixed load before adding new concrete.

6. Each batch of concrete shall be mixed in truck mixer for at least 70 revolutions of drum or blades at rotation rate designated by equipment manufacturer. Additional mixing, if any, shall be at agitating speed designated by equipment manufacturer. All materials, including mixing water shall be in mixer drum before actuating counter to count rotations.

7. Truck mixers and their operation shall ensure concrete throughout mixed batch is discharged within acceptable limits of uniformity of consistency, mix and grading.

8. Slump tests taken at approximately ¼ point and ¾ points of load during discharge shall give slumps within 2" of each other. Mixers failing to meet this requirement shall not be used on job until causing condition is corrected and satisfactory performance is verified on-site using additional slump tests. All mechanical parts of failing mixer, including water measurement and discharge apparatus, blades, rotation speed and drum clearances shall be serviced and checked before further attempt to use equipment.

9. Each delivery of ready-mixed concrete shall be accompanied by delivery ticket furnished to Owner's Representative as described in Paragraph 1.6 above.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install Concrete structural systems before submitting Shop Drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Before placing concrete within forms, each trade having embedded items, including water stops within forms and affected by pour shall certify all items are properly located, placed and braced.

C. Thoroughly wet earth surfaces by sprinkling before placing concrete. At time of concrete placement, ground surface shall be moist, but free from standing water, mud and debris.

D. Cold joints in concrete shall be deemed to occur whenever placement of concrete is interrupted for any reason so new concrete is neither incorporated integrally with previously placed concrete in opinion of Owner's Representative nor keyed in place with preformed construction joint shown on Contract Documents or accepted Shop Drawings. Prepare horizontal surfaces of cold joints as follows:

   1. Compacting and roughen horizontal with minimum ¼" amplitude profile for good bond.

   2. Clean tooled joint surface of all laitance, loose or defective concrete and foreign matter by hydroblasting or sandblasting to expose aggregate.

   3. Thoroughly wash hydro-blasted or sandblasted surface with clean water.

   4. Remove all ponded water from surface of construction joints.

   5. Coat joint surface with epoxy-bonding agent unless otherwise shown.

E. Construction joints shown on Contract Documents and accepted Shop Drawings may be made as shown with provision of keys or other locking shapes to secure proper union with subsequent work.

F. Before placing concrete, verify location of embedded items with affected trades. Accuracy of placement of embedded items is Contractor's responsibility.

G. Before placing concrete, secure inspection of steel reinforcement and obtain acceptance by Owner's Representative at least 4 hours before placing concrete.

H. Before placing concrete, provide dewatering, runoff diversion and protection as needed to ensure proper and water-free environment suitable for concrete hardening and curing. Do not place concrete underwater or in spaces where standing water is present. Protect uncured concrete from exposure to rain, runoff or groundwater.

I. Notify Owner's Representative in writing at least 24 hours before placing any concrete. Do not place concrete except when Owner's Representative or his duly authorized representative is present.

J. Order of placement of concrete shall be acceptable to Owner's Representative. To minimize shrinkage effects, place concrete in units bounded by construction joints shown in Shop Drawings. Placement shall occur such that each unit shall cure at least 7 days for hydraulic structures and 3 days for all other structures before contiguous units are placed, except corner sections of vertical walls shall not be placed until the 2 adjacent wall panels have cured at least 14 days for hydraulic structures and 7 days for all other structures.

K. Provide sufficient illumination in interior of all forms so concrete at places of deposit is visible from deck or runway.

L. Schedule concrete placement during evening or morning hours or provide ice or pre-cooled aggregate as needed to maintain temperature of concrete within the following ranges immediately before placement.

1. Concrete less than 12" thick: 55°F to 90°F

2. All other concrete: 50°F to 90°F

3. When concrete temperature exceeds 80°F, only set retarding admixtures shall be used.

4. When concrete temperature exceeds 85°F, time between introducing cement to aggregates and discharge shall not exceed 45 minutes.

5. No additional compensation will be made to contractor for measures used to maintain concrete temperature within specified limits.

M. Hot weather placement shall proceed as follows:

1. Comply with ACI 305.

2. From initial placement through curing, protect concrete from adverse effects of high temperature, low humidity and wind.

N. All ends of chutes, hopper gates, and all other points of concrete discharge shall be arranged so concrete passing from them will flow continuously into receiving vessel without separation. Conveyor belts, if used, shall be wiped clean by device operated so mortar adhering to belt is not wasted and shall be of type acceptable to Owner's Representative. Chutes shall be no longer than 50' long. Slopes of chutes shall permit free and continuous flow of concrete being placed.

3.2 Installation/Application

A. Refer to Sections 01 73 00 for basic execution and installation requirements.

B. Furnish and install concrete at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. California Building Code Chapter 19 "Concrete"
4. Other applicable building and CalGreen code requirements
5. ACI 301 Structural Concrete for Buildings Chapter 8.
6. ACI 318 Building Code Requirements for Reinforced Concrete
7. Standard Specifications for Public Works Construction Section 303 "Concrete and Masonry Construction."

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Pumping of concrete will only be permitted if satisfactory end results are obtained.

1. For redundancy, provide standby pump on site or provide pumping equipment with two cylinders, designed to operate with one cylinder only.
2. Replace pumping equipment or hoses that fail to function properly.
3. Minimum diameter of hose and conduits shall be in accordance with ACI 304
4. Do not use aluminum conduits to convey concrete.
5. Concrete samples for slump, air content and test cylinders will be taken at placement (discharge) end of line.

F. Do not drop concrete through reinforcing steel or into any deep form, nor place concrete in any form in manner permitting accumulation of mortar on surfaces above placed concrete. If necessary, use hoppers or vertical ducts of canvas, rubber or metal to convey concrete to place of final deposit without separation or splashing. Free fall shall not exceed 4' below ends of ducts, chutes or buggies except in column forms. In no case shall concrete be displaced horizontally in forms by more than 6' after depositing. Deposit concrete in uniform horizontal layers not deeper than 2'. Avoid inclined layers or inclined construction joints except where required for sloping members. Place each layer while previous layer is still soft. Rate of placement in forms shall not exceed 5 vertical feet of rise per hour.

G. Thrust blocks shall be placed behind all non-welded, non-flanged or non-restrained valves, fittings, reducers, tees, crosses, bends and dead ends. Place thrust blocks as follows:

1. Wrap fittings and valves, leaving stainless steel bolts exposed. Do not allow concrete to contact flanges or bolts.
2. Owner's Representative shall inspect formwork and be present throughout placement of concrete.
3. Unless otherwise shown on Plans, provide bearing surface not less than 3 times pipe diameter in all directions.

4. Thrust block shall bear against undisturbed soil.

5. In soft or disturbed soil, increase bearing surface as directed by Owner's Representative.

H. Concrete in ramps and sloping slabs shall be placed uniformly from bottom to top for full width of placement. As work progresses, vibrate concrete and carefully work it around reinforcement. Screed ramp surface in an up-slope direction.

I. Thoroughly settle, compact and consolidate concrete in forms or excavations throughout entire depth of concrete layer being placed.

1. Consolidate concrete into dense, homogeneous mass, filling all corners and angles, thoroughly embedding reinforcement and embedments, eliminating all rock pockets and bringing only a slight excess of water to exposed concrete surface during placement.

2. Vibrators shall be Group 3 per ACI 309. Use high-speed power vibrators (8,000 rpm to 12,000 rpm) of immersion type in sufficient number and with (at least one) standby units as required to accomplish specified results within 15 minutes after concrete is deposited. Group 2 vibrators may be used only at specific locations when accepted by Owner's Representative.

3. When placing concrete around waterstops, carefully rod and vibrate concrete to eliminate all air and rock pockets. Where flat-strip waterstops are placed horizontally, work concrete under waterstops by hand, making sure all air and rock pockets are eliminated. Concrete surrounding waterstops shall receive additional vibration over and above that used for adjacent concrete to assure complete embedment of waterstops in concrete.

4. Concrete in walls shall be internally vibrated and at same time, rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills forms or excavations and closes snugly against all surfaces. Do not place subsequent layers of concrete until previously placed layers have been worked thoroughly as specified. Keep vibrating head from contact with form surfaces.

5. Do not vibrate concrete excessively or work it in any manner causings segregation of its constituents.

J. Horizontal surfaces of concrete shall be level whenever run of concrete is stopped. To ensure level, straight joint on exposed surfaces of walls, tack wood strip at least ¾" thick to forms on these surfaces. Carry concrete about ½" above underside of strip. About one hour after concrete is placed, remove wood strip. Using trowel, remove irregularities in edge formed by strip, and remove all laitance.

K. Concrete finishing shall proceed as follows:

1. As soon as forms are removed, examine all exposed surfaces and rub or grind all fins, bulges or ridges in satisfactory method to provide smooth, uniform and continuous surface.

2. Do not plaster or coat surfaces to be smoothed.

3. Do not use aluminum finishing tools.

4. Finished surfaces shall present finished, smooth, continuous hard surface.

5. Tolerances of finished concrete shall be as shown in Section 03 10 00.

6. Owner's Representative will inspect finished surface for voids, holes, honeycombing, rock pockets or similar depression defects. Damage shall be repaired as specified.

7. Repair surface defects within 2 hours of form removal.

8. Surface defect repairs that cannot be made within 2 hours following form removal shall be delayed until after curing compound has been applied. In such case, area involved shall then be wet sandblasted to remove curing compound following which repairs shall be made as specified, and curing compound shall be reapplied over repaired area.

L. Repair defective work at Contractor's expense as follows:

SURFACE DEFECTS	
DEFECT	**REPAIR METHOD**
Tie Rod Cone Holes	Ream circular holes with suitable toothed reamers to leave surfaces of holes clean and rough. Do not ream rectangular holes or holes deeper than their least surface dimension. Repair holes in approved manner with dry-packed cement grout.
Cracks in Retaining Walls and Walls in Contact with Backfill	Apply waterproofing membrane to cover fill side of wall. or Vee cracks on water-bearing face with suitable tools. Fill with construction joint sealant designed for water-bearing structures
Cracks and Honeycombing in Underground Vaults Constructed with Waterproof Concrete	Apply waterproofing membrane to cover fill side of wall. and Repair honeycombing and cracking in accordance with cementitious crystalline admixture manufacturer including relevant Method statements.
Cracks in Water-bearing Structures	Vee cracks on water-bearing face with suitable tools. Fill with construction joint sealant designed for water-bearing structures.
Minor Voids, Holes or Honeycombing	Cut back from trueline at least ½" over entire area. Use chipping and cutting tools as needed. Do not feather edges. Remove 1/32" of surface film from hardened and cured portions by wet sandblast. Remove all laitance or soft material before bonding. Moisten exposed surface but do not wet it enough to overcome suction needed for bond. Mix for repair shall be 1 sack cement to 3 cubic feet sand with Atlas white Portland cement added as needed on interior walls to make patch match finish. Apply bonding agent if required. Apply repair mix.
HOLES EXTENDING THROUGH CONCRETE	
DEFECT	**REPAIR METHOD**
Small Holes less than 12" in least dimension	Fill hole with non-shrink grout. Where face of repaired surface is exposed to view, hold grout back 2" from finished surface. Patch remaining 2" as described above for "Minor Voids, Holes or Honeycombing." For water bearing structures, apply bentonite or other accepted waterstop material around perimeter of hole.
Large Holes greater than 12" in least dimension	Chip keyway into edge of opening. Repair keyed opening as described above for "Small Holes."
Large Holes greater than 24" in least dimension	Chip keyway into edge of opening If reinforcing is not present, dowel and epoxy reinforcing of size matching reinforcing in existing wall across opening in both directions. Repair keyed and reinforced opening as described above for "Small Holes.".

M. Perform all repairs using approved methods that do not disturb bond or cause sagging or horizontal fractures. Finished surfaces shall be cured using methods and duration similar to that for adjacent concrete.

N. Concrete finishing of unformed surfaces shall proceed as follows:

1. After proper and adequate vibration and tamping, bring unformed surfaces of slabs, floors, walls and curbs to uniform surface with suitable tools.

2. Screed concrete and then immediately treat with liquid evaporation retardant. Reuse retardant as needed after each operation to prevent drying shrinkage cracks.

3. Classes of unformed surfaces shall be as follows:

FINISH	LOCATION	DESCRIPTION
U1 (screeded finish)	Grade slabs and foundations to be covered with concrete or fill material	Sufficient leveling and screeding to produce even, uniform surface with surface irregularities not exceeding ⅜". No further special finish.
U2 (float finish)	Preparation for U3 finish	After sufficient stiffening of concrete, float finish surface with wood or metal floats or with finishing machine using float blades. Do not excessively float surfaces while concrete is plastic. Floating shall be minimum necessary to produce uniform-texture surface free from screed marks. Do not dust dry cement or sand on concrete surface to absorb excess moisture. Surface irregularities shall not exceed ¼"..
U3 (steel trowel finish)	Top surface of walls Water-bearing slabs with slopes of 10% or less	After floated finish U2 hardens sufficiently to prevent excess of fine material from being drawn to surface, steel trowel surface with firm pressure to flatten sandy texture of floated surface and produce dense uniform surface free from blemishes, ripples and trowel marks. Finish shall be smooth and free from all irregularities.
U4 (hairbroom finish)	Non water-bearing slabs Water bearing slabs with slopes >10%	After completing steel trowel finish U3, add light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. Resulting surface shall be rough enough to provide nonskid finish.

O. Do not backfill against walls until concrete has obtained 100% of specified 28-day compressive strength.

P. Concrete floor slab surface hardeners shall be applied as follows:

1. Notify surface hardener Manufacturer at least 3 days before initial use of product.

2. Place job mockup of 100 square feet using materials proposed for project as follows.

3. After concrete has been leveled and as soon as concrete will support operator and machine without disturbing level or working up excessive fines, float surface of slab using mechanical float fitted with float shoes.

4. Following floating, apply ½ to ⅔ of total amount of dry shake surface hardener so uniform distribution of surface hardener is obtained. Use of mechanical spreader is recommended.

5. Do not place dry shake on concrete surface when bleed water is present.

6. Once shake has absorbed sufficient moisture (indicated by darkening of shake), float the surface.

7. Immediately apply remaining ⅓ to ½ of shake and allow to absorb moisture.

8. Use finishing machines with detachable floor shoes. Compact surface by a third mechanical floating if time and set of concrete allow this. Do not add water to surface.

9. As surface further stiffens, indicated by loss of sheen, hand or mechanically trowel with blades set relatively float. Remove all marks and pinholes in final raised trowel operation.

10. Cure finished floors using fill-forming curing compound recommended by surface hardener Manufacturer. Uniformly apply curing compound over entire surface at coverage providing moisture retention in excess of requirements of ASTM C309.

11. Maintain ambient temperature of at least 50°F throughout curing period.

12. Factory-trained full-time representative of surface hardener shall be present during installation of mockup and initial period of installation to advise on proper use of product.

13. After review of mockup, revise materials and procedures as recommended by surface hardener representative to obtain acceptable surface finish.

14. Complete application of floor hardener using same controls and procedures used in mockup with revisions recommended by surface hardener representative to obtain acceptable surface finish.

15. Keep floors covered and free of traffic and loads for at least 14 days after completion.

Q. Concrete curing shall proceed as follows:

SURFACE	DESCRIPTION
Unstripped Forms	Method 1: Wet wood forms completely after concrete has been placed, and keep wet with water until forms are removed. For steel forms, keep exposed concrete surfaces continuously wet until forms are removed. If forms are removed within 14 days of placing concrete, continue curing as described for surfaces with forms removed
Construction Joints between Footings & Walls & between Floor Slab & Columns	Method 2: Cover surface with burlap mats. Wet mats with water for duration of curing period until concrete in walls has been placed. Do not apply curing compound to these surfaces.
Encasement Concrete & Thrust Blocks	Method 3: Cover surface with moist earth 4 to 24 hours after concrete is placed. Earthwork operations that may damage concrete shall not begin until at least 7 days after concrete is placed.
Concrete Surfaces not Described Elsewhere	Method 4: As soon as concrete hardens enough to prevent marring on unformed surfaces, and within 2 hours after form removal, spray surface with liquid curing compound in accordance with Manufacturer's application instructions. Cover no more than 200 square feet of surface per gallon with uniform film that seals thoroughly. Do not damage seal during curing. If seal is damaged or broken, apply additional curing compound over damaged portion. Where curing compound is accidentally applied to surfaces against which concrete is to be subsequently placed, remove curing compound by wet sandblasting just before placing new concrete. Where concrete is placed adjacent to panel coated with curing compound, apply curing compound to all previously coated panel areas within 6' of joint and apply to any other location where curing membrane is disturbed. Following curing, remove all visible traces of curing compound in such manner that surface finish is not damaged.

SURFACE	DESCRIPTION
Floor Slabs on Grade	Method 5: Before curing medium is applied, keep entire surface damp using nozzles that atomize flow so surface is not marred or washed. Apply curing material using Method 4 described above. After 1 hour but not more than 4 hours have elapsed after applying curing material, wet surface with water delivered through fog nozzle. Place concrete curing blankets on slab, with edges butted together and with joints between strips sealed with 2" wide strips of sealing tape or with edges lapped at least 3" and fastened with waterproof cement to form continuous watertight joint. During first 3 days of curing, no traffic and no depositing of materials shall be permitted on curing blankets. After 3 days, any traffic or material deposits shall only occur on top of ⅝" minimum plywood sheets laid over curing blankets. Leave curing blankets in place for 14 days. Add water under curing blanket as often as necessary to maintain damp concrete surfaces. Do not remove curing blankets until after concrete for adjacent work has been placed. Should curing blankets tear or become damaged, replace damaged sections.
Surfaces with Forms Removed & Slabs not on Grade	Keep concrete continuously wet by applying water for at least 14 consecutive days beginning immediately after concrete reaches final set or after forms are removed. Before curing medium is applied, keep entire surface damp using nozzles that atomize flow so surface is not marred or washed. Use heavy curing mats secured in place with weights along all edges to continuously retain moisture during curing period. Use sprinklers or other means to maintain moist surface condition during and after normal working hours. At end of curing period, remove curing medium. Rewet any dry spots and apply curing compound in accordance with Method 4 above.

R. Excess curing water shall be disposed of in manner that avoids damage to Work.

S. Concrete finishing of formed surfaces shall proceed as follows:

1. Repair surface defects.

2. Immediately after stripping forms, inspect concrete surface. Repair all poor joints, voids, rock pockets and other defective areas.

3. Fill form tie holes as directed in Section 03 10 00.

4. Allow concrete to cure at least 14 days before applying architectural finishes.

5. All architectural finishes shall conform to accepted sample required herein in texture, color and quality. Sample for smooth concrete finish shall be 200 square foot panel prepared as described below. Sample for sandblasted finish shall be 3-square foot sample.

6. Classes of architectural finishes shall be as follows:

FINISH	LOCATION	DESCRIPTION
Smooth Concrete Finish	All exposed formed surfaces of buildings except where otherwise shown	Concrete surface shall be wetted and smooth concrete finish grout described above shall be brush applied. Vigorously rub grout into concrete surface with wood float to fill all small air holes. Then remove surface grout with steel trowel. Allow to dry, then vigorously rub surface with burlap to remove remaining surface grout so no visible paint-like film remains. (Complete all work on same panel within one 8-hour day. Do not leave grout on surface overnight.) Finished surface should be light-colored concrete surface of uniform color and texture with no appearance of paint or grout film. If procedures above result in inferior finish, rub inferior areas with carborundum bricks.

3.3 Field Quality Control

A. Field testing and inspection of formwork shall be per Section 03 10 00.

B. Field testing and inspection of concrete accessories, waterstops and joints shall be per Section 03 15 00.

C. Field testing and inspection of steel reinforcement shall be per Section 03 20 00.

D. Field testing and inspection of embedded steel bolts shall be per Section 05 12 00.

E. CBC Chapter 17 special inspection shall only be required for Class AA "premium" concrete, Class A "structural" concrete and concrete having specified compressive strength f'_c exceeding 2500 psi.

F. Maintain placing record on-site showing time and date of placement of all concrete having specified compressive strength f'_c exceeding 2500 psi as required in CBC Section 1704.4.2.

G. Special inspection and field testing of Class AA and Class A concrete required by Chapter 17 of CBC (Table 1704.4) shall be completed by ICBO-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Class A Concrete and Concrete having f'_c exceeding 2500 psi	Design Mix Verification	ACI 318, Ch 4 & 5.2-5.4, CBC 1904.25.25, 1913.2, & 1913.3	Periodic per CBC Table 1704.4	Owner	Contractor to reimburse Owner for costs of first deputy inspector if re-inspection is required
	Slump	ACI 318 Sec. 5.6& 5.8, ASTM C31, ASTM C172 & CBC 1913.10 Slump per ASTM C143	Continuous per CBC Table 1704.4 taken at at ¼ point and ¾ point of batch and at time fresh concrete is sampled to fabricate cylinders for strength tests		
	Air Content	ACI 318 Sec. 5.6& 5.8, ASTM C31, ASTM C172 & CBC 1913.10 Air content per ASTM C173 or C231			
	Temperature	ACI 318 Sec. 5.6& 5.8, ASTM C31, ASTM C172 & CBC 1913.10			
	Proper Placement of Concrete	ACI 318 Sec. 5.9-5.10, CBC 1913.6, 1913.7,& 1913.8	Continuous per CBC Table 1704.4		
	Verification of in-situ Concrete Strength Prior to Removal of Shores and Forms	ACI 318, Sec. 6.2 See below for concrete strength test requirements	Periodic per CBC Table 1704.4		
	Curing Temperature and Techniques	ACI 318, Sec. 5.11-5.13, & CBC 1913.9	Periodic per CBC Table 1704.4		

H. Additional field testing of concrete shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Concrete Compressive Strength f'_c	Trial Batch	1st 3 cylinder tests at 7 days 2nd 3 cylinder tests at 28 days average compressive strength at 28 days shall exceed 125% of specified compressive strength f'_c	3 drying shrinkage samples and 6 compression test cylinders for each class or mix of concrete used	Contractor	Contractor
	Cylinder Sampling	ASTM C172	Sample each 100 cy concrete and each separate mix design placed on any day	Contractor	Contractor
	Cylinder Testing of Compressive Strength f'_c	Field Cylinders per ASTM C31 Section 9.2 Laboratory Cylinders per ASTM C192 Testing per ASTM C39 Average of two cylinders Evaluation per ACI 214 & ACI 318 Chapter 5 "Concrete Quality" Standard deviation of test results shall not exceed 640 psi.	Make six 6" diameter x 12" high cylinders per 100 cy concrete and separate mix design placed on any day 1st test at 7 days 2nd test at 28 days Save remaining cylinders to verify test results as directed.	Owner	Contractor
	Test Core Testing of Compressive Strength f'_c	Take test cores per ASTM C42 if minimum strengths fall below those specified. Concrete tested by coring shall be acceptable if average f'_c of 3 cores equals 85% of specified f'_c and no single core strength is less than 75% of specified f'_c	3 cores per test as directed	Contractor	Contractor
Concrete	Flexural Strength	ASTM C78	As directed	Contractor	Contractor
	Unit Weight Yield	ASTM C138	As directed	Contractor	Contractor
	Drying Shrinkage	California Test 530	As directed	Contractor	Contractor
Mortar	Setting of Mortar	ASTM C191 or C266	As directed	Contractor	Contractor
	Mortar Cube Test	California Test 515	As directed	Contractor	Contractor
Concrete Finishing	Dimensional Tolerance	ACI 117 and Section 03 10 00	Inspection at Owner's discretion	Owner	Owner
	Surface Defects	Holes larger than ½" diameter or greater than ¼" deep are defined as surface defects. More stringent requirements exist for some specified finishes.	As directed	Owner	Owner
	Permeability and Cracking in Water-Bearing Structures	Section 03 08 50	As directed	Owner	Owner
Concrete Finishing (cont.)	Cracking in Flatwork and	No cracks wide enough to stick a dime in except at expansion or	As directed	Owner	Owner

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
	Non-Water-bearing Structures	contraction joints.			
Concrete	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

I. Concrete samples for batch testing shall be furnished in steel drums at no cost to Owner.

J. In lieu of trial batch testing, Contractor may submit previously designed, tested and successfully used concrete mixes using materials similar to those intended for this project, together with at least 3 certified test reports of 28-day strength of proposed concrete mix and shrinkage test results for concrete used as part of a hydraulic structure.

K. Laboratory used for field testing shall meet or exceed requirements of ASTM C1077.

L. Contractor shall provide concrete for testing at no charge to Owner, and shall assist Owner's Representative and laboratory personnel in obtaining samples, and disposal and cleanup of excess material.

M. Statistical analysis of compression test results will be performed according to ACI 214. Standard deviation of test results shall not exceed 640 psi when ordered at equivalent water content as estimated by slump. When said standard deviation exceeds 640 psi, increase average strength for which mix is designed as needed to satisfy statistical requirement that

1. Probability of any test being more than 500 psi below specified strength < 1%.

2. Probability of average of any 3 consecutive tests being below specified strength <1%.

Required average strength shall be calculated using Criterion Number 3 of ACI 214 using actual standard deviation.

N. All concrete which fails to meet ACI requirements and these Specifications is subject to removal and replacement at no increase in cost to Owner.

O. In lieu of removing and replacing slightly deficient concrete having 85% or more of specified strength, Owner may, at their sole discretion, elect to reduce payment due to Contractor for substandard concrete as described in Caltrans Standard Specification Section 90-9 "Compressive Strength."

3.4 Cleaning

A. Wash out chutes, shovels, finishing trowels and all other equipment that has been in contact with wet concrete at a designated concrete washout area.

B. Do not discharge or deposit wet concrete, debris, or other concrete washout effluent on bare ground, on area tributary to storm drain or natural channel or in any storm drain facility.

C. Dispose of concrete and concrete waste in accordance with all pollution prevention laws and regulations.

D. Refer to Section 01 74 00 for cleanup and disposal requirements.

3.5 Protection

A. Protect all concrete against injury until final acceptance by Owner.

B. Fresh concrete shall be protected from damage due to impact, overstress, vandalism and weather, including precipitation or extremes in temperature or humidity until final acceptance.

C. Any new concrete not complying with these specifications shall be repaired or removed and replaced prior to final acceptance except where Owner agrees to reduce payment as described above.

END OF SECTION

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SECTION 03 60 00
GROUTING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of dry-pack grout, cement grout, non-shrink grout, epoxy grout and pressure grouting.

B. See Section 03 64 26 for Epoxy Injection Grouting

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 03 30 00: Cast-in-Place Concrete
I. Section 03 64 26: Epoxy Injection Grouting
J. Section 04 05 00: Masonry Mortaring and Grouting
K. Section 05 50 00: Metal Fabrications
L. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete grouted system with applicable embedments, including appurtenant structural, mechanical, and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Plant testing of aggregate shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Aggregate	Sieve Analysis	ASTM C136	1 each trial batch	Owner	Contractor
	Amount passing #200 sieve	ASTM C117	1 each trial batch	Owner	Contractor
Fine Aggregate	Sand Equivalent	ASTM D2419	As directed	Owner	Contractor
	Organic Impurities	ASTM C40	As directed	Owner	Contractor
	Soundness	ASTM C88	As directed	Owner	Contractor

C. Plant testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Concrete	Certification of Mix Design	ACI 301 certified by independent testing laboratory	1 per mix	Contractor	Contractor
Grout Materials	Materials Inspection	See Paragraph 2.2 below	As directed	Owner	Owner

1.5 References

A. ASTM C33 - Concrete Aggregate.
B. ASTM C40 - Organic Impurities in Sand for Concrete.
C. ASTM C88 - Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
D. ASTM C117 - Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing.
E. ASTM C136 - Sieve or Screen Analysis of Fine and Course Aggregates.
F. ASTM C150 - Portland Cement.
G. ASTM C494 - Chemical Admixtures for Concrete.
H. ASTM C1107 - Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
I. ASTM D695 - Compressive Properties of Rigid Plastics.
J. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
K. California Test No. 217 - Sand Equivalent
L. California Building Code (CBC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Product data required for bonding compounds, non-shrink grout, epoxy grout and water reducing retardant per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
Certificate of Compliance	Submit mill test certification including fineness for each shipment of cement per ACI 301.
	Submit aggregate gradation and certification per ACI 301.
	Submit admixture certification including chloride ion content per ACI 301.
	At least 24 hours before placing concrete, submit certification from each trade having embedded items in concrete to be placed stating that embedded items for each trade are properly located, placed and braced and that equipment pads are properly sized.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and certificates of compliance.

C. When sources of aggregate are changed, a new certification shall be provided for new material prior to its use.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of grout shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant thereto.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Bonding Agent (Noncorrosive)	Concresive Div BASF	Freeport, TX
	Edoco	Kansas City, KS
	Master Builders Inc.	Cleveland, OH
	Sika Corporation "Armatec 110 EpoCem"	Lyndhurst, NJ
	Accepted equal	
Lubricant for Cement Pressure Grouting	Intrusion Prepakt Intrusion Aid	
	Sika Corporation Intraplast	Lyndhurst, NJ
	Accepted equal	
Non-Shrink Grout	Masterflow "713"	
	Sika Corporation "Sikagrout 212"	Lyndhurst, NJ
	Accepted equal	
Water Reducing Retarder	Plastocrete "161MR"	
	Sika Corporation "Plastiment"	Lyndhurst, NJ
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Grout shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Cement	Portland Cement	ASTM C150 Type II/V Modified Low Alkali/Sulfate Resisting, including Table 2 optional requirements At least 85% of cement by weight shall pass a 325 screen Low Alkali containing maximum 0.60% alkalis
Water	Clean, Clear Potable Water	TDS<1000 mg/l
Aggregate	All Aggregate	ASTM C33 Nonreactive clean hard durable washed material From pits acceptable to Owner's Representative Ratio of silica released to reduction in alkalinity <1.0 Ratio of fine aggregate to total aggregate shall be <41% for hydraulic structures and <50% for all other structures.
	Fine Aggregate	Natural sand, manufactured sand or combination Sand Equivalent not less than 75% average for 3 samples or less than 70% for any one sample. Gradation – well graded per ASTM C33 100% passing #8 sieve 45% or more passing #40 sieve 3% max passing #200 sieve Variation will be accepted if average of 3 consecutive tests falls within limits and variation does not exceed the following: Sieves #30 or coarser - 2.0% maximum variation Sieves #50 or finer - 0.5% maximum variation Soundness – 10% maximum loss with sodium sulfate Fineness modulus – <3.00

ITEM	MATERIAL	SPECIFICATION	
Admixtures	All Admixtures	Compatible with grout Conform to ASTM C494 Do not use admixtures containing calcium chloride Use admixtures in accordance with Manufacturer's recommendations Add admixtures separately to grout mix	
	Fly Ash	Not permitted	
	Water Reducing Retarder	ASTM C494 Type D	
Bonding Agent		Epoxy resin with anti-corrosive properties	
Grout	Dry-Pack Grout	Proportions (parts by volume)	1 part cement 2 parts fine aggregate Water reducing retarder Sufficient water to make stiff workable mix.
	Cement Grout	Proportions (parts by volume)	1 part cement 2 parts fine aggregate Pressure grouting admixture Sufficient water to make stiff workable mix.
	Non-shrink Grout	f'_c	6000 psi
		Non-metallic, free-flowing, cement-based grout Conform to ASTM C1107	
	Epoxy Grout	f'_c	8000 psi
		Solvent-free, high-strength, high-flow 100% solids grout	

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install grout before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Do not place grout in freezing weather unless adequate protection is provided in accordance with Manufacturer's recommendations.

C. Apply bonding agent to existing surfaces before applying grout or mortar.

D. Holes required for grouting shall be blown clean. Drill horizontal holes for grouting at a slight downward angle to facilitate holding grout until setting is complete. Slightly bend bolts or reinforcing steel installed in horizontal grout holes accordingly.

3.2 Installation

A. Refer to 01 73 00 for basic execution and installation requirements.

B. Furnish and install grout at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install grout to tolerances recommended by Manufacturer. Unless otherwise shown, install grout true and level using precision gauges and levels.

F. Dry-pack grout shall be installed as follows:

1. Use dry-pack grout for built-up surfaces, setting miscellaneous metal items and minor repairs.

2. Roughen surfaces required to be built up with dry-pack grout by brushing, cleaning, and coating with bonding agent specified in this section before applying grout.

3. Apply dry-pack grout immediately after applying bonding compound. Apply grout in bands or strips to form a smooth covering of required thickness.

4. Slope construction joints in grout. Clean and wet construction joints before resuming application.

5. Cure dry-pack grout in accordance with Section 03 30 00,

G. Cement grout shall be installed as follows:

1. Use cement grout for filling nonbearing portions of equipment pads and pressure grouting.

2. Except for specialized equipment for pressure grouting, mixing and placing apparatus shall be similar to that normally used for cast-in-place concrete.

3. Mix grout for at least one minute. Agitate diluted grout to keep ingredients mixed.

H. Non-shrink grout shall be installed as follows:

1. Use non-shrink grout for bearing surfaces of machinery and equipment bases, column baseplates and bearing plates, and for setting bolts and reinforcing steel in holes for grouting.

2. Place non-shrink grout in accordance with grout Manufacturer's instructions.

I. Pressure grout shall be installed as follows:

1. Pressure grouting equipment shall include a mixer and holdover agitator tanks and shall be designed to place grout at pressures up to 50 psi. Provide gages to indicate pressure used. Provide mixer with meter capable of indicating grout volume used to ±0.10 cubic feet.

2. Prior to grouting, wash systems and holes to be grouted. Washing is not required for grouting soil voids outside pipe cylinders or casing pipes.

3. Complete grouting without stoppage once grouting commences. If equipment breaks down, wash out grouting system sufficiently to ensure fresh grout and adequate bond and penetration occur upon restarting grouting.

4. Maintain grout pressure until grout has set.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Cement Grout Mix	Material Properties	ASTM C1019	2 samples per day	Contractor	Contractor
	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 03 64 23
EPOXY INJECTION GROUTING

PART 1 - GENERAL

1.1 Work Included

A. Work necessary for repair of cracks by injection of epoxy resin adhesive.

B. Work necessary for doweling and epoxying reinforcing bars into existing concrete.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 08 50: Leakage Testing of Hydraulic Structures
H. Section 03 20 00: Concrete Reinforcing
I. Section 03 30 00: Cast-in-Place Concrete
J. Section 03 60 00: Grouting
K. Section 09 90 00: Painting and Coating

1.3 System Description

A. Epoxy used in water bearing structures for crack repair shall provide watertight seal evidenced by water test of structure in accordance with Section 03 08 50 to verify leakage is no greater than specified allowances.

B. Epoxy used in potable water bearing structures shall be NSF61-listed for such use.

C. Epoxy used for doweling rebar into existing concrete shall securely bond rebar to concrete.

1.4 Quality Assurance

A. Epoxy injection shall be performed by applicator certified by epoxy Manufacturer.

B. Contractor's/Subcontractor's operator engaged in epoxy injection process shall have satisfactory operator experience in methods of restoring concrete structures using specific epoxy injection process required. Operator's experience shall include previous repairs of cracked or damaged concrete structures, technical knowledge of correct material selection and use, and operation, maintenance and trouble-shooting of equipment.

1.5 References

A. ASTM D638 Test Method for Tensile Properties of Plastics
B. ASTM D695 Test Method for Compressive Properties of Rigid Plastics
C. ASTM C882 Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements
Installation, Mixing and Application Instructions	Required
Evidence of applicator certification	Submit upon request
Deputy inspection report	Submit report of field testing and observation.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, and installation instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Epoxy Adhesive Grout for Cracks in Horizontal Slabs and Surfaces	Pecora Corporation “Dynapoxy EP450”	Harleysville, PA
	Sika Chemical Corporation “Sikadur 35 Hi-Mod LV LPL”	Lyndhurst, NJ
	Sika Chemical Corporation “Sikadur 52”	Lyndhurst, NJ
	SPC SelectBond GP-4400	Upland, CA
	Accepted equal	
Epoxy Adhesive Grout for Cracks in Vertical, Overhead, or Horizontal Surfaces	Pecora Corporation “Dynapoxy EP450”	Harleysville, PA
	Sika Chemical Corporation “Sikadur 33”	Lyndhurst, NJ
	Sika Chemical Corporation “Sikadur Injection Gel”	Lyndhurst, NJ
	Accepted equal	
Epoxy Bonding Adhesive for Rebar	Edoco “BurkEpoxy NS”	Kansas City, KS
	Master Builders Inc. “Concresive Paste LPL”	Cleveland, OH
	Pecora Corporation “Dynapoxy EP430 Fast”	Harleysville, PA
	Sika Corporation “Sikadur 31 Hi-Mod Gel” (vertical or overhead applications)	Lyndhurst, NJ
	Sika Concrete Restoration Systems SikaDur 32, Hi-Mod LPL	Lyndhurst, NJ
	Simpson Strong Tie Co.	Dublin, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Epoxy adhesive grout shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION	
Epoxy Resin Adhesive for Injection or Bonding/Grouting	100% 2-part water insensitive low viscosity epoxy-resin system	Minimum 7-day tensile strength (ASTM D638)	6,000 psi
		Minimum 7-day compressive strength(ASTM D695)	8,000 psi
		Minimum 14-day bond strength Plastic Concrete to Steel (ASTM C882)	1,500 psi

C. Surface seal material is that material used to confine injection adhesive in fissures during injection and cure. Surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.

2.3 Equipment

A. Equipment used to meter and mix the 2 injection adhesive components and inject mixed adhesive into crack or opening shall be portable, positive-displacement pumps with interlock to provide positive ratio control of exact proportions of the 2 components at nozzle. Pumps shall be electric or air powered and shall provide in-line metering and mixing.

B. Injection equipment for crack or fissure repair shall have automatic pressure control capable of discharging mixed adhesive at any preset pressure up to 200 psi ±5 psi and shall be equipped with manual pressure control override.

C. Injection equipment for crack or fissure repair shall have capability of maintaining volume ratio for injection of adhesive prescribed by Manufacturer of adhesive within tolerance of ± 5% by volume at any discharge pressure up to 200 psi.

D. Equipment used to meter and mix the 2 injection adhesive components and inject mixed adhesive into openings for securing rebar dowels shall be approved in writing by epoxy Manufacturer.

PART 3 - EXECUTION

3.1 Preparation

A. Excavate as needed to expose both sides of vertical or overhead cracks.

B. Clean out surface adjacent to cracks or other areas of application to remove dirt, dust, grease, efflorescence or other foreign matter which may be detrimental to integrity of bond.

C. Provide entry ports at intervals of not less than thickness of concrete at that location.

D. Prime concrete or grouted masonry in accordance with grout Manufacturer's instructions.

E. Apply surface seal to face of crack between entry ports. For through cracks, apply surface seal to both faces.

F. Allow enough time for surface seal material to gain adequate strength before proceeding with injection.

3.2 Injection

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install epoxy adhesive injection systems at locations shown on Plans and Submittals and where required due to cracks observed in field.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Epoxy repair of cracks shall proceed as follows:

1. Injection of epoxy adhesive shall begin at lower entry port and continue until there is an appearance of epoxy adhesive at next entry port adjacent to entry port being pumped.

2. When epoxy adhesive travel is indicated by appearance at next adjacent port, discontinue injection at entry port being pumped and transfer injection to next adjacent port where epoxy adhesive has appeared.

3. Perform epoxy injection continuously until cracks and openings are completely filled.

4. If port-to-port travel of epoxy adhesive is not indicated, work shall immediately be stopped and Owner's Representative shall be notified.

5. When openings or cracks are completely filled, cure epoxy adhesive for sufficient time to allow removal of surface seal without any draining or runback of epoxy material from cracks.

F. Epoxy bonding of concrete to steel reinforcing dowels shall proceed in accordance with Manufacturer's mixing and application instructions.

3.3 Field Quality Control

A. Field testing during concrete placement and prestressing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Epoxy Injection	Deputy Inspection	Use approved deputy inspector. Deputy inspector shall submit report on tests below.	Continuous inspection	Contractor	Contractor
Injection Equipment	Pressure Test	Connect mixing head of injection equipment, and run until clear uniformly mixed material flows into purge pail. Operator shall engage equipment shutoff nozzle valve and subsequently bump on-off switch while monitoring pressure on psi gauge until pressure reaches 200 psi. Monitor pressure gauge for one minute. If pressure is maintained between 190-200 psi, check valves shall be considered to be functioning properly and injection may proceed. If pressure drops to <190 psi, install new seals on check valves and retest equipment.	On each machine at beginning and after meal break of each shift using machine	Contractor	Contractor
	Ratio Test	Place masking tape on sides of A&B reservoirs full height. After filling reservoirs, mark and monitor A& B levels while running injection machine into purge pail for 60 seconds.	On each machine at beginning and after meal break of each shift using machine	Contractor	Contractor

3.4 Adjusting and Cleaning

A. Remove surface seal material and injection adhesive runs or spills from concrete surfaces.

B. Finish face of crack or opening flush to adjacent concrete showing no indentations or protrusions caused by placement of entry ports.

END OF SECTION

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SECTION 04 05 00
MASONRY MORTARING AND GROUTING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of mortar and grout for masonry.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 04 29 00: Engineered Unit Masonry

1.3 System Description

A. Furnish and install complete functional grout and mortar complete in place in accordance with Manufacturer's installation requirements (including anchors required by equipment Manufacturers) and in compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Field mix testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Mortar Mix	Compressive strength, consistency, mortar aggregate ratio, water content, air content, splitting tensile strength and slump	ASTM C780	1 each batch	Contractor	Contractor
Grout Mix	Material properties	ASTM C1019	1 each batch	Contractor	Contractor

B. All equipment for mixing and transporting mortar and grout shall be clean and free from set mortar, dirt or other foreign matter.

1.5 References

A. ACI 530.1/ASCE 6/TMS602 Specification for Masonry Structures
B. ASTM C5 Quicklime for Structural Purposes
C. ASTM C91 Masonry Cement
D. ASTM C94 Ready Mixed Concrete
E. ASTM C144 Aggregate for Masonry Mortar
F. ASTM C150 Portland Cement
G. ASTM C207 Hydrated Lime for Masonry Purposes
H. ASTM C270 Mortar for Unit Masonry
I. ASTM C387 Packaged Dry Combined Materials for Mortar and Concrete
J. ASTM C404 Aggregates for Masonry Grout
K. ASTM C476 Grout for Reinforced and Nonreinforced Masonry

L. ASTM C595 Blended Hydraulic Cement
M. ASTM C780 Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
N. ASTM C1019 Method of Sampling and Testing Grout
O. California Building Code (CBC)
P. IMAC International Masonry Industry All-Weather Council Recommended Practices and Guide Specifications for Cold Weather Masonry Construction.
Q. UBC Standard 21-16 Field Tests Specimens for Mortar

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Design Mix	Show proportion or property method used. Show required environmental conditions and admixture limitations.
Catalog (Product) Data	Required per catalog data requirements.
Installation Instructions	Required for premix mortar per installation instruction requirements.
Certificate of Compliance	Submit Manufacturer's certificate that products meet or exceed specified requirements per Certificate of Compliance requirements.
Test Record Transcripts	Submit test reports on mortar showing conformance to ASTM C780. Submit test reports on grout showing conformance to ASTM C1019. Comply with Test Record Transcript requirements.
Material Samples	Submit color samples for mortar on request. Mortar color shall match masonry.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, certificates of compliance, test record transcripts, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instructions and warranty requirements for delivery, storage and handling of grout and mortar shall be strictly followed.

C. Store cement, lime and other cementitious materials to site in dry, weather-tight sheds or enclosures, in unbroken bags, barrels or other approved containers, plainly marked and labeled with Manufacturer's name and brands.

D. Protect packaged materials from dampness, freezing and foreign matter. Keep materials clean and dry.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Admixture for Grout	Master Builders (Pozzolith - normal)	Cleveland, OH
	Sika Company (Grout Aid – Type II)	Lyndhurst, NJ

ITEM	MANUFACTURER	MANUFACTURER LOCATION
	Accepted equal	
Admixture for Mortar	Master Builders (PS-235 or Rheomix 235)	Cleveland, OH
	Sika Company (Red Label)	Lyndhurst, NJ
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Mortar and grout shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION	
Mortar	Mix	ASTM C270 Type S using Property Method	
		f'_m	1800 psi
		Proportions (parts by volume):	1 part Portland Cement + ¼ to ½ part lime then add 2 ¼ - 3 parts damp loose sand per part cement-lime mixture + precise amount of water needed to produce required strength and workability
		Color	Match block color
	Portland Cement	ASTM C150 Type II/V Modified Low Alkali/Sulfate Resisting	
	Aggregate	ASTM C144 Standard masonry type sand	
	Lime	Hydrated Lime - ASTM C207 Type S Pulverized Quicklime (alternate) ASTM C5 passing No 20 sieve with 90% passing No 50 sieve	
	Water	Clean clear and potable	
Premix Mortar	Mix	ASTM C387, using gray cement, Normal	
	Water	Clean clear and potable	
Pointing Mortar	Mix	ASTM C270 Type N using Property Method	
	Portland Cement	ASTM C150 Type II/V Modified Low Alkali/Sulfate Resisting	
	Aggregate	ASTM C144 Standard masonry type sand	
	Water	Clean, clear and potable	
Grout	Mix	f'_c	2000 psi
		Proportions (parts by volume)	1 part Portland Cement + no more than 1/10-part lime + 2¼ - 3 parts damp loose sand per part cement-lime mixture + no more than 2 parts pea gravel (omit pea gravel when grout space < 4") + precise amount of water needed to produce required strength and workability
	Slump	8"-11"	
	Portland Cement	ASTM C150 Type II/V Modified Low Alkali/Sulfate Resisting	
	Coarse Aggregate	ASTM C404	
	Lime	Hydrated Lime - ASTM C207 Type S Pulverized Quicklime (alternate) ASTM C5 passing No 20 sieve with 90% passing No 50 sieve	
	Water	Clean clear and potable	

C. Mortar sand shall conform to the following gradation from Standard Specifications for Public Works (Greenbook) Table 200-1.5.5(A):

PERCENTAGE PASSING SIEVES BY WEIGHT	
SIEVE SIZE	**MORTAR SAND GRADATION**
No. 4	100%
No. 8	95-100%
No. 16	70-95%
No. 30	35-70%
No. 50	5-35%
No 100	0-10%
No. 200	0-5%

D. Admixtures, except air-entraining admixtures may be added only when approved by Owner's Representative. Do not use admixtures that reduce grout or mortar compression strength. Do not use fly ash.

PART 3 - EXECUTION

3.1 Preparation

A. Maintain materials and surrounding air temperatures to at least 50°F (10°C) prior to, during and 48 hours after completion of masonry work.

B. When ambient temperature exceeds 99°F in shade with relative humidity below 50%, during and 48 hours after completion of masonry work, protect work from direct exposure to wind and sun.

C. Apply bonding agent to existing surfaces before applying grout or mortar.

D. Plug cleanout holes to prevent leakage of grout materials. Brace masonry for wet grout pressure.

E. Protect wall surfaces and other finish surfaces from droppings of mortar or grout.

F. Lime paste shall be made with pulverized quicklime or with hydrated lime that shall be allowed to soak for at least 72 hours before use; except hydrated lime processed by steam method shall be allowed to soak for not less than 24 hours and shall be made by adding lime to water. In lieu of hydrated lime paste for use in mortar, hydrated lime may be added in dry form.

G. Provide proper equipment for accurate measurements for proportioning mortar and grout before mixing. Shovel measurements are not acceptable.

3.2 Mortar Mixing

A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.

B. Mix mortar by placing ½ of water and sand in operating mixer, and adding cement, lime, and remaining sand and water. After all ingredients are in mixer, mechanically mix mortar for at least 5 minutes.

C. Add mortar color and admixtures in accordance with Manufacturer's instructions. Provide uniformity of mix and coloration.

D. Do not use anti-freeze compounds to lower freezing point of mortar.

E. If water is lost by evaporation, retemper only within one hour of mixing.

F. Retempering shall be done on a mortar board by adding water within a basin formed within mortar and reworking mortar into water.

G. Use mortar within one hour after mixing. Mortar that is not used within one hour shall be discarded.

3.3 Grout Mixing

A. Grout shall comply with ASTM C94, or thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476.

B. Add admixtures in accordance with Manufacturer's instructions. Provide uniformity of mix.

C. Do not use anti-freeze compounds to lower freezing point of grout.

3.4 Installation of Mortar

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install premixed mortar and grout at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Building Code Chapter 21 "Masonry" Section 2103 "Masonry Construction Materials"

4. Other applicable building code requirements

5. ASTM C780 Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Buttering of corners of joints or excessive furrowing of mortar joints is not permitted.

F. Remove excess mortar as work progresses.

G. Remove excess mortar from grout spaces before grouting.

3.5 Installation of Grout

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install grout at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

    1. Manufacturer's installation and warranty requirements

    2. Applicable OSHA and Cal OSHA regulations

    1. Applicable building code requirements

    3. ASTM C94 Ready Mixed Concrete

    4. ASTM C476 Grout for Reinforced and Nonreinforced Masonry

D. Refer variances between tabove documents and Contract Documents to Owner's Representative.

E. Do not begin grouting until wall has cured for 24 hours.

F. Wet masonry unit surfaces in contact with grout just prior to placing grout.

G. Fill all cells solidly with grout.

H. Do not displace reinforcement while placing grout.

I. Grout spaces less than 2" wide with fine grout using low lift grouting techniques. Grout spaces 2" wide or greater using high or low lift grouting techniques.

J. Consolidate grout at time of pouring by puddling or vibrating.

K. When grouting is stopped for more than one hour, terminate grout 1½" below top of upper masonry unit to form positive key for subsequent grout placement.

L. Low lift grouting shall proceed as follows.

    1. Place reinforcement.

    2. If Special or Deputy Inspection is required, provide Special or Deputy Inspection.

    3. Place first lift of grout to height of 16" and rod grout to ensure consolidation.

    4. Place subsequent lifts in 8" increments and rod grout to ensure consolidation.

M. High lift grout shall proceed as follows.

    1. Provide cleanout opening at least 4" high at bottom of each cell to be grouted by cutting one face shell of masonry unit.

    2. Clean out masonry cells and cavities with high-pressure water spray. Permit complete water drainage.

    3. Request Owner's Representative to inspect cells and cavities. Allow 3 days advance notice of inspection. If Special or Deputy Inspection is required, provide Special or Deputy Inspection at this time.

    4. After cleaning and cell inspection, seal openings with masonry units.

5. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.

6. Limit grout lift to 48" and rod grout to ensure consolidation. Wait 30 to 60 minutes before placing next lift.

N. Provide cleanout openings at bottoms of all cells to be filled at each lift or pour of grout where such lift or pour is over 4' high. Any overhanging mortar or other obstructions or debris shall be removed from insides of such cell walls. Seal cleanouts before grouting and after inspection. Cleanout openings shall match finished wall in exposed masonry.

3.6 Field Quality Control

A. Level 2 special inspection and field testing required by Chapter 17 of CBC (Table 1704.5.3) for Occupancy Risk Category IV shall be completed by ICBO-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Grout and Mortar	Grout Space Cleanliness	ACI 530.1/ ASCE 6/TMS 602, Art. 3.2D	Continuous per CBC Table 1704.5.3	Owner	Contractor to reimburse Owner for costs of first deputy inspector if re-inspection is required
	Mortar Proportioning	ACI 530.1/ ASCE 6/TMS 602 Art. 2.6A	Periodic per CBC Table 1704.5.3		
	Masonry Unit Placement and Mortar Joint Construction	ACI 530.1/ ASCE 6/TMS 602, Art. 3.3B			
	Grout Proportioning	ACI 530.1/ ASCE 6/TMS 602 Art. 2.6A			
	Grout and Mortar Specimen Preparation	CBC Sec 2105.2.2 & 2105.3, ACI 530.1/ ASCE 6/TMS 602, Art. 1.4	Continuous per CBC Table 1704.5.3		
	Grout Placement	ACI 530.1/ ASCE 6/TMS 602, Art. 3.5			

B. Field testing shall also include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Mortar Mix	Compressive Strength, Consistency, Mortar Aggregate Ratio, Water Content, Air Content, Splitting Tensile Strength and Slump	UBC 21-16	2 samples per day on first 3 successive work days 2 samples of first batch representing each change of material or job conditions 4 to 10 random tests taken when requested by Owner's Representative	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Grout Mix	Material Properties	ASTM C1019	2 samples per day on first 3 successive work days 2 samples of first batch representing each change of material or job conditions 4 to 10 random tests taken when requested by Owner's Representative	Contractor	Contractor

C. Store test samples in moist environment until tested.

D. In addition to minimum testing described above, Owner's Representative may elect to perform additional testing or testing at frequency greater than specified. Such additional testing shall be at Owner's expense although Contractor shall provide free and safe access to Owner personnel at no cost to Owner. Where additional tests at Owner's expense fail to verify compliance with Contract Documents, cost of all additional tests required to demonstrate compliance shall be borne by Contractor.

END OF SECTION

SECTION 04 29 00
ENGINEERED UNIT MASONRY

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of engineered unit masonry systems including concrete masonry units, reinforcement, anchorage and accessories.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 74 00: Cleaning and Waste Management
H. Section 03 20 00: Concrete Reinforcing
I. Section 04 05 00: Masonry Mortaring and Grouting
J. Section 09 90 00: Painting and Coating
K. Section 32 31 13: Chain Link Fence and Gates

1.3 System Description

A. Furnish and install complete functional reinforced unit masonry system including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements (including anchors required by equipment Manufacturers) and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures
B. ACI 530/ASCE 5/TMS 402 Building Code Requirements for Concrete Masonry Structures
C. ACI 530.1/ASCE 6/TMS602 Specification for Masonry Structures
D. ANSI/ASTM A82 Cold-Drawn Steel Wire for Concrete Reinforcement
E. ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
F. ASTM A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate
G. ASTM A525 Steel Sheet, Zinc Coated, (Galvanized) by Hot Dip Process
H. ASTM A580 Stainless and Heat Resisting Steel Wire
I. ASTM A615 Deformed and Plain Billet Steel Bars for Concrete Reinforcement
J. ASTM C55 Building Brick, Concrete
K. ASTM C90 Hollow Load-Bearing Masonry Units
L. ASTM C140 Sampling and Testing Concrete Masonry Units
M. ASTM C145 Solid Load Bearing Concrete Masonry Units
N. ASTM C426 Drying Shrinkage of Concrete Block
O. ASTM E447 Compressive Strength of Masonry Prisms
P. California Building Code (CBC)

Q. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 201 "Concrete, Mortar, and Related Materials
R. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 202 "Masonry Materials
S. SSPWC Standard Specifications for Public Works Construction Section 303 "Concrete and Masonry Construction."

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
CBC Chapter 17 Special Inspection Required Contractor Statement of Responsibilitiy	As required in CBC Section 1706
Shop Drawings	Required per shop drawing requirements. Show bar sizings, spacings, locations, reinforcement quantities, bending and cutting schedules and supporting and spacing devices.
Catalog (Product) Data	Required for masonry block per catalog data requirements.
O & M Instructions	Required per operation and maintenance instruction requirements.
Certificate of Compliance	Submit Manufacturer's certificate that products meet or exceed specified requirements per certificate of compliance requirements.
Material Samples	Submit full size color sample blocks. Texture of color sample blocks shall match texture of installed work.
Sample Panel	Submit 6' minimum square free standing sample panel containing all types of both 8" and 12" masonry work. Sample panel shall remain in place on jobsite for reference until masonry work is complete.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, operation and maintenance instructions, certificates of compliance and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Remove damaged or chipped masonry blocks from jobsite.

C. Do not stack masonry materials on newly-constructed floors or slabs such that uniformly distributed loading exceeds 30 pounds per square foot. Newly-constructed floors shall be defined as all floors except for

1. Floors in existence before date of Notice to Proceed.

2. Concrete floors or slabs successfully tested for compliance with specified 28-day strength.

D. Do not store masonry materials in direct contact with earth.

E. Cover masonry units to protect from weather and laitance.

F. Manufacturer's instruction and warranty requirements and requirements of Masonry Design Manual for delivery, storage and handling of Masonry Blocks shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Concrete Masonry Units	Angelus Block Co.	Sun Valley, CA
	Desert Block Company	Mojave, CA
	Orco Block Company	Stanton, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Reinforced unit masonry shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION	
Concrete Masonry Units	Hollow Load-Bearing Block Units	Grade	ASTM C90
		Maximum Linear Shrinkage	0.06% from standard to oven dried condition
		Weight	Medium weight
		Modular Size	8" x 8" x 16", unless otherwise shown on Plans
		Finish and Color	Color: "Sandstone" Interior walls: Precision Block Exterior Walls: Split-face exterior, smooth face interior Fence: Split face both sides Submit sample to Owner's Representative for confirmation
	Bond Beam Blocks	Use deep cut bond beam blocks where horizontal rebar is embedded. H-block bond beams may be used at locations other than openings.	
	Cap Blocks	Modular Size	8" x 4" x 16" bevel cap
		Finish and Color	Solid block Color = Sandstone.
		Barbed Wire	Per Section 32 31 13 where shown on Plans
Reinforcing Steel		ASTM A615, 60 ksi yield (Grade 60) deformed billet bars, unprotected finish	
Preformed Control Joints	Rubber	Provide with corner and tee accessories, cement fused joints	
Joint Filler	Closed-Cell Rubber	Self expanding, Oversize 50% to joint width.	
Building Paper	#30 Asphalt-Saturated Felt		
Nailing Strips	Softwood	Preservative treated for moisture resistance, dovetail shape, sized to masonry joints.	
Cleaning Solution		Nonacidic not harmful to masonry work or adjacent materials	

C. Where required or necessary, provide bond beam, lintel, sill, corner and other specially shaped blocks. Specially shaped nonstructural blocks may be constructed by saw cutting. Color and texture of specially shaped blocks shall match adjacent units.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install Masonry Blocks before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Before beginning work, verify items covered under other sections of Contract Documents are properly sized and located. Verify built-in items are in proper location and ready for roughing into masonry work.

C. Direct and coordinate placing of metal anchors, bolts, reglets, sleeves, conduits and other items supplied by other trades and installed in masonry.

D. Before beginning work, clean reinforcing steel of all loose rust and scale, and all dirt, paint, laitance or other detrimental substances which may reduce bonding of steel and grout.

E. Before beginning work, verify field conditions are acceptable and ready to receive work.

F. Immediately before beginning work, clean concrete upon which masonry will be set using pressurized water.

G. Provide full mortar joint for first course.

H. Maintain materials and surrounding air temperatures to at least 40°F (10°C) prior to, during and 48 hours after completion of masonry work.

I. Action of beginning masonry installation shall be deemed sufficient evidence both Contractor and installer accept existing field conditions as acceptable for masonry construction.

J. Provide safe and adequate scaffolding, planking, ladders and ramps in accordance with OSHA and Cal OSHA regulations and Safety Orders.

K. Provide temporary bracing during installation of masonry work. Maintain bracing in place until building structure provides permanent bracing for all required live and dead loads.

L. Concrete masonry wall shall be braced to withstand all forces to which they will be subjected during construction. Walls are not designed to be self supporting for lateral loads until attached to floor and roof elements.

3.2 Installation of Mason's Ironwork

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install mason's ironwork at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, and electrical code requirements

4. SSPWC Standard Specifications for Public Works Construction Section 303 "Concrete and Masonry Construction."

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Furnish, set and build into masonry all ironwork necessary for masonry construction including rebar, anchors, bolts and ties to be enclosed in masonry.

F. Reinforce masonry unit cores and cavities with steel reinforcing and grout as shown. Do not continue horizontal joint reinforcement through control and expansion joints.

G. Retain vertical reinforcing in position at top and bottom of cells and at intervals not exceeding 192 bar diameters. Splice reinforcing in accordance with Section 03 20 00.

H. Unless otherwise noted, anchors, bolts, ties, and other embedded items shall embed fully and solidly into at least ⅔ of wall thickness shown.

I. Set and build into masonry all items, including bolts, reglets, inserts, attachments penetrations and sleeves, required to secure and accommodate work furnished by other trades. Setting shall consist of bedding or setting in mortar or dry pack.

J. Build into masonry all items furnished, located and set by other trades including door and window frames, vents, conduit, and pipes. Building items into masonry shall consist of filling with mortar and grout around said items, including hollow metal door frames. Set and build in such items so there are no voids anywhere in contact with them and so items are installed rigid, solid, monolithic with masonry and are secured accurately in place.

3.3 Installation of Masonry

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install handrails and railings at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Building Code Chapter 21 "Masonry"

4. Other applicable building code requirements

5. ACI 530/ASCE 5/TMS 402 Building Code Requirements for Concrete Masonry Structures

6. ACI 530.1/ASCE 6/TMS602 Specification for Masonry Structures

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Perform jobsite cutting of masonry units with proper machinery to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

F. Mix and place mortar as described in Section 04 05 00.

G. Masonry blocks shall be furnished and installed by Contractor at location shown on Plans and Submittals. Unless otherwise shown, install masonry blocks in line, straight, level, plumb and true to dimensions shown using precision gauges and levels.

H. Establish and maintain lines, level and coursing shown. Protect from displacement. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

I. Unless otherwise shown, lay concrete masonry units in running bond. Course one unit and one mortar joint equal to 8". Vertical and horizontal joints shall be uniform and approximately ⅜" wide. Unless otherwise shown, form raked concave mortar joints.

J. Place mortar in masonry unit bed joints back ¼" from edge of unit grout spaces. Bevel back and upward.

K. Lay hollow masonry units with face shell bedding on head and bed joints.

L. Interlock intersections and external corners.

M. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed, measuring not less than 3" by 3" cross section.

N. Joint control devices shall be placed at intervals not to exceed 20 horizontal feet on any wall as follows:

    1. Install preformed control joint devices in continuous lengths. Seal butt and corner joints in accordance with Manufacturer's installation instructions.

    2. Size control joint in accordance with sealant Manufacturer's recommendations.

O. Cut and fit masonry for pipe and conduit sleeves. Coordinate with other trades to provide correct size shape and location of cuts.

P. Where cutting or fitting of masonry is not shown on Plans, or where appearance or strength of masonry may be impaired, secure approval from Owner's Representative before cutting or fitting masonry work.

Q. Allow mortar to cure 24 hours before mixing and placing grout as described in Section 04 05 00.

3.4 Field Quality Control

A. All work shall conform to standard of quality established by Owner's Representative's acceptance of free standing sample panel required to be constructed before starting masonry work.

B. Field testing and inspection of steel reinforcement shall be in accordance with Section 03 20 00.

C. Field testing and inspection of mortar and grout shall be in accordance with Section 04 05 00.

D. Level 2 special inspection and field testing required by Chapter 17 of CBC (Table 1704.5.3) for Occupancy Risk Category IV shall be completed by an ICBO-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Masonry	Structural Element Sizes and Locations	ACI 530.1/ ASCE 6/TMS 602 Art. 3.3G	Periodic per CBC Table 1704.5.3	Owner	Contractor to reimburse Owner for costs of first deputy inspector if re-inspection is required
	Grout Space Cleanliness	ACI 530.1/ ASCE 6/TMS 602, Art. 3.2D	Continuous per CBC Table 1704.5.3		
	Placement of Reinforcement, Connectors, and Anchors	ACI 530/ ASCE 5/TMS 402, Sec 1.13, & ACI 530.1/ ASCE 6/TMS 602, Art. 3.4 & 3.6A	Periodic per CBC Table 1704.5.3		
	Cold or Hot Weather Protection	CBC Section 2104, ACI 530.1/ ASCE 6/TMS 602, Art. 1.8C & 1.8D			
	Compliance with Inspection Provisions of Construction Documents and Accepted Submittals	ACI 530.1/ ASCE 6/TMS 602, Art. 1.5			
Reinforcement, Connectors and Anchors	Location, Grade and Size of Rebars	ACI 530/ ASCE 5/TMS 402, 1.13 & ACI 530.1/ ASCE 6/TMS 602, Art. 2.4, 3.4 & 3.6A	Periodic per CBC Table 1704.5.3		
	Welding	ACI 530/ ASCE 5/TMS 402, Sec 2.1.10.7.2 & 3.3.3.4(b)	Continuous per CBC Table 1704.5.1		
Anchors	Type Size and Locations of Anchors	ACI 530/ ASCE 5/TMS 402, Sec 1.2.2(e), 2.1.4, & 3.1.6	Continuous per CBC Table 1704.5.3		

E. Field testing shall also include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Masonry Units	Quality	ASTM C140	Per ASTM C140	Contractor	Contractor
Masonry	Workmanship	Conform to standard of quality established by Owner's Representative's acceptance of sample panel	Any location	Owner	Owner
Masonry Courses	Variation from Level Coursing	⅛" maximum in 3' ¼" maximum in 10' ½" maximum in 30'	Any location	Owner	Owner
	Variation from Unit to Adjacent Unit	1/32" maximum	Any location, any direction	Owner	Owner

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
	Deviation from Plane of Wall	¼" maximum in 10' ½" maximum in 20'	Any location, any direction	Owner	Owner
Finished Structure	Deviation from plumb	¼" maximum per story non cumulative ½" maximum in 2 or more stories	Any location	Owner	Owner
Accessories and Anchors	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed Literature	1 test	Contractor	Contractor
Finish Masonry Work	Appearance Including Cleaning and Pointing	Demonstrate work meets standards established by approved sample panel	All locations	Owner	Owner
Finished Structure	11-Month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's Printed literature	1 test	Owner	Contractor

3.5 Adjusting and Cleaning

A. Clean work under provisions of Section 01 74 00.

B. Remove excess mortar and mortar smears. Clean and point finish masonry in manner satisfactory to Owner's Representative based on standards established by accepted sample panel.

C. Masonry surfaces exposed to view shall be cleaned by light sandblasting to remove stains and other imperfections.

D. Replace defective mortar. Match adjacent work.

E. Clean soiled surfaces with cleaning solution.

F. Use non-metallic tools in cleaning operations.

3.6 Protection

A. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of structural steel load-bearing systems including beams, columns, bracings, connections, appurtenances and galvanizing.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 05 50 00: Metal Fabrications
I. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete operating structural steel load-bearing system including appurtenant mountings or connections required for compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Welding operators shall submit documentary evidence of having been qualified by tests as prescribed by AWS D1.1 Section 5 and AWS W1 Section 7, to perform type of welding indicated.

C. Fabricate and erect structural steel work in accordance with AISC S326. Any discrepancies between Contract Documents and AISC S326 shall be brought to attention of Owner's Representative immediately upon discovery.

D. All structural steel welding in off-site fabrication shops shall be continuously inspected by governing jurisdiction's Certified Special Inspector.

E. For fabrication performed in shop of licensed Fabricator approved by governing Building Official and certified by ICBO, only field welding and high strength bolting of structural steel assemblies will be required to be performed under continuous inspection by ICBO-certified Special Inspector.

F. Owner's Representative reserves right to inspect fabricated material or steel at Fabricator's shop to verify materials used check with mill tests, affidavits of test reports, and that fabrication and welding procedures meet specifications. Notify Owner's Representative and supply Owner's Representative with test reports at least 2 working days in advance of fabrication to allow shop inspection of steel to occur at Owner's option.

G. In event Owner's Representative identifies faulty materials or workmanship in fabricated material at Fabricator's shop, Contractor shall pay Owner's reasonable costs for subsequent retests or inspections.

H. Owner's choice to forego shop inspection shall in no way relieve Contractor of any responsibility for timely or quality work.

I. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fabricated Steel	Off-jobsite Welding Special Inspection	ICBO Certified Special Inspector selected by Building Official	Continuous	Contractor	Contractor
	Inspection at Fabricator's Plant	Verify materials used check with mill tests and test report affidavits and that fabrication and weld procedures meet Contract Documents	At Owner's Discretion	Owner	Owner
	Surface Imperfections	ASTM A6	At Owner's Discretion during Owner instigated shop inspection	Owner	Contractor
	Visual and Dimensional Inspection	Contract Documents			
	Inspection of High Strength Bolted Connections	ASTM A325 or ASTM A490			
	Welding Procedures	AWS D1.1			
	Chemical and Physical Properties	Varies with steel	Submit certificate of compliance	Contractor	Contractor

1.5 References

A. AISC M011 Manual of Steel Construction for Shop and Field Welding
B. AISC 316 Manual of Steel Construction ASD
C. AISC 317 Manual of Steel Construction Volume II Connections
D. AISC 341 Seismic Provisions for Structural Steel Buildings
E. AISC 360 Structural Steel Buildings
F. AISC S326 Design Fabrication and Erection of Structural Steel for Buildings
G. ANSI AWS A2.4 Standard Symbols for Welding, Brazing and Nondestructive Examination
H. ANSI AWS A2.3 Standard Welding Terms and Definitions
I. ANSI AWS A5.5 Classification E70XX - A1, low hydrogen
J. ANSI AWS B3.0 Welding Procedures and Performance Qualifications
K. ANSI AWS D1.1 Structural Welding Code – Steel
L. ANSI AWS D1.3 Structural Welding Code - Sheet Steel
M. ANSI AWS W1 Welding Metallurgy
N. ASTM A6 Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling
O. ASTM A36 Carbon Structural Steel
P. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless
Q. ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
R. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
S. ASTM A283 Low and Intermediate Tensile Strength Carbon Steel Plates
T. ASTM A325 Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength

U. ASTM A490 Heat-Treated Steel Structural Bolts 150ksi Minimum Strength
V. ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
W. ASTM A568 Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled
X. ASTM A572 High-Strength Low-Alloy Columbium-Vanadium Structural Steel
Y. ASTM A992 Steel for Structural Shapes Used in Building Framing
Z. ASTM B6 Zinc
AA. ASTM F436 Hardened Steel Washers
BB. California Building Code (CBC)
CC. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 206 "Miscellaneous Metal Items"
DD. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 304 "Metal Fabrication and Construction"

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
CBC Chapter 17 Special Inspection Required Contractor Statement of Responsibility	As required in CBC Section 1706
Shop Drawings	Required for steel framing per structural shop drawing requirements. Shop drawings shall show tag numbers for each piece delivered.
Catalog Data (Shop Painting)	Submit product list with product data sheets of intended shop coats per catalog data requirements. For compatibility, these products shall be primers recommended by Manufacturer of finished paint system.
Test Record Transcripts	Submit steel Manufacturer's certified physical and chemical mill test reports or affidavits for material used for structural members per test record transcript requirements.
Welder Qualification Certificates	Required for all welders performing work on this project. Also submit certifications of procedure qualifications for each welding procedure used.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, and foundry or test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Notify Owner's Representative at least 7 days before shipment of material to allow time for Factory Inspection at Owner's option.

C. Deliver fabricated material to jobsite in sequence approved by Owner's Representative.

D. Tag shipped materials with metal tags showing piece-marks corresponding to accepted shop drawings.

E. Material damaged in shipment shall be removed from jobsite and replaced at Contractor's expense.

F. All material shipments shall include sufficient bolts for erection plus the following extra bolts:

1. High strength bolts – Add a minimum of 2% extra bolts of each size.

2. Unfinished bolts – Add a minimum of 5% extra bolts of each size.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Galvanized Touch Up Material	American Solder and Flux Company (Drygalv)	
	Glidden ICI Dulux Paints (GlidZinc Organic 5526/5527/5528)	Cleveland OH
	Koppers Industries (CarboZinc 11)	Pittsburgh, PA
	Rust-Oleum Corp (2185 Cold Galvanizing Compound)	Vernon Hills, IL
	Sherwin Williams (ZincClad I Low VOC B69AW9)	Pittsburgh, PA
	Tnemec Co. Inc. (90-97)	Kansas City, MO
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Structural steel load-bearing systems shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Structural Steel Rolled Plates, and Bars	Carbon Structural Steel – Galvanized	ASTM A572 (F_y=50ksi, F_u=65ksi, E=29000ksi)
	Zinc Coating	ASTM A123 - 3.4-mil thickness – 2.00 ounce/ft^2
Structural Steel Rolled Shapes and Bars	Carbon Structural Steel – Galvanized	ASTM A992 (F_y=50ksi, F_u=65ksi, E=29000ksi)
	Zinc Coating	ASTM A123 - 3.4-mil thickness – 2.00 ounce/ft^2
Structural Steel Bolts (Connection Bolts and Anchor Bolts	High-Strength Carbon Steel – Galvanized	ASTM A325 or ASTM A490
	Zinc Coating	ASTM A153 - 2.1-mil thickness - 1.30 ounce/ft^2
Washers	Carbon Steel – Galvanized	ASTM F436 – Square or rectangular smooth beveled washers, tapered in thickness
	Zinc Coating	ASTM A153 - 2.1-mil thickness - 1.30 ounce/ft^2
Stainless Steel Members	Stainless Steel	SAE Type 316
Welding Electrodes	Steel Electrodes	AWS D1.1 E70xx except E7024 rods or electrodes shall not be used

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION
Steel Fabrications	Comply with CBC and AISC S327

D. Structural steel encased in concrete shall not be galvanized or painted, and shall have a clean surface for bonding to concrete.

E. Any galvanized part that warps during galvanizing shall be straightened.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install structural steel load-bearing systems before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Cast-in-place bolt locations shall be measured in field before drilling companion holes in structural steel beam or assembly.

C. Properly locate embedded anchor bolts and anchors using templates. Concrete wedge anchors and epoxy anchors set after concrete has hardened are not an acceptable substitute for cast-in-place anchor bolts.

D. After anchor bolts are embedded, protect threads with grease and by screwing on nuts until appurtenant metalwork is secured to anchors.

E. Where steel construction requires special inspection under CBC Chapter 17, coordinate with Owner regarding work schedule to facilitate inspection.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install structural steel load-bearing systems at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer’s installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. California Building Code Chapter 22 “Steel”
4. Other applicable building code requirements
5. AWS B3.0 Welding Procedures and Performance Qualifications
6. AWS D1.1 Structural Welding Code – Steel
7. AWS D1.3 Structural Welding Code - Sheet Steel
8. AISC 360 Structural Steel Buildings
9. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 304 “Metal Fabrication and Construction”

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install structural steel load-bearing systems to tolerances recommended by Manufacturer and AISC standards. Unless otherwise shown, install structural steel load-bearing systems plumb, square, and level using precision gauges and levels.

F. Protect dissimilar metals from galvanic corrosion using pressure tapes, coatings, or isolators.

G. Flame-cutting of structural members using a gas-cutting torch will not be permitted except on non-structural members and then, only with written permission from Owner's Representative.

H. Structural assemblies and shop and field welding shall comply with AISC M011 and AISC S326.

I. Welding shall be completed as follows:

1. Welding shall comply with AWS D1.1 and AWS D1.3,

2. Use submerged arc or gas-shield arc process using electrodes intended for grade of steel being joined.

3. Provide two passes for metal 3/16-inch thick plus one additional pass for each additional ⅛-inch in metal thickness.

4. Welds shall be reasonably uniform in width and size throughout their length with each layer of weld smooth, free of slag, cracks, pinholes and undercutting, and completely fused to adjacent base metal and weld beads. Avoid coarse ripples, irregular surfaces, non-uniform bead patterns, high crowns, deep ridges or valleys between beads.

5. Form butt welds slightly convex of uniform height and fully penetrating.

6. Form fillet welds with full throat, and with each leg of uniform length of indicated size in accordance with Contract Documents and Shop Drawings.

7. Repairs, chipping and grinding of welds shall be completed so as not to gouge, groove or reduce base metal thickness.

J. Bolting shall be completed as follows:

1. Bolt holes shall be 1/16" larger than nominal bolt sizes. Where thick metals are indicated, holes shall be subpunched and drilled and reamed.

2. Bolts shall not be permitted to drift, and holes shall not be enlarged to correct misalignment. If mismatching of holes occurs, provide new materials.

3. Drive bolts accurately into holes without damaging thread.

4. Protect boltheads from damage during driving, and replace if damaged.

5. Boltheads and nuts shall rest squarely against metal. Draw boltheads and nuts tight against work using suitable wrench not less than 15 inches long or a torque wrench set to provide a similar torque. Tap bolt heads with hammer while nut is being tightened. After being tightened, nuts shall be locked.

6. Bolts used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to bolt axis shall be provided with beveled washers to provide full bearing of boltheads and nuts.

7. Where self-locking nuts are not furnished, bolt threads shall be upset to prevent nuts from backing off.

8. Bolts shall extend entirely through nut but not more than ¼ inch beyond outside face of nut.

3.3 Field Quality Control

A. Special inspection and field testing required by Chapter 17 of CBC (Table 1704.3 and 1704.4) shall be completed by an ICBO-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Structural Steel	Material Verification	AISC 360 Sec A3.3, ASTM A6, ASTM A568, and CBC Sec 1708.4	Periodic per CBC Table 1704.3	Owner	Contractor to reimburse Owner for costs of first deputy inspector if re-inspection is required
	High-Strength Bolting	AISC 360 Sec. M2.5 and CBC 1704.3.3	Periodic per CBC Table 1704.3		
	Welding Materials	AISC Sec. A3.5 and CBC Sec 1708.4	Periodic per CBC Table 1704.3		
	Welding	AISC 341, AWS D1.1, D1.3, CBC 1704.3.1, and CBC Table 1704.3. Also inspect for proper dimensions and absence of cracks, undercutting, surface holes or slag inclusions	Periodic per CBC Table 1704.3 for single-pass fillet welds 5/16" or smaller on roof deck welding		
		AISC 341, AWS D1.1 CBC 1704.3.1, and CBC Table 1704.3	Continuous per CBC Table 1704.3 for all other welds		
	Joint Details	CBC 1704.3.2	Periodic per CBC Table 1704.3		
	Embedded Bolts in Concrete and Masonry	CBC Table 1704.4, CBC 1911.5 & CBC Table 1911.1	Continuous per CBC Table 1704.3 Verify edge distances and spacings		

B. Additional field testing of structural steel shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Structural Steel	Installation	Visual inspection of finished installation No bends, twists or open joints No projecting edges or corners at intersections	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 inspection	Owner	Contractor

C. Notify Owner's Representative at least 24 hours in advance of required special inspections.

D. Prior to Special Inspection of steel welding, verify seam welds and puddle welds are made in accordance with Contract Documents. Inspection shall ensure proper electrodes, current, travel and speed are used and that no cracks, serious undercutting, overlap, surface holes, or slag inclusions occur.

E. Provide copies of special inspection reports to Owner's Representative and applicable Building Official.

END OF SECTION

SECTION 05 31 23
STEEL ROOF DECKING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of steel roof decks.

B. Extent of steel decking is shown on Plans including basic layout and type of decking required.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 05 12 00: Structural Steel Framing
H. Section 07 22 16: Roof Board Insulation
I. Section 07 62 00: Sheet Metal Flashing and Trim
J. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete steel roof deck system including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. AISC 341 Seismic Provisions for Structural Steel Buildings
B. AISC 360 Structural Steel Buildings
C. AISC S326 Design Fabrication and Erection of Structural Steel for Buildings
D. AISI Specifications for Design of Cold-Formed Steel Structural Members
E. ASTM A568 Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled
F. ASTM A653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated
G. ASTM A924 Steel Sheet, Metallic Coated by Hot-Dip Process
H. AWS/ANSI D1.3 Specification for Welding Sheet Steel in Structures

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for deck layout, framing and supports per structural shop drawing requirements. Show locations of welds and details of accessories.
Catalog Data	Required per catalog data requirements. Include applicable ICBO Reports.
Installation Instructions	Required per installation instruction requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, and installation instructions,

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of steel roof decks shall be strictly followed.

C. Steel roof deck sections shall be stored off ground, protected from moisture with one end elevated for drainage.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Steel Roof Deck	ASC Pacific	West Sacramento, CA
	CanAm Steel Corporation	Point of Rocks, MD
	Cor Deck Div Kam Industries	Kenosha, WI
	Epic Metals Corp.	Rankin, PA
	IMSA Building Products, Inc.	Las Vegas, NV
	James River Steel	
	Verco Manufacturing Company	Fontana, CA
	Accepted equal	

B. Requests for substitutions shall be accompanied by ICBO Evaluation Reports certifying diaphragm shear requirements and shear and moment resistance under vertical loading are in no way compromised by substitution.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Steel roof decks shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Deck	Galvanized Steel	ASTM A663 Grade 40
Acoustical Insulation Batts	Glass Fiber	Cut to proper width
Finish	Galvanized and Primed	ASTM A924 G60 Commercial Finish base Finish coating per Section 09 90 00

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Design Criteria	Depth	1½"
	Thickness	20 gage
	Section Modulus	S= 0.230 in^3/ft
	Moment of Inertia	I= 0.219 in^4/ft
	Diaphragm Shear Value	q= 216 lbs/ft
Finish on Deck	Galvanized and Primed	ASTM A924 G60 Commercial Finish base Finish coating per Section 09 90 00
Accessories	Steel profile closures	Required to fill gap above or below decking and roofing

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install steel decking before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Check supporting members for correct layout and alignment.

C. Verify surfaces to receive deck are clean and free of debris.

D. Do not proceed with installation until defects are corrected in underlying work.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install steel roof decks at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install steel roof decks to tolerances recommended by manufacturer. Unless otherwise shown, install steel roof decks true and level, using precision gauges and levels.

F. Refer variances between manufacturer's installation instructions and Contract Documents to Owner's Representative.

G. Place roof deck units as follows:

1. Position deck units onto supporting steel framework and adjust to final position with ends bearing at least 2" on supporting members.

2. Place units end to end before being permanently fastened.

3. Align ribs over entire length of run.

H. Fasten roof deck units securely using ½" effective diameter fusion welds unless otherwise shown or required by manufacturer to develop specified diaphragm shear.

3.3 Protection

A. Do not use deck units for storage or working platforms until permanently secured in position.

B. Construction loads shall not exceed rated carrying capacity of deck.

3.4 Field Quality Control

A. Special inspection and field testing required by Chapter 17 of CBC (Table 1704.3) shall be completed by an ICBO-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Steel Roof Deck	Structural Steel Material Verification	AISC 360, ASTM A568, and standards listed in CBC Table 1704.3	Periodic per CBC Table 1704.3	Owner	Contractor to reimburse Owner for costs of first deputy inspector if re-inspection is required
	Welding	AISC 341, AWS D1.3, & CBC 1704.3.1 Also inspect for proper dimensions and absence of cracks, undercutting, surface holes or slag inclusions	Periodic per CBC Table 1704.3		

B. Additional field testing of steel roof deck shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Steel Roof Deck	Finish	No visible mars or scratches in areas visible upon project completion	As directed	Owner	Owner
	Level	No more than ¼" deviation from level in any 32" of level surface.	As directed	Owner	Owner

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of metal fabrications, including concrete anchor bolts, steel enclosures, eyebolts, and formed metal fabrications.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 03 15 00: Concrete Accessories
I. Section 03 30 00: Cast-in-Place Concrete
J. Section 05 12 00: Structural Steel Framing
K. Section 05 51 00: Stairs and Ladders
L. Section 05 56 00: Metal Castings
M. Section 07 72 33: Roof and Floor Hatches
N. Section 09 90 00: Painting and Coating
O. Section 33 05 31: Pipeline Joint Materials
P. Section 33 05 38: Hangers and Supports

1.3 System Description

A. Furnish and install metal fabrications where shown including appurtenant mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ANSI/ASME B18.15 Forged Eyebolts
B. ANSI AWS A2.4 Standard Symbols for Welding, Brazing and Nondestructive Examination
C. API 9A Wire Rope
D. ASSE 1060 Outdoor Enclosures for Backflow Prevention Devices
E. ASTM A36 Carbon Structural Steel
F. ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
G. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
H. ASTM A167 Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet, and Strip
I. ASTM A193 Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
J. ASTM A194 Carbon and Alloy Steel Nuts for High-Pressure and High Temperature Service
K. ASTM A276 Standard Specification for Stainless Steel Bars and Shapes
L. ASTM A325 Structural Bolts, Steel, Heat Treated 120/105-ksi Minimum Tensile Strength

M. ASTM A489 Carbon Steel Lifting Eyes
N. ASTM A490 Heat-Treated Steel Structural Bolts 150ksi Minimum Strength
O. ASTM B6 Zinc
P. ASTM B633 Electrodeposited Coatings of Zinc on Iron and Steel
Q. ASTM F541 Alloy Steel Eyebolts
R. ASTM F593 Stainless Steel Bolts, Hex Cap Screws and Studs
S. ASTM F594 Stainless Steel Nuts
T. AWS D1.1 Structural Welding Code – Steel
U. California Building Code (CBC)
V. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 206 "Miscellaneous Metal Items"
W. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 304 "Metal Fabrication and Construction"
X. ANSI/NSF Standard 61, Drinking Water System Components – Health Effects

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION	
Shop Drawings	Required for formed metal fabrications per structural shop drawing requirements	.
Catalog Data	Required for all manufactured products per catalog data requirements.	
Installation Instructions	Required per installation instruction requirements	
Certificate of Compliance	Submit coating system and application certification per certificate of compliance requirements. Submit NSF 61 certification for anti-galling compound and concrete adhesive anchors exposed to reservoir interior.	
Foundry or Test Record Transcripts	Submit for factory tests upon request per foundry or test record transcript requirements.	
Material Samples	Required on request	
Welder Qualification Certificates	Required for all welders performing work on this project. Also submit certifications of procedure qualifications for each welding procedure used.	
Warranty	Furnish one-year warranty from date of final acceptance	

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, certificates of compliance, foundry or test records and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of metal fabrications shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Anti-Galling Compound	Hercules	
	Laco	
	Accepted Equal	
Concrete Anchors – Epoxy Adhesive Anchor Systems	Hilti Corp.	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Simpson Strong Tie Co. “Epoxy-Tie”	Pleasanton, CA
	Accepted Equal	
Concrete Anchors – Expansion Bolt Systems	Hilti Corp.”Kwik Bolt II”	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Simpson Strong Tie Co. “Wedge-All”	Pleasanton, CA
	Accepted Equal	
Concrete Anchors – Powder Actuated Fastening Systems	Hilti Corp.	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Approved Equal	
Enclosures – Expanded Metal Steel Cage	Allspec Enclosures, Inc.	San Jacinto, CA
	Pipeline Products BFE	San Marcos, CA
	Accepted Equal	
Lifting Eyebolts	Cleveland City Forge	Wellington, OH
	Accepted Equal	
Perforated Metal and Expanded Metal	McNichols Company	Tampa, FL
	Accepted Equal	
Wire Cloth	McNichols Company	Tampa, FL
	Accepted Equal	
Wire Rope	McMaster Carr	
	Southwest Wire Rope	
	Accepted Equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Structural steel shall comply with requirements of Section 05 12 00.

C. Bolts, anchors and welds shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Bolts (Connection Bolts and Anchor Bolts)	High-Strength Carbon steel – Galvanized	ASTM A325 or ASTM A 490 With self-locking nuts or lock-washers and plain nuts
	Zinc Coating	ASTM A153 - 2.1 mil thickness - 1.30 ounce/ft^2
Bolts (Connection Bolts and Anchor Bolts) - Stainless Steel	Stainless Steel	ASTM A193 Grade B8M bolts with ASTM A194 Grade 8M nuts Alternate ASTM F593 Type 316 bolts with ASTM F594 SAE Type 316 nuts Washers – same material as nuts
Bolts – Embedded Eyebolts and Lifting Eyebolts	Stainless Steel	ASTM F541 SAE Type 316 Dimensions per ANSI/ASME B18.15 Welded eye type
	Carbon Steel	ASTM A489 SAE Type 316 Dimensions per ANSI/ASME B18.15 Welded eye type
Chain	Stainless Steel	AISI Type 316

ITEM	MATERIAL	SPECIFICATION
Concrete Anchors – Epoxy Adhesive Anchor Systems	Stainless Steel	AISI Type 316
Concrete Anchors – Expansion Bolt Systems	Stainless Steel	AISI Type 316
Powder Actuated Fastening Systems	Steel	AISI 1061 Hardness 52-58 Rockwell C
	Galvanized Coating	ASTM B633 - 2.1 mil thickness - 1.30 ounce/ft^2
Washers	Carbon steel – Galvanized	Square or rectangular smooth beveled washers, tapered in thickness
	Galvanized Coating	ASTM A153 - 2.1 mil thickness - 1.30 ounce/ft^2
Washers Exposed to Potable Water Reservoir Interior	Stainless steel	Flat washers ASTM F844 punched from ASTM A276, Type 316 Square or rectangular smooth beveled washers, tapered in thickness where indicated
Welding Electrode - Steel	Steel Electrodes	AWS D1.1 E70xx except E7024 rods or electrodes shall not be used

D. Metal shapes and members shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Hardware – Steel Including Castings, Rolled, Pressed and Forged Articles	Steel Hardware	ASTM A153
	Galvanized Coating	ASTM A123 - 3.4-"mil thickness - 2.00 ounce/ft^2
Perforated Metal and Expanded Metal	Steel	ASTM A153 Gauge as shown on plans – minimum 16 gauge
	Galvanized Coating	ASTM A123 - 3.4 mil thickness - 2.00 ounce/ft^2
Plate and Sheet – Stainless Steel	Stainless Steel	ASTM A167 SAE Type 316
Structural Members – Stainless Steel	Stainless Steel	SAE Type 316

E. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Enclosures – Expanded Metal Steel Cage	Design Standard	ASSE 1060
Eyebolt	Size and Diameter	1" eyebolt (1-13/16"ID / 3-9/16"OD)
Wire Rope	Size and Nominal Strength	¼" wire rope 6000-lb rated

F. Zinc coatings shall be applied by hot-dipped or electro-depositing process. Zinc shall comply with ASTM B6.

G. Before leaving shop, all steel not shown or specified to be galvanized or stainless shall receive one coat of pigmented primer recommended by Manufacturer of final paint system. Parts inaccessible after assembly shall be given second coat of same primer. Final painting shall be as specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to fabricate and install metal fabrications before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Clean surfaces of metalwork to be in contact with concrete, removing all rust, dirt, grease and other foreign substances before concrete is placed.

C. Aluminum surfaces to contact concrete shall be coated with heavy alkali-resistant bituminous paint or one coat of zinc chromate.

D. Aluminum surfaces to contact dissimilar metals shall be insulated from dissimilar metals using neoprene gaskets or washers.

E. All embedded metalwork shall be secured accurately in position when concrete is placed to prevent displacement or undue vibration during or after placement of concrete.

F. Concrete anchors not cast in place shall be installed in holes drilled or cored to dimensions shown in anchor Manufacturer's installation instructions.

G. Where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Division 3 Concrete.

3.2 Installation

A. Refer to Section 01 73 00 and 01 73 24 for execution and installation requirements.

B. Furnish and install metal fabrications at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Building Code Chapter 20 "Aluminum"

4. California Building Code Chapter 22 "Steel"

5. Other applicable building and fire code requirements

6. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 304 "Metal Fabrication and Construction"

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Unless expressly shown otherwise or supported by Contractor-submitted and Owner-accepted shop drawings and engineering calculations, install bolts with embedments, edge distances and spacings per CBC Table 1911.2 including the following requirements:

BOLT DIAMETER	MINIMUM EMBEDMENT	EDGE DISTANCE	SPACING
¼"	2½"	1½"	3"
⅜"	3"	2¼"	4½"
½"	4"	3"	6"
⅝"	4½"	3¾"	7½"
¾"	5"	4½"	9"
⅞"	6"	5¼"	10½"
1"	7"	6"	12"
1⅛"	8"	6¾"	13½"
1¼"	9"	7½"	15"

F. Install metal fabrications to tolerances recommended by Manufacturer. Unless otherwise shown, install metal fabrications true, plumb, and level using precision gauges and levels.

G. Welding shall comply with Section 05 12 00. Permanent connections shall be continuously welded along entire area of contact.

H. Bolting for structures shall comply with Section 05 12 00.

I. Fastenings shall be concealed whenever possible.

J. Bolting for piping shall comply with Section 33 05 31.

K. Joints shall have close fit with corner joints coped or mitered and in true alignment.

L. Built-up parts shall be free of warp.

M. Exposed ends and edges of metal shall be slightly rounded.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Metal Fabrications	No Bends, Twists or Open Joints No Projecting Edges or Corners at Intersections	Visual inspection	All metalwork	Owner	Owner
	Edge Distances and Spacings	Visual inspection and measurement per CBC Table 1911.2	All bolts	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 05 51 00
LADDERS

PART 1 - GENERAL

1.1 Work Included

A. This section includes materials, testing, and installation of stairs and ladders.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 05 12 00: Structural Steel Framing
I. Section 05 50 00: Metal Fabrications
J. Section 07 72 33: Roof and Floor Hatches
K. Section 09 90 00: Painting and Coating
L. Section 09 96 56: Epoxy Linings and Coatings
M. Section 33 05 38: Hangers and Supports

1.3 System Description

A. Furnish and install complete stairs and ladders where shown including appurtenant mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ANSI / ASC A14.3 Ladders - Fixed - Safety Requirements
B. ASTM A36 Carbon Structural Steel
C. ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
D. ASTM B6 Zinc
E. California Mechanical Code (CMC) Section 904.10
F. OSHA Standard 29 CFR1910.24 Fixed Industrial Stairs
G. OSHA Standard 29 CFR1910.27 Fixed Ladders

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for fabricated stairs and ladders per structural shop drawing requirements
Catalog Data	Required for all manufactured products per catalog data requirements.
Installation Instructions	Required per installation instruction requirements

SUBMITTAL	DESCRIPTION
Certificate of Compliance	Submit coating system and application certification per certificate of compliance requirements.
Foundry or Test Record Transcripts	Submit for factory tests upon request per foundry or test record transcript requirements.
Material Samples	Required on request
Welder Qualification Certificates	Required for all welders performing work on this project. Also submit certifications of procedure qualifications for each welding procedure used.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, certificates of compliance, foundry or test records and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of stairs and ladders shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Fall Prevention System	Capital Safety Group DBI Sala "Lad-Saf"	Red Wing, MN
	Inwesco "Safety Ladder Assistant"	Azusa, CA
	Miller Equipment "Sure Track"	Porterville
	North Safety Products Div Honeywell "Saf-T-Climb"	Cranston, RI
	Accepted equal	
Ladders - Aluminum	Alaco Ladder Co.	Chino, CA
	Accepted equal	
Ladder – Stainless Steel	Inwesco	Azusa, CA
	Pipeline Products VL100	San Marcos, CA
	Accepted equal	
Ladder Safety Post	Bilco Company "Ladder Up"	New Haven, CT
	Inwesco "Safety Ladder Assistant"	Azusa, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Structural steel shall comply with requirements of Section 05 12 00.

C. Ladders shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION	
Interior Ladders - Aluminum	Aluminum	Dimensions	See plans and OSHA Std CFR1910.27
		Rung Diameter	¾" minimum
		Clear Length of Rung or Cleat	16" minimum
		Distance Between Rungs	12" maximum
		Clearance Between Rungs and Walls or Obstructions Behind Ladder	7" minimum
Interior Ladders – Stainless Steel	Stainless Steel	Type	SAE Type 316
		Dimensions	See plans and OSHA Std CFR1910.27
		Stringer	2½" x ¼" steel bar
		Rung Diameter	¾" minimum
		Clear Length of Rung or Cleat	16" minimum
		Distance Between Rungs	12" maximum
		Clearance Between Rungs and Walls or Obstructions Behind Ladder	7" minimum
	Coating on Rungs	Coarse grain epoxy Color - gray	
Fall Prevention System (Required on all ladders more than 8' high)	Stainless Steel	SAE Type 316	
		Standards	ANSI / ASC A14.3
		Cable Size	⅜"
		Rated User Weight	300 lbs
Ladder-Top Safety Post (Interior Ladders)	Stainless Steel	SAE Type 316 Removable	
Ladder-Top Handrail Extensions (Exterior Ladders)	Stainless Steel	SAE Type 316	

D. Zinc coatings shall be applied by hot-dipped or electro-depositing process. Zinc shall comply with ASTM B6.

E. Before leaving shop, all steel not shown or specified to be galvanized or stainless shall receive one coat of pigmented primer recommended by Manufacturer of final paint system. Parts inaccessible after assembly shall be given second coat of same primer. Final painting shall be as specified in Section 09 90 00 or 09 96 56.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to fabricate and install stairs and ladders before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Clean surfaces of work to be in contact with concrete, removing all rust, dirt, grease and other foreign substances before concrete is placed.

C. Aluminum surfaces to contact concrete shall be coated with heavy alkali-resistant bituminous paint or one coat of zinc chromate.

D. Aluminum surfaces to contact dissimilar metals shall be insulated from dissimilar metals using neoprene gaskets or washers.

E. All embedded metalwork shall be secured accurately in position when concrete is placed to prevent displacement or undue vibration during or after placement of concrete.

F. Where work is to be installed in recesses in formed concrete, said recesses shall be made, work installed, and recesses filled with dry-pack mortar in conformance with Division 3 Concrete.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install stairs and ladders at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations.

3. Applicable building and fire code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install stairs and ladders to tolerances recommended by Manufacturer. Unless otherwise shown, install stairs and ladders true, plumb and level using precision gauges and levels.

F. Welding shall comply with Section 05 12 00. Permanent connections shall be continuously welded along entire area of contact.

G. Bolting shall comply with Section 05 12 00. Conceal fastenings whenever possible.

H. Joints shall have a close fit with corner joints coped or mitered and in true alignment.

I. Built-up parts shall be free of warp.

J. Exposed ends and edges of work shall be slightly rounded.

K. Mount ladders so clearance from back of ladder to wall behind ladder at all times exceeds 7".

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Stairs and Ladders	No bends, twists or open joints No projecting edges or corners at intersections	Visual inspection	All work	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 05 56 00
METAL CASTINGS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of metal castings.

B. Manhole covers for sewer manholes are covered in Section 33 39 13.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 05 12 00: Structural Steel Framing
I. Section 05 50 00: Metal Fabrications
J. Section 07 72 33: Roof and Floor Hatches
K. Section 09 90 00: Painting and Coating
L. Section 33 05 38: Hangers and Supports
M. Section 33 39 13: Manholes and Structures

1.3 System Description

A. Furnish and install metal castings where shown including appurtenant mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Castings	Hammer Test	No blisters, blowholes or shrinkage	Each casting	Contractor	Contractor

1.5 References

A. ASTM A48 Gray Iron Castings
B. ASTM A536 Ductile Iron Castings
C. ASTM B6 Zinc

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required for all manufactured products per catalog data requirements.
Installation Instructions	Required per installation instruction requirements
Foundry or Test Record Transcripts	Submit for factory tests upon request per foundry or test record transcript requirements.
Material Samples	Required on request
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, foundry or test records and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of metal fabrications shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Castings – Cast Iron	Alhambra Foundry Company Ltd.	Alhambra, CA
	Long Beach Iron Works, Inc.	Long Beach, CA
	Neenah Foundry	Neenah, WI
	South Bay Foundry	National City, CA
	U S Foundry and Manufacturing Corp	Medley, FL
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Castings shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Castings – Ductile Iron	Ductile Iron	ASTM A536
Castings – Gray Iron	Gray Iron	ASTM A48
Manhole Frames and Covers	Gray Cast Iron	ASTM A48 Class 30 or 35 Design for H-20 highway wheel loading Incorporate pick-hole for lifting purposes Castings with blisters, blowholes and shrinkage are not permitted. Clean all castings. Grind and finish cover to fit in its frame without rocking.
Manhole Frames and Covers (cont.)		

ITEM	MATERIAL	SPECIFICATION
	Coating	Dip twice in asphalt or coal tar and oil mixture at temperature between 290ºF and 310ºF to form firm and tenacious coating

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Manhole Frames and Covers	Loading	AASHTO H-20 Loading
	Manhole Cover Marking	Cast letter "S" into cover as appropriate into cover No other lettering on cover top is permitted

D. Before leaving shop, all cast steel not shown or specified to be galvanized or stainless shall receive one coat of pigmented primer recommended by Manufacturer of final paint system. Parts inaccessible after assembly shall receive second coat of same primer. Final painting shall be as specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to fabricate and install metal fabrications before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Clean surfaces of metalwork to be in contact with concrete, removing all rust, dirt, grease and other foreign substances before concrete is placed.

C. Aluminum surfaces to contact concrete shall be coated with heavy alkali-resistant bituminous paint or one coat of zinc chromate.

D. Aluminum surfaces to contact dissimilar metals shall be insulated from dissimilar metals using neoprene gaskets or washers.

E. All embedded metalwork shall be secured accurately in position when concrete is placed to prevent displacement or undue vibration during or after placement of concrete.

F. Where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with the specifications in Division 3.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install castings at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install metal castings to tolerances recommended by Manufacturer. Unless otherwise shown, install metal fabrications true and level using precision gauges and levels.

F. Exposed ends and edges of metal shall be slightly rounded.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Metal Castings	No Bends, Twists or Open Joints No Projecting Edges or Corners at Intersections	Visual inspection	All castings	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 07 13 00
SHEET WATERPROOFING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of sheet membrane waterproofing on earth side of base slabs and grade walls.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 07 92 00: Joint Sealants
H. Section 31 23 00: Excavation and Fill

1.3 System Description

A. Furnish and install complete sheet waterproofing system including appurtenant seams and connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASTM D41 Asphalt Primer Used in Roofing and Waterproofing
B. ASTM D226 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
C. ASTM D312 Asphalt Used in Roofing
D. California Building Code (CBC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per Structural and Architectural Shop Drawing requirements.
Catalog Data	Required per Catalog Data requirements.
Installation Instructions	Required per Installation Instruction requirements.
Warranty	Furnish one-year warranty from date of final acceptance.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, and installation instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of sheet waterproofing materials shall be strictly followed.

1.8 Unit Prices

A. Payment for the Work in this section shall be included as part of the lump-sum or unit-price bid amount for which such Work is appurtenant thereto.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for sheet moisture-proofing products include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Moisture-proofing Coating	Koppers "Bitumastic 50"	Pittsburgh, PA
	Porter "Tarmastic 100"	Louisville, KY
	Accepted equal	

B. Acceptable Manufacturers for sheet waterproofing include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Waterproofing Coating	Koppers "Bitumastic 300-M"	Pittsburgh, PA
	Porter "Tarset Maxibuild II"	Louisville, KY
	Accepted equal	
Waterproofing Membrane	Protecto Wrap Company "Jiffy Seal"	Denver, CO
	W R Grace and Company "Bituthene"	Augusta, GA
	Accepted equal	
Waterproofing Membrane (Bentonite)	Effective Buyilding Products "Bentonize"	Saint Paul, MN
	Volteco "Volclay Panels"	Venice, ITA
	Accepted equal	
Waterproofing Protective Board	Celotex Insulation Board	
	Accepted equal	

C. Acceptable Manufacturers for below grade waterproofing systems include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Below-Grade Waterproofing System	Flintkote Company "EMW-1"	San Francisco, CA
	Accepted equal	
Expansion Joint Sheets	Flintkote Company "Flash-bend"	San Francisco, CA
	W R Grace and Company "Bituthene"	Augusta, GA
	Accepted equal	
Emulsion	Liquid Boot, LBI Technologies, Inc.	Santa Ana, CA
	Accepted equal	
Geotextiles	Mirafi "300HV" Protection Course	Charlotte, NC
	Accepted equal	

D. Acceptable Manufacturers shall be domestic Manufacturers who have been engaged in manufacture of specified waterproofing materials for at least 5years

E. Acceptable Manufacturers shall supply printed literature endorsing use of their project for waterproofing application shown.

F. Where air quality regulations prohibit use of a listed product, substitute equivalent product meeting local air quality regulations.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following moisture-proofing or waterproofing or systems are required on concrete and masonry surfaces:

WETTED SURFACE	DRY SIDE	SYSTEM REQUIRED
Soil or backfill	Precast manhole, precast wet well or precast vault interiors	No system required unless shown on Plans
Soil or backfill less than 12 inches in height	Precast manhole, precast wet well or precast vault interiors, or dry side of retaining walls or fence walls	
Undersides of concrete slabs on grade	Rooms, tunnels, galleries to be occupied by equipment, piping, conduit or personnel	Apply moisture-proofing underlay
Soil or backfill 1 to 5 feet in height against masonry	Rooms, to be occupied by equipment, piping, conduit or personnel or dry side of masonry retaining walls	Apply moisture-proofing coating to exterior
Soil or backfill where backfill height exceeds 5 feet against concrete. (Do not backfill > 5 feet against masonry.)	Rooms, tunnels, dry wells, galleries and cast-in-place vaults to be occupied by equipment, piping, conduit or personnel	Apply waterproofing membrane / Apply below-grade waterproofing system / Apply waterproofing membrane or below-grade waterproofing system
Walls and bottoms of concrete channels and tanks	Rooms, tunnels, dry wells, and galleries to be occupied by equipment, piping, conduit or personnel	Apply waterproofing coating to water side
Soil or backfill	Below-grade planters	Apply below-grade waterproofing system to planter exterior on sides where backfill is placed against exterior and to planter interior to prevent weeping and efflorescence in filled planters where exterior is exposed to view.

C. Moisture-proofing underlay shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Moisture-proofing Underlay	Polyethylene Film	Minimum 6 / 10 mil thickness Provide at least 1 perforation per 100 square feet to allow proper hardening of concrete during curing.
Moisture-proofing Underlay Tape	Pressure Sensitive Polyethylene Tape	Minimum 2 inch width

D. Moisture-proofing coating shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Moisture-proofing Coating	Coal Tar Solution	15 mil minimum system DFT

E. Below-grade waterproofing for concrete block masonry or concrete walls shall be designed to withstand 20 feet of hydrostatic head and shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Primer Coat		1 coat
Waterproofing Coat	Fibrated Asphalt Emulsion	3 coats 20 mil minimum system DFT
Membrane Protection	Bituminous-Impregnated Fiberboard	15-lb asphalt bituminous-impregnated fiberboard
Expansion Joint Sheets	Rubberized-Asphalt-Coated Polyethylene	Tough, pliable waterproof sheets coated on one side with factory-applied layer of adhesive-consistency rubberized asphalt

F. Sheet waterproofing shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Waterproofing Coating	Coal Tar Epoxy Resin	
Waterproofing Membrane	Bituminous and Synthetic Resin Reinforced by Inert Material	40-mil minimum thickness
	Bentonite Composition Panels	
Waterproofing Protective Board	Asphalt-Impregnated Insulation Board	½-inch thick

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install sheet waterproofing materials before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Prepare backfilled surface to receive moisture proofing underlay by removing sharp objects, protrusions or rocks which might perforate the sheet membrane.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Refer to Section 31 23 00 for excavation requirements.

C. Furnish and install sheet waterproofing at locations shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building code requirements

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. Moisture-proofing underlay shall be installed as follows:

1. Level off and smooth backfilled surfaces to receive moisture-proofing underlay to minimize contact with sharp edges.

2. Lap moisture-proofing membrane by at least 6 inches at all joints and seal with pressure sensitive tape.

3. Where pipes and conduits pass through membrane, wrap tightly with separate sheets of membrane and seal to main membrane with pressure sensitive tape.

4. Support reinforcing steel or wire mesh according to Manufacturer's written requirements to protect membrane from puncture.

G. Moisture-proofing coating shall be applied to masonry as follows:

1. New concrete or masonry surfaces to be waterproofed shall have aged at least 28 days and allowed to dry to moisture content recommended by coating Manufacturer.

2. Fill holes, cracks or other joint defects with mortar and repoint.

3. Remove loose or splattered mortar by scraping and chipping.

4. Clean masonry surfaces with clear water by washing and scrubbing. Do not use muriatic acid.

5. After cleaning, seal or fill masonry surfaces with block filler compatible with primer.

6. Apply each primer and finish coat at rate of 70 square feet per gallon.

7. Allow drying time recommended by Manufacturer before applying subsequent coats.

H. Waterproofing membrane shall be applied to concrete as follows:

1. Concrete surfaces shall be clean, dry and free of voids, spalled areas, loose aggregate, and sharp protrusions, with no coarse aggregate visible.

2. Prime surface in accordance with Manufacturer's installation instructions.

3. Apply waterproofing membrane in accordance with Manufacturer's installation instructions.

4. Pipes or conduits entering structures shall be watertight.

5. Force protective board directly against membrane before backfilling.

6. Where membrane is turned up from base of walls, at angles in walls, and at any other place where membrane might be subjected to unusual strain, apply two additional plies of membrane.

I. Below-grade waterproofing system shall be installed in accordance with Manufacturer's installation instructions.

J. Waterproofing coating shall be applied to concrete as follows:

1. New concrete surfaces to be waterproofed shall have aged at least 28 days and allowed to dry to moisture content recommended by coating Manufacturer.

2. Sandblast surface to be coated.

3. Repair voids and cracks.

4. Apply prime coat at rate of 200 to 300 square feet per gallon depending on surface condition.

5. Allow drying time recommended by Manufacturer before applying subsequent coats.

6. Apply finish coat at rate of 100 square feet per gallon.

7. Final coat shall be black.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Moisture-proofing Underlay	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
Moisture-proofing Coatings	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 inspection	Owner	Owner
Waterproofing Systems	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed lLiterature	1 inspection	Owner	Owner

END OF SECTION

SECTION 07 22 16
ROOF BOARD INSULATION

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of roof board insulation.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 05 31 23: Steel Roof Decking
H. Section 07 54 23: Single Ply Roofing

1.3 System Description

A. Furnish and install complete operating roof board insulation including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASTM C578 Rigid Cellular Polystyrene Thermal Insulation
B. ASTM C728 Perlite Thermal Insulation Board
C. ASTM C1289 Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
D. California Energy Code (CEnC)
E. California Green Building Standards Code (CALGreen Code)
F. FedSpec HH-I-558B Insulation, Blocks, Boards, Blankets, Felts, Sleeving, and Pipe Fitting Covering, Thermal

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per structural shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application Instruction requirements.
Certificate of Compliance	Submit coating system and application certification per certificate of compliance requirements.
Test Record Transcripts	Submit for factory tests per test record transcript requirements.
Material Samples	Required.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, certificates of compliance, test record transcripts, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of roof board insulation shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Cant Strip	Cant Strip Corporation of America	Phoenix, AZ
	Accepted equal	
Glass Fiber Reinforced Gypsum Board	Georgia Pacific Dens-Deck Roof Board	Atlanta, GA
	Accepted equal	
Polyisocynaturate Insulation	Apache Products Company	
	Atlas Roofing Corporation	
	Celotex Corporation	
	Firestone Building Products Company ISO 95+	Indianapolis, IN
	GAF Building Materials Corporation	
	Johns-Manville	Denver, CO
	RMAX Inc	
	Accepted equal	
Perlite Board Insulation	GAF Building Materials Corporation	
	Johns-Manville	Denver, CO
	Accepted equal	
Tapered Crickets	Cant Strip Corporation of America	Phoenix, AZ
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Where roof profile allows space between roof covering and steel or combustible roof decking, construct spaces to prevent flame or ember intrusion in spaces above decking or install one of the following above combustible or steel decking:

ITEM	MATERIAL	SPECIFICATION
Felt Underlayment	72-lb asphalt base sheet	ASTM D2626 Type I
Roll Roofing		
Cap Sheet under Tiles		
Glass-Fiber-Reinforced Gypsum Board		

C. Roof board insulation shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION	
Roof Board Insulation	Preformed Roofing Insulation Boards	Thickness	1-inch minimum
		Taper	¼-inch per 12 inches
		Density	1.0 pcf nominal
		Flame Spread	<25
Polyisocyanurate Board Insulation	Rigid Cellular Polyisocyanurate Insulation	ASTM C1289 Facer Type II felt or glass fiber mat on both major surfaces	
Perlite Board Insulation	Rigid Mineral-aggregate Insulation Board	ASTM C728 Top surface seal-coated	

D. The following product design criteria, options and accessories are required for roof installation beneath the ceiling in the electrical room to meet Title 24 requirements above conditioned spaces:

ITEM	DESCRIPTION	
Design Criteria	Composite U-factor from Title 24 Joint Appendix JA4 Table 4.2.7	0.063 maximum
	Layers of Insulation	Double Layer
	R-Value	R19
	Thermal Blocks at Supports	Required
	Installation System	Standing seam roof with double layer of insulation beneath deck.

E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Furnish roofing insulation accessories recommended by insulation Manufacturer for intended use and compatible with sheet roofing material.

G. Use primer/conditioner, and adhesive and/or mechanical fastener system recommended by roof insulation system Manufacturer.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install roof board insulation before ordering materials.

B. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of work. Do not proceed until unsatisfactory conditions are corrected.

C. Verify that substrate and adjacent materials are dry.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install roof board insulation at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building code requirements

D. Refer variances between the above documents and Contract Documents to Owner's Representative.

E. Install roof board insulation to tolerances recommended by Manufacturer.

F. Place insulation boards using a method that maximizes tight joints. Stagger vertical or sloped joints. Butt edges and ends tight to adjacent board and to protrusions.

G. Secure boards to substrate by mechanical attachment or by beads of adhesive to achieve a continuous flush finished insulation surface.

H. Cover finished work as needed to prevent installed insulation from becoming wet or damaged prior to installation of roofing system.

I. Install insulation as follows:

1. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

2. Install tapered insulation under area of roofing to conform to slopes indicated.

3. Install insulation under area of roofing in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

4. Trim surface of insulation where necessary at roof drains so completed surface is flush with drain ring.

5. Install insulation with long joints of insulation in continuous straight lines with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding ¼-inch with insulation.

6. Cut and fit insulation within ¼-inch of nailers, projections, and penetrations.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Roof Board Insulation	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 07 54 23
SINGLE PLY ROOFING

PART 1 - GENERAL

1.1 Work Included

A. This section includes materials, testing, warranty and installation of single ply roofs.

B. Single ply roof products shall be installed over the following spaces:

1. Flat roof over new pump station building.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 07 62 00: Sheet Metal Flashing and Trim
I. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete California Title 24-compliant cool roof system for zone and roof slope specified below.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Single Ply Roof Products	Solar Reflectance	CRRC 1	All products shall bear CRRC label	Contractor	Contractor
	Thermal Emittance	CRRC 1	All products shall bear CRRC label	Contractor	Contractor

C. Provide 25 year Manufacturer's Warranty on product and workmanship.

1.5 References

A. ASTM D1079
B. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual".
C. Roof Consultants Institute "Glossary of Roof Terms".
D. Sheet Metal Terminology and Techniques: SMACNA "Architectural Sheet Metal Manual".
E. California Building Code (CBC)
F. California Energy Code (CEnC)
G. California Green Building Standards Code (CALGreen Code)

H. California Mechanical Code (CMC)
I. Cool Roof Rating Council (CRRC) Product Rating Program Manual
J. California Title 24 Building Efficiency Standards

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per architectural shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements
Certificate of Compliance	Products must bear CRRC product label and information showing compliance with these specifications

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of single ply roofs shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Single Ply Roof Systems	Firestone Building Products	Indianapolis, IN
	Johns Manville Roofing Products	Littleton, CO
	Accepted Equal	

B. Products shall be listed in CRRC's Rated Product Directory as complying with these specifications and California Energy code (Title 24) requirements.

C. Products used in South Coast Air Quality Management jurisdiction shall be compliant with current South Coast Air Quality Management requirements.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Single Ply roof shall be constructed of the following materials:

1. Fabric-reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric reinforced.
   a. Thickness shall be no less than 60 mils (1.52mm).
   b. Exposed face color shall be WHITE.

2. One layer of 5/8" Dens-Deck Coverboard directly under the single – ply roofing.

3. Two layers of 1 ½" Polyisocyanurate Insulation between the Dens-Deck (above) and the corrugated metal decking.

4. Auxiliary materials recommended by the roofing system manufacturer for intended use, and compatible with their product including but not exclusively the following: sheet flashing, bonding adhesive, urethane adhesive, metal termination bars, ,fasteners, TPO pourable sealer, TPO pipe boots, TPO universal corners, edge sealant, membrane primer, sealing mastic, etc.

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Single – Ply Roofing	Climate Zone	Climate Zone 8 Orange County inland from 405 and L A County Gateway Cities
	Roof Slope	Low (<2:12)
	3-year Weathered Solar Reflectance	>0.55
	3-year Weathered Thermal Emittance	>0.75
	Solar Reflectance Index SRI	>64
	Fire Rating	UL Class A assembly rating

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install cool roofs before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Examine areas and conditions under which Work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install single-ply roof at locations shown on Plans and Submittals.

C. Install single-ply roof as described in technical specification for type of roofing system furnished.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Building Code Chapter 15 “Roof Assemblies and Rooftop Structures”

4. Other applicable building, fire, mechanical and plumbing, code requirements

E. Refer variances between above documents and Contract Documents to Owner’s Representative.

F. Install single-ply roofing to tolerances recommended by Manufacturer. Unless otherwise shown, install roofing true and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Single-Ply Roofing Products	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer’s printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer’s printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of sheet metal flashing and trim.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 07 92 00: Joint Sealants
H. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install flashing and sheet aluminum not specifically described in other sections of these Contract Documents but required to prevent water penetration through exterior shell of building and as needed for complete and proper installation. Include appurtenant structural or mechanical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building, fire, mechanical, and plumbing codes and standards.

1.4 Quality Assurance

A. Comply with pertinent recommendations contained in SMACNA Architectural Sheet Metal Manual.

B. Fasteners shall be compatible with adjoining materials.

C. Fabricator and installer shall be company specializing in sheet metal flashing work with 5 years documented experience.

1.5 References

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate
B. ASTM B221 Aluminum and Aluminum-Alloy Extended Bars, Rods, Wire Shapes and Tubes
C. ASTM D412 Test Methods for Vulcanized Rubbers and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
D. California Building Code (CBC)
E. California Fire Code (CFC)
F. California Mechanical Code (CMC)
G. California Plumbing Code (CFC)
H. Fed Spec QQ-A-250D
I. Fed Spec SS-C-153
J. Fed. Spec. TT-P-641d
K. NRCA Roofing and Waterproofing Manual
L. SMACNA Architectural Sheet Metal Manual

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per architectural shop drawing requirements. Include locations of sleeper strips to secure aluminum to masonry and steel
Catalog Data	Required per catalog data requirements. Provide Manufacturers data on flashing cement.
Installation Instructions	Required per installation instruction requirements on flashing cement
Material Samples	Required. Review and acceptance of samples by Owner's Representative will be for color and finish only.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and material samples.

C. In absence of Manufacturer's installation requirements, the following may be submitted and will be accepted as "Manufacturer's installation instructions" for the corresponding sheet metal materials.

1. Aluminum Association – Aluminum Construction Manufacturer: Aluminum Sheet Metal Work and Building Construction.

2. Copper Development Association – Contemporary Copper, a Handbook of Sheet Copper Fundamentals, Design Details and Specifications, Copper Roofing, a Practical Handbook, and Sheet Copper Applications.

3. NRCA Roofing and Waterproofing Manual

4. SMACNA – Architectural Sheet Metal Manual

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of flashing and sheet metal shall be strictly followed.

C. Stack preformed material to prevent twisting, bending or abrasion and to provide ventilation.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Cant Strip	Cant Strip Corporation of America	Phoenix, AZ
	Accepted equal	
Fasteners	Modern Materials	Los Angeles, California

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Fasteners (cont.)	Accepted equal	
Neoprene Flashing Cement	Christian Company	
	Gaco Western Company	
	Accepted equal	
Polyurethane Sealant	Sika Corporation Sika Fkex 1-A	Lyndhurst, NJ
	Accepted equal	
Sheet Metal Flashing Specialties	La Rocque	Rancho Cucamonga, CA
	Accepted equal	
Roof Underlayment (Asphalt-Saturated Organic Fiber Felt Base Sheet)	Fontana Paper Mills	Fontana, CA
	Accepted equal	
Roof Underlayment (Synthetic Felt)	Tri-Built Synthetic Felt	East Rutherford, NJ
	Accepted equal	
Sheet Metal Flashing Specialties	La Rocque	Rancho Cucamonga, CA
	Accepted equal	

B. Standard commercial items may be used for flashing, trim, reglets and similar purposes provided such items meet or exceed specified quality standards.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Flashing and sheet metal shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Sheet Materials	Aluminum	ASTM B209 or Fed Spec QQ-A-250D alloy 3003-H14 Alclad 3003, Alclad 3004 or Alclad 3005 shall be clad on 2 sides. 20-gauge (0.032") minimum
Cant Strip	Perlite	3x3x3-7/8"
	Wood Fiber	3x3x3-7/8"
Fasteners to Concrete or Masonry		Use drilled plugholes and plugs.
Parapet Cap	Galvanized Steel	24 gauge minimum of profile shown Lengths 10' with 12"-long internal sleeves. Internal sleeves of same material and profile for exposed coping
Extruded Shapes	Aluminum	ASTM B221
Roof Underlayment, Roll Roofing or Cap Sheet	Asphalt-Saturated Organic Fiber Felt Base Sheet	ASTM D2626 Type I or II 30 lbs/square unless roofing material specification stipulates heavier weight Mopped into place and impervious to water
	Synthetic Felt	Polypropylene
Flashing Cement	Neoprene	Trowel grade, 500 lb. psi tensile strength per ASTM D412 250% elongation per ASTM D412
	Asphalt	Fibered, FS-SS-C-153, Type 1 Manufactured to perform on vertical surface without sag at 180°
Sealant	Polyurethane Base Sealant	Non-hardening, non-sagging, one part polyurethane Use where needed to make sheet metal work watertight between sheet metal components, or between metal and adjoining work of other trades, except when specified to be done under adjoining work. Conform to Section 07 92 00.

C. Where sheet metal is required and no metal or gage is shown on Plans, provide highest quality and gage commensurate with referenced standards.

D. Fasteners shall be compatible with base material and support structure.

E. Fasteners shall have exposed parts finished to match flashing metal.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install flashing and sheet metal before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid structural conflicts.

B. Examine areas, substrates and conditions under which Work of this section is to be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected. Surfaces to receive sheet metal shall be clean, even, smooth, dry and free from defects and projections which might adversely affect application. Verify slope prior to installing materials.

C. Provide one 36" wide layer of No 72 ASTM cap sheet running full length of valley beneath valley flashings.

D. Shop Priming: Clean black iron and steel items or components, chemically pretreat and prime hereunder with rust inhibitive primer.

E. Field Priming: Except for repair of damaged galvanized coating specified below, where priming of galvanized surfaces is required, prime at site per Section 09 90 00 prior to installation. Do not install work until priming is dry; leave in clean condition ready for finish painting.

F. Repair of Damaged Galvanized Coating: Clean by effective means to remove weld flux, weld spatter, rust and foreign matter. Pretreat with phosphoric and vinyl resin primer, Formula 117 for Metals, "DOD-P-15328". If metal is to be painted, coat damaged areas with Zinc Dust Zinc Oxide Primer, Fed. Spec. TT-P-641d.

G. Do not proceed with work until curb and substrate construction, cant strips, blocking, reglets, sleepers and other construction to receive work is completed.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install sheet metal flashing and trim at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, mechanical and plumbing, code requirements

4. Aluminum Association – Aluminum Construction Manufacturer: Aluminum Sheet Metal Work and Building Construction.

5. NRCA Roofing and Waterproofing Manual

6. SMACNA – Architectural Sheet Metal Manual

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Isolate dissimilar metals using either building paper or asphaltum paint.

F. Install flashing and sheet metal to tolerances recommended by Manufacturer. Accurately form work to sizes, shapes, and dimensions shown, with angles and lines straight, sharp and in true alignment. Cope, miter or flange intersections for proper accurate fit and fuse together securely. Lockseam or rivet and fuse joints in strong manner. Fabricate items in maximum lengths and keep joints to minimum. Turn back exposed edges to form ½" hem. Erect work plumb, level, in proper plane, without bulges or waves.

H. Install flashing as follows:

1. Form flashings to protect roofing materials from physical damage and shed water. Form sections in maximum possible lengths, free from distortion or defects. Form components true to shape, accurate in size, square and free from distortion or defects.

2. Hem exposed edges ½" on underside. Miter and seal corners. Fabricate vertical faces with bottom edge formed outward ¼" and hemmed to form drip.

3. Secure work in proper location. Do required drilling and tapping in other Work for attachment of sheet metal.

4. Adequately support openings through tiles for vents and similar protrusions by adding blocking or framing as required.

5. Form flashing around pipes, vents, flues, chimneys, and other penetrations to match tile contours.

6. Establish wind block at longitudinal edges of flashings by grouting with Portland cement mortar or other acceptable material.

G. Form, fabricate and install sheet metal so as to accurately provide for expansion and contraction in finished work.

H. Finished sheet metal work shall be watertight and weather-tight.

I. Fabricate and install flashings and counter flashings where shown or required.

J. Do not solder aluminum.

K. Seams shall meet the following requirements.

1. Comply with SMACNA Architectural Sheet Metal Manual Plate 99 and 100 and other plates applicable to specific installations.

2. Flat lock seams shall be at least ¾" wide flat and true to line.

3. Lap seams shall overlap at least 6". Lap according to pitch. Do not solder lap seams.

4. Orient seams properly for direction of water flow.

L. Joints shall be watertight. Join parts with rivets or sheet metal screws where necessary for strength or stiffness. Seal joints water tight.

M. Install starter and edge strips and cleats. Wherever possible, secure metal by means of clips or cleats without nailing through exterior metal.

N. For size and spacing of cleating see SMACNA Architectural Sheet Metal Manual. Secure one end with 2 fasteners and fold cleat over fastener heads. Unless otherwise shown, use 2" wide by 3" long cleats of same material and thickness as metal being installed.

O. Secure flashings, in place using specified fasteners. Space nails, rivets and screws not more than 8" apart. Where exposed to weather, use appropriate washers.

P. Install parapet caps as follows:

1. Miter corner pieces

2. Set coping over wood nailers into neoprene flashing cement over internal sleeves before cement starts to cure.

3. Leave ½" space between ends of exposed coping.

4. Paint per Section 09 90 00.

Q. Flashing for ducts, pipes and vents, and conduits, including collar flashing shall be furnished under mechanical work and electrical work and installed by roofer.

R. Embed metal in connection with roofs in a solid bed of sealant.

S. Apply plastic cement compound between metalwork and felt flashings.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Flashing	Leakage	1-hour hose or rainbird test to simulate rain	As directed	Contractor	Contractor
	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 07 71 23
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of gutters and downspouts.

B. Gutters and downspouts shall be aluminum. Fasteners and nails shall be constructed of same metal.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 07 62 00: Sheet Metal Flashing and Trim
H. Section 07 92 00: Joint Sealants
I. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete gutter and downspout system to direct roof runoff as shown on Plans. Include appurtenant structural or mechanical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Comply with pertinent recommendations contained in SMACNA Architectural Sheet Metal Manual.

B. Fasteners shall be compatible with adjoining materials.

C. Follow primary roofing material Manufacturer's printed instructions for coordinating installation of eave trims with gutter installation.

1.5 References

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate
B. ASTM B221 Aluminum and Aluminum-Alloy Extended Bars, Rods, Wire Shapes and Tubes
C. California Fire Code (CFC)
D. California Plumbing Code (CPC)
E. Fed Spec QQ-A-250D
F. Fed. Spec. TT-P-641d
G. NRCA Roofing Manual
H. SMACNA Architectural Sheet Metal Manual

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per architectural shop drawing requirements. Include locations of sleeper strips to secure aluminum to masonry and steel
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.
Material Samples	Required. Review and acceptance of samples by Owner's Representative will be for color and finish only.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and material samples.

C. In absence of Manufacturer's installation requirements, applicable sections of the following may be submitted and will be accepted as "Manufacturer's installation instructions" for corresponding sheet metal materials.

1. Aluminum Association – Aluminum Construction Manufacturer: Aluminum Sheet Metal Work and Building Construction.

2. National Roofing Contractors Association Roofing Manual

3. SMACNA – Architectural Sheet Metal Manual

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of flashing and sheet metal shall be strictly followed.

C. Stack preformed material to prevent twisting, bending or abrasion and to provide ventilation.

D. Products furnished with strippable plastic film shall have film removed prior to installation. Do not expose such products to sunlight for more than 30 minutes without removing film.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Standard commercial items may be used for flashing, trim, reglets and similar purposes provided such items meet or exceed specified quality standards.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Comply with requirements of Chapter 11 of California Plumbing Code, “Storm Drainage.”

C. Roof gutters shall be provided with means to prevent accumulation of leaves and debris in gutter.

D. Gutters and downspouts shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Gutters, Downspouts and Support Brackets	Aluminum	ASTM B209 or Fed Spec QQ-A-250D alloy 3003-H14 Alclad 3003, Alclad 3004 or Alclad 3005 shall be clad on 2 sides. Mill finish
Fasteners to Concrete or Masonry		Use drilled plugholes and plugs.
Extruded Shapes	Aluminum	ASTM B221
Sealant	Polyurethane Base Sealant	Non-hardening, non-sagging, one part polyurethane Use where needed to make sheet metal work watertight between sheet metal components, or between metal and adjoining work of other trades, except when specified to be done under adjoining work. Conform to Section 07 92 00.
Splash Blocks	Precast Concrete	2500 psi

E. Where sheet metal is required and no metal or gage is shown on Plans, provide highest quality and gage commensurate with referenced standards.

F. Fasteners shall be compatible with base material and support structure.

G. Fasteners shall have exposed parts finished to match flashing metal.

H. Gutter and downspout anchorage devices shall be of type recommended by fabricator.

I. Gutter supports shall be brackets, straps, or spikes and ferrules.

J. Downspout supports shall be brackets of straps.

K. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION
Gutters	Rectangular or square SMACNA style profile. Manufactured in 10’0” lengths of 0.040” mill finish aluminum Color to match trim
Downspouts	Rectangular, square or round profile Manufactured in 10’0” lengths of 0.040” mill finish aluminum Provide factory offset on one end to provide ¾” telescoping joint. Color to match trim
Support Brackets	1/8” x 1” aluminum designed to provide resistance lock. Provide support brackets and interior straps for installation at 30” on center. Color to match adjacent gutter or downspout
End Caps, Downspout Outlets	Profiled to suit gutters and downspouts Color to match downspout

L. Form components true to shape, accurate in size, square and free from distortion or defects. Form pieces in longest practical lengths.

M. Hem exposed edges ½" on underside. Miter and seal corners. Fabricate vertical faces with bottom edge formed outward ¼" and hemmed to form drip.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install gutters and downspouts before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid structural conflicts.

B. Examine areas, substrates and conditions under which Work of this section is to be performed. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

C. All wood framing, wood plates and nailers to receive gutters shall be installed true and straight, free of splinters, knots or other irregularities.

D. Fascia boards shall be installed in vertical fashion, true, straight and free of knots, splinters, or other irregularities. Soffits, extenders or cladding to be applied to fascias shall be installed prior to gutter installation.

E. Wall surfaces which may be subject to water runoff from gutters shall be protected when project conditions do not allow immediate installation of downspouts.

F. Shop Priming: Clean black iron and steel items or components, chemically pretreat and prime hereunder with rust inhibitive primer.

G. Field Priming: Except for repair of damaged galvanized coating specified below, where priming of galvanized surfaces is required, prime at site per Section 09900 prior to installation. Do not install work until priming is dry; leave in clean condition ready for finish painting.

H. Repair of Damaged Galvanized Coating: Clean by effective means to remove weld flux, weld spatter, rust and foreign matter. Pretreat with phosphoric and vinyl resin primer, Formula 117 for Metals, "DOD-P-15328". If metal is to be painted, coat damaged areas with Zinc Dust Zinc Oxide Primer, Fed. Spec. TT-P-641d.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install gutters and downspouts at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Plumbing Code Chapter 11 "Storm Drainage."

4. Other applicable building, fire and plumbing code requirements

5. Aluminum Association – Aluminum Construction Manufacturer: Aluminum Sheet Metal Work and Building Construction.

6. NRCA Roofing Manual

7. SMACNA – Architectural Sheet Metal Manual

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Review carefully and follow primary roof materials Manufacturer's recommendations for joining waterproof membranes to gutter system.

F. Dissimilar metals shall be isolated using either building paper or asphaltum paint.

G. Joints shall be watertight. Join parts with rivets or sheet metal screws where necessary for strength or stiffness. Seal joints water tight.

H. Do not solder aluminum.

I. Secure gutters and downspouts in place using specified fasteners. Space nails, rivets and screws not more than 8" apart.

J. Embed metal in connection with roofs in solid bed of sealant.

K. Install gutters and downspouts to tolerances recommended by Manufacturer. Install gutter supports, gutters and downspouts true to grade and straight. Use precision gauges, levels, chalk lines or lasers, and plumbs. Unless otherwise shown, slope gutters ¼" per 40'.

L. Do not locate bracket directly over downspout outlet locations.

M. Attach brackets with 2"x#10 stainless steel wood screws.

N. Install gutter sections into support brackets, inserting each section into previous section for lap of 1". Seal and rivet at 2" on center or as required by Manufacturer. Nail rear upper portion of gutter with 12d nails through prepunched elongated holes at 12" on center.

O. Watertight elastomeric expansion joint assemblies shall be provided for runs of more than 40' except where closer spacing is shown on Plans or required for proper installation.

P. Install welded miter units at corners and where shown. Gutter corners shall have 30" legs, prepunched, notched and telescoping to match gutter. Fascia corners shall have 3-" legs and shall be finished after fabrication. Grinding and touch up painting will not be allowed.

Q. Provide end caps at all end terminations. Rivet end caps at 2" on center, and seal.

R. Locate all outlet locations and field cut holes in neat workmanlike manner. Locate hole 1" from backside of gutter. Insert stainless steel outlet, fasten in place with 4 rivets (one on each flange), and seal.

S. Finished work shall be watertight. Make lock seam work flat and true to line. Make lock seams and lap seams when fused, at least ½" wide. Where lap seams are not fused, lap according to pitch, but in no case less than 3". Make flat and lap seams in direction of flow.

T. Set splash blocks under downspouts.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Gutters and Downspouts	Leakage in Gutters	Demonstrate gutter watertightness with standing water	As directed	Contractor	Contractor
	Leakage in Downspouts	CPC Section 1109 Add air or water and maintain at 5 psi for 15 minutes. (Do not air-test plastic pipe) Joints shall show no visible leaks. Pressure shall remain unchanged for 15 minutes without adding air or water	All drainage piping within building interior	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 07 72 33
ROOF AND FLOOR HATCHES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of roof and floor hatches.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 05 12 00: Structural Steel Framing
I. Section 05 50 00: Metal Fabrications
J. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete operating floor hatch including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Building Code (CBC)
B. California Fire Code (CFC)
C. California Mechanical Code (CMC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per structural shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements. Include rough-in diagrams.
O & M Instructions	Required per operation and maintenance instruction requirements
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and O&M instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of roof and floor hatches shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Traffic-Rated Hatches	Bilco Co.	New Haven, CT
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Roof and floor hatches shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Hatch - Aluminum	Aluminum	
Hatch Hardware	Stainless Steel	SAE Type 316

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Hatch	Construction	Single Leaf or Double Leaf as shown
	Size	See plans
	Design Load	H-20 Loading
	Loading Condition	High Density Traffic (in paved right of way)
	Maximum Deflection under Design Load	Span/150
	Lid Design for Traffic	Lids subjected to any vehicle traffic shall be capable of being bolted down
	Lid Finish	¼" Diamond Pattern Checker Plate
	Channel Frame	¼" frame with anchor flange around perimeter and 1½" drainage coupling on corner where required to prevent ponding.
	Door Operator	Compression or Torsion Assist Spring Required
	Hold-Open Arm	Provide automatic hold open arm with release handle
	Safety Chains	Provide minimum 2 straight link 3/16" diameter 12-link per inch (minimum) safety chains on each door with harness snap on one end to allow chain to be removed. Space chains approximately half door height apart.
	Locking Hardware	Provide recessed padlockable hasp and heavy duty padlock keyed to Owner's requirements
	Factory Finish Aluminum	Mill finish with bituminous coating on aluminum frame exterior
	Intrusion Alarm	Coordinate with instrumentation as required regarding intrusion alarms

D. Hatch opening dimensions refer to clear opening space available without obstruction by any portion of the leaves, framing, reinforcement or attached hardware except for spring operators which may occupy no more than a 2”x3” square area in each corner when hatch doors are fully open. If Manufacturers’ standard design does not provide such clear openings, then their standard design shall be modified as required to comply with Contract Documents at no additional cost to Owner.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install roof and floor hatches before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install roof and floor hatches at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer’s installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner’s Representative.

E. Install roof and floor hatches to tolerances recommended by Manufacturer. Unless otherwise shown, install roof and floor hatches true and level using precision gauges and levels.

F. Connect 1” stainless steel pipe to drains required on hatch frames to prevent ponding and extend to drain freely. Drain roof hatches to drains or gutters where available or off edge of roof where drains or gutters are not available.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Roof and Floor Hatches	No bends, twists or open joints No projecting edges or corners at intersections	Visual inspection	All metalwork	Owner	Owner
	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of joint sealants.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating

1.3 System Description

A. Where required throughout Work to provide positive barrier against passage of moisture and air, furnish and install complete operating joint sealant system in conformance with Manufacturer's installation requirements and compliance with applicable building, fire, mechanical, and plumbing codes and standards.

B. Caulking, if noted shall be synonymous with sealant.

1.4 References

A. ASTM C834 Latex Sealants
B. ASTM C920 Elastomeric Joint Sealants
C. ASTM C990
D. ASTM D994 Preformed Expansion Joint Filler for Concrete (Bituminous Type)
E. ASTM D1751 Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
F. ASTM D1752 Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
G. California Green Building Standards Code (CALGreen Code)
H. Federal Specification SS-S-210 Sealing Compound, Preformed Plastic for Expansion Joints and Pipe Joints
I. Federal Specification TT-S-01543A
J. Federal Specification TT-S-00230-C
K. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 201-3 "Expansion Joint Filler and Joint Sealants"

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements. Include Manufacturer's recommendations for primer, joint cleaner and bond breaker.
Certificate of Compliance	Submit sealant system certification per certificate of compliance requirements.
Material and Color Samples	Required.
Color Charts	Submit Manufacturer's standard color charts to allow owner to select color to match adjacent work.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, certificates of compliance, and material samples.

1.6 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of joint sealants shall be strictly followed.

C. Do not retain any material at job site which has exceeded shelf life recommended by Manufacturer.

D. Do not retain any mixed sealant material at job site which has exceeded pot life recommended by Manufacturer.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable sealant Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Sealant Type A Two-Part Polyurethane Self Leveling for Horizontal Surfaces	AEP Span	
	Atas International. Inc. Monarch	
	Pecora Corporation Traffic Grade Polyurethane	Harleysville, PA
	Roadware Incorporated "Flexible Cement II"	South Saint Paul, MN
	Accepted equal	
Sealant Type B Non Sag for Vertical Surfaces	AEP Span	
	Atas International. Inc. Monarch	
	Chem Link "Nova Link"	Schoolcraft, MI
	Accepted equal	
Sealant Type C Silicone	AEP Span	
	Atas International. Inc. Monarch	
	Pecora Corporation 800 Series	Harleysville, PA
	Accepted equal	
Sealant Type D Acrylic Latex	AEP Span	
	Atas International. Inc. Monarch	

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Sealant Type D Acrylic Latex (cont.)	Pecora Corporation 900 Series	Harleysville, PA
	Accepted equal	
Sealant Type E Acoustical Sealant	Pecora Corporation AIS 919	Harleysville, PA
	Accepted equal	
Sealant Type F Polysufide for Prolonged Submersion	Pecora Corporation Synthacalk GC2+	Harleysville, PA
	Accepted equal	
Mastic Premolded Plastic Gasket	Conseal International, Inc.	Tipp City, OH
	RAM-NEK Division Henry Company	Houston, TX
	Accepted equal	

B. Acceptable Manufacturers for foam filler include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Polyethylene Foam Filler for Pipe Support Bearing Pad	Sealed Air Corporation "Ethafoam"	Elmwood Park, NJ
	Hercules Inc Plastic Products Group Industrial Systems Department "Minicell"	Middletown, DE
	W R Meadows Sealtight "Deck-O-Foam" Expansion Joint Filler	Hampshire, IL
	Accepted equal	
Closed-Cell Sponge Rubber Foam Filler for Pipe Support Bearing Pad	American National Rubber "Rubberlite"	Ceredo, WV
	Armacell "Armaflex"	Munster, NRW, DE
	B F Goodrich Sponge Products, Div	Shelton, CT
	Cypress Sponge Rubber "Rubberite"	Santa Ana, CA
	Monmouth Rubber and Plastics Corp. "Durofoam"	Long Branch, NJ
	RBX Industries "Rubatex Insul-Tube 180"	Roanoke, VA
	Uniroyal Chemical "Ensolite"	Mishawaka, IN
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Adhesives, sealants and caulks used on Work shall comply with VOC limits set forth in Section 5.504.4.1 of CALGreen Code.

C. Joint sealants shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Sealant Type A Two-Part Polyurethane Self Leveling for Horizontal Surfaces	Pour Grade Urethane	ASTM C920 Grade P Class 25
Sealant Type B Non Sag for Vertical Surfaces	Single Component Fed Spec TT-S-00230-C	ASTM C920 Type S Grade NS Class 25
Sealant Type C Silicone	Silicone	Fed Spec TT-S-01543A Class A
Sealant Type D Acrylic Latex	Acrylic Latex	ASTM C834
Sealant Type E Acoustical Sealant		
Sealant Type F Polysufide for Prolonged Submersion		
Preformed Elastomeric Sealant		ASTM D268

ITEM	MATERIAL	SPECIFICATION
Mastic Joint Sealant for Buried Manholes and Vaults	Mortar	One part Portland cement to 2 parts well-graded sand passing No. 8 sieve per Section 03 30 00.
	Preformed Plastic Sealing Compound	Fed Spec SS-S-00210
Primer		Nonstaining type recommended by sealant Manufacturer
Joint Cleaner		Noncorrosive and nonstaining type recommended by sealant Manufacturer, compatible with joint compounds
Bond Breaker	Pressure Sensitive Tape	Recommended by sealant Manufacturer to suit application.
Rope Yarn	Rope Fiber or Cotton Wicking	Use raveled strands.

D. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION
Design Criteria	No leakage in plant quality control test at 10 psi for 1 hour minimum Temperature range 30°F to 120°F
Color	Owner will select from standard colors available from Manufacturer

E. Do not use non-elastic putty-type compounds.

F. Sealant compounds shall be of proper consistency to be readily worked and not be affected by vibration or by long exposure to outside climate and temperature.

G. Sealant compounds shall form a thin, tough, elastic film on surface, but remain permanently plastic underneath.

H. Sealant compounds shall contain no acid nor ingredients which will stain stone, corrode metal or have an injurious effect on painting.

I. Sealant compounds shall be colored to match adjacent work.

J. Special sealants called for elsewhere shall be provided and installed as directed by Manufacturer.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install joint sealants before submitting catalog data or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Verify surfaces are ready to receive work and joint measurements and surface conditions are as recommended by sealant Manufacturer.

C. Remove loose materials and foreign matter which may affect adhesion of sealant.

D. Joints and spaces to be sealed shall be clean, free from dust, and dry.

E. Joints more than ¾" deep and joints where suitable backstop has not been provided shall be packed with rope yarn to within ½" of surface before applying and sealing.

3.2 Application

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and apply joint sealants at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, mechanical and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install joint sealants to tolerances and within temperature ranges recommended by Manufacturer.

F. Tool joints concave unless otherwise shown.

G. Joints in stone and precast work shall be slightly convex.

H. Seal joints before final coat of paint is applied to adjacent work.

I. Apply compound with a pressure gun having proper size nozzle or with knife as required.

J. Use sufficient pressure to fill all voids and joints solid. Superficial painting of joints with a skin head will not be accepted.

K. Remove excessive sealant and leave surfaces neat and clean. Upon completion, sealant shall have a smooth, even finish.

L. All sealed joints shall be watertight.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Joint Sealants	Installation & Leakage	Visual inspection of finished installation and water test at Owner's discretion	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 08 11 00
METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of steel doors and frames.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 04 29 00: Engineered Unit Masonry
I. Section 08 71 00: Door Hardware
J. Section 08 81 00: Glass Glazing
K. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete operating steel door and frame including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Doors	Fire Rated Frame Construction	UL 10-B and UL labeling requirements Door shall bear label for fire-resistive rating indicated or provide certificate from qualified independent laboratory that doors and frames conform to ASTM E152.	1 label or certificate each fire-rated door type	Contractor	Contractor

C. California Energy Code test requirements are as follows:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Steel Doors and Frames	U-Factor of Door Glass	Do not exceed limits in California Energy Code Table 116A. See See Section 08 81 00.	All glass shall bear visible labels	Contractor	Contractor
	Solar Heat Gain Coefficient (SHGC) of Door Glass	Do not exceed limits in California Energy Code Table 116B. See Section 08 81 00.	All glass shall bear visible labels	Contractor	Contractor
	Air Leakage	0.3 cfm/ft^2 maximum for single doors at 1.57 psf test pressure per ASTM A283	All doors shall bear visible labels	Contractor	Contractor
		1.0 cfm/ft^2 maximum for industrial double doors at 1.57 psf test pressure per ASTM A283			

D. Doors shall be ENERGY STAR qualified and bear ENERGY STAR labeling.

E. Doors, frames and related accessories shall be products of one Manufacturer and shall be compatible.

F. Where both wrap-around and butt-type frames are used to accommodate modular masonry dimensions, the 2 types of door frames shall be products of one Manufacturer, presenting a similar architectural finish and 2" face width around door in compliance with SDI 110 dimensions.

G. Do not provide shop or field modifications to individual products.

H. Doors shall be rigid and neat in appearance and free from warpage or buckle. Corner bends shall be true and straight and shall be of not less than minimum radius for gage of metal used.

I. Locations of louvers, windows and other appurtenances shall be uniform for doors of similar dimensions.

J. Conform to SDI 100 and ANSI A117.2

1.5 References

A. Americans with Disabilities Act (ADA)
B. ANSI A115 Door and Frame Preparation Series
C. ANSI A117.1 Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People
D. ANSI A123.1 Nomenclature for Steel Doors and Steel Door Frames
E. ANSI/SDI 100 Standard Steel Doors and Frames
F. ANSI/SDI 105 Recommended Erection Instructions for Steel Frames
G. ANSI/SDI 107 Hardware on Steel Doors
H. ANSI/SDI 108 Recommended Selection and Usage Guide for Standard Steel Doors
I. ANSI/SDI 110 Standard Steel Doors and Frames for Modular Masonry Construction
J. ANSI/SDI 111 Recommended Standard Details, Steel Doors and Frames
K. ANSI/SDI 114 Test Procedure and Acceptance Criteria for Acoustical Performance for Steel Door and Frame Assemblies

L. ANSI/SDI 117 Manufacturing Tolerances – Standard Steel Doors and Frames
M. ANSI/SDI 118 Basic Fire Door Requirements
N. ANSI/SDI 119 Steel Door Frames and Frame Anchors
O. ASTM A152 Fire Tests of Door Assemblies
P. ASTM A366 Steel, Carbon, Cold Rolled Sheet, Commercial Quality
Q. ASTM A525 Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process
R. ASTM A568 Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements forASTM B117 Salt Spray (Fog) Testing
S. ASTM D1735 Water Fog Testing of Organic Coatings
T. ASTM E90 Laboratory Measurement of Airborne Sound
U. ASTM E152 Fire Tests of Door Assemblies
V. ASTM E283 Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across Specimen
W. California Building Code (CBC)
X. California Energy Code (CEnC)
Y. DHI A115 Steel Door Preparation Standards
Z. Door and Hardware Institute (DHI) - Recommended Locations for Builders Hardware
AA. National Association of Architectural Metal Manufacturers (NAAMM) Standards
BB. NFPA 80 Fire Doors and Other Opening Protectives
CC. NFRC 400 (Fenestration Product Air Leakage)
DD. SSPC SP6/NACE 3 Commercial Blast Cleaning
EE. UL 10-B Fire Tests of Door Assemblies
FF. Underwriters Laboratories Standards

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per architectural shop drawing requirements.
	Employ terms specified in ANSI A123.1
	Include details of each frame type and each variation of opening condition with specific information on connections to adjoining materials.
	Show anchorage and accommodation of accessory items.
	Elevations shall show position of glass lites, louvers, hardware and other accessory items.
	Detail construction joints, connections and location and installation requirements of finish hardware and any supplemental reinforcement. Indicate coordination with other trades with respect to glazing and other accessories.
	Provide schedule for all doors, frames, sizes, types, louvers and glass using same reference numbers for details and openings as used on Plans.
	Schedules shall show hardware.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required for automated doors per operation and maintenance Instruction requirements.
Certificate of Compliance	Provide evidence of ENERGY STAR Rating
Certificate of Compliance – Acoustical Rated Doors	Provide certified test reports from independent testing laboratory of sound transmission class (STC) ratings
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of steel doors and frames shall be strictly followed.

C. Ship doors and frames with temporary stiffeners and spacers in place to prevent distortion.

D. Carefully store doors and frames on wood blocking in an area protected from elements and from damage, denting or marring of finish.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Door Anchors	Steelcraft Manufacturing Company (Lok-In)	Cincinnati, OH
	Accepted equal	
Steel Doors and Frames	Amweld International, LLC	Stow, OH
	Ceco Door Products	Milan, TN
	Curries Company	Mason City, IA
	Deansteel Manufacturing Company	San Antonio, TX
	Door Components, Inc.	Fontana, CA
	Haley Architectural Doors	Buena Park, CA
	Mesker Door, Inc.	Huntsville, AL
	Pioneer Industries, Inc.	Hackensack, NJ
	Republic Builders Products	McKenzie, TN
	Security Metal Products Corporation	Culver City, CA
	Steelcraft Manufacturing Company	Cincinnati, OH
	Accepted equal	
Acoustical Steel Doors and Frames	Ceco Door Products	Milan, TN
	Curries Company	Mason City, IA
	Door Components, Inc.	Fontana, CA
	Haley Architectural Doors	Buena Park, CA
	Industrial Acoustics Company IAC	Bronx, NY
	Republic Builders Products	McKenzie, TN
	Steelcraft Manufacturing Company	Cincinnati, OH
	Accepted equal	
Door Louvers	Anemostat Door Products	Carson, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Manufacture doors and frames per SDI 100, SDI 110, and SDI 111.

C. Meet manufacturing tolerance requirements of DHI A115 and SDI 117.

D. All steel doors and frames shall be shop-fabricated and shop-assembled per referenced standards except as amended herein. Provide custom shapes and sizes as defined. Reinforce doors for hardware where necessary. After fabrication, grind smooth and fill all tool marks and other surface imperfections.

E. Fire-rated doors and frames shall comply with applicable requirements of DHI A115, SDI 100 and SDI 118. Classification shall be based on door-and-frame assemblies tested per ASTM A152

F. Fire-rated doors and frames shall bear Underwriters Laboratory (UL) label showing certified door rating. Steel doors and frames for fire-rated openings shall conform to Underwriter's Laboratories listing and shall be UL labeled. Design and construction of such products shall have specific UL approval according to current procedures for fire rating shown.

G. Provide temporary stiffeners, spacers and other accessories needed to facilitate handling and accurate erection.

H. Steel doors and frames shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Doors and Frames	Commercial Grade Cold-Rolled Steel, Galvanized	ASTM A366, Type II or III
Base Coat	Rust-Inhibitive Epoxy Primer	ASTM B117 - Pass 120-hour salt spray test ASTM D1735 – Pass 250-hour humidity test
Hardware Reinforcement	Commercial Grade Cold-Rolled Steel, Galvanized	ANSI A115

I. The following product design criteria, options and accessories are required for door frames and appurtenances:

ITEM	DESCRIPTION	
Metal Frames Exterior Doors	Design	Combination welded-unit type buckled pressed steel frame.
	Type	Wrap-around or Butt-type as shown on door schedule. Dimensions per SDI 110 for modular masonry construction.
	Thickness	16-gauge level 3 extra heavy duty cold-rolled galvanized steel
	Drip Edge	16-gauge gutter-type drip edge at head extending 1" beyond door opening
Metal Frames Interior Doors	Design	Combination welded unit type buckled pressed steel frame.
	Type	Wrap-around or Butt-type as shown on door schedule. Dimensions per SDI 110 for modular masonry construction.
	Thickness	18-gauge level 2 heavy duty cold-rolled galvanized steel
Floor Anchors	Construction	Weld inside each frame jamb head and provide holes for floor anchorage
	Thickness	14 gauge minimum steel
Anchors for Masonry/Concrete Installation	Design	Adjustable jamb anchors of T-strap, stirrup and strap, or wire type
	Quantity of Anchors	Frames up to 7'6" high – 3 anchors

ITEM	DESCRIPTION	
Anchors for Masonry/Concrete Installation (cont.)	Quantity of Anchors (cont.)	Frames 7'6" to 8'0" high – 4 anchors Frame head anchors shall not be fewer than those required by Reference Standards.
Dust Cover Boxes and Mortar Guards	Construction	Required for all hardware mortises on frames set in masonry, concrete, gypsum board or plaster.
	Thickness	24 gauge minimum steel
Silencer Holes	Provide holes for silencers in doorframes not designated to receive weatherstripping, seals or sound seals	
Surface Preparation	After SSPC-SP6/NACE 3 Commercial blast cleaning, chemically treat doors to maximize paint adhesion.	
Hardware	Reinforce doors and frames and drill or tap for fully templated mortised hardware.	

J. The following product design criteria, options and accessories are required for interior doors:

ITEM	DESCRIPTION	
Steel Doors - Interior	Construction	Full flush
	Accessibility Requirements	On all swinging doors flush or non-flush, bottom 10" shall have smooth uninterrupted surface per CBC Section 1133B2.6 to allow door to be opened by wheelchair footrest without creating trap or hazardous condition.
	Design	Seamless face sheets with continuous fully welded seam edges Hollow metal construction No visible seams Internally reinforce door top and bottom with steel members welded in place
	Top Enclosure	Flush Water and Weather-tight
	Bottom Rail Drip	Provide 16-gauge galvanized steel bottom rail-drip flashing convex shape.
	Door Thickness	1¾"
	Metal Thickness	18-gauge level 2 heavy duty cold-rolled stretcher-leveled steel
Door and Transom Cores	Construction	Water-resistant honeycomb
	Minimum R	2.4
	Sound Transmission Class STC	32 when tested per ASTM E90
	Sound Transmission Class STC (Acoustically-Rated Doors)	40 when tested per ASTM E90
Louvers	Construction	Mold louvers integral with door plates
	Frame	18 gauge minimum
	Blades	22 gauge minimum Inverted "V" blade
	Insect Screen	Stainless Steel
Glazed Openings	Construction	Mold window openings integral with door plates. Provide mitered stops for glass of sizes shown
	Glass	Tempered Float Glass
		Double-Pane
		Clear
		Meet energy efficiency requirements of this section, Section 08 81 00 and California Energy Code Section 116
	Fire-Rated Doors	Meet UL requirements for specified rating.
Surface Preparation	After SSPC-SP6/NACE 3 Commercial blast cleaning, chemically treat doors to maximize paint adhesion.	
Hardware	Reinforce doors and frames and drill or tap for fully templated mortised hardware.	

K. The following product design criteria, options and accessories are required for exterior doors:

ITEM	DESCRIPTION	
Steel Doors – Exterior	Construction	Full flush
	Accessibility Requirements	On all swinging doors flush or non-flush, bottom 10" shall have smooth uninterrupted surface per CBC §1133B2.6 to allow door to be opened by wheelchair footrest without creating trap or hazardous condition.
	Design	Seamless face sheets with continuous fully welded seam edges Hollow metal construction with visible seams Internally reinforce door top and bottom with steel members welded in place.
	Door Thickness	1¾"
	Metal Thickness	16-gauge level 3 extra heavy duty cold-rolled stretcher-leveled steel
	Door Stiles	Door stiles shall be wide enough to accommodate heavy-duty mortise type locks.
Steel Doors – Exterior Outward Swinging	Construction	Full flush
	Accessibility Requirements	On all swinging doors flush or non-flush, bottom 10" shall have smooth uninterrupted surface per CBC Section 1133B2.6 to allow door to be opened by wheelchair footrest without creating trap or hazardous condition.
	Design	Seamless face sheets with continuous fully welded seam edges Hollow metal construction with visible seams Internally reinforce door top and bottom with steel members welded in place.
	Top Enclosure	Flush Water and Weather-tight
	Bottom Rail Drip	Provide 16-gauge galvanized steel bottom rail-drip flashing convex shape.
	Thickness	16-gauge cold-rolled stretcher-leveled steel
	Door Stiles	Door stiles shall be wide enough to accommodate heavy-duty mortise type locks.
Door and Transom Cores	Construction	Water-resistant honeycomb
	Minimum R	2.4
	Sound Transmission Class STC (Acoustically-Rated Doors)	48 when tested per ASTM E90 Glazed double doors need not exceed 44 Glazed single doors need not exceed 48 Unglazed double doors need not exceed 48
	Fire-Rated Doors	Solid or fiber mineral core doors as required to meet applicable Codes and Reference Standards
Louvers	Construction	Mold louvers integral with door plates
	Frame	18 gauge minimum
	Blades	22 gauge minimum Inverted "Y" blade"
	Insect Screen	Stainless Steel
Glazed Openings	Construction	Mold window openings integral with door plates. Provide mitered stops for glass of sizes shown
	Glass	Tempered Float Glass per Section 08 81 00
		Double-Pane
		Clear
		Meet energy efficiency requirements of this section, Section 08 81 00 and California Energy Code Section 116
	Fire-Rated Doors	Meet UL requirements.

ITEM	DESCRIPTION
Hardware	Reinforce doors and frames and drill or tap for fully templated mortised hardware.

L. Abbreviations on door schedules are as follows:

1. F Flush finish
2. L Louvered (top or bottom)
3. G Half Glass
4. GL Half Glass and Louvered

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install steel doors and frames before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Where practicable, place frames before constructing enclosing walls and ceilings. Brace frames during installation. Remove braces after wall construction.

C. Examine and properly prepare substrates on which frames will be installed before beginning work.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install steel doors and frames at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Energy Code Section 116 "Mandatory Requirements for Fenestration Products and Exterior Doors"

4. Applicable building, fire, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install steel doors and frames to tolerances recommended by Manufacturer. Unless otherwise shown, install steel doors and frames using precision gauges and levels. Finished metal frames shall be strong and rigid, neat in appearance, and square, plumb, true, level and free of defects, warp, or buckle.

F. Molded members, trims and stops shall be clean cut, straight and shall be of uniform profile throughout their lengths.

G. Corner joints shall have all contact edges tightly closed with all trim faces mitered, welded and finished smooth. Do not use gussets.

H. Install doors in accordance with SDI 100 except where otherwise shown.

I. Remove door finish hardware before painting. Reinstall after painting.

J. Prepare doors and frames to receive mortised and concealed finish hardware in accordance with templates from hardware supplier and ANSI A115.

K. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at jobsite.

L. Locate finish hardware as shown on submittals, or, if not shown, in accordance with "Recommended Locations for Builder's Hardware."

M. When installed in prepared openings in concrete and masonry, use sealant between frame and substrate.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Doors	Plumbness and Level	Maximum 1/16" diagonal distortion	Each door	Owner	Owner
	Door Clearances	+1/32"-3/32" but not to exceed limits specified in Manufacturer's installation instructions	Each door	Owner	Owner
	Warpage	3/16" maximum out of plane	Each door	Owner	Owner
	Operation	Doors shall operate freely but not loosely and shall be free from rattling while closed.	Each door	Owner	Owner
	Finish	No damage, flaws, mars or other defects detrimental to appearance.	Each door	Owner	Owner
	11-Month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of overhead doors.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 08 11 00: Metal Doors and Frames
H. Section 08 71 00: Door Hardware
I. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete operating overhead door including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building, fire, and electrical codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASTM A653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanneald) by the Hot Dip Process
B. ASTM E84 Surface Burning Characteristics of Building Materials
C. California Building Code (CBC)
D. California Electrical Code (CEC)
E. California Fire Code (CFC)
F. NFPA 71 National Electric Code

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per structural and architectural shop drawing requirements.
	Required for motorized door operators under electrically-controlled equipment shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements. Submit templates required for installing anchorage devices.
O & M Instructions	Required per operation and maintenance instruction requirements

SUBMITTAL	DESCRIPTION
Certificate of Compliance	Submit coating system and application certification per certificate of compliance requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions and O&M instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of overhead doors shall be strictly followed.

1.8 Unit Prices

A. Payment for the Work in this section shall be included as part of the lump-sum or unit-price bid amount for which such Work is appurtenant thereto.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Steel Motor-Operated Overhead Doors and Frames	Cookson "FMWI"	Phoenix, AZ
	North American (Kinnear)	Mississauga ON
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Rollup steel doors and frames shall be metal curtain design, weather and dust resistant and shall be shop-fabricated and shop-assembled per referenced standards, complete with slats, guides, hoods, reduction gears, galvanized hand chain, operating mechanism, brackets, gears, head, bottom and side weather-stripping, hardware and all other items necessary for complete and fully functional installation.

C. Provide custom shapes and sizes as defined. Reinforce doors for hardware where necessary. After fabrication, grind smooth and fill all tool marks and other surface imperfections.

D. Fire-rated doors and frames shall bear Underwriters Laboratory (UL) label showing certified rating of door. Steel doors and frames for fire-rated openings shall conform to Underwriter's Laboratories listing and shall be UL labeled. Designs and construction of such products shall have specific UL approval according to current procedures for fire rating (3-hour, 1½-hour, ¾-hour or 20 minute) as shown.

E. Provide temporary stiffeners, spacers and other accessories needed to facilitate handling and accurate erection.

F. Overhead coiling doors and frames shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION	
Door Curtain Slats	Commercial Grade Cold-Rolled Steel Galvanized Sheets	ASTM A653	
Door Curtain Core Material	Polyurethane Foam	ASTM E84	
		Flame Spread	25 (maximum)
		Fuel Contributed	5 (maximum)
		Smoke Developed	25 (maximum)
Base Coat	Rust-inhibitive Epoxy Primer	ASTM B117 - Pass 120-hour salt spray test ASTM D1735 – Pass 250-hour humidity test	
Hardware Reinforcement	Commercial Grade Cold-rolled Steel, Galvanized	ANSI A115	
Weather Seals	Vinyl or Neoprene		
Torsion Spring	Tempered Steel		
Hood	Galvanized Steel	24 gauge with bonderized treatment.	
Hood Baffle	Neoprene and Sheet Metal		

G. The following product design criteria, options and accessories are required for guides, stops, frames and accessories:

ITEM	DESCRIPTION	
Guides	Galvanized steel angle assembly (3/16" min thick) of proper size to retain curtain. Provide weather stripping on guides. Do not paint inside working area of guides.	
Guide Anchors	Bolt Size	⅜" minimum
	Maximum Spacing	30" on center
	Extend anchors jamb angles and anchors above door head to support coil brackets.	
Stops	Provide removable stops on guides to prevent curtain overtravel. Provide continuous bar for holding wind locks where required.	
Surface Preparation	After SSPC-SP6/NACE 3 Commercial blast cleaning, chemically treat doors to maximize paint adhesion.	

H. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Door Curtain Slats	Exterior Surface	20-gauge minimum
	Interior Surface	24-gauge minimum
	Height	Approximately 3"
	Core Filler Material	Polyurethane foam
	R Value	6.29 minimum
Operation	Chain Operated	
Design Wind Load	20 pounds per square foot	
Endlocks	Malleable iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets. Provide locks on alternate curtain slats for curtain alignment and lateral resistance.	
Bottom Bar	Two 1½"x1½"x⅛" (minimum) angles galvanized and bolted back to back on each side of curtain to match floor profile. Provide replaceable flexible vinyl or neoprene gasket as weather seal and cushion bumper.	
Surface Preparation	After SSPC-SP6/NACE 3 Commercial blast cleaning, chemically treat doors to maximize paint adhesion.	
Weather Seals	Door Head Seal	⅛" continuous strip secured to inside of curtain coil hood
	Door Jamb Strip	⅛" continuous strip secured to exterior side of jamb guide

ITEM	DESCRIPTION	
Hardware	Reinforce doors and frames and drill or tap for fully templated mortised hardware.	
Counterbalancing Mechanism	Spring	Steel helical torsion spring(s) mounted around steel shaft in spring barrel. Connect to door curtain with required barrel rings. Spring shall transfer full load to steel torsion bar in barrel. Spring shall be adjustable from outside barrel.
	Barrel Assembly	Steel pipe of sufficient diameter and thickness to support roll-up curtain without slat distortion Minimum diameter – 4” Maximum deflection of barrel - 0.03in//ft span
	Bearings	Self-lubricated graphite or grease-sealed ball bearings
	Brackets	5/16” thick cold-rolled steel plate or equal strength cast iron. Shall have bell-mouth guide groove for curtain. Attach to jamb guide with ½” bolts
Hood	Hood shall fit over end brackets. Roll and reinforce top and bottom edges of hood for stiffness. Provide intermediate supports as needed.	
Manual Operator	Design	Endless chain sprocket and reduction gearing to barrel
	Chain Pull	Maximum 35 lbf
	Sprockets and Gears	Machine cut or machine molded teeth.
	Bearings	Self-aligning and lubricated for life (graphite or grease-sealed precision ball bearings)
	Chain	Hot-dip galvanized continuous loop at side of door. Extend to 24” above floor. Provide chain and gear guards as needed to protect against malfunction or hazard.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install overhead doors before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install overhead doors at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer’s installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install overhead doors to tolerances recommended by manufacturer. Unless otherwise shown, install overhead doors true, plumb, and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Door	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	Operation	Shall open and close with less than 35-lb pull on chain.	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Repair damaged prime-painted zinc-coated surfaces and bare zinc-coated surfaces by spot-priming with a galvanized repair compound.

C. Provide services of factory authorized representative on-site to provide the following:

1. Installation assistance, inspection and startup of complete overhead door system.

2. Field testing and adjustment.

3. Instruction of Owner's personnel in operation and maintenance.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of door hardware.

B. Include all fabrication and mounting templates needed for fabricators and for control of application of metal items. Provide all trim, attachments, and fastenings shown or required for proper and complete installation.

C. Work of this section shall include all hardware not included in other sections, whether or not such hardware is specifically scheduled herein.

D. Coordinate hardware work with Work of other sections, Furnish hardware items of proper design for use on doors and frames of thickness, profile, swing, security, and similar requirements shown as needed for proper installation and function.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 08 11 00: Metal Doors and Frames
H. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete operating door hardware including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

B. Exit doors shall be operable at all times, from inside, without use of key or any special knowledge or effort.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Hardware shall be coordinated and designed for proper fit with frame and door size, thickness, profile, swing and security requirements for doors in which they are installed.

C. Manufacturer's requirements for actual size of door closers, brackets and holders shall be observed.

D. Finish hardware shall be neatly and properly installed in accordance with best practices as prescribed by Manufacturers.

E. All hardware items, including cylinders for locks and all fitting, adjusting and securing of each item neatly and firmly in place shall be in perfect working order. Any nonconforming works will be rejected.

F. No extra cost will be allowed because of changes or corrections needed to facilitate installation of any hardware. Contractor shall be responsible for proper fabrication of all Work or material to receive hardware.

G. Architectural Hardware Supplier shall examine Contract Documents and furnish proper hardware for all openings, whether listed or not. Any omissions in hardware groups, with regard to regular doors, shall be called to attention of Owner's Representative for instructions before placement of order.

H. All items of hardware shall be provided as required to complete Work in accordance with Contract Documents. Items of hardware not shown in Contract Documents or in Hardware Schedules shall be furnished at no additional cost where required to provide functional installation complying with applicable Codes and Standards. Contractor and Architectural Hardware Supplier shall be responsible for providing correct item of hardware for each specific application in which hardware item is required.

I. Hardware for fire rated openings shall comply with NFPA 80. Only such hardware shall be provided which has been tested and listed by UL for type and size of door required, and which complies with requirements for door and door frame labels. Latching hardware, door closers, ball bearing hinges, and seals shall be required whether listed in hardware schedule or not. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label indicating "Fire Door to be Equipped with Fire Exit Hardware," and provide UL label on exit device indicating "Fire Exit Hardware."

1.5 References

A. Americans with Disabilities Act (ADA)
B. BHMA Builders' Hardware Manufacturers Association Standards
C. BHMA/ANSI A156.1 Butts and Hinges
D. BHMA/ANSI A156.2 Bored and Preassembled Locks & Latches
E. BHMA/ANSI A156.3 Exit Devices
F. BHMA/ANSI A156.4 Door Controls-Closers
G. BHMA/ANSI A156.5 Auxiliary Locks and Associated Products
H. BHMA/ANSI A156.6 Architectural Door Trim
I. BHMA/ANSI A156.7 Template Hinge Dimensions
J. BHMA/ANSI A156.8 Door Controls
K. BHMA/ANSI A156.13 Mortise Locks
L. BHMA/ANSI A156.16 Auxiliary Hardware
M. BHMA/ANSI A156.17 Self-Closing Hinges and Pivots
N. BHMA/ANSI A156.18 Materials and Finishes
O. California Building Code (CBC)
P. California Code of Regulations - Title 24
Q. California Fire Code (CFC)
R. Door Hardware Institute (DHI) Architectural Scheduling Sequence and Format
S. Door Hardware Institute (DHI) Recommended Procedure for Processing Hardware Schedules and Templates
T. ICC/ANSI A117.1 Specifications for Making Buildings and Facilities Usable by Physically Handicapped People
U. MIL Spec R6130
V. MIL Spec R6855
W. NFPA 80 Fire Doors and Fire Windows

X. NFPA 101 Life Safety Code
Y. NFPA 105 Smoke and Draft Control Door Assemblies
Z. NFPA 252 Fire Tests of Door Assemblies
AA. UL 10B Fire Tests of Door Assemblies as amended to incorporate positive pressure testing
BB. UL 305 Panic Hardware
CC. UL 437 Key Locks
DD. Underwriters Laboratories, Inc, (UL) Requirements and Approvals

1.6 Submittals

A. Submittals shall comply with Door Hardware Institute (DHI) Recommended Procedure for Processing Hardware Schedules and Templates.
B.
C. Schedule shall show each item provided in accordance with Door Hardware Institute (DHI) Architectural Scheduling Sequence and Format, and shall show:

D. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Hardware Schedule	Submit complete detailed hardware list and schedule before ordering hardware. Organize schedule into "Hardware Sets" with index of doors and heading indicating complete designations of every item required for each door or opening. Follow DHI Architectural Hardware Scheduling Sequence and Format. Include for each hardware item all items listed below:
	Type, style, function, size, quantity & finish.
	Name, part number, and Manufacturer.
	Fasteners and other pertinent information needed for securing and installing.
	Locations of hardware items cross-referenced to floor plan and door schedule.
	Explanations of all abbreviations, codes and symbols used in schedule.
	Indication of specific locations and mounting heights
	Indications of door and frame sizes and materials
	Listing of all Manufacturers used with nearest representative and name, address and telephone number.
	Indications of door and frame sizes and materials
	Listing of all Manufacturers used with nearest representative and name, address and telephone number.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Parts list and maintenance instructions required per operation and maintenance instruction requirements.
Material Samples	Submit representative samples in correct finish and color of each visible hardware component.
Templates	Submit hardware templates to each fabricator of doors. frames and other work where factory preparation or installation is required for proper installation of hardware.
Warranty	Furnish the following warranties: Closers, except electronic closers – 3 years Mortise Locks – 3 years Exit Devices – 3 years All other items one-year warranty from date of final acceptance

E. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, O&M instructions, and material samples.

F. Where exact types of hardware specified are not adaptable to finished geometry of members requiring hardware, Architectural Hardware Supplier shall advise Contractor and Owner's Representative in writing, as part of submittal process. Suggestions may be offered at that time for suitable alternatives equivalent in function, operation and quality to those specified.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Do not order or ship any hardware until complete hardware submittal has been reviewed and accepted by Owner's Representative.

C. Architectural Hardware Supplier shall furnish to Contractor with delivery of hardware a complete list of hardware clearly marked to match marking on each package with hardware schedule.

D. Each set of finished hardware shall be individually packaged, complete with proper fastening screws, bolts, keys, installation template, instructions and appurtenances. Clearly mark package on outside to show contents, item numbers and names corresponding to those listed on hardware schedule.

E. Check all hardware on delivery with aid of representative from Architectural Hardware Supplier. Contractor shall be responsible for proper storage of all hardware until ready for installation.

F. Contractor shall verify that standard ANSI cutouts are provided in metal frames.

G. Small items that would not require specific location identification such as door stops, coat and hat hooks and door silencers may be quantity packed if properly labeled with item numbers and other identification.

H. Manufacturer's instruction and warranty requirements for delivery, storage and handling of door hardware shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Astragals on Double-Doors	Pemko	Ventura, CA
	Accepted equal	
Cylinders	Best Access Systems	Indianapolis, IN
	Accepted equal	
Door Closers	DORMA Group North America. #8900	Reamstown, PA
	Hager Companies 5100 Series	Ventura, CA
	LCN Closers	Princeton, IL
	Norton Industries #7500	Cleveland, OH
	Sargent Manufacturing Co. #1430	New Haven, CT
	Accepted equal	
Door Holders	Corbin Russwin Architectural Hardware 840 Series	Berlin CT
	FS Type 1164	
	Glynn-Johnson, Div Ingersoll Rand GJ 320 Series	Indianapolis, IN
	Hager Companies 5100 Series	St Louis, MO

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Door Holders (cont.)	Ives	
	Rockwood	
	Accepted equal	
Door Seals	Pemko	Ventura, CA
	Reese	
	Zero	
	Accepted equal	
Door Stops	Builders Brass Works (part #'s shown below) F-823X Floor stop w/holder F-8061X Floor stop dome W-141X Wall stop w/holder expansion bolts W140 Wall stop w/holder FH weather stripping W9X Wall dome stop w/ expansion bolts W9T Wall dome stop w/toggle bolts W145X Wall stop/base/expansion bolts W145 Wall stop/base	Los Angeles, CA
	Hager Companies	St Louis, MO
	Ives	
	Quality Manufacturing (part #'s shown below) 139 Floor stop w/holder 431ES Floor stop dome 136 Wall stop w/holder expansion bolts 36 Wall stop w/holder FH weather stripping W307S Wall dome stop w/ expansion bolts 307TB Wall dome stop w/toggle bolts 138 Wall stop/base/expansion bolts 38 Wall stop/base	
	Rockwood	
	Accepted equal	
Drip Cap	National Guard	
	Accepted equal	
Hinges	Bommer	
	Hager Companies	St Louis, MO
	Ives	
	McKinley Iron Works, Inc.	Fort Worth, TX
	Stanley Hardware	New Britain, CT
	Accepted equal	
Key Cabinets	Lund	
	TelKee	
	Accepted equal	
Kickplates	Builders Brass Works #37	Los Angeles, CA
	Hager Companies	St Louis, MO
	Ives	
	Quality Manufacturing #48	
	Rockwood	
	Accepted equal	
Locksets	Folger Adam Security, Inc.	Lemont, IL
	Hager Companies	St Louis, MO
	Schlage Lock Company Div Ingersoll Rand D Series	Colorado Springs, CO
	Schlage Lock Company Div Ingersoll Rand C Series in Corrosive or Marine Environments)	Colorado Springs, CO
	Accepted equal	
Mullion	Hager Companies 4500 Series	St Louis, MO
	Accepted equal	
Panic Exit Devices	DORMA Group North America	Reamstown, PA
	Hager Companies 4500 Series	St Louis, MO
Panic Exit Devices	Precision Hardware, Inc. Apex	Romulus, Inc.

ITEM	MANUFACTURER	MANUFACTURER LOCATION
(cont.)	Von Duprin 98	Indianapolis, IN
	Accepted equal	
Passage Sets (Interior)	Baldwin	
	Hager Companies	St Louis, MO
	Schlage Lock Company Div Ingersoll Rand	Colorado Springs, CO
	Accepted equal	
Pivots	Glynn-Johnson, Div Ingersoll Rand	Indianapolis IN
	Accepted equal	
Pulls	Builders Brass Works #5034	Los Angeles, CA
	Quality Manufacturing #402	
	Accepted equal	
Push Plates	Builders Brass Works #47	Los Angeles, CA
	Quality Manufacturing #40	
	Rockwood Manufacturing Co. #70	Rockwood, PA
	Accepted equal	
Rapid Entry System for Fire Department Access	Knox Company Knoxbox Series 3200 with recessed mounting kit	Phoenix, AZ
	Accepted equal	
Silencers	Glynn-Johnson Div Ingersoll Rand (part #'s shown below) 64 Wood Frames 65 Metal Frames	Indianapolis, IN
	Hager Companies (part #'s shown below) 307D Wood Frames 308D Metal Frames	St Louis, MO
	Ives	
	Rockwood	
	Accepted equal	
Thresholds	Ceco Corporation	Oakbrook Terrace, IL
	Hager Companies	St Louis, MO
	Pemko	Ventura, CA
	Reese	
	Zero	
	Accepted equal	
Weatherstripping and Seals	Hager Companies	St Louis, MO
	National Guard Products, Inc. #TM181	Memphis TN
	Pemko S88D	Ventura, CA
	Accepted equal	

B. Each type of hardware (latch and locksets, cylinders, exit devices, hinges, closers, etc.) shall be obtained from only one Manufacturer even though several may be shown as offering products which meet specifications.

C. Catalog numbers referred to in Contract Documents for door hardware items are taken from catalogs of listed Manufacturers. They are used only to establish quality and type of hardware to be used. Hardware equal in quality and utility will be considered, provided it is judged by Owner's Representative to conform in operation, quality, weight, size, workmanship and finish to products described in Contract Documents.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Door hardware for Hardware Set HW-E1 (for single exterior doors) shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Top Pivots	Bronze	Offset type
Intermediate Pivots	Bronze	Offset type
Bottom Pivots	Bronze	Offset type
Hinges	Stainless Steel	Type 630 (US32D) Satin finish Nonremovable pin with stainless steel
Pull Plate	Brushed Stainless Steel	
Panic Bar Device	Stainless Steel	See below
Lockset	Stainless Steel	Type 630 (US32D) Satin finish
Deadbolt lock	Stainless Steel	Type 630 (US32D) Satin finish
Head Mounted Closer		Concealed 110 degree with hold open feature
Dome Floor Stop	Stainless Steel	Type 630 (US32D) Satin finish
Threshold	Brushed stainless steel	By Door Manufacturer
Frame Head Drip	Stainless Steel	By Door Manufacturer
Door Bottoms	Stainless Steel	By Door Manufacturer
Weather Stripping Head and Jambs)	Pile	By door manufacturer
Acoustical Seals, Head & Jambs	Neoprene	MIL Spec R6855 CL III Grade 40
	Sponge Neoprene	MIL Spec R6130 Type II Group C
	Polyurethane	By Door Manufacturer
Acoustical Sill		By Door Manufacturer
Kick Plates (pair)	Brushed Stainless Steel	Mount on inside

C. Door hardware for Hardware Set HW-I1 (for single interior doors) shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Hinges	Stainless Steel	Type 630 (US32D) Satin finish Nonremovable pin with stainless steel
Passage Set	Stainless Steel	Type 630 (US32D) Satin finish
Threshold	Brushed stainless steel	By Door Manufacturer
Acoustical Seals, Head & Jambs	Neoprene	MIL Spec R6855 CL III Grade 40
	Sponge Neoprene	MIL Spec R6130 Type II Group C
	Polyurethane	By Door Manufacturer
Acoustical Sill		By Door Manufacturer

D. Door hardware for Hardware Set HW-E2 (for double exterior doors) shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Hinges	Stainless Steel	Type 630 (US32D) Satin finish Nonremovable pin with stainless steel
Pull Plate	Brushed Stainless Steel	
Active Leaf Panic Bar Device	Stainless Steel	See below
Active Leaf Lockset	Stainless Steel	Type 630 (US32D) Satin finish
Deadbolt lock	Stainless Steel	Type 630 (US32D) Satin finish
Dead Leaf Manual Flush Bolts	Stainless Steel	Type 630 (US32D) Satin finish
Surface Closers (2)	Stainless Steel	Type 630 (US32D) Satin finish 110 degree with hold open feature
Floor Stops with Holders	Stainless Steel	Type 630 (US32D) Satin finish
Threshold	Brushed stainless steel	By Door Manufacturer
Frame Head Drip	Stainless Steel	By Door Manufacturer
Door Bottoms	Stainless Steel	By Door Manufacturer
Weather Stripping Head and Jambs)	Pile	By Door Manufacturer
Acoustical Astragal		By door manufacturer
Acoustical Seals, Head &	Neoprene	MIL Spec R6855 CL III Grade 40

ITEM	MATERIAL	SPECIFICATION
Jambs	Sponge Neoprene	MIL Spec R6130 Type II Group C
	Polyurethane	By Door Manufacturer
Acoustical Sill		By Door Manufacturer
Kick Plates (2 ea leaf)	Brushed Stainless Steel	Mount on inside

E. Door hardware for Hardware Set HW-E3 (for single exterior doors with panic hardware) shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Top Pivots	Bronze	Offset type
Intermediate Pivots	Bronze	Offset type
Bottom Pivots	Bronze	Offset type
Lockset	Stainless Steel	Type 630 (US32D) Satin finish
Deadbolt Lock	Bronze 313	Activated to open by panic hardware
Head Mounted Closer		Concealed 110 degree with hold open feature
Threshold	Brushed stainless steel	By Door Manufacturer
Weather Stripping	Pile	By Door Manufacturer
Acoustical Seals, Head & Jambs	Neoprene	MIL Spec R6855 CL III Grade 40
	Sponge Neoprene	MIL Spec R6130 Type II Group C
	Polyurethane	By Door Manufacturer
Acoustical Sill		By Door Manufacturer

F. Panic exit devices shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Exterior Material	Stainless steel	Type 630 (US32D) Satin finish
Interior Material	Dropforged bronze	
Backplate	Stainless steel or bronze	
Fasteners, Screws, Pins	Stainless steel	Type 630 (US32D) Satin finish
Lever Arm	Stainless steel	Type 630 (US32D) Satin finish
Latch Bolt	Stainless steel	Type 630 (US32D) Satin finish
Tailpiece	Cadmium-plated steel	
Latch Bolt Retractor and Axle	Stainless steel	Type 630 (US32D) Satin finish
Compression Springs	Stainless steel	
Cylinder Cam and Lever Arm Operating Stand	Stainless steel	Type 630 (US32D) Satin finish

G. The following product design criteria, options and accessories are required for latchsets:

ITEM	DESCRIPTION
Door Operator	Lever-Type per CBC 1133B.2.5.2 on both sides

H. The following product design criteria, options and accessories are required for passage sets:

ITEM	DESCRIPTION
Door Operator	Lever-Type per CBC 1133B.2.5.2 on both sides

I. The following product design criteria, options and accessories are required for locksets:

ITEM	DESCRIPTION
Cylinders	Best, 7 pin, replaceable interchangeable core. All 7 pins shall be operational. Furnish and install temporary construction cores for security purposes. Temporary cores shall be keyed alike and interchangeable with Best cores. Furnish permanent cores to Owner's lockshop for final installation.
Keys	Provide Owner with copies of control key and operating key upon project completion. Keys and cores shall have visual key control. Keys shall be stamped "NO NOT DUPLICATE"

ITEM	DESCRIPTION	
Locksets on Exterior Doors	Meeting UL 437 and ANSI 156.3 requirements and approved by Federal Bureau of Prisons Locks require separate springs internal to lock case. Lever return springs shall operate interior and exterior hubs independently No springs shall extend outside of door or under escutcheon or rose. Hubs shall have roller bearing assembly Do not use cylindrical locksets.	
	Strikes	16 gauge curved lip stroke, stainless steel with 1" minimum depth metal strike box. Strike lips shall be of sufficient width to clear trim and protect clothing
	Locks	¾" minimum throw
	Deadbolts	Stainless steel with 1" minimum throw without internal riveted actuator. When deadbolt is extended by 1", at least 2" shall remain in lockcase.
	Levers	Solid cast Do not use hollow levers Provide approved fusible links at levers for labeled doors.
	Locks	Shall have replaceable shear lug which disables lever when broken. Do not use clutch mechanisms
	Finish	626 (26D) finish. Do not use bright chrome or painted finish
Locksets on Interior Doors	Mortise type Locks require separate springs internal to lock case. Lever return springs shall operate interior and exterior hubs independently No springs shall extend outside of door or under escutcheon or rose. Hubs shall have roller bearing assembly	
	Strikes	16-gauge curved lip stroke, stainless steel with 1" minimum depth metal strike box. Strike lips shall be of sufficient width to clear trim and protect clothing
	Locks	¾" minimum throw
	Deadbolts	Stainless steel with 1" minimum throw without internal riveted actuator. When deadbolt is extended by 1", at least 2" shall remain in lockcase.
	Levers	Solid cast Do not use hollow levers Provide approved fusible links at levers for labeled doors.
	Locks	Shall have replaceable shear lug which disables lever when broken. Do not use clutch mechanisms
	Finish	626 (26D) finish. Do not use bright chrome or painted finish
Padlocks	Heavy duty type Keyed as shown above using same Manufacturer as locksets	

J. All locks and cylinders will be permanently keyed by Owner.

K. The following product design criteria, options ad accessories are required for rapid entrance systems for fire department access

ITEM	DESCRIPTION	
Rapid Entrance Systems	Door	Hinged
	Recessed Mounting Kit	Required for boxes mounted on concrete or masonry

L. The following product design criteria, options and accessories are required for hinges:

ITEM	DESCRIPTION	
Hinges	Hinge Style	Regular weight ball bearing hinges conforming to BHMA No.A2112 or A5112 or Heavy weight ball bearing hinges conforming to BHMA No A2111 or A 5112. Hinge Manufacturers design options such as 3-knuckle hinges and concealed ball bearing hinges are acceptable. Provide flush bearings.
	Pins	Steel Pins on exposed exterior door hinges shall have security studs and nonremoveable pins (NRP)
	Quantity	3 hinges on doors up through 7' 6" 4 hinges on doors from 7'-7" through 10' 4 hinges on each leaf of double doors
	Open Widths	minimum, but of sufficient size to permit door to swing 180 degrees
Hinge Sizes	**Door Width**	**Hinge Size**
	30" and under	4½" high - regular weight
	31"-39" interior	4½" high - regular weight
	31"-39" exterior	4½" high - heavy weight
	40"-41" interior	4½" high - regular weight 4 ball bearing
	40"-41" exterior	4½" high - heavy weight 4 ball bearing
	42" and up	4½" high – extra heavy weight 4 ball bearing

M. The following product design criteria, options and accessories are required for surface door closers:

ITEM	DESCRIPTION	
Closers	Back-Check Regulating Screws	Include separate screws for closing & latching speeds
	Maximum Required Force to Open Door	8 lbs
	Floor Transom Offset Brackets	Use where parallel closers are listed for doors with fixed panels over. Provide soffit shoes where corner brackets or regular arm closers are not used and where they are necessary for proper function of hardware
	Drop Brackets	Required at narrow head rails
	Labeled Doors	Provide self closers
	Hold-Open Mount	Not Required
	Color and Finish	Spray paint to match door color
	Coordinate door closers and hold open devices to ensure arms, fasteners and other components function properly and without interference.	
Closer Sizes	**Door Type**	**Size**
	Exterior	Size 2 through 6
	Interior Nonrated	Size 1 through 4

N. The following product design criteria, options and accessories are required for door holders:

ITEM	DESCRIPTION	
Door Holders	Type	Concealed
	Operation	90 degrees unless 180 degree opening is shown. Allow for checkmating
	Location	Provide overhead stops if wall-types stops can't be used and floor stops create tripping hazard.
	Finish	Chrome plated bronze - US26D unless otherwise shown

O. The following product design criteria, options and accessories are required for doorstops:

ITEM	DESCRIPTION	
Doorstops	Type	See hardware schedule
	Anchors to concrete and masonry	Machine screws and anchors
	Material	Use aluminum, chrome and stainless steel finish Use brass for other finishes

P. The following product design criteria, options and accessories are required for push plates kick plates and pulls:

ITEM	DESCRIPTION	
Push plates	Size	4"x16"x0.050" thick
	Anchors to concrete and masonry	Machine screws and anchors
Kick plates	Size	10"x(door width -2")x0.050" thick
Pulls	Thru bolted	

Q. The following product design criteria, options and accessories are required for seals:

ITEM	DESCRIPTION	
Seals	Finish	Match adjacent frame color
Pulls	Thru bolted	

R. The following product design criteria, options and accessories are required for silencers:

ITEM	DESCRIPTION	
Silencers	Location	Interior hollow metal frames except where sound or light seals occur
	Quantity	3 for single doors, 4 for pairs of doors

S. The following product design criteria, options and accessories are required for exit devices:

ITEM	DESCRIPTION	
Panic Exit Devices	UL Listing	UL 305 listed for panic hardware
	Design	Outside trim, inside trim and crossbar shall match
	Crossbars	Side-mounted
	Cylinder	Retained in case by threaded bronze ring
	Lever arm	Stainless steel, investment-cast cases
	Tailpiece	3/8" min
	UL Label	Required

T. The following product design criteria, options and accessories are required for fasteners:

ITEM	DESCRIPTION	
Fasteners	Finish and material	Match adjacent hardware
	Screws at exposed conditions	Phillips head
	Screws for metal doors and frames	Machine screws

U. The following product design criteria, options and accessories are required for thresholds:

ITEM	DESCRIPTION	
Thresholds	Maximum rise at entryway	½" per CBC 1008.1.6. For raised threshold greater than ¼" at doorway, bevel threshold at slop0e not greater than 1 unit vertical to 2 units horizontal per CBC 1008.1.6.
	Return miters	Required at thresholds on floor closers

V. The following product design criteria, options and accessories are required for weatherstripping:

ITEM	DESCRIPTION	
Weatherstripping	Location	Install on head, jamb and astragals
	Weatherstripping on exterior doors	5/16" x 5/8" closed cell neoprene
	Weatherstripping on interior doors	Self-adhesive bubble configuration door seal
	Design for smoke, air, sound and weather infiltration	
	Fire rating	Fire tested and labeled as gasketing for use on steel frames with wood or steel doors for 20 minutes with C-label, 1 hour B label and 1½-hour B-label doors.

W. Finishes of various hardware items shall coordinate in both texture and color and shall be as consistent as possible both for purpose of appearance and to prevent galvanic corrosion from dissimilar metals. Aluminum items shall be finished to match predominant adjacent material. Colors of nonmetallic items, such as seals, shall coordinate with frame color.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install door hardware before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Prepare metal frames to receive hardware using templates or actual hardware items.

C. Reinforcing required to install hardware in metal jambs shall be furnished by jamb Manufacturer, coordinated with hardware Manufacturer and interfaced with such devices as magnetic door hold-opens to be interfaced with fire-alarm system.

D. Hardware required at or near painted surfaces shall be fitted before paining, dismantled before painting Work, and reinstalled after finish painting Work is completed.

E. Coordinate any requirements for mechanical and electrical devices in connection with hardware items interfacing with such devices.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install door hardware at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Building Code Chapter 11 "Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Publicly Funded Housing"

4. Applicable building, fire and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Installation shall conform to applicable codes and ordinances of local authorities having jurisdiction.

F. Do not install surface mounted items until finishes have been completed on substrate.

G. Provide all necessary screws, bolts, nuts, expansion shields, shim plates, anchors and other fasteners of suitable types and sizes recommended by Manufacturer as required to securely withstand hard usage over long life. Screws in gypsum board shall extend through gypsum board and connect solidly with backing. Fasteners shall match hardware material in finish and material.

H. Coordinate hardware provided such as expansion bolts, sex bolts, toggle bolts and other approved anchorages with each setting condition on job.

I. Door hardware shall be furnished and installed by Contractor at location shown on Plans and Submittals.

J. Install door hardware to tolerances recommended by Manufacturer. Unless otherwise shown, install door hardware true and level using precision gauges and levels. Adjust and reinforce attachment substrate as needed for proper installation and operation.

K. Mounting positions shall be as follows:

ITEM	MOUNTING LOCATION
Top Hinge	5" from door top to top of hinge
Bottom Hinge	10" from door bottom to bottom of hinge
Intermediate Hinges	Equally spaced between top and bottom hinges and from each other
Hinge Mortise on Door Leaf	¼ to 5/16" from stop side of door
Lock	38" from finished floor to center of lever or knob
Push Bar	45" from bottom of door to center of bar
Push Plate	48" from bottom of door to center of plate
Pull Plate	42" from bottom of door to center of pull
Panic Bar	39-13/16" from finished floor to center of pad
Dead Bolt	Not more than 72" from floor to operating knob or lever
Door Stops Mounted on Doors	Mount near floor so as to strike base, but not to rub carpet or flooring
Deadlock Strike	44" from floor, centered

L. Except at exterior doors, do not mount closers on corridor or vestibule side of door.

M. Install latches and bolts to automatically engage in keepers, whether activated by closers or by manual push. In no case shall additional manual pressure be required to engage latch or bolt in keepers.

N. Carefully adjust closers and hinges to ensure doors operate noiselessly and evenly. Install hinges so as not to bind. Closers, closer arms and hold-open arms shall be attached with sex bolts.

O. Provide all doors with weather-stripping or seals unless silencers, product weather stripping or other special seals are indicated. Whenever 2 types of seals are shown on Hardware Schedule for a given door, both shall be provided.

P. Protect all finish hardware from damage during construction, painting and cleanup. Provide strippable coating of removable tape protection or other approved means to prevent any damage or staining of hardware during construction. Remove such protective measures before final cleaning.

Q. Thoroughly polish and clean all hardware before turning building over to Owner.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Hardware	Inspection by Architectural Hardware Supplier	Manufacturer's factory-authorized representative to certify to Owner's Rep installation complies with Manufacturer's installation instructions and warranty requirements	Each hardware set	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. After hardware is installed and after air supply has been turned on, a factory authorized representative of Architectural Hardware Supplier shall inspect and operate each hardware installation and each door to verify proper installation and operation of all hardware and locks. Make all adjustments recommended by Architectural Hardware Supplier. Remove and reinstall any hardware improperly installed. Closers and other hardware features requiring adjustment shall be adjusted by Manufacturer's factory-authorized representative.

C. Furnish all necessary wrenches and tools required for proper adjustment and maintenance of hardware.

D. Architectural Hardware Supplier shall include in their guarantee a statement this inspection has been accomplished.

END OF SECTION

SECTION 08 91 19
FIXED LOUVERS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of stationary louvers.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 07 62 00: Sheet Metal Flashing and Trim
H. Section 07 92 00: Joint Sealants
I. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete stationary louver including appurtenant mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Stationary Louvers	Airflow Performance Rating	AMCA Certified Ratings Seal based on AMCA 511	1 each louver type	Contractor	Contractor
	Water Penetration Ratiings	AMCA Certified Ratings Seal based on AMCA 511	1 each louver type	Contractor	Contractor

1.5 References

A. AA - Designation System for Aluminum Finishes
B. AAMA 605.2 - High Performance Organic Coatings on Architectural Extrusions and Panels
C. AMCA 500 - Test Methods for Louvers, Dampers and Shutters
D. AMCA 511 - Certified Ratings Program for Air Control Devices
E. ASTM B221 – Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes
F. ASTM E90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per structural and architectural shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
Material Samples	Submit sample of louver to show frame, blades, insulation, bird screen, accessories, finish, and color
Warranty	Furnish one-year warranty from date of final acceptance.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of stationary louvers shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Stationary Louvers	Airolite Company	
	Industrial Acoustic Company	Bronx, NY
	Industrial Louvers, Inc	
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Stationary louvers shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Louver Frame	Aluminum	ASTM B221 alloy 6063-T5 16 gauge (0.0598 in) minimum casing
Blades	Aluminum	ASTM B221 alloy 6063-T5 16 gauge (0.0598 in) minimum thickness
Anchors, Fasteners, Reinforcing	Stainless Steel	
Extended Sills	Aluminum	ASTM B221 alloy 6063-T5 Minimum nominal wall thickness 0.060"
Mullions		Manufacturer's standard horizontal or vertical for architectural accent as shown on Drawings
Finish		Anodized Coating
Bird Screen	Galvanized Steel	16-gauge ½" mesh
Security Bars	Not Required	

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Stationary Louvers	Blade Angle	37½ degrees
	Blade Style	Sightproof Inverted V style
	Louver Size	See plans
	Minimum Face Area	50% (2.0 sf)
	Maximum Pressure Drop	0.10 in wg @ 850 fpm
	Water Penetration	Zero @ 850 fpm
	Sound Attenuation Free Field Noise Reduction (minimum across field)	STC-13 per ASTM E90
	Thickness	4"
	Wind Load	Design mountings to withstand 25 psf

PART 3 - EXECUTION

3.1 Preparation

A. Inspect areas to receive louvers. Notify Owner's Representative of conditions that might adversely affect installation or subsequent use of louvers.

B. Do not proceed with installation until unsatisfactory conditions are corrected.

C. Make field measurements needed to install stationary louvers before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install stationary louvers at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building and fire code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install stationary louvers to tolerances recommended by Manufacturer. Unless otherwise shown, install stationary louvers true and plumb using precision gauges and levels.

F. Install joint sealants as specified in Section 07 92 00.

G. Install 0.04 inch aluminum flashing at sill to match louver. See Section 07 62 00.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Louver	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING
IN SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

PART 1 - GENERAL

1.1 Work Included

A. Requirements for preparation of surfaces and subsequent application of protective coatings. Furnish all labor, materials and equipment required for satisfactory completion of all Work described herein.

B. Requirements for waterproofing of buried concrete surfaces are specified in Section 07 13 00.

C. Requirements for fusion-bonded epoxy systems are specified in Section 09 96 56.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 74 00: Cleaning and Waste Management
H. Section 07 13 00: Sheet Waterproofing
I. Section 09 96 56: Fusion-Bonded Epoxy Linings and Coatings
J. Section 33 11 19: Mastic and Tape-Wrap Systems for Ferrous Pipe

1.3 System Description

A. Furnish and install complete functional coating system for specified surface in compliance with applicable local air quality management regulations and NSF requirements for use with potable water where applicable. Comply with Manufacturer’s application requirements and applicable codes and standards.

B. The term dry film thickness or DFT shall refer to thickness of fully cured coat of paint measured in mils (1/1000”)

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Offsite Surface Preparation and Priming for Prefabricated Steel Structures	Offsite Inspection of Priming Operation	Applicable standards	As directed	Contractor to pay travel expenses for Inspector hired by Owner	Contractor to pay travel expenses and Inspection costs for Inspector hired by Owner
Paint from Proposed "equals"	Spectrographic and Durability Tests	Applicable ASTM standards	As directed	Contractor	Contractor
Valve, Pump, Hydrant, Meter and Pipeline Appurtenance Interiors and Exteriors	Holidays	Certify as holiday free using low voltage (22.5-80V with approximately 80,000 ohm resistance) holiday detector and sponge saturated with 0.5% sodium chloride solution	Each lined item	Contractor	Contractor
	Lining Thickness	Verify thickness with magnetic-type dry film thickness gauge.	Each lined item	Contractor	Contractor

C. All surface preparation and priming operations accomplished offsite for prefabricated structural members will be monitored 100% by an Owner-appointed quality control inspector at Owner's option. All additional costs incurred by offsite inspection shall be borne by Contractor. These include but are not limited to travel, lodging, food, auto rental (where applicable) and any other expenses directly related to offsite inspection.

D. Contractor shall provide with his bid a schedule of shop activities including hours of work per day, days of work per week and total hours required for performance of all shop cleaning and priming operations. Contractor shall notify Owner's Representative at least 7 days in advance of shop cleaning and priming operations.

E. If shop work is not scheduled on consecutive basis to facilitate scheduling of an offsite inspector, expenses incurred by multiple trips to shop will be borne by Contractor.

F. Failure by Owner to exercise option for shop inspection shall in no way relieve Contractor of his duty to meet Contract requirements.

1.5 References

A. ANSI/NSF 61 Drinking Water System Components – Health Effects
B. ASTM D16 Terminology Relating to Paint, Varnish, Lacquer and Related Products
C. ASTM D449 Asphalt Used in Dampproofing and Waterproofing
D. ASTM D6386 Surface Preparation of Galvanized Surfaces
E. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
F. California Green Building Standards Code (CALGreen Code)
G. SSPC PA1 Shop, Field and Maintenance Painting
H. SSPC PA2 Measurement of Dry Paint Thickness with Magnetic Gauges
I. SSPC SP1 Solvent Cleaning
J. SSPC SP2 Hand Tool Cleaning
K. SSPC SP3 Power Tool Cleaning

L. SSPC SP5/NACE 1 White Metal Blast Cleaning
M. SSPC SP6/NACE 3 Commercial Blast Cleaning
N. SSPC SP7 Brush-off Blast Cleaning
O. SSPC SP10/NACE 2 Near White Blast Cleaning
P. SSPC SP11 Power Tool Cleaning to Bare Metal
Q. SSPC SP13/NACE 6 Surface Preparation of Concrete
R. SSPC SP15 Commercial-Grade Power Tool Cleaning
S. SSPC Vis1 Pictorial Surface Preparation Standards for Painting Steel Surfaces
T. SSPWC Standard Specifications for Public Works Construction (Greenbook)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Submit product data sheets per catalog data requirements.
Application Instructions	Required for each paint and coating per application instruction requirements. Include 1. Surface Preparation Requirements. 2. MSDS sheets identifying flammability, toxicity, allergenic properties and any other characteristics requiring field precautions. 3. Safety practices 4. Minimum and maximum recommended dry-film thicknesses per coat for prime, intermediate, and finish coats. 5. Percent solids by volume. 6. Recommended thinners. 7. Statement verifying selected prime coat is recommended by Manufacturer for use with selected intermediate and finish coats. 8. Recommended application, equipment, humidity, and temperature limitations. 9. Curing requirements and instructions.
O & M & Cleaning Instructions	Required per operation and maintenance Instruction requirements.
Certificate of Compliance	1. Submit certification that all coatings conform to applicable local Air Quality Management District rules and regulations for products and application 2. Submit coating system and application certification that coatings comply with specified requirements and are suitable for intended application per certificate of compliance requirements.
Material and Color Samples	Required. Submit current Manufacturer's color samples showing full range of available standard colors. Owner will select colors.
Applicator's Quality Assurance	Submit list of at least 5 completed projects of similar size and complexity. Include product name and location, name of owner, name of contractor, name of engineer, name of coating Manufacturer, approximate area of coatings applied and date of completion
Inspection Reports	Submit written third-party report from approved testing agency describing inspections made and actions taken to correct nonconforming work. Report nonconforming work not corrected.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, application instructions, O&M instructions, certificates of compliance, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Labels on all coating system containers shall clearly show

1. Coating or material name
2. Manufacturer
3. Color name and number
4. Batch or lot number
5. Date of manufacture
6. Storage life
7. Mixing and thinning instructions

C. Deliver materials to Project Site in their original, unopened containers bearing label information shown above.

D. All paint and coating materials used on job shall be stored in one place designated by Owner's Representative.

E. Manufacturer's instruction and warranty requirements for delivery, storage and handling of painting and coating systems shall be strictly followed. Store materials in clean dry area within temperature range stipulated by Manufacturer.

F. Keep containers sealed until ready for use.

G. Do not open or use painting and coating system materials until Owner's Representative has inspected containers and has obtained necessary data from information shown on containers and labels.

H. Do not use materials beyond Manufacturer's shelf life limits.

I. Do not use mixed materials beyond pot life limits.

J. Do not apply new coatings to surfaces beyond Manufacturer's specified recoat limits.

K. Protect materials from damage or contamination. Keep containers closed when not in use.

L. Delivery, storage and handling of shop-primed steel shall adhere to the following procedures and practices:

1. Upon completing blasting and priming, primer on steel shall be cured sufficiently to minimize damage during handling.
2. When transporting structural steel, use spacers and other protection to eliminate scuffing of primer during unloading. If wood spacers are used, no splinters or wood particles shall remain in primed surfaces after separation.
3. To prevent road salts, fuel residue and other contaminants from being deposited on primed surfaces during transit, shop primed steel shall be covered 100%.
4. Bind loaded steel with padded chains or ribbon binders to minimize damage to paint and coatings during shipment.

5. Exercise care to prevent abrasion damage during loading, unloading, storage and erection. Sliding of steel across another plate or member will not be permitted except to fit sheets into position during roof fabrication.

6. Do not store shop-primed steel on ground or on top of other steelwork unless ground or steelwork is covered with approved covering. Steel may be elevated above ground level or other steel members using approved spacers.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. All materials shall be those of current manufacture and shall meet all applicable regulations for application and intended service. All materials shall meet all applicable Federal, state and local regulations, including Air Quality Management District Regulations. All coats of any particular coating system shall come from same Manufacturer and shall be approved by Manufacturer for intended service. Should product specified herein no longer be manufactured or not meet current regulations, Contractor shall substitute currently manufactured product of at least equal performance meeting all applicable regulations subject to Owner's Representative's approval, at no additional cost.

B. Materials specified are those that have been evaluated for the specific service. Listed products establish a standard of quality. Standard products of Manufacturers other than those listed will be accepted when it is proved to satisfaction of Owner's Representative they are equal to or better than specified materials in the following properties:

1. Quality
2. Composition
3. Utility
4. Durability
5. Resistance to abrasion and physical damage
6. Life expectancy
7. Ability to recoat in future
8. Solids content by volume
9. Dry film thickness per coat
10. Compatibility with other coatings
11. Suitability for intended service
12. Resistance to chemical attack

13. Temperature limitations in service and during application

14. Type and quality of recommended undercoats and topcoats

15. Ease and convenience of application

16. Ease and convenience of repairing damaged areas

17. Stability of colors

C. Paints and coatings used on Work shall comply with VOC limits set forth in Section 5.504.4.3 of CALGreen Code.

D. Products listed were in general use in 2007. If changes in air quality, water quality or other regulations render listed product obsolete, Contractor shall substitute an equivalent product shown in Manufacturer's literature as being formulated and appropriate for surface to be coated.

E. Factory-applied base coatings to a specific product may differ slightly from those listed below where primers are factory-applied by Manufacturers. Such base-coat substitutions for convenience of Contractor are subject to the following stipulations.

1. Surface preparation shall meet or exceed surface preparations specified below.

2. Primer or base coat shall be that recommended and normally used by Manufacturer for condition and exposure of finished installation.

3. Chemical composition of factory-applied base coats shall be similar to chemical composition specified below.

4. If different coating system is recommended by Manufacturer to meet performance specifications of other sections, Manufacturer shall notify Contractor in writing and said notice shall be forwarded to Owner's Representative.

5. Contractor shall verify compatibility of adjacent coats with coating Manufacturers.

6. Total DFT shall equal or exceed DFT specified below.

7. Finish coat shall be as stipulated below.

8. In event of paint system failure, Contractor shall repair paint system in failed area to specifications of this section.

F. Acceptable Manufacturers for industrial and architectural applications include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Industrial Coating System	3M	St Paul, MN
	Ameron Corrosion Control Division	Brea, CA
	Carboline Co.	St Louis, MO
	ICI Devoe - Sinclair - ICI Dulux Paint Div. Glidden Co.	Cleveland, OH
	E I DuPont de Nemours & Co	Wilmington, DE
	Sherwin-Williams Co.	Cleveland, OH
	Tnemec Co Inc.	Kansas City, KS
	Accepted equal	

G. Acceptable Manufacturers for masonry graffiti control systems include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Graffiti Coating System	Dunn Edwards Oxon System	Los Angeles, CA
	ICI Devoe - Sinclair - ICI Dulux Paint Div. Glidden Co.	Cleveland, OH
	Rainguard International Products Co.	Corona del Mar, CA
	Tnemec Chemprobe Dur A Pel GS	Kansas City, MO
	U S Specialty Coatings Monopole Elastoseal	Cleveland, OH
	Vitrocem Div Bithell, Inc.	Covina, CA
	Accepted equal	

H. Acceptable Manufacturers for concrete waterproof interior sealant systems include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Concrete Waterproof Interior Sealant	Raven Lining Systems AquataPoxy	Tulsa, OK
	Sherwin-Williams Co.	Cleveland, OH
	Tnemec Co Inc.	Kansas City, KS
	Accepted equal	

I. Substitutions will be considered providing the following minimum conditions are met.

1. Request for substitution shall be approved in writing by addendum before date of bid.

2. Proposed coating system dry film thickness shall equal or exceed specified system thickness.

3. Proposed coating system shall employ an equal or greater number of separate coats.

4. Proposed coating system shall employ coatings or paints of same generic type.

5. Requests for substitution shall include full descriptive literature and required for submittal above including generic coating type, non-volatile content by volume and a list of 10 similar projects, all at least 3 years old where coatings or paints have been applied to similar exposure.

6. Owner's Representative may also require submittal of laboratory data sheets certified by independent testing laboratory satisfactory to Owner's Representative, showing results of complete spectrographic and durability tests on proposed substitute.

7. Owner's Representative shall be sole and final judge of acceptability of substitutions.

J. In addition to requirements stated elsewhere, acceptable manufacturers shall demonstrate at least 10 years' domestic experience in manufacture of coating systems similar to those furnished.

K. In addition to requirements stated elsewhere, all painting, coating and coating application accessories shall be products of one manufacturer.

L. Thinners shall comply with Manufacturer's application instructions.

2.2 Materials - General

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Surface preparation, prime coatings, and finish coats for various systems are specified herein. Unless otherwise noted, all intermediate and finish coats shall be of slightly contrasting colors. Coating alternates specified herein shall serve as general guide for type of coating desired.

C. Painting and coating materials shall be especially adapted for use around surface to be coated in its expected environment. Primer coats shall be used as recommended by Manufacturer for these conditions and shall be applied at rates and thicknesses recommended by Manufacturer.

D. Materials schedules below list competing products of 2 manufacturers to establish general standard of quality required. Other listed manufacturers shall furnish products of equivalent chemistry, thickness and product life where their products are not itemized.

E. Colors shall be selected by Owner from color samples submitted by Contractor.

2.3 Materials – Painting and Coating of Valves, Pumps, Hydrants, Flow Meters, Pipelines and Pipeline Appurtenances

A. Prime valve, pump and hydrant exteriors at place of manufacture. Apply intermediate and finish coats to valves in field. Finish coat shall match color of adjacent piping. Coat hand-wheels and floor stands same as valves. Coat exterior of hydrants and buried metal valves at place of manufacture.

B. Epoxy coatings per Section 09 96 56 may be substituted for epoxy system specified below for valve, pump, hydrant, flowmeter or pipeline appurtenance exterior coating.

C. Coating systems for non-buried valve, hydrant, flow meter, pipeline and pipeline appurtenance exteriors shall meet the following requirements:

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Valve, Pump, Hydrant, Flow Meter or Pipeline Appurtenance Exterior Coating	Epoxy Urethane	AWWA D102 OCS-5 or 6 Total DFT 8.0-13.0 mils		
Surface Preparation		SSPC-SP6/NACE 3 Commercial blast cleaning 1.0-1.5-mil surface angular blast anchor profile		
Base Coat (Shop-Applied)	Polyamidomine Epoxy	Tnemec Series V69 Epoxoline DFT 3.0-5.0 mils	Sherwin Williams Macropoxy 646-100 DFT 3.0-5.0 mils	
Intermediate Coat	Polyamidomine Epoxy	Tnemec Series V69 Epoxoline DFT 3.0-5.0 mils	Sherwin Williams Macropoxy 646-100 DFT 3.0-5.0 mils	
Finish Coat	Aliphatic or Acrylic Urethane	Tnemec Endura-Shield II Series 1095 (1E85 Low VOC Urethane) DFT 2.0-3.0 mils	Sherwin Williams Hi-Solids Polyurethane 100 (Semigloss or Gloss) DFT 2.0-3.0 mils	

D. Coating systems for buried valve, hydrant, flow meter, pipeline and pipeline appurtenance exteriors shall meet requirements for buried metal specified elsewhere in this section.

E. Apply interior lining of valves and hydrants 2-1/2" and larger as follows: Coat interior metal surfaces excluding seating areas and bronze and stainless-steel pieces. Remove all protuberances which may produce pinholes in lining. Round all sharp edges to be coated. Remove any contaminants which may prevent bonding of lining.

F. Apply interior lining of valves and hydrants 2-1/2" and larger per AWWA C550 and Section 09 96 56.

G. Where valves and hydrants 2-1/2" and larger are specified to receive fusion-bonded epoxy lining, a similar fusion-bonded epoxy coating of thickness specified above may be substituted for liquid epoxy system above provided lining is factory-tested and certified in accordance with Section 09 96 56.

2.4 Metal, Interior and Exterior, Normal Exposure

A. Paint all exposed steelwork, non-galvanized handrails, exposed pipework, fittings, all mechanical equipment, pumps, motors, doors, door frames and window sash with this coating system.

B. All metalwork previously given shop prime coat accepted by Owner's Representative shall be touched up as required in field with Tnemec Series 4 Versare Primer or equal.

C. Coating systems for normally exposed metal shall meet the following requirements:

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Coating for Normal-Exposure Steel	Polyamidoamine Epoxy / Aliphatic Acrylic Urethane	Total DFT 8.0-13.0 mils		
Surface Preparation		SSPC-SP6/NACE 3 Commercial blast cleaning (Where blast cleaning is not possible, provide SSPC SP-15 Commercial-Grade Power Tool cleaning.)		
Base Coat (Shop-Applied)	Polyamidoamine Epoxy	Tnemec Series V69 Epoxoline DFT 3.0-5.0 mils	Sherwin Williams Macropoxy 646-100 DFT 3.0-5.0 mils	
Intermediate Coat (Field-Applied)	Polyamidomine Epoxy	Tnemec Series V69 Epoxoline DFT 3.0-5.0 mils	Sherwin Williams Macropoxy 646-100 DFT 3.0-5.0 mils	
Finish Coat (Field-Applied)	Aliphatic or Acrylic Urethane	Tnemec Endura-Shield II Series 1095 (1E85 Low VOC Urethane) DFT 2.0-3.0 mils	Sherwin Williams Hi-Solids Polyurethane 100 (Semigloss or Gloss) DFT 2.0-3.0 mils	

2.5 Metal, Submerged or Intermittently Submerged

A. Paint all metalwork, gates, equipment, pumps, valves, exposed pipework and all other metalwork within areas to be submerged in wastewater, except as noted hereinafter, with this coating system.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Coating for Metal Submerged or Intermittently Submerged in Recycled Water or Wastewater	Cycloaliphatic Amine Epoxy	Total DFT 16.0-24.0 mils		
Surface		SSPC-SP10/NACE 2 Near-white metal blast cleaning		

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Preparation		Minimum 2.0-mil surface angular blast anchor profile		
Base Coat	Cycloaliphatic Amine Epoxy	Tnemec Series 61 Tneme-liner DFT 8.0-12.0 mils,	Sherwin Williams Sherglass FF Low VOC DFT 8.0-12.0 mils	
Finish Coat	Cycloaliphatic Amine Epoxy	Tnemec Series V69 Epoxy DFT 8.0-12.0 mils,	Sherwin Williams Sherglass FF Low VOC DFT 8.0-12.0 mils	

2.6 Metal, Galvanized, Aluminum, Copper, or Brass

A. Copper, bronze, chromium plate, nickel, stainless steel, aluminum, and factory-finished materials and surfaces shall not be painted except as otherwise specified.

B. Any nameplates painted over shall be replaced in kind.

C. Galvanized finish will not be considered a factory finish.

D. Coat all galvanized metal, aluminum, copper or brass with this coating system where coating is required.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Coating for Galvanized Metal, Aluminum, Copper or Brass	Hydrophobic Acrylic Primer / HDP Acrylic Polymer Finish	Total DFT 4.0-8.0 mils		
Surface Preparation		SSPC-SP1 Solvent Cleaning followed by SSPC-SP2 Hand Tool Cleaning Prepare in accordance with ASTM D6386 Thoroughly scarify surface in accordance with ASTM D6386		
Base Coat	Etch	Chemically etch in accordance with Tnemec Technical Memo #10-78 and in accordance with ASTM D6386	Chemically etch in accordance with Manufacturer's recommendations	
Intermediate Coat	Hydrophobic Acrylic	Tnemec Series 115 Uni Bond DF DFT 2.0-3.0 mils	Sherwin Williams Macropoxy 646-100 DFT 3.0-5.0 mils	
Finish Coat	HDP Acrylic Polymer	Tnemec Series 1029 Enduratone DFT 2.0-3.0 mils	Sherwin Williams Hi-Solids Polyurethane 100 Gloss DFT 2.0-3.0 mils	

2.7 Metal, Buried

A. Coat all buried metal which includes valves, hydrant buries, bolts, nuts, structural steel and fittings with this system.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Coating for Buried Metal	Hybrid Inorganic Water-Based Epoxy	Total DFT 12.0-24.0 mils	Total DFT 16.0-24.0 mils	
Surface Preparation		SSPC-SP6/NACE 3 Commercial blast cleaning Minimum 1.5-mil surface angular blast anchor profile		
Base Coat	Hybrid Inorganic Water-Based Epoxy	Tnemec Series 27 WB Typoxy DFT 6.0-12.0 mils	Sherwin Williams Sherglass FF Low VOC DFT: 8.0-12.0 mils	
Finish Coat	Hybrid Inorganic Water-Based Epoxy	Tnemec Series 27 WB Typoxy DFT 6.0-12.0 mils	Sherwin Williams Sherglass FF Low VOC DFT: 8.0-12.0 mils	

2.8 Materials – Painting and Coating of PVC, CPVC and FRP

A. Paint PVC, CPVC and FRP items with this system.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
PVC, CPVC and FRP pipe	Modified Polyamine Epoxy / Pigmented Aliphatic Acrylic Urethane	Total DFT 4.0-6.0 mils		
Surface Preparation		SSPC-SP1 Solvent cleaning followed by thorough and uniform abrasion with medium grain sandpaper		
Base Coat	Modified Polyamine Epoxy	Tnemec Series V69 Epoxy DFT 2.0-3.0 mils	Sherwin Williams Macropoxy 646 DFT 2.0-3.0 mils	
Finish Coat	Pigmented Aliphatic Acrylic Urethane	Tnemec Endura-Shield II Series 1095 DFT 2.0-3.0 mils,	Sherwin Williams Hi-Solids Polyurethane 100 Gloss DFT 2.0-3.0 mils	

B. Paint PVC, CPVC and FRP where such pipe is above grade and exposed to sunlight, or where required in vaults and buildings for color coding of pipes, or to match adjacent finishes.

2.9 Masonry, Exterior, Normal Exposure

A. Where Contract Documents require masonry to be painted, paint all exterior masonry surfaces subject to normal exposure with this system.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Coating for Exterior Masonry Surfaces	Modified Waterborne Acrylate	Total DFT 8.0-16.0 mils		
Surface Preparation		Remove dirt, dust, grease, laitance or other deleterious matter.		
Filler	Filler	Fill cracks and voids with suitable caulking material compatible with specified coating.		

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Base Coat	Modified Waterborne Acrylate	Tnemec Series 156 Envirocrete DFT 4.0-8.0 mils	Sherwin Williams Loxon Block Surfacer DFT 8.0–12.0 mils	
Finish Coat	Modified Waterborne Acrylate	Tnemec Series 156 Envirocrete DFT 4.0-8.0 mils	Sherwin Williams Pro Industrial Acrylic DFT 2.0–4.0 mils	

2.10 Masonry, Exterior, Graffiti-Proof Coating

A. Where Contract Documents require masonry to be coated with graffiti-proof coating, paint exterior masonry surfaces with this system.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Coating for Exterior Masonry Surfaces	Specialty Coating	Total DFT 6-8 mils			
Surface Preparation		Remove dirt, dust, grease, laitance or other deleterious matter.			
Filler	Filler	Fill cracks and voids with suitable caulking material compatible with specified coating.			
Base Coat	Acrylic Latex, Polyester, or RTV Silicone Rubber	Tnemec Series 626 Dur-a-Pel GS (Graffiti Shield) 65-85 sf/gal	Vitrocem Hi-Build Anti-Graffiti Glazed Coating	Dunn-Edwards Oxon Masonry Sealer	U S Specialty Coatings Monopole Elastoseal
2nd Coat	Acrylic Latex, Polyester, or RTV Silicone Rubber	Tnemec Series 626 Dur-a-Pel GS (Graffiti Shield) 65-85 sf/gal	Vitrocem Hi-Build Anti-Graffiti Glazed Coating	Dunn-Edwards Oxon Ultrashield Clear Polyurethane Enamel	U S Specialty Coatings Monopole PermaShield
3rd Coat	Polyester or Polyurethane Enamel			Dunn-Edwards Oxon Ultrashield Clear Polyurethane Enamel	U S Specialty Coatings Monopole PermaShield
4th Coat	Polyester or Polyurethane Enamel			Dunn-Edwards Oxon Ultrashield Clear Polyurethane Enamel	U S Specialty Coatings Monopole PermaShield

2.11 Concrete Walls, Ceilings, and Floors – Waterproof Sealant

A. Where Contract Documents require interior concrete surfaces to be sealed, seal interior concrete surfaces with this system.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Sealant for Concrete Walls, Ceilings, and Floors	Epoxy	ANSI/NSF 61 certified for any use with potable water. Total DFT 10-12 mils		
Surface Preparation		SSPC SP13/NACE 6 Concrete Surface Preparation		
Filler		Fill voids, holes, and pits with Manufacturer-approved filler	Fill voids, holes, and pits with Sherwin Williams Steel Seam FT910	

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Base Coat	Epoxy		Sherwin Williams Macropoxy 646-100 DFT 5.0-6.0 mils	
Finish Coat	Epoxy	Raven Lining Systems Aquatapoxy DFT 10.0-12.0 mils	Sherwin Williams Macropoxy 646-100 DFT 5.0-6.0 mils	

2.12 Steel Decking

A. Paint all steel buildings and decking with this system except where Manufacturer's factory-applied coating of equivalent thickness is furnished.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Coating for Steel Buildings and Steel Decking	Self Cross Linking Hydrophobic Acrylic	Total DFT 4.0-6.0 mils		
Surface Preparation		Any steel provided to jobsite with shop prime must be patch tested for compatibility with top coats. Remove all surface contaminants by air blast cleaning, hand cleaning, and solvent cleaning as required. Coat puddle welds with Tnemec Series 115 Unibond DF or equal.		
Base Coat	Self Cross Linking Hydrophobic Acrylic	Tnemec Series 115 Uni Bond DF DFT 2.0-3.0 mils	Sherwin ProCryl Universal Primer DFT 2.0-4.0 mils	
Intermediate Coat	Vinyl	n/a	n/a	
Finish Coat	HDP Acrylic Polymer	Tnemec Series 1029 Enduratone DFT 2.0-3.0 mils	Sherwin Williams Pro Industrial Acrylic DFT 3.0-4.0 mils	

2.13 Traffic Striping, Pavement Marking, and Curb Marking

B. Where Contract Documents require marking or striping of pavement, paint asphalt-concrete pavement and Portland cement concrete pavement with this system.

ITEM	MATERIAL	SPECIFICATION
Traffic Line Paint in Arterial Streets	Thermoplastic paint	Total DFT 125 to 188 mils SSPWC Section 210-1.6.2
Traffic Line Paint in Local Streets and Parking Lot Stripes and Markings	Rapid dry paint	SSPWC Section 210-1.6.3 Total WFT per SSPWC Tables 310-5.6.5 (A) and (B)

PART 3 - EXECUTION

3.1 Preparation

A. Preapplication meeting shall be held one to 2 weeks before start of coating system application for products covering more than 100 square feet. Meeting shall be attended by Contractor, applicator, Manufacturer's representative and Owner's Representative and shall cover the following topics:

1. Environmental requirements set by Manufacturer for his product

2. Protection of surfaces not scheduled to be coated

3. Stormwater pollution prevention requirements

4. Surface preparation

5. Application

6. Disinfection

7. Repair

8. Field quality control

9. Cleaning

10. Protection of coating systems

11. Eleven-month inspection

12. Coordination with other work

B. Notify Owner's Representative at least 3 days before start of any field surface preparation work.

C. All surfaces to be coated or painted shall be in proper condition to receive material specified before any coating or painting is done.

D. Sandblasting shall be done as follows:

1. No more sandblasting or surface preparation than can be coated or painted in a normal working day will be permitted. All sharp edges, burrs, and weld spatter shall be removed. All concrete and masonry surfaces shall cure 30 days prior to coating or painting.

2. Sandblasting shall be done not more than 8 hours ahead of painting, subject to humidity and weather conditions between time of sandblasting and painting operations. If any rusting or discoloration of sandblasted surfaces occurs before painting, remove such rusting or discoloration by additional sandblasting. Sandblasted surfaces shall not be left overnight before painting.

3. Protect surrounding areas and surfaces not scheduled to be blasted and/or coated from damage or coloration during surface preparation and coating application. Place drop cloths or apply masking tape where required to prevent spatter, dripping and overspray from contact with floors, surfaces and equipment not scheduled to receive paint or coatings. Take all necessary precautions to protect all adjacent Work and surrounding property and improvements from damage due to painting and coating procedures.

4. Abrasive blasting nozzles shall be equipped with "deadman" emergency shutoff nozzles. Blast nozzle pressure shall be at least 95 psi and shall be verified using an approved nozzle pressure gauge at each start-up period or as directed by Owner's Representative. Nozzles used during all blast cleaning operations shall be sufficient to ensure timely completion of work on schedule.

5. Field blast cleaning for all surfaces shall be by dry method unless otherwise stated. Contractor shall maintain dust emissions within legal levels and that level which will not create a nuisance.

6. Particle size of abrasives used in blast cleaning shall produce a 2.0-mil (0.002") surface profile or in accordance with recommendations of Manufacturer of specific paint or coating system to be applied, subject to approval by Owner's Representative.

7. Abrasives used in blast cleaning shall be new, washed, graded and free of contaminants which would interfere with adhesion of coatings and paints. Do not reuse abrasive unless specifically approved by Owner's Representative.

8. Blast cleaning from rolling scaffolds shall only be done within confines of interior perimeter of scaffold. Reaching beyond limits of perimeter will be allowed only if blast nozzle is maintained in position which will produce profile acceptable to Owner's Representative.

9. Keep work areas in clean condition. Do not allow blasting materials to accumulate as to constitute nuisance or hazard to prosecution of Work or operation of existing facilities. Remove spent abrasives and other debris at Contractor's expense. If waste is determined to be hazardous, dispose of waste as required by law.

10. Blast cleaned and coated/painted surfaces shall be cleaned prior to application of specified paint or coating systems by combination of blowing with clean dry air, brushing/brooming and/or vacuuming as directed by Owner's Representative. Air hose for blowing shall be at least ½" diameter and shall be equipped with shut-off device.

11. Hydroblasting (water blast cleaning) shall be used only when and as directed by Owner's Representative, who will determine pressure to best remove loose, peeling/flaking paint or coating or other detrimental surface contaminants.

12. Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours. Any cleaned areas not receiving base coat within an eight-hour period shall be recleaned prior to application of base coat.

E. Prepare steel surfaces in accordance with applicable Manufacturer's instructions and SSPC standards.

F. Ensure surfaces to receive coatings are dry and free from visible oil, grease, dirt, dust, mill scale, rust, paint oxides, corrosion products and other foreign matter in accordance with specified SSPC standards.

G. Before application, examine areas and conditions under which coating systems are to be applied. Notify Owner's Representative of areas or conditions which are not acceptable to receive coatings. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

H. Arrange with Owner's Representative so that all surface preparation may be inspected and approved prior to application of any coatings.

I. Surface preparation inspection for metals shall be based on comparison with SSPC-Vis1 "Surface Preparation Standards for Painting Steel Surfaces"

J. Neutralize all welds with suitable chemical compatible with specified paint or coating system.

K. Using brush, stripe paint critical locations such as welds, corners, edges, roof lap seams, nuts, bolts, ends, rafter flanges and other areas identified by Owner's Representative using specified primer.

L. Only good, clean brushes and equipment shall be used and all brushes, buckets, and spraying equipment shall be cleaned immediately at end of each painting period.

M. Where surfaces are joined so closely that proper surface preparation and paint application is not possible, prepare and paint such surfaces prior to assembly or installation.

3.2 Application

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install paint and coating systems at locations shown on Plans and Submittals.

C. Unless otherwise specified, all ferrous surfaces except for stainless steel or galvanized iron or steel surfaces shall be painted or coated, including top surfaces of steel roof support framing and underside of steel roof plates bearing on roof supports.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, mechanical and electrical code requirements

4. SSPC-PA1 "Shop, Field and Maintenance Painting

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. Mixing shall be done thoroughly using slow-speed power mixer until all components are thoroughly combined and are of smooth consistency. Use exact proportions specified by Manufacturer. Exercise care to ensure all material is removed from containers during mixing and metering.

G. Thinning shall only be permitted within limits set by applicable regulatory agencies and as permitted by Manufacturer and approved by Owner's Representative. All thinning shall be done in presence of Owner's Representative.

H. Use application equipment, tools, pressure settings and techniques in accordance with Manufacturer's application instructions.

I. Contractor's painting and coating equipment shall be maintained in first-class working condition. Compressors shall have suitable traps and filters to remove water and oils from air. Blotter test shall be accomplished at each start-up period and as deemed necessary by Owner's Representative.

J. Do not apply coatings when environmental conditions are not appropriate or which jeopardize appearance or quality of coating in any way. This includes but is not limited to the following unsatisfactory environmental conditions.

1. When air temperature is below 50°F or above 125°F or is outside limits recommended by Manufacturer for satisfactory application.

2. When it is expected air temperature will drop below 40°F or above 125°F within 8 hours after application of coating.

3. When surface temperature is not at least 5°F (3°C) above dew point or is outside limits recommended by Manufacturer for satisfactory application.

4. When relative humidity is outside limits recommended by Manufacturer for satisfactory application.

5. During precipitation including rain, sleet, snow, fog or mist.

6. When wind velocity is outside limits recommended by Manufacturer for satisfactory application.

7. In dust or smoke-laden atmospheres.

K. When above conditions are prevalent, postpone paint or coating application until conditions are favorable. The day's paint or coating application shall be completed in time to permit film sufficient drying and curing time before damage by atmospheric conditions.

L. Uniformly apply coatings at spreading rate required to achieve specified DFT. Application shall be by airless spray method, except brush and roller application may be required for exterior surfaces if environmental and neighborhood conditions preclude spray application.

M. Spraying shall be done by cross-lap method of spraying, stroking first in one direction and shortly later, spraying across this section at right angles to first set of passes. Exercise care during spraying to hold nozzle perpendicular and sufficiently close to receiving surface to avoid excessive evaporation of volatile components or loss of material to air or bridging of cracks and crevices.

N. Drying time between coats stated in Manufacturer's instructions between coats shall be strictly observed.

O. Apply coatings to be free of film characteristics such as runs or blisters that would adversely affect performance or appearance of coating systems.

P. Brush coats shall be properly brushed out so as to show minimum of brush marks. When finished and dried, brush strokes shall appear in one direction only and there shall be no curved brush strokes showing.

Q. Immediately remove spills, oversprays and all coatings that fall on surrounding areas and surfaces not scheduled to receive specified coating.

R. After completing each coat application, request inspection by Owner's Representative before applying next coat. Work performed in absence of prescribed inspection by Owner's Representative may be required to be removed and replaced with proper inspection and entire cost of removal and replacement, including cost of materials which may be furnished by Owner and used in removed Work shall be borne by Contractor regardless of whether Work removed is found to be defective or not. Work covered up without authority of Owner's Representative shall upon order of Owner's Representative be uncovered to extent required, and Contractor shall similarly bear entire cost of performing all Work and furnishing all materials necessary for removal of covering and its subsequent replacement as directed and approved by Owner's Representative.

S. Pinholes and holidays detected during testing shall be marked, repaired in accordance with Manufacturer's printed instructions and retested. No pinholes or other irregularities will be permitted in final coating.

T. Protect finished surfaces between coats. For subsequent coats, remove dust, dirt, oil, grease and any foreign matter which will affect adhesion or durability of finish by washing with clean rags dipped in commercial cleaning solvent approved by paint and coating system Manufacturer. Surface shall then be rinsed with clean water and wiped dry with clean rags.

U. Coats that do not hide undercoat shall be given another coat.

V. Coats shall be thoroughly dry and cured according to Manufacturer's recommendations before next coat is applied.

W. Upon completion, remove masking and other temporary coverings and protection of surrounding areas and surfaces.

X. Additional special provisions for coating systems are as follows:

1. Schedule coating work to avoid excessive dust and airborne contaminants. Protect work from dust and airborne contaminants during coating application and curing.

2. Work is subject to intermittent shutdown if, in opinion of Owner's Representative, cleaning, coating and painting operations are creating localized condition detrimental to ongoing facility activities, personnel or adjacent property. In event of emergency shutdown by Owner's Representative, Contractor shall immediately correct deficiencies. All additional costs created by shutdown shall be borne by Contractor.

Y. Following application and testing, protect surfaces of coating systems from damage during construction.

3.3 Field Quality Control

A. Contractor shall hold current C-33 Painting and Decorating Contractor's license and have at least five years practical experience and successful history in applying specified products to surfaces of steel standpipes, reservoirs, vessels and elevated tanks for water storage. Upon request, he shall substantiate this requirement by furnishing list of references.

B. Employees working on project shall be skilled craftsmen, trained for application of specified coatings and qualified to perform required Work. Work shall be done in manner comparable with best standards of practice found in that trade. Apply materials evenly so as to be free from sags, runs, crawls, brush marks, wrinkles, skips, holidays or other application defects, blemishes or evidence of poor workmanship. All coats shall be of proper consistency. Cut lines shall be sharply cut to lines.

C. Before beginning work, prepare 10-foot by 10-foot mockup for each coating system using same materials, tools, equipment and procedures for actual surface preparation and application. Obtain Owner's Representative's approval of mockups. Retain mockups on site to establish standards by which finished coating systems shall be compared.

D. Repair or replace damaged or colored materials and surfaces not scheduled to be coated.

E. Touch up or repair damaged coatings shall be acceptable if result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture or color.

F. Repair in accordance with Manufacturer's instructions coatings that exhibit film characteristics or defects that might adversely affect performance or appearance of coating systems.

G. Manufacturer's representative shall provide technical assistance and guidance as needed for proper surface preparation and coating system application.

H. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Mock-up	Compliance with Specifications	Described above	1 each coating system covering more than 1000 sf	Owner	Owner
Surface Preparation	Visual Inspection	SSPC Vis 1, ASTM D2200, NACE Std TM01-70	As directed	Owner	Owner
	Contaminants	Chemical or ultraviolet tests	Owner's option	Owner	Contractor
	Anchor Profile	2 mils or Manufacturer's requirement to be verified by nondestructive instrument such as Keane-Tator Surface Profile Comparator or Testex Press-O Film System	As directed	Owner	Contractor
Compressor	Verify absence of water and oil	Blotter test	1 each startup	Contractor	Contractor
Atmospheric Conditions	Dewpoint	Sling Psychrometer and US Dept of Commerce Weather Bureau Psychrometric Tables	As directed	Contractor	Contractor
Each Coating System	Compliance with Mockup	Comparison with mockup Contractor to submit written report from approved testing agency on reinspection	Owner's option	Owner	Contractor
Each Coat	Holidays	Nondestructive holiday tester such as Tinker-Rasor Model AP or AP-W Contractor to submit written report from approved testing agency on reinspection	Owner's option	Owner	Contractor
	Dry-Film Thickness	SSPC-PA2 Nondestructive magnetic-type thickness gauge such as "Inspector" or "Positest" or when destructive testing is ordered, instrument such as Tooke Gage Contractor to submit written report from approved testing agency on reinspection	Owner's option	Owner	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
	Film Characteristics and Defects	Visual inspection. Contractor to submit written report from approved testing agency on reinspection	As directed	Owner	Contractor
Finished Coating System	11-Month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturers printed literature as described below. Repair identified deficiencies.	1 inspection attended by Owner, Contractor, Owner's Representative and Manufacturer's representative	Owner	Contractor

I. Contractor shall furnish inspection devices in good working condition for detection of holidays and measurement of dry-film thickness of paints and coatings. Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of thickness gauges. Dry film thickness gauges and holiday detectors shall be available at all times until final acceptance of application. Inspection devices shall be operated by, or in presence of Owner's Representative with location and frequency basis determined by Owner's Representative. Owner's Representative is not precluded from furnish his own inspection devices and rendering his opinion based solely on their tests.

J. Owner's Representative shall have right to reject all unsatisfactory material or work and to replace it at Contractor's expense if any deficiency is found in quality of installed coating.

K. Upon completion of work, remove all staging, scaffolding and containers from project site. Clean site to satisfaction of Owner's Representative.

L. Warranty Inspection shall be conducted during 11th month following completion of all coating and painting work. Repair all defective work in strict accordance with Contract Documents and to satisfaction of Owner's Representative.

1. Owner will establish inspection date and will notify Contractor at least 30 days in advance. Owner will uncover or otherwise expose surfaces to be inspected. Contractor shall provide at his expense suitable lighting and ventilation for inspection. Contractor shall provide all other necessary inspection equipment to Owner's satisfaction.

2. Entire interior coating system shall be visually inspected. All defective coatings as well as damaged or rusting spots shall be satisfactorily repaired by and at sole expense of Contractor. All repaired areas shall then be tested as specified herein and repair/testing procedure repeated until surface meets specified requirements.

3. Entire exterior paint system shall be visually inspected. All defective, damaged or rusting areas shall be satisfactorily repaired by and at sole expense of Contractor.

4. Warranty Inspection Report will be prepared by Owner's Representative and delivered to Contractor. It will set forth number and type of failures observed, percentage of surface area where failure has occurred, and names of persons making inspection.

5. Repairs shall proceed promptly. Upon completion of inspection and receipt of Inspection Report, Owner will establish date for Contractor to proceed with remedial Work. Delay on part of Contractor to proceed with remedial work on schedule shall constitute breach of this Contract. In such case, Owner may proceed to have defects remedied as outlined in Contract Documents.

6. Remedial Work shall occur at any location where paint or coating has peeled, bubbled, or cracked and at any location where rusting is evident. All such locations shall be considered failures. Contractor shall make repairs at all points where failures are observed by removing deteriorated coating or paint , cleaning surface and repainting or recoating with same system. If area of failure exceeds 25% of specific coated or painted surface, entire paint or coating system shall, at Owner's option, be removed and recoated or repainted in accordance with original Contract Documents.

7. Costs of warranty inspection and repair shall be borne by Contractor, who shall include an appropriate amount for testing and repair in his bid. No additional allowance will be paid by Owner for Warranty Inspection and repairs.

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SECTION 09 96 56
EPOXY LININGS AND COATINGS

PART 1 - GENERAL

1.1 Work Included

A. Requirements for surface preparation, application and testing of fusion-bonded epoxy lining and coating systems for ferrous surfaces of valves, hydrants, flow meters, pumps, pipelines, fittings, or pipeline appurtenances.

B. Do not apply fusion-bonded epoxy systems to aluminum, brass, bronze, copper, plastic, rubber, or stainless steel surfaces.

C. Where Owner deems fusion-bonded epoxy coatings to be impractical, liquid epoxy lining systems may be substituted as described herein.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 74 00: Cleaning and Waste Management
H. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete functional coating system for specified surface in compliance with applicable local air quality management regulations and NSF requirements for use with potable water where applicable. Comply with Manufacturer's application requirements and applicable codes and standards.

B. The term "dry film thickness" or DFT shall refer to thickness of fully-cured paint coat measured in mils (1/1000")

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Cured lining or coating shall be smooth and glossy with no graininess or roughness. Lining or coating shall have no blisters, cracks, bubbles, under-film voids, mechanical damage, discontinuities or holidays.

C. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Offsite Surface Preparation and Priming	Offsite Inspection of Priming Operation	Applicable standards	As directed on	Contractor	Contractor
Paint from Proposed "Equals"	Spectrographic and Durability Tests	Applicable ASTM standards	As directed	Contractor	Contractor
Valve, Hydrant, Flow Meter, Pump, Pipe, Fitting, or Pipeline Appurtenance Interior Lining or Coating	Visual Inspection	Pipe or items will be rejected due to: a. Any sizeable protrusion in lining obviously caused by lining over foreign material. b. Any defect indicating double flow or fold in lining. c. Any chuck marks or gouges extending to bare metal. d. Any bubble or area which appears to be unbonded to underlying metal surface	Each lined pipe spool or item	Contractor	Contractor
	Holidays	AWWA C213 Section 5.3.3. If number of holidays or pinholes for items ≤12" is ≤5 per item, repair per coating Manufacturer's recommendation and retest. If more holidays are found, sandblast, recoat and retest entire item.	Each lined Valve, Hydrant, Flow Meter, Pump, Pipe, Fitting, or Pipeline Appurtenance	Contractor	Contractor
		AWWA C213 Section 5.3.3 If less than one holiday per 10 square feet of pipe surface is found, repair per coating Manufacturer's recommendation and retest. If more holidays are found, sandblast, recoat and retest entire pipe spool. Also check weld seam centerlines to verify no porous blisters, craters or pimples lie along peak of weld crown.	Each lined Valve, Flow Meter, Pump, Pipe Spool, Fitting, or Pipeline Appurtenance ≥16"	Contractor	Contractor
	Lining Thickness	Verify thickness with magnetic-type dry film thickness gauge. Average shall exceed minimum thickness, No individual thickness value shall be more than 2 mils below or 3 mils above specified minimum thickness. Items not meeting these criteria shall be sandblasted, recoated and retested.	Each lined Valve, Hydrant, Flow Meter, Pump, Pipe, Fitting, or Pipeline Appurtenance t at 3 locations per item	Contractor	Contractor

1.5 References

A. ANSI/NSF 61 Drinking Water System Components – Health Effects
B. ASTM D1002 Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)
C. ASTM D1044 Resistance of Transparent Plastics to Surface Abrasion

D. ASTM D2370 Tensile Properties of Organic Coatings
E. ASTM D2583 Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
F. ASTM G17 Penetration Resistance of Pipeline Coatings
G. AWWA C210 Liquid Epoxy Coating Systems for Interior and Exterior of Steel Water Pipelines
H. AWWA C213 Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines
I. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
J. AWWA C620 Spray-Applied In-Place Epoxy Lining of Water Pipelines 3" and Larger
K. California Green Building Standards Code (CALGreen Code)
L. MSS SP98 Protective Coatings for Interior of Valves, Hydrants, and Fittings
M. SSPC PA1 Shop, Field and Maintenance Painting
N. SSPC PA2 Measurement of Dry Paint Thickness with Magnetic Gauges
O. SSPC SP5/NACE 1 White Metal Blast Cleaning
P. SSPC SP10/NACE 2 Near White Blast Cleaning
Q. SSPC Vis1 Pictorial Surface Preparation Standards for Painting Steel Surfaces

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Submit product data sheets per catalog data requirements.
Application Instructions	Required for each paint and coating per application instruction requirements. Include 1. Surface Preparation Requirements. 2. MSDS sheets identifying flammability, toxicity, allergenic properties and any other characteristics requiring field precautions. 3. Minimum and maximum recommended dry-film thicknesses per coat for prime, intermediate, and finish coats. 4. Percent solids by volume. 5. Statement verifying selected prime coat is recommended by Manufacturer for use with selected intermediate and finish coats. 6. Application and curing requirements and instructions.
Certificate of Compliance	1. For work done in California, submit certification that all coatings conform to applicable local Air Quality Management District rules and regulations for products and application 2. Submit coating system and application certification that coatings comply with specified requirements and are suitable for intended application per certificate of compliance requirements. 3. Submit description of repair procedures used if any.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, application instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. All materials shall be those of current manufacture and shall meet all applicable regulations for their application and intended service. All materials shall meet all applicable Federal, state and local regulations, including Air Quality Management District Regulations. All coats of any particular coating system shall be of same Manufacturer and shall be approved by Manufacturer for intended service. If product specified herein is no longer manufactured or does not meet current regulations, Contractor shall provide a substitute, currently manufactured product of at least equal performance which meets all applicable regulations subject to Owner's Representative's approval, at no additional cost.

B. Linings and coatings used on Work shall comply with VOC limits set forth in Section 5.504.4.3 of CALGreen Code.

C. Factory-applied base coatings to a specific product may differ slightly from those listed below where primers are factory-applied by Manufacturers. Such base-coat substitutions for Contractor's convenience are subject to the following:

1. Surface preparation shall meet or exceed surface preparations specified below.

2. Primer or base coat shall be that recommended and normally used by Manufacturer for condition and exposure of finished installation.

3. Chemical composition of factory-applied base coats shall be similar to chemical composition specified below.

4. If different coating system is recommended by Manufacturer to meet performance specifications of other sections, Manufacturer shall notify Contractor in writing and said notice shall be forwarded to Owner's Representative.

5. Contractor shall verify compatibility of adjacent coats with coating Manufacturers.

6. Total DFT shall equal or exceed DFT specified below.

7. Finish coat shall be as stipulated below.

8. If paint system fails, Contractor shall repair paint system in failed area to specifications of this section.

D. Acceptable Manufacturers for NSF-61 approved fusion-bonded epoxy include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
NSF-Approved Fusion-Bonded Epoxy Linings and Coatings	3M Scotchkote 134W, 206N or 6233	Saint Paul, MN
	Northtown Keysite 740	Huntington Beach, CA
	Accepted equal	

E. Acceptable Manufacturers for fusion-bonded epoxy where NSF approval is not required include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Fusion-Bonded Epoxy Linings and Coatings	3M Scotchkote 134, 135, 203, 206, 206N or 6233	Saint Paul, MN
	Gilpon	
	Northtown Keysite 740	Huntington Beach, CA
	Valspar "Pipe Clad" 1500 Red	Indianapolis, IN
	Accepted equal	

F. Acceptable Manufacturers for field-applied epoxy coating for patching include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Field-Applied Liquid Epoxy Linings and Coatings for Patching	3M Scotchkote 306	Saint Paul, MN
	Accepted equal	

G. Acceptable Manufacturers for NSF-61 approved liquid epoxy where permitted include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
NSF-Approved Liquid Epoxy Linings and Coatings	3M Scotchkote 323	Saint Paul, MN
	ICI Devoe - Sinclair - ICI Dulux Paint Div. Glidden Co. Bar Rust 233 series	Cleveland, OH
	PPG Industries Amercoat 370	Pittsburgh, PA
	Tnemec Pota-Pox L140	Kansas City, KS
	Accepted equal	

H. Acceptable Manufacturers for liquid epoxy where NSF 61 approval is not required include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Liquid Epoxy Linings and Coatings	3M Scotchkote 312 or 314	Saint Paul, MN
	ICI Devoe - Sinclair - ICI Dulux Paint Div. Glidden Co. Bar Rust 233 series	Cleveland, OH
	PPG Industries Amercoat 370	Pittsburgh, PA
	Tnemec Pota-Pox L140 (For nonpotable water use Tnemec Series L69)	Kansas City, KS
	Accepted equal	

2.2 Materials - General

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Interior lining of valves and hydrants 2-1/2" and larger for use with potable or reclaimed water shall meet requirements of AWWA C550.

C. Fusion-bonded epoxy lining systems for all other valve, hydrant, flow meter, pump, pipe, pipe fitting, or interiors shall meet the following requirements.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION*
Valve, Hydrant, Flow Meter, Pump, Pipe, Fitting, or Pipeline Appurtenance Interior Lining or Coating	Fusion-Bonded Epoxy	AWWA C213 ANSI/NSF 61 certified for any use with potable water. 100% solids powdered thermosetting epoxy per AWWA C550 Hardness per ASTM D2583: Barcol 17 Hardness on "M" Scale: Rockwell 50 Abrasion Resistance per ASTM D1044 with Tabor CS17 wheel 1000-gram wheel, 1000 cycles: 0.05 gram removed / 5000 cycles 0.115 gram removed Adhesion 3,000 psi (Elcometer) Tensile Strength per ASTM D2370: 7300 psi Penetration per ASTM G17: 0 mil Adhesion Overlap Shear, ⅛" steel panel, 0.010 glue line per ASTM D1002: 4300 psi Impact (100 in-lb minimum (Gardner ⅝" diameter tip) Total DFT 12.0 mils Total DFT 5.0-16.0 mils on ring grooves and flange faces	
Surface Preparation		SSPC-SP5/NACE 1 White metal blast cleaning	
Base Coat (Apply at Place of Manufacture)	Polyamide Epoxy	3M Company Epoxy Primer DFT 5.0-6.0 mils,	
Finish Coat (Apply at Place of Manufacture)	Polyamide Epoxy	Scotchkote 134 or 206N	Lilly "Pipe Clad" 1500 Red

D. Field-applied epoxy coating for patching shall meet the following requirements.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION*
Valve, Hydrant, Flow Meter, Pump, Pipe, Fitting, or Pipeline Appurtenance Interior Lining or Coating	Epoxy	ANSI/NSF 61 certified for any use with potable water. 80% solids liquid resin Total DFT 12.0 mils	
Patching Compound	Polyamide Epoxy	Scotchkote 323	

E. Liquid epoxy lining systems for valve, hydrant, flow meter, pump, pipe, pipe fitting, or pipeline appurtenance interiors shall be used only when Owner deems fusion-bonded epoxy coating to be impractical. Liquid epoxy lining systems for valve, hydrant and appurtenance interiors shall meet the following requirements.

ITEM	MATERIAL	SPECIFICATION	ALTERNATE SPECIFICATION	ALTERNATE SPECIFICATION
Valve, Hydrant, Flow Meter, Pump, Pipe, Fitting, or Pipeline Appurtenance Interior Lining or Coating	Epoxy	ANSI/NSF 61 certified for any use with potable water. Total DFT 16.0 mils		
Surface Preparation		SSPC-SP5/NACE 1 White metal blast cleaning		
Base Coat (Apply at Place of Manufacture)	Polyamide Epoxy	Tnemec Pota-Pox L140 (For nonpotable water use Tnemec Series L69) DFT 4.0-5.0 mils,	3M Company Epoxy Primer DFT 4.0-5.0 mils,	ICI Devoe Bar-Rust 233V DFT 5.0-6.0 mils
Intermediate Coat (Apply at Place of Manufacture)	Polyamide Epoxy	Tnemec Pota-Pox L140 (For nonpotable water use Tnemec Series L69) DFT 4.0-5.0 mils,	3M Skotchkote 312 or 314 DFT 4.0-5.0 mils,	ICI Devoe Bar-Rust 233V DFT 4.0-5.0 mils,
Finish Coat (Apply at Place of Manufacture)	Polyamide Epoxy	Tnemec Pota-Pox L140 (For nonpotable water use Tnemec Series L69) DFT 4.0-5.0 mils,	3M Skotchkote 312 or 314 DFT 4.0-5.0 mils,	ICI Devoe Bar-Rust 233V DFT 4.0-5.0 mils,

*Powdered thermosetting epoxy or two coats of polyamide epoxy may be substituted.

F. All epoxy lining shall meet current Volatile Organic Compound (VOC) content regulations. Epoxy lining for potable water valves and hydrants shall also be listed by National Sanitation Foundation (NSF) for contact with potable water and shall contain no perchloroethylene, lead, chromium or zinc.

G. Spray-applied epoxy lining of pipelines in place shall conform to AWWA C620.

PART 3 - EXECUTION

3.1 Preparation

A. All surfaces to be coated or painted shall be in proper condition to receive material specified before any coating or painting is done.

B. Prepare iron or steel surfaces in accordance with applicable Manufacturer's instructions and SSPC standards.

C. Grind surface irregularities, welds, and weld spatter smooth before applying epoxy. Remove all protuberances including slivers, scales, burrs and gouges which may produce pinholes in lining. Grind at least 0.020" off weld caps on pipe weld seams before beginning surface preparation and heating of pipe. Round all sharp edges to be coated.

D. Allowable grind area shall not exceed 0.5 square feet per location and maximum grind area shall not exceed 2 square feet per item or piece of equipment. Do not use items, pipes or pieces of equipment not meeting these requirements.

E. Ensure surfaces to receive coatings are dry and free from visible oil, grease, dirt, dust, mill scale, rust, paint oxides, corrosion products and other foreign matter in accordance with specified SSPC standards.

F. Preheat pipe, item or piece of equipment prior to blast cleaning to remove surface moisture. Preheat shall ensure surface temperature is at least 5°F above dew point temperature during blast cleaning and inspection.

G. Sandblast surfaces as specified, protecting beveled pipe ends from abrasive blast cleaning.

H. After sandblasting, apply 5% (by weight) phosphoric acid solution wash to pipe, item or piece of equipment. Average temperature measured in three different locations shall be between 80°F and 130°F during acid wash procedure. Duration of acid contact with surface shall be as follows:

Temperature	Contact Time
80°F	52 seconds
85°F	45 seconds
90°F	36 seconds
95°F	33 seconds
100°F	28 seconds
105°F	24 seconds
110°F	21 seconds
130°F	10 seconds

I. After completing acid wash, remove acid with demineralized water having maximum conductivity of 5 micromhos/cm at a minimum nozzle pressure of 2500 psi.

3.2 Application

A. Refer to Section 01 73 00 for basic execution and application requirements.

B. Furnish and install fusion-bonded epoxy linings and coatings at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements including minimum and maximum drying time between required coats, except as modified herein

2. Applicable OSHA and Cal OSHA regulations

3. AWWA C213 Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Coat interior metal surfaces excluding seating areas and bronze and stainless-steel pieces.

F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

G. Apply coatings to be free of film characteristics such as runs or blisters that would adversely affect performance or appearance of coating systems.

H. Apply lining and coating by electrostatic spray or fluidized bed process. Heat and cure per epoxy Manufacturer's recommendations. Heat source shall not leave residue or contaminant on metal surface. Do not allow surfaces to oxidize or flash rust prior to coating.

I. Pinholes and holidays detected during testing shall be marked, repaired in accordance with Manufacturer's printed instructions and retested. No pinholes or other irregularities will be permitted in final coating.

J. Protect finished surfaces between coats. For subsequent coats, remove dust, dirt, oil, grease, and any foreign matter which will affect adhesion or durability of finish by washing with clean rags dipped in commercial cleaning solvent approved by paint and coating system Manufacturer. Surface shall then be rinsed with clean water and wiped dry with clean rags.

K. Coats shall be thoroughly dry and cured according to Manufacturer's recommendations before next coat is applied.

L. Upon completion, remove masking and other temporary coverings and protection of surrounding areas and surfaces.

M. Following application and testing, protect surfaces of coating systems from damage during construction.

N. Spray-applied epoxy lining of pipelines in place shall be completed in accordance with AWWA C620.

3.3 Field Quality Control

A. Repair or replace damaged or colored materials and surfaces not scheduled to be coated.

B. Repair in accordance with Manufacturer's instructions coatings that exhibit film characteristics or defects that might adversely affect performance or appearance of coating systems. Wire brush or sandblast damaged areas per SSPC SP10. Lightly abrade or sandblast lining and coating on sides of damaged area before applying liquid repair coating specified above. Patched areas shall overlap parent or base coating at least ½". If damaged area exceeds 20 square inches, remove entire lining and coating and recoat and retest entire item.

C. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Finished Lining or Coating	Holidays	Nondestructive holiday tester such as Tinker-Rasor Model AP or AP-W Contractor to submit written report from approved testing agency on re-inspection	Owner's option	Owner	Contractor
	Dry Film Thickness	SSPC-PA2 Nondestructive magnetic-type thickness gauge such as "Inspector" or "Positest." Coated items failing inspection will be subject to rejection.	Owner's option	Owner	Contractor
	Film characteristics and defects	Visual inspection. Contractor to submit written report from approved testing agency on reinspection	As directed	Owner	Contractor
Finished Coating System	11-Month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature as described below. Repair identified deficiencies.	1 inspection attended by Owner, Contractor, Owner's Representative and Manufacturer's representative	Owner	Contractor

D. Contractor shall furnish inspection devices in good working condition for detection of holidays and measurement of dry-film thickness of paints and coatings. Contractor shall also furnish U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to test accuracy of thickness gauges. Dry film thickness gauges and holiday detectors shall be available at all times until final acceptance of application. Inspection devices shall be operated by, or in presence of Owner's Representative with location and frequency basis determined by Owner's Representative. Owner's Representative is not precluded from furnish his own inspection devices and rendering their opinion based solely on their tests.

E. Owner's Representative shall have right to reject all unsatisfactory material or work and to replace it at Contractor's expense if any deficiency is found in quality of installed coating.

F. Upon completion of work, remove all staging, scaffolding and containers from Work site. Clean site to satisfaction of Owner's Representative.

G. Warranty Inspection shall be conducted between eleventh month following completion of all coating and painting work. Repair all defective work in strict accordance with Contract Documents and to satisfaction of Owner's Representative.

1. Owner will establish inspection date and will notify Contractor at least 30 days in advance. Owner will uncover or otherwise expose surfaces to be inspected. Contractor shall provide at his expense suitable lighting and ventilation for inspection. Contractor shall provide all other necessary inspection equipment to Owner's satisfaction.

2. Entire interior coating system shall be visually inspected. All defective coatings as well as damaged or rusting spots shall be satisfactorily repaired by and at sole expense of Contractor. All repaired areas shall then be tested as specified herein and repair/testing procedure repeated until surface meets specified requirements.

3. Entire exterior paint system shall be visually inspected. All defective, damaged or rusting areas shall be satisfactorily repaired by and at sole expense of Contractor.

4. Warranty Inspection Report will be prepared by Owner's Representative and delivered to Contractor. It will set forth number and type of failures observed, percentage of surface area where failure has occurred, and names of persons making inspection.

5. Repairs shall proceed promptly. Upon completion of inspection and receipt of Inspection Report, Owner will establish date for Contractor to proceed with remedial Work. Delay on part of Contractor to proceed with remedial work on schedule shall constitute breach of this Contract. In such case, Owner may proceed to have defects remedied as outlined in Contract Documents.

6. Remedial Work shall occur at any location where paint or coating has peeled, bubbled, or cracked and at any location where rusting is evident. All such locations shall be considered failures. Contractor shall make repairs at all points where failures are observed by removing deteriorated coating or paint , cleaning surface and repainting or recoating with same system. If area of failure exceeds 25% of any coated or painted surface, entire paint or coating system shall, at Owner's option, be required to be removed and recoated or repainted in accordance with original Contract Documents.

7. Costs of warranty inspection and repair shall be borne by Contractor, who shall include an appropriate amount for testing and repair in their bid. No additional allowance will be paid by Owner for Warranty Inspection and repairs.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 Work Included

A. Materials and installation of signs.

B. Materials and installation of markers, labels, and signs for pipes, ducts, and valves, for mechanical equipment, for hazardous materials warnings, and for miscellaneous services.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 33: Mechanical Identification
H. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install signage including appurtenant structural and mechanical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building and fire codes and standards.

B. Furnish and install one internally illuminated exit sign per room as required by CBC Chapter 1011.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Building Code (CBC)
B. California Fire Code (CFC)
C. NEMA/ANSI 250 Enclosures for Electrical Equipment
D. NFPA 70 National Electric Code (NEC)
E. NFPA 101 Life Safety Code
F. NFPA 704 Identification of the Hazards of Materials for Emergency Response
G. OSHA Standard 29 CFR 1910.144
H. UL 924 Emergency Lighting and Power Equipment

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per architectural shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.
Material Samples	Required
Warranty	Furnish one-year warranty from date of final acceptance.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of signs shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Self-Luminous Exit Signs	Clarion Safety Systems	Alpena, MI
	Merit Lighting	Pasadena, CA
	The Exit Light Company	San Diego, CA
	Accepted equal	
Signage	Clarion Safety Systems	Alpena, MI
	Seton Name Plate Corporation	Branford, CT
	W.H. Brady	Milwaukee, WI
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Lettering shall conform to OSHA requirements on all signage.

C. No sign shall be smaller than 10 inches wide by 7 inches high

D. The following signs are required:

LOCATION	INSCRIPTION	NFPA 704 PLACARDING (IF APPLICABLE)
Each Item of Motor-Operated Equipment	"CAUTION--EQUIPMENT STARTS AND STOPS AUTOMATICALLY"	
Self-Luminous Exit Sign over Door	"EXIT"	
Four Locations directed by Owner's Representative	"NO SMOKING"	

E. Signs shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Sign	Adhesive-Back Plastic Plate	Weather and ultraviolet-resistant
Backing Where Required for Mounting to Masonry	14-gauge Minimum Steel Plate	Epoxy coat steel plate per Section 09 90 00. Color selected by Owner. Anchor backing to masonry at four corners with minimum ¼-inch anchors with 1-inch minimum embedment. Signs less than 3-inches high may be anchored at 2 ends only

F. Exit signs shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Housing	Aluminum	

G. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION
Color	Unless otherwise shown signs shall use black letters on white background. NFPA Placards shall be color-coded as shown
Mounting	Use adhesive backed signs
	Where mounting location is not shown on plans, attach to item described or mount within 12 inches of item described by sign. Where feasible, place bottom of sign approximately 4 feet from finish floor. Interior signs shall face center of room.
Letter Height	Exterior Signs: 3" unless otherwise shown
	Interior Signs: 1½" minimum unless otherwise shown

H. The following product design criteria, options and accessories are required for exit signs:

ITEM	DESCRIPTION
Color	White self-illuminating letters on red background
Number of Sides	1
Lumination	Self-illuminating tritium-filled Pyrex glass light tube with phosphor coating
	Luminance of sign face 50 lux or greater
Mounting	Secure to wall with Manufacturer's recommended mounting hardware matching openings on sign frame provided for mounting
Letter Height	6-inch block letters with stroke of at least ¾ inch
UL LIsting	List to UL Standard 924, NFPA Life Safety Code 101
Warranty	10 years

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install signs before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid conflicts.

3.2 Installation

A. Refer to Sections 01 73 00 and 01 73 33 for basic execution and installation requirements.

B. Furnish and install signage at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building and fire code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install signs to tolerances recommended by Manufacturer. Unless otherwise shown, install signs true, plumb, and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Signs	Installation & Level	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 10 14 19
DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 Work Included

A. Materials and installation of dimensional letters.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install dimensional letters where shown including appurtenant structural, and/or mechanical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Building Code (CBC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per architectural shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements. Submit installation proof kit, consisting of digital, full-scaled, dimensioned drawing showing letters and/or numbers ordered and layout of these items with professional kerning.
Material Samples	Required
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of dimensional letters shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Dimensional Letters and Numbers	Accurate Image, Incorporated	Seattle, WA
	Weston Letters	North Hollywood, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Dimensional letters shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Dimensional Letters	Cast Aluminum	
Mounting Hardware	Same as Letters or Numbers	Electrolytically compatible with substrate and with mounted letters.
Mounting Adhesive	Silicone Glue	Use to affix mounting studs to installation location

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Font	California Bold, California Medium, or California Light as shown	For sample see http://www.accurateimageinc.com/Cut%20Metals/CutCaliforniaBold.aspx
Dimensions	Height	6 inches as shown
	Depth	1-inch
	Spacer	Same dimension as letter depth
Color		Black
Finish		Anodized
Mounting Hardware	Threaded Mounting Studs	Threaded so studs screw into receptacles on reverse side of each number or letter. Provide all hardware required including standoff spacers and/or nuts for all thread studs for mounting on plaques.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install dimensional letters before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install dimensional letters at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Other applicable building code requirements

D. Refer variances between the above documents and Contract Documents to Owner's Representative.

E. Install dimensional letters to tolerances recommended by Manufacturer. Unless otherwise shown, install dimensional letters and numbers true, plumb, and level using precision gauges and levels.

F. Install dimensional letters as follows:

1. Tape paper template at location to receive numbers or letters. Use level to ensure accurate and true horizontal and vertical positioning.

2. Once template is taped to secure in place, drill holes into installation surface using precise location of mounting studs shown on template.

3. After holes are drilled, pretest alignment with numbers or letters studs. Use fingers to screw studs into holes on back of number or letter. Add spacers if required between letters and substrate.

4. Then push studs into respective drilled holes.

5. If pieces line up correctly, fill drilled holes with glue, coat each stud with silicone glue, and press studs into glue-filled holes.

6. Secure numbers or letters to wall surface with masking tape until silicone glue hardens.

7. After glue sets, remove masking tape and lean letter surfaces.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Dimensional Letters	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	Level	Level to within ¼-inch over 8 feet	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 10 28 13
COMMERCIAL TOILET ACCESSORIES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of commercial toilet accessories.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install commercial toilet accessories including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods or proper performance of Work of this section.

1.5 References

A. Americans with Disabilities Act (ADA)
B. ASTM A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
C. ASTM A240 Heat-Resisting Chromium and Chromium Nickel Stainless Steel plate, Sheet and Strip for Pressure Vessels
D. ASTM A269 Seamless and Welded Austenitic Stainless Steel Tubing for General Service
E. ASTM A554 Welded Stainless Steel Mechanical Tubing
F. ASTM A666 Annealed or Cold-Worked Austenitic Stainless Steel
G. ASTM A1008 Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
H. ASTM C1036 Flat Glass
I. ASTM F446 Grab Bars and Accessories Installed in the Bathing Area
J. California Building Code (CBC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per architectural shop drawing requirements. Locate each specified unit. Indicate mounting height of each specified unit.
Catalog Data	Required per catalog data requirements. Indicate options to be furnished
Installation Instructions	Required per installation or application instruction requirements.
Warranty	Furnish one-year warranty from date of final acceptance
Warranty-Mirrors	Furnish 10-year limited warranty against silver spoilage

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, and installation instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of commercial toilet accessories shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Paper Towel Dispenser and Disposal – Surface Mounted	AJW Architectural Products	New Windsor NY
	American Specialties, Inc.	Yonkers, NY
	American Standard Inc.	Piscataway, NJ
	Bradley Corporation	Menomonee Falls, WI
	Bobrick Washroom Equipment, Inc. "B3909"	North Hollywood, CA
	Accepted equal	
Soap Dispenser	AJW Architectural Products	New Windsor NY
	American Specialties, Inc.	Yonkers, NY
	American Standard Inc.	Piscataway, NJ
	Bobrick Washroom Equipment, Inc. "B-155"	North Hollywood, CA
	Bradley Corporation	Menomonee Falls, WI
	Accepted equal	
Mirror	American Standard Inc.	Piscataway, NJ
	Bobrick Washroom Equipment, Inc. "B-1556"	North Hollywood, CA
	Bradley Corporation "700"	Menomonee Falls, WI
	Accepted equal	
	Accepted equal	
Toilet Seat Cover Dispenser	American Specialties, Inc.	Yonkers, NY
	American Standard Inc.	Piscataway, NJ
	Bobrick Washroom Equipment, Inc. "B-3574"	North Hollywood, CA
	Bradley Corporation "583"	Menomonee Falls, WI
	Accepted equal	
Toilet Seat Cover	American Specialties, Inc.	Yonkers, NY

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Dispenser	American Standard Inc.	Piscataway, NJ
	Bobrick Washroom Equipment, Inc. “B-221”	North Hollywood, CA
	Accepted equal	
Toilet Tissue Dispenser – Cabinet Type	American Specialties, Inc.	Yonkers, NY
	American Standard Inc.	Piscataway, NJ
	Bobrick Washroom Equipment, Inc. “B272”	North Hollywood, CA
	Accepted equal	
Waste Receptacle	AJW Architectural Products	New Windsor NY
	American Specialties, Inc.	Yonkers, NY
	American Standard Inc.	Piscataway, NJ
	Bobrick Washroom Equipment, Inc.	North Hollywood, CA
	Bradley Corporation	Menomonee Falls, WI
	Accepted equal	
Grab Bar	American Standard Inc.	Piscataway, NJ
	Bobrick Washroom Equipment, Inc. “B6806”	North Hollywood, CA
	Bradley Corporation “837”	Menomonee Falls, WI
	Pawling Corp. Architectural Products Division	Wassaic, NY
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Commercial toilet accessories shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Sheet Steel	Steel	ASTM A1008
Finish	Steel	Baked enamel
Tubing	Stainless Steel	ASTM A269 SAE Type 304 (18-8)
Adhesive	2-Component Epoxy	Waterproof
Fasteners, Screws, Bolts and Washers	Stainless Steel	Tamper-resistant security type

C. Grab bars shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Grab Bars and Flanges	Stainless Steel	ASTM A167 SAE Type 304 18-8 alloy
Tubing	Stainless Steel	ASTM A269 SAE Type 304
Fasteners, Screws, Bolts and Washers	Stainless Steel	Tamper-resistant security type

D. The following product design criteria, options and accessories are required for commercial toilet accessories:

ITEM	DESCRIPTION	
Paper Towel Dispenser	Type	Folded paper
Seat Cover Dispenser	Capacity	500 seat covers each side
Waste Receptacle	Capacity	20 gallons minimum
	Liner	Removable heavy-duty vinyl liner attached at minimum 4 points with stainless steel grommets and hooks
Locks	Type	Tumble locks
	Keying	Key all locks to work with one master key Deliver 5 keys for each accessory key type to Owner’s Representative

ITEM	DESCRIPTION	
Mirrors	Type	Stainless Steel framed First quality glass mirrors Triple-silvered and electro-copper plated Baked enamel backing
	Size	24" wide x 36" high
	Frame	0.05" angle shapes with mitered and welded ground corners and tamperproof hanging system
	Backing	Full mirror sized minimum 0.03" galvanized steek sheet and nonabsorbtive filler material
	Glass	Float glass ASTM C1036 Type 1 Quality Q2 6mm thick

E. The following product design criteria, options and accessories are required for grab bars:

ITEM	DESCRIPTION	
Grab Bar	Design	ASTM F446
	Allowable Force	900 lbf
	Bar Diameter	1¼"
	Minimum Wall Thickness	0.05"
	Clearance from Wall	1½-inch between wall and grab bar interior
	Radius	1½-inch radius return to wall at each end
	End Flange	Heliarc-weld each end to minimum 11-gage circular flange
	Finish	Peened
	Grab-Bar Snap-on Mounting Flange	Snap-on stainless steel cover 0.0313-inch, 3-inch diameter x ½-inch deep for concealing grab-bar mounting flange

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install commercial toilet accessories before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install commercial toilet accessories at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Building Code Chapter 11 "Accessibility to Public Buildings, Public Accomodations, Commercial Buildings, and Publicly Funded Housing"

4. Other applicable building code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install commercial toilet accessories to tolerances recommended by manufacturer. Unless otherwise shown, install commercial toilet accessories true, plumb and level, rigidly anchored to substrate using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Commercial Toilet Accessories	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of fire extinguishers.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete operating fire extinguisher including appurtenant structural, and/or mechanical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building and fire codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Fire Code (CFC)
B. NFPA 10 Portable Fire Extinguishers
C. NFPA 101 Life Safety Code
D. UL (FPED) Fire Protection Equipment Directory

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per equipment shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements. Include test, refill, or recharge schedules and re-certification requirements.
Certificate of Compliance	Submit Underwriters Laboratories Inc certification and label
Warranty	Furnish one-year warranty from date of final acceptance.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of fire extinguishers and smoke detectors shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Fire Extinguishers	J L Industries, Inc.	Bloomington, MN
	Larsen's Manufacturing Company	Minneapolis, MN
	Potter Roemer Division Acorn Engineering Co. No 3020	City of Industry, CA
	Walter Kidde and Company Pro Series	Mebane, NC
	Accepted equal	
Fire Extinguisher Cabinets	J L Industries, Inc.	Bloomington, MN
	Larsen's Manufacturing Company	Minneapolis, MN
	Potter Roemer, Inc Buena Series 7145-19-VR	City of Industry, CA
	Walter Kidde and Company	Mebane, NC
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Portable fire extinguishers shall comply with NFPA 10.

C. Portable fire extinguishers shall be UL listed

D. Portable fire extinguishers shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Fire Extinguisher Shell	Steel	
	Coating	Red Enamel
Fire Extinguisher Brackets	Steel	
	Coating	Red Enamel
Pressure Gauge		Required on all units

E. Fire extinguisher cabinets shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Cabinet Frame	Aluminum	
Panel Door	Acrylic	¼-inch smoke acrylic with vertical red lettering

F. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Fire Extinguisher	Type	Portable Dry chemical (ammonium phosphate) type
	Size	15-lb
	Class	Class ABC multipurpose
	UL Rating	20A:120B:C

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install fire extinguishers before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install fire extinguishers at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building and fire code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install fire extinguishers to tolerances recommended by Manufacturer. Unless otherwise shown, install fire extinguisher cabinets true, plumb, and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fire Extinguishers and Cabinets	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 22 10 00
PLUMBING

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of plumbing on customer side of meters and laterals including

1. Domestic cold water systems.

2. Drain, waste and vent systems.

B. Utility work on Utility side of meters and laterals is typically covered by other sections which reflect standards of Servicing Utility.

C. Do not use asbestos cement pipe for plumbing applications.

D. Do not use Type 304 stainless steel pipe for buried applications.

E. Do not use brass pipe under any of the following circumstances:

1. To convey potable water.
2. For buried pipe.

F. Do not use PVC schedule 40, 80 and 120 plastic pressure pipe under any of the following circumstances:

1. For pipelines where working pressure exceeds 50 psi for Schedule 40 pipe.
2. For pipelines 1” and smaller where working pressure exceeds 150 psi.
3. For pipelines 2” and smaller where working pressure exceeds 100 psi
4. For pipelines 4” and smaller where working pressure exceeds 80 psi
5. For pipelines 6” and smaller where working pressure exceeds 70 psi
6. For force mains, pump station discharges and pipe subject to repeated pressurization / depressurization cycles.
7. For pipelines having fluid velocities in excess of 5 feet per second.
8. For potable water piping on public side of meter.
9. For piping inside buildings or plenum areas, CPC Table 6-4 prohibits use of PVC piping.
10. For exterior piping exposed to sunlight.
11. For pipe larger than 6” diameter.

G. Outdoor piping exposed to sunlight shall be painted with coat of water-based latex paint per Section 09 90 00. Use pastel shades or white to reduce thermal expansion.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint

H. Section 01 73 33: Mechanical Identification
I. Section 09 90 00: Painting and Coating
J. Section 09 96 56: Epoxy Linings and Coatings
K. Section 22 40 00: Plumbing Fixtures
L. Section 31 23 00: Excavation and Fill
M. Section 33 05 26: Utility Identification
N. Section 33 05 31: Pipeline Joint Materials
O. Section 33 05 38: Hangers and Supports
P. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
Q. Section 33 11 11: Ductile Iron Pipe
R. Section 33 11 21: Brass and Copper Pipe
S. Section 33 12 09: Backflow Prevention Devices
T. Section 33 13 00: Disinfecting of Water Utility Distribution
U. Section 33 30 11: Ferrous Drainage and Soil Pipe
V. Section 33 30 21: Vitrified Clay Pipe
W. Section 33 30 31: PVC Gravity Sewer Pipe
X. Section 33 12 22: Bronze Valves 3" and Smaller

1.3 System Description

A. Furnish and install complete operating plumbing including appurtenant structural, mechanical, and/or electrical mountings, vents, valves, and connections required for compliance with Manufacturer's installation requirements and compliance with applicable plumbing codes and standards.

1.4 Quality Assurance

A. National Sanitation Foundation marking shall appear on all potable water piping.

B. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with the Federal Reduction of Lead in Drinking Water Act and California law AB1953, and shall be marked as complying.

C. Stainless steel products may be substituted for bronze products provided dielectric protection is provided between stainless steel and bronze or copper alloys.

D. National Sanitation Foundation marking shall appear on all drainage service piping.

1.5 References

A. ASME/ANSI A13.1 Scheme for Identification of Piping Systems
B. ASME/ANSI A112.18.1 Plumbing Supply Fittings
C. ASME/ANSI A112.18.2 Plumbing Waste Fittings
D. ASME/ANSI A112.18.6 Flexible Water Connectors
E. ASME/ANSI B1.20.1 NPT National Pipe Thread Taper
F. AWWA C203 Coal Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape, Hot-Applied
G. AWWA C209 Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines
H. AWWA C651 Disinfecting Water Mains
I. California Energy Code (CEnC)
J. California Fire Code (CFC)
K. California Green Building Standards Code (CALGreen Code)
L. California Plumbing Code (CPC)
M. NSF/ANSI 61 Drinking Water Standards Health Effects

N. NSF/ANSI 372 Drinking Water System Components – Lead Content (Formerly NSF/ANSI 61 Annex G)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance Instruction requirements.
Certificate of Compliance	Submit certified report of testing of factory-applied linings
Warranty	Furnish one-year warranty from date of final acceptance for plumbing fixtures.

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and O&M instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of plumbing, fixtures, and appurtenant equipment shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Flashing – Pipes	Elmdor/Stoneman Stormtite	City of Industry, CA
	Semco	Columbia MO
	Accepted Equal	
Flashing – Vents	Elmdor/Stoneman Stormtite 1000 series	City of Industry, CA
	Approved Equal	
Polyethylene Encasement	Northtown Company	Huntington Beach, CA
	Trumbull Industries, Inc.	Youngstown, OH
	Accepted Equal	
Polyethylene Pipe Wrap Joint Tape	3 M Construction Markets Division (Scotchwrap No 50)	St Paul, MN
	Tyco Adhesives (Polyken 900)	Norwood MA
	Accepted Equal	
Tape Wrap – Cold Applied	Northtown Company	Huntington Beach, CA
	Protecto-Wrap Co (200)	Denver CO
	Tapecoat Company (CT)	Evanston, IL
	Accepted Equal	
Tape Wrap – Hot-Applied	Protecto-Wrap Co (110)	Denver CO
	Tapecoat Company (20)	Evanston, IL
	Accepted Equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Identify piping systems per ANSI A13.1.

C. Comply with requirements of Chapter 6 of California Plumbing Code, “Water Supply and Distribution.”

D. Comply with requirements of Chapter 7 of California Plumbing Code, “Sanitary Drainage.”

E. Comply with requirements of Chapter 9 of California Plumbing Code, “Vents.”

F. Comply with requirements of Chapter 10 of California Plumbing Code, “Traps and Interceptors.”

G. Comply with requirements of Chapter 12 of California Plumbing Code “Fuel Piping.”

H. Comply with insulation requirements of Section 123 of California Energy Code “Requirements for Pipe Insulation.”

I. Plumbing supply fittings shall comply with ASME/ANSI A112.18.1.

J. Plumbing waste fittings shall comply with ASME/ANSI A112.18.2.

K. Exterior and buried plumbing shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION	
DWV and Sanitary Sewer Pipe Outside Building Envelope	Ductile Iron Drainage Pipe	Pipe, Joints, and Fittings	See Section 33 30 11
		Coating	AWWA C105 PE wrap 8-mil
		Backfill	Native earth
	Galvanized Steel DWV Pipe	Pipe, Joints, and Fittings	See Section 33 30 11
		Coating	AWWA C209 cold-applied coal-tar 35-mil tape
		Alternate Coating	AWWA C203 Section 3 hot-applied coal tar 50-mil tape
		Alternate Coating	32 mil epoxy coating
		Backfill	Imported sand to 12” over top of pipe
	Copper Type DWV	Pipe, Joints, and Fittings	See Section 33 11 21
		Coating	AWWA C209 35 mil cold-applied coal-tar tape
		Backfill	Imported sand to 12” over top of pipe
	Vitrified Clay Pipe	Pipe, Joints, and Fittings	See Section 33 30 21
		Backfill	¾” gravel to 12” over top of pipe
	PVC Pipe	Pipe, Joints, and Fittings	See Section 33 30 31
		Backfill	Imported sand to 12” over top of pipe
Water Piping Outside Building Envelope	Ductile Iron Pipe	Pipe and Fittings	See Section 33 11 11
		Joints	Restrained style
		Coating	AWWA C105 PE wrap 8-mil
		Backfill	Native earth

ITEM	MATERIAL	SPECIFICATION	
Water Piping Outside Building Envelope (cont.)	Copper Tubing	Pipe, Joints, and Fittings	See Section 33 11 21
		Coating	AWWA C209 35 mil cold-applied coal-tar tape
		Backfill	Imported sand to 12" over top of pipe
	PVC Pipe	Pipe, Joints, and Fittings	See Section 33 11 33
		Wall Thickness	Schedule 40
		Coating	Paint pipe exposed to sunlight per Section 09 90 00
		Backfill	Imported sand to 12" over top of pipe

L. Interior plumbing shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION	
DWV Pipe Inside Building Envelope	Ductile Iron Drainage Pipe	Pipe, Joints, and Fittings	See Section 33 30 11
	Galvanized Steel DWV Pipe	Pipe, Joints, and Fittings	See Section 33 30 11
	Copper Type DWV	Pipe, Joints, and Fittings	See Section 33 11 21
	PVC Pipe	Pipe and Fittings	See Section 33 30 31 ASTM D2729 sewer ASTM D2665 DWV
		Wall Thickness	Schedule 40
		Joints	Solvent weld joints
Water Piping Inside Building Envelope	Copper Tubing	Pipe and Fittings	See Section 33 11 21
		Joints	Compression joints or Solder
	Brass	Pipe and Fittings	See Section 33 11 21
		Joints	Threaded or flanged
	Ductile Iron	Pipe and Fittings	See Section 33 11 11
		Joints	Threaded or flanged
	Flexible Water Connectors	Pipe and Fittings	ASME/ANSI A112.18.6
		Joints	ASME/ANSI A112.18.6
	Galvanized Steel	Pipe and Fittings	See Section 33 11 14
		Joints	Threaded or flanged
	PVC Pipe	Pipe, Joints, and Fittings	See Section 33 11 33
		Wall Thickness	Schedule 40
		Joints	solvent weld joints
Escutcheons for Pipes Passing through Unfinished Floors, Walls, Partitions & Ceilings	Cast Brass	One piece solid design to fit pipe on one end and cover sleeve projecting through floor or wall on other end.	
	Painted Cast Iron		
Escutcheons for Pipes Passing through Finished Interior Walls, Partitions & Ceilings	Cast Brass Chromium Plated		

M. For small diameter pipe 4" and under, size shown shall be pipe inside diameter.

N. The following product design criteria, options and accessories are required on flashing:

ITEM	DESCRIPTION	
Flashing on Pipe other than Vents	Flashing Assembly	Vandalproof
	Counterflashing	4-lb sheet lead sealed with nonhardening mastic and secured to pipe with stainless steel draw-band clamp
Flashing on Vents	Flashing Assembly	4-lb seamless lead type Extend up to vent for full height and turn down into pipe to form waterproof seal.
	Boot	Steel reinforced conical boot with hooded cast-iron counterflashing
	Hood	Minimum 2 to 1 free area to vent pipe size

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install plumbing before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Verify adjacent construction is ready to receive rough-in work of this section.

C. Ream pipe and tube ends. Remove scale and dirt on inside and outside piping before assembly. Prepare piping connections to equipment with flanges or unions.

D. Coordinate cutting or forming of roof or floor construction to receive drains to required invert elevations.

E. Use wall flanges and seep rings as shown and as required to prevent moisture migration through wall slab and floor penetrations.

F. Inspect pipe before installation. Repair or patch damaged areas on interior or exterior coatings with material matching original lining and coating.

G. Pipe requiring taping shall have tape applied in 2”, 3”, or 4” tape wrap applied spirally with minimum overlap of 50% of tape width.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for execution and installation requirements.

B. Refer to Section 31 23 00 for open trench requirements.

C. Furnish and install plumbing work at locations shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Manufacturer’s installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Plumbing Code Chapter 6 “Water Supply and Distribution” Section 609 “Installation, Testing, Unions and Location.”

4. California Plumbing Code Chapter 7 “Sanitary Drainage.”

5. California Plumbing Code Chapter 9 “Vents.”

6. California Plumbing Code Chapter 10 “Traps and Interceptors.”

7. California Plumbing Code Chapter 11 “Storm Drainage.”

8. Other applicable building, fire and plumbing code requirements

E. Refer variances between above documents and Contract Documents to Owner’s Representative.

F. Use pipe hangers and supports as detailed on Plans, as specified, and as required by applicable plumbing codes.

G. Obtain and review dimensioned shop drawings from equipment and fixture suppliers before roughing in for any equipment.

H. Lay out plumbing system in careful coordination with Drawings, determining proper elevations for all components of system. Coordinate locations and setting heights with related trades before floors and walls are constructed. Follow general layout shown in drawings in all cases except where other work may interfere. Lay out pipes to fall within partition, wall or roof cavities and to not require furring other than as shown on Drawings.

I. Stub rough-in piping 3” from finish building surfaces. Temporarily plug and cap piping until fixtures and equipment are ready to be installed.

J. Install piping to conserve building space and not to interfere with use of space. Use minimum number of bends to produce satisfactory functioning system.

K. Install pipe without springing, forcing or stressing pipe.

L. Bends in copper pipe and metallic tubing shall be made with suitable bending tool. Replace pipe flattened during bending process with new pipe.

M. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

N. Provide clearance for installation of insulation and access to valves and fittings.

O. Install escutcheons on exposed pipes wherever they penetrate floors, ceilings, walls or partitions. (Penetrations inside cabinets or closets shall be considered exposed.)

P. Install plumbing fixtures and equipment to tolerances recommended by Manufacturer. Unless otherwise shown or required for drainage, install plumbing and fixtures true and level using precision gauges and levels.

Q. Drainage piping shall be installed as follows:

1. Make changes in direction using 45 degree wyes, long or short sweep ¼ bends, 1/6 bends, 1/8 bends, 1/16 bends or by a combination of these or equivalent fittings. Use single or double sanitary tees and ¼ bends only where direction of flow is from horizontal to vertical. Do not use straight tee branches as drainage fittings.

2. Maintain minimum separation of 3' between drains and parallel bearing walls.

3. Slope horizontal piping and arrange to drain at low points. If no slope is shown, slope at rate of ¼" per foot.

4. Install drainage and sewer cleanouts where shown, at bends, angles, upper terminals, and not more than 50' apart in any linear run of piping. Bring floor cleanouts to grade.

5. Close openings for connections with screw plugs until used. Close handholes at once. Remove any earth or foreign matter that may get into sewer.

R. Vents shall be installed as follows:

1. Extend vents 12" above roof lines. Provide regular connections to receive flashing made for this purpose.

2. Where vents penetrate finished roof, install vents before roof is installed.

S. Painting and Coating shall comply with Division 9 and the following.

1. Coat exposed ferrous piping materials taking special care including taping to avoid accidentally coating CISP rubber sleeve or gasket joints.

3.3 Field Quality Control

A. Use adequate numbers of skilled plumbers trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Do not pressure test sections of concrete encased piping until concrete has cured at least 10 days.

C. Presoak nonmetallic pipe materials for 48 hours before pressure testing to allow materials to absorb water.

D. Allowable leakage if not otherwise shown shall be computed as

$$\text{Allowable Leakage (gallons per hour)} = NDP^{1/2}/7400$$

where:

N = number of gasketed joints being tested
D = pipe diameter in inches
P = test pressure in psi

E. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Trench Backfill	Backfill Compaction	ASTM D1557	As directed	Owner	Contractor
Potable Water Lines	Bacteria after Disinfection	Section 33 13 00 and AWWA C651 performed by independent lab chosen by Owner	2 samples, 24 hours apart at max interval of 1200' - See AWWA Section 7	Contractor	Contractor
Drainage Piping	Leakage	CPC Section 612 Add air or water and maintain at 5 psi	All interior drainage pipe	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Inside Buildings		for at least 15 minutes. (Do not air-test plastic pipe) Joints shall show no visible leaks. Pressure shall remain unchanged for 15 minutes without adding air or water			
Drainage Piping Outside Buildings	Leakage	CPC Section 623 Add air or water and maintain at 5 psi for 15 minutes. (Do not air-test plastic pipe) Joints shall show no visible leaks. Pressure shall remain unchanged for 15 minutes without adding air or water	All buried drainage pipe	Contractor	Contractor
Water Piping	Leakage	CPC Section 609.4 Add water and maintain pressure at 65 psi for 15 minutes. Joints shall show no visible leaks. Pressure shall remain unchanged for 15 minutes without adding water	All water pipe	Contractor	Contractor
Plumbing	Installation & Leakage	Air or water test and visual inspection of finished installation	1 inspection	Contractor	Contractor
	Field Performance	Demonstrate compliance of fixtures and equipment to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance of all work to Contract Documents and Manufacturer's printed literature	1 inspection	Owner	Contractor

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 Work Included

A. This section includes materials, testing, and installation of plumbing fixtures and trim.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 22 10 00: Plumbing Piping
I. Section 33 12 22: Bronze Valves 3" and Smaller

1.3 System Description

A. Furnish and install complete operating plumbing fixture units including appurtenant structural, mechanical and/or electrical mountings, valves or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 References

A. ASME/ANSI A112.4.3 Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System
B. ASME/ANSI A112.6.1 Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
C. ASME/ANSI A112.6.2 Framing-Affixed Supports for Off-the-Floor Water Closets with Concealed Tanks
D. ASME/ANSI A112.6.3 Floor and Trench Drains
E. ASME/ANSI A112.6.4 Roof, Deck, and Balcony Drains
F. ASME/ANSI A112.18.1 Plumbing Fixture Fittings
G. ASME/ANSI A112.19.2 Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
H. ASME/ANSI A112.19.5 Trim for Water-Closet Bowls, Tanks, and Urinals
I. ASME/ANSI A112.19.12 Wall-Mounted and Pedestal-Mounted Adjustable and Pivoting Lavatory and Sink Carrier Systems
J. ASME/ANSI A112.19.14 Six-Liter Water Closets Equipped with a Dual Flushing Device
K. ASME/A112 A112.36 Cleanouts
L. ASSE 1002 Anti-Siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks
M. ASSE 1010 Water Hammer Arresters
N. ASSE 1018 Trap Seal Primer Valves-Potable Water Supplied
O. ASSE 1037 Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures
P. ASTM D3311 Drain, Waste and Vent (DWV) Plastic Fitting Patterns
Q. California Green Building Standards Code (CALGreen Code)
R. California Plumbing Code (CPC)
S. ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities

T. NEMA/ANSI 250 Enclosures for Electrical Equipment
U. NFPA 70 National Electric Code
V. NSF/ANSI 61 Drinking Water System Components – Health Effects
W. UL 969 Marking and Labeling Systems
X. USEPA WaterSense Tank-Type High Efficiency Toilet Specification

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per fixtures, and valves per Catalog Data requirements If catalog data does not show rough in data, submit shop drawings.
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and O&M instructions.

C. For exposed fixtures including water closets and lavatories, pre-submit two complete sets of catalog data packages for full coordinating line of fixtures proposed for installation to allow Owner to select Owner's preferred option from at least two competing options. Unless otherwise accepted by Owner, options submitted shall have matching trim and finish.

1.6 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of plumbing fixtures shall be strictly followed.

C. Protect equipment from damage until final acceptance. Wrap exposed pipes and fittings to prevent damage or scratching.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

1.8 Warranty

A. Provide 1-year warranty from date of final acceptance against defects including any cracking or crazing of finish. Replace defective fixtures with new fixture from same Manufacturer at no additional cost to owner for one year following Owner's formal acceptance.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Floor Cleanouts	Jay.R. Smith Mfg. Co (Figure 4100)	Montgomery AL
	Josam Co. (56070 Series)	Tyler TX
	Zurn Industries (Z1400 "Leveltrol")	Erie, PA
	Accepted Equal	
Floor Drains 8" Circular Cast Iron	Jay.R. Smith Mfg. Co (Figure 2110)	Montgomery AL
	Wade (W-1200-13)	Tyler TX
	Zurn Industries	Erie, PA
	Accepted Equal	
Lavatory	American Standard (Roxalyn 0195.073)	Piscataway, NK
	Eljer Plumbingware (Mayburne 051-2314))	Dallas, TX
	Kohler Company	Kohler, WI
	Zurn Industries/Sloan	Erie, PA
	Accepted equal	
Lavatory Faucet	Chicago Faucet Co.	Des Plaines, IL
	Delta Faucet Company, Division Masco Corporation	Indianapolis, IN
	Moen, Inc. Model 8130	North Olmsted, OH
	Pfister Division Stanley Black & Decker	Lake Forest, CA
	Speakman Co.	Wilmington, DE
	Zurn Industries/Sloan	Erie, PA
	Accepted equal	
Lavatory Wall Hanger Floor-Mounted	Jay.R. Smith Mfg. Co (760)	Montgomery AL
	Josam Co.	Tyler TX
	Zurn Brass Operations (Z-1230 series)	Sanford NC
	Accepted equal	
Lavatory Wall Hanger Wall-Mounted	Jay.R. Smith Mfg. Co (710)	Montgomery AL
	Josam Co.	Tyler TX
	Zurn Brass Operations (Z-1250 series)	Sanford NC
	Accepted equal	
Roof Drains 8" dome	Jay.R. Smith Mfg. Co (Figure 1330)	Montgomery AL
	Zurn Industries	Erie, PA
	Accepted Equal	
Trap Primer (Electronic)	Mifab Inc. (M-500)	Chicago, IL
	Precision Plumbing Products	Portland, OR
	Accepted Equal	
Vacuum Breakers on Fixtures not Standard Equipped with Vacuum Breakers	Hersey Measurement Co. (BCP)	Spartanburg, SC
	Watts Automatic Control Valves (No. 9D)	Houston TX
	Accepted equal	
Wall Cleanout Tees	Jay.R. Smith Mfg. Co (Figure 4510)	Montgomery AL
	Josam Co. (58510 Series)	Tyler TX
	Zurn Industries Z1447	Erie, PA
	Accepted Equal	
Water Closets Porcelain	American Standard (Afwall 2477.016)	Piscataway, NJ
	Eljer Plumbingware (Walvortex Watersaver)	Dallas, TX
	Kohler Company	Kohler, WI
	Zurn Industries/Sloan	Erie, PA
	Accepted equal	
Water Closets Stainless Steel	Acorn Engineering Company	City of Industry, CA
	Accepted equal	
Water Closet Supports	Jay.R. Smith Mfg. Co. (210D)	Montgomery AL

ITEM	MANUFACTURER	MANUFACTURER LOCATION
	Josam Co. (Series 11000)	Michigan City IN
	Zurn Industries (Z1200 series)	Erie, PA
	Accepted equal	
Water Closet Flush Valves	Delany (402)	
	Zurn Industries/Sloan (Royal 110-FYVYO)	Franklin Park IL
	Accepted equal	
Water Closet Seat	Beneke	
	Church Seat Company	Sheboygan Falls WI
	Zurn Industries/Sloan	Erie, PA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Comply with requirements of Chapter 4 of California Plumbing Code, "Plumbing Fixtures and Fixture Fittings."

C. Comply with requirements of Sections 5.303 and 5.304 of California Green Building Standards Code Nonresidential Mandatory Measures for indoor and outdoor water use.

D. Drains and cleanouts shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Floor Drains	Body	Cast Iron
Floor Cleanouts	Body	Cast Iron
	Top	Scoriated nickel bronze
Roof Drain	Body and Dome	Cast Iron
Trench Drain	Cast Iron	
Wall Cleanouts	Caulk Ferrule	Cast Iron
	Taper Thread	Lead-free cast bronze

E. Bronze or brass trap-primer valves shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Trap Primer Box (Electronic Valves)	Construction	Stainless Steel
	Dimensions	12" x 12" x 4"
Body, Bonnet	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
Trim (plunger, core tube plunger spring, and cage assembly	Stainless Steel	SAE Types 302, 304, or 305

F. Fixtures shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Exposed Metal Piping on Lavatory and Water Closet Fixtures and Exposed Pipe Connections	Chrome Plated Brass	
Lavatory	Bowl	Vitreous china, White
	Exposed Metal Parts and Pipe Connections	Chrome-plated brass
	Carrier	Cast Iron Body
Water Closet	Bowl	ASME/ANSI A112.19.2 Vitreous China, White / SAE Type 304 Stainless Steel
	Bowl Size	Extended 18½"
Water Closet (cont.)	Exposed Metal Parts and Pipe Connections	Chrome-plated brass

ITEM	MATERIAL	SPECIFICATION
	Flanged Fixture Connections - Plastic	ASME/ANSI A112.4.3
	Carrier	Cast Iron Body
Water Closet Seat	Bowl Size	Extended 18½"
	Design	Open-end

G. The following product design criteria, options and accessories are required for drains and cleanouts:

ITEM	DESCRIPTION	
Floor Cleanouts	Standard	ASME/ANSI A112.36.2
Floor Drain (in Concrete Slab on Grade)	Applicable Code	Comply with CPC Section 411
	Standard	ASME/ANSI A112.6.3
	Grating	Medium duty tractor grate per ANSI A112.21
	Inlet	8" circular inlet
	Outlet	Inside caulk 2" outlet
Roof Drain	Applicable Code	Comply with CPC Section 1105
	Standard	ASME/ANSI A112.6.4
	Grating	Cast iron dome
	Inlet	8" domed inlet
	Outlet	No hub outlet
	Accessories	Provide sump receiver, under-deck clamp and extension
P-Traps	Location	Deep seal P-trap required on all floor drains Running P-traps required with double hub vent required on drain
	Primer Tap	Provide ½" primer tap on P-Trap
Trap Primer	Standard	ASSE 1018
	Activated by	Electronic solenoid valve energized to open to fill P-traps under each floor drain upon signal from control panel.
	Fluid Conveyed	Potable water
	Minimum Rated Working Pressure	Class 150 (300 WOG psi at 150F)
	Ends	Female threaded ASME/ANSI B1.20.1 / Soldered
	Electrical Requirements	See below
Wall Cleanouts	Standard	ASME/ANSI A112.36.2

H. The following product design criteria, options and accessories are required for water closet facilities:

ITEM	DESCRIPTION	
Water Closets – Gravity Tank Type	Grade	Commercial
	Bowls	Comply with CBC Section 408.1 and ASME/ANSI 199.2
	Seats	Comply with CBC Section 408.2 Elongated Handicap accessible, white solid plastic open front with stainless steel check hinges
	Flushing Device	ASSE 1002 Antisiphon fill valve (ballcock) and 1" quiet stop
	Flushing Handle and Trim	ASME/ANSI A112.19.5 White metal handle 1" quiet stop
	Maximum Fixture Flow Rate	1.28 gallons per flush per CGBC Table 5.303.2.3 and CPC Section 402
Water Closets – Gravity Tank Type	Carrier	ASME/ANSI A112.6.1 floor-mounted / ASME/ANSI A112.6.2 wall-mounted

ITEM	DESCRIPTION	
(cont.)		Buttress feet shall anchor to floor, with adjustable extension gaskets, studs and locknuts.
Water Closets – Flushometer Tank Type	Grade	Commercial
	Bowls	Comply with CBC Section 408.1 and ASME/ANSI 199.2
	Seats	Comply with CBC Section 408.2 Handicap accessible, white solid plastic open front with stainless steel check hinges
	Flushing Device	ASSE 1037 Pressurized flushometer Quiet flushing non hold-open diaphragm type with approved vacuum breaker
	Flushing Handle and Trim	ASME/ANSI A112.19.5 White metal handle 1" quiet stop
	Maximum Fixture Flow Rate	1.28 gallons per flush per CGBC Table 5.303.2.3 and CPC Section 402
	Carrier	ASME/ANSI A112.6.1 floor-mounted / ASME/ANSI A112.6.2 wall-mounted Buttress feet shall anchor to floor, with adjustable extension gaskets, studs and locknuts.
Water Closets – Flushometer Valve Type	Grade	Commercial
	Bowls	Comply with CBC Section 408.1 and ASME/ANSI 199.2
	Seats	Comply with CBC Section 408.2 Handicap accessible, white solid plastic open front with stainless steel check hinges
	Flushometer Valve	ASSE 1037 Pressurized flushometer Quiet flushing non hold-open diaphragm type with approved vacuum breaker
	Flushing Handle and Trim	ASME/ANSI A112.19.5 White metal handle 1" quiet stop
	Maximum Fixture Flow Rate	1.28 gallons per flush per CGBC Table 5.303.2.3 and CPC Section 402
	Carrier	ASME/ANSI A112.6.1 floor-mounted / ASME/ANSI A112.6.2 wall-mounted Buttress feet shall anchor to floor, with adjustable extension gaskets, studs and locknuts.

I. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Lavatory	Grade	Commercial
	Bowl	Single
	Bowl Size	20" x 18"
	Outlet	P-trap with overflow
	Faucet Holes	4" on centers
	Carrier	ASME/ANSI A112.6.1 floor mounted / ASME/ANSI A112.19.12 wall or pedestal mounted
Lavatory Faucet	Grade	Commercial
	Operation	Double handle (hot and cold)
	ADA compliant	Required
	Strainer	Required per CPC Section 404.1
	Finish	Chrome
	Maximum Fixture Flow Rate	0.4 gpm @ 60 psi per CGBC Table 5.303.2.3
Lavatory Faucet (cont.)	Metering Faucet Maximum Fixture Flow Rate	0.2 gallons/cycle per CGBC Table 5.303.2.3

ITEM	DESCRIPTION	
	Minimum cycle time	10 seconds
Lavatory Water Saver	Type	Heritage" pop-up type

J. The following electrical design criteria are required for equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Nonhazardous
Enclosures	NEMA 250 Enclosure Rating	NEMA 3R – Rainproof, Sleet-Resistant
Power Supply	Drinking Fountain	120VAC – 1 phase – 60Hz with cord and plug
	Trap Primers	120VAC

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install plumbing fixtures before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Verify adjacent construction is ready to receive rough-in work of this section.

C. Ream pipe and tube ends. Remove scale and dirt on inside and outside piping before assembly. Prepare piping connections to equipment with flanges or unions.

D. Coordinate cutting or forming of roof or floor construction to receive drains to required invert elevations.

3.2 Installation

A. Refer to Sections 01 73 00 and 01 73 24 for basic execution and installation requirements.

B. Furnish and install plumbing fixtures at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. California Plumbing Code Chapter 4 "Plumbing Fixtures and Fixture Fittings"
4. California Green Building Standards Code Section 5.303.6
5. Other applicable building, fire, plumbing, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Support wall hung fixtures with fixed or adjustable chair carriers. Provide chair carriers with block base supports or with feet turned backwards and bolted to floor in pipe spaces.

F. Lay out plumbing system in careful coordination with Drawings, determining proper elevations for all components of system. Follow general layout shown in drawings in all cases except where other work may interfere. Lay out pipes to fall within partition, wall or roof cavities and to not require furring other than as shown on Drawings.

G. Set fixtures plumb, level and true to wall lines. Shim fixture to proper level if necessary to secure perfect fit at walls or floor. Caulk fixtures at wall or floor.

H. Install plumbing fixtures complete with all water, waste and vent connections.

I. Connect pipes to fixtures with chrome plated brass couplings or unions such that fixtures can be removed and reset without making new joints. Make supply connections with ground joint unions. Do not use slip joints. 7/16" O.D. flexible risers may be used for lavatory or sink supply connections.

J. Install piping to conserve building space and not to interfere with use of space. Use minimum number of bends to produce satisfactory functioning system.

K. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

L. Provide clearance for installation of insulation and access to valves and fittings.

M. Slope water piping and arrange to drain at low points.

N. Install each fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers and escutcheons.

O. Provide loose key stop, finished to match fixture trim, on each supply location.

3.3 Field Quality Control

A. Use adequate numbers of skilled plumbers trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Plumbing Fixtures	Installation & Leakage	Air test and visual inspection of finished installation	1 inspection	Contractor	Contractor
	Field Performance	Demonstrate compliance of fixtures and equipment to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance of all work to Contract Documents and Manufacturer's printed literature	1 inspection	Owner	Contractor

3.4 Adjusting and Cleaning

A. Upon completion, remove trade labels and clean fixtures.

B. Clean fixtures a second time immediately before turning them over to Owner.

END OF SECTION

SECTION 23 05 48
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of HVAC equipment vibration isolators, isolating sleeves and sound barriers.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 09 90 00: Painting and Coating
I. Section 09 96 56: Epoxy Linings and Coatings
J. Section 23 34 00: HVAC Fans

1.3 System Description

A. Furnish and install complete operating HVAC equipment vibration isolation system including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. NFPA 90A Installation of Air Conditioning and Ventilating Systems
B. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
HVAC Unit Isolator Schedule	Submit schedule prepared by HVAC equipment Manufacturer's representative showing HVAC equipment and corresponding vibration isolation to be used.
Shop Drawings	Required per equipment shop drawing requirements.
Catalog Data	Required for each type of isolator, isolating sleeve or sound barrier per catalog data requirements. Include spring diameters, deflections, compressed spring heights, solid spring heights and scale drawings.
Installation Instructions	Required per installation or application instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and O&M instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of HVAC equipment vibration isolators shall be strictly followed.

1.8 Unit Prices

A. Payment for the Work in this section shall be included as part of the lump-sum or unit-price bid amount for which such Work is appurtenant thereto.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. All isolators shall be furnished by one Manufacturer.

B. Acceptable Manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
HVAC Equipment Vibration Isolation Systems	Kinetic Noise Control	Dublin, OH
	Mason Industries, Inc.	Anaheim, CA
	Vibration Eliminator Company, Inc.	Copiague, NY
	Accepted Equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. HVAC equipment vibration isolation systems shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Isolator Pads	Neoprene	Compression type with steel load plate bonded to double-ribbed neoprene pad.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install HVAC equipment vibration isolation systems before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Sections 01 73 00 and 01 73 24 for basic execution and installation requirements.

B. Furnish and install HVAC equipment vibration isolation systems at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, mechanical and electrical code requirements

4. NFPA 90A Installation of Air Conditioning and Ventilating Systems

5. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems

D. Refer variances between the above documents and Contract Documents to Owner's Representative.

E. Install HVAC equipment vibration isolation systems to tolerances recommended by Manufacturer. Unless otherwise shown, install HVAC equipment vibration isolators true and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Vibration Isolators	Free Travel	Verify isolators have free travel along full range of compression.	1 each isolator	Contractor	Contractor
	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Provide services of factory authorized representative on-site to provide the following:

1. Installation assistance, inspection and startup of the complete HVAC equipment vibration isolation system.

2. Field testing and adjustment.

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 Work Included

A. testing, adjusting and balancing (TAB) of air conditioning and ventilating systems to produce design objectives specified.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 23 34 00: HVAC Fans
H. Section 40 91 20: Temperature Instruments

1.3 System Description

A. Testing, adjusting and balancing shall consist of regulating fluid flow rate and air patterns at terminal equipment including adjustment of dampers or fan speeds in order to best achieve design objectives.

1.4 Quality Assurance

A. Engage a TAB firm certified by AABC.

B. Certify TAB field data reports. Review field data reports to verify accuracy of data and to prepare certified TAB reports. Certify that the TAB team complied with the approved TAB plan and the procedures specified herein.

C. Prepare TAB reports on standard forms of AABC.

D. Instrumentation type, quantity and accuracy shall be as described in AABC's "National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems."

E. Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

F. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. AABC National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems.

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Qualification Data	Within 45 days from Notice to Proceed, submit evidence Testing, Adjusting and Balancing contractor is AABC certified.
Instrument Calibration Data	On owner's request, submit current record of instrument calibration indicating date of calibration and name of party performing instrument calibration.
Certified TAB Reports	Submit two copies of reports prepared as specified herein on AABC approved forms certified by TAB firm. This report is described below in more detail.

B. Final report shall be computer printed in letter quality font on standard bond paper. Furnish report in three-ring binder, tabbed and divided into sections by tested and balanced systems. All pages shall be numbered. Use standard AABC or NEBB test forms where applicable. Report shall include the following:

1. First sheet shall be Title Page, with signed and sealed certification by certified testing and balancing engineer. Title page shall also show name and address of TAB firm, project name and location, report date, and names and addresses of Owner and Contractor.

2. Include Table of Contents with page numbers for each report section.

3. Include list of instruments used during TAB along with proof of calibration.

4. Include summary of contents including indicated versus final performance, notable characteristics of systems and description of operation sequence.

5. Include nomenclature sheets for each item of equipment. Sheets shall include name of device, Manufacturer's name, date of calibration and correction factors.

6. Include data for terminal units, including Manufacturer, type and size of fittings.

7. Include fan curves.

8. Include test settings for controllers.

9. Include motor data including the following:
    a. Make and frame type and size.
    b. Horsepower and rpm
    c. Volts, phase and Hertz
    d. Full load amperage and service factor
    e. Sheave make, size in inches and bore
    f. Sheave dimensions, center-to-center and amount of adjustments in inches.

10. Include notes explaining why certain final data in body of reports varies from indicated values.

11. Include Manufacturers' test data.

12. Include test conditions for fan and pump performance forms including fan drive settings, percentage of maximum pitch diameter and other system operating conditions affecting performance.

13. Include certified field test report data on approved AABC forms. Test data shall show indicated and actual values for the following:
    a. Total airflow in cfm.
    b. Total system pressure in inches wg.
    c. Fan rpm.
    d. Discharge static pressure in inches wg.

14. Other information relative to equipment performance but not including shop drawings or product data.

1.7 Project Conditions

A. Owner may occupy completed areas of construction before Substantial Completion. Cooperate with Owner during TAB operations to minimize interference with Owner's operations.

1.8 Unit Prices

B. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

1.9 Warranty

A. National Project Performance Guarantee: Provide guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems" forms stating AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to Contract Documents.

2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS

2.1 Acceptable Testing Adjusting and Balancing Firms

A. Acceptable Manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
TAB Consultant	Associated Air Balance	Mira Loma, CA
	Accepted equal	

B. TAB consultant shall be certified by AABC.

2.2 Materials

A. Test holes shall be a manufacturer's standard product constructed of cast aluminum with gasketed screw cap and base.

PART 3 - EXECUTION

3.1 Preparation

A. Examine Contract Documents and Project Record Documents to become familiar with project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Prior to beginning testing and adjusting, contact equipment manufacturers and obtain and review any data required for TAB including adjusting, balancing or operating instructions.

C. Notify Owner's Representative at least three working days prior to performing tests and final adjustments. At that time, clarify with Owner's Representative any questions regarding expected system performance.

D. Comply with applicable OSHA and Cal OSHA Regulations.

E. Furnish required test instruments including:

1. Velometer with probes and pitot tube.

2. Rotating vane aneometer, 4-inch size.

3. ASRAE standard pitot tubes, stainless steel, 5/16" outside diameter, 18 inches and 36 inches long.

4. Differential air pressure gages, 0-0.5 inch wg, 0-1 inch wg, and 0-5 inches wg, each arranged as portable unit for use with standard pitot tube.

5. Combination inclined-vertical portable manometer, range 0-5 inches wg.

6. Portable hook gage, range 0-12 inches wg.

7. Portable flexible u-tube manometer, magnetic mounting clips, range 0-18 inches wg.

F. Install test holes at inlet and outlet of all air handling unit fans, exhaust fans, utility fans and elsewhere as required to facilitate traverses and to test air systems.

G. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 Adjusting and Cleaning

A. Perform TAB procedures on each system according to the procedures contained in the AABC's "National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems" and this section.

B. Take and record testing and balancing measurements in inch-pound units.

C. Make pitot tube traverse of main supply, exhaust and return ducts.

D. Test and adjust supply, return, exhaust and relief fan rpm's to design requirements within limits of mechanical equipment provided. Change v-belt drive assemblies as needed to balance system to design airflows.

E. Set fan airflow rates to within minus five to plus 10%.

F. Balance airflows in duct mains to design cfm.

G. Do not use register shutters or dampers for balancing. Leave them wide open while balancing system. Adjust flow patterns from terminal units as shown on drawings.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fans	Operation	AABC Standards and see below	Each fan	Contractor	Contractor
Temperature Controllers	Operation	AABC Standards and see below	Each controller	Contractor	Contractor

B. Prepare test reports for fans. Obtain manufacturer's recommended testing procedures. Measure, adjust and record airflow of each fan including fans in package HVAC units.

C. Verify temperature controllers are calibrated and commissioned. Check transmitter and controller locations and note conditions that would adversely affect control functions. Record controller settings and note variances between set points and actual measurements.

END OF SECTION

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SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of fans.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 09 90 00: Painting and Coating
I. Section 09 96 56: Epoxy Linings and Coatings
J. Section 23 05 48: Vibration and Seismic Controls for HVAC
K. Section 23 05 93: Testing, Adjusting and Balancing
L. Section 26 05 00: Common Work Results for Electrical
M. Section 26 05 53: Identification for Electrical Systems
N. Section 33 71 73: Electrical Utility Services
O. Section 40 91 20: Temperature Instruments

1.3 System Description

A. Furnish and install complete operating fans as shown on Plans including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

B. Fan control system input control variables shall include the following:

ITEM	VARIABLE	DESCRIPTION
Input signals (Discrete)	High Temperature (ON) Switch	Thermostat to turn fan ON
	Light Switch	Relay to turn fan ON with lights on.
	Low Temperature (OFF) Switch	Thermostat to turn fan OFF
	Operation mode (Selectors)	Manual start
Input (Manual)	Operation mode (Selectors) Settings	Emergency stop switch
		Temperature (set in field)

C. Centrifugal fan control system output variables shall include the following:

ITEM	VARIABLE	DESCRIPTION
Output signals (Discrete)	Run condition (Lamp or LED)	

D. Ventilation normal start sequence shall trigger a circuit to turn equipment on when any of the following conditions occur

1. The thermostat temperature exceeds a preset maximum.

2. The lights are on.

3. Provide manual override feature.

E. Bathroom exhaust fans shall activate automatically when bathroom lights are turned on.

F. Ventilation normal shut down sequence shall shut down equipment when all of the following conditions occur:

1. The thermostat temperature drops below a preset minimum.

2. The lights are off.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Dynamically and statically balance fan wheels and propellers at factory per AMCA 204.

C. Factory testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fans	Factory Test Procedures	AMCA 300	Certified rating for each fan type	Contractor	Contractor
	Sound Power Level	AMCA 301 and AMCA 302	Certified rating for each type of fan	Contractor	Contractor
	Vibration	Fan and shaft assembly shall not pass through critical speed as unit comes up to rated rpm.	1 each fan	Contractor	Contractor
	Aerodynamic Performance Ratings (Flow rate, pressure, power, air density, rotation speed, efficiency	AMCA Bulletin 210	1 test each unit	Contractor	Contractor
Fan Motors	Amperage Draw	Damper fan from free-flow to no-flow operation and record amperage draw at 6 points.	1 test each fan	Contractor	Contractor
Fan	Operation	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test each unit	Contractor	Contractor

1.5 References

A. AMCA 99 Standard Handbook
B. AMCA 204 Balance Quality and Vibration Levels for Fans
C. AMCA 210 Laboratory Methods of Testing Fans for Rating
D. AMCA 300 Reverberant Room Method for Sound Testing of Fans
E. AMCA 301 Methods for Calculating Fan Sound Ratings from Laboratory Test Data

F. AMCA 302 Application of Sone Ratings for Non-Ducted Air Moving Devices
G. ANSI ABMA 9 Load Ratings and Fatigue Life for Ball Bearings
H. ASTM A653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
I. ASTM B88 Seamless Copper Water Tube
J. California Mechanical Code (CMC)
K. NEMA/ANSI 250 Enclosures for Electrical Equipment
L. NFPA 70 National Electric Code
M. NFPA 90A Installation of Air Conditioning and Ventilating Systems
N. SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for electrically powered equipment under electrically powered equipment shop drawing requirements.
Catalog Data	Required per catalog data requirements. Submit fan curves and test reports for each type and size of fan showing compliance
Installation Instructions	Required per installation or application instruction requirements including spare parts list
O & M Instructions	Required per operation and maintenance instruction requirements.
Test Record Transcripts	Submit for factory tests per test record transcript requirements.
Motor Data	Required per motor data requirements of Section 26 05 00.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, and test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Deliver motorized equipment as factory assembled unit to extent allowable by shipping limitations, with protective crating and covering.

C. Disassemble and reassemble units as required for moving to final location according to Manufacturer's written instructions.

D. Lift and support units with Manufacturer's designated lifting or supporting points.

E. Manufacturer's instruction and warranty requirements for delivery, storage and handling of ventilation equipment shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Exhaust Wall Direct-Drive Fans 1009 cfm @ 1/8" SP	Cook, Loren Company	
	Greenheck Fan Corp.	Schofield, WI
	Accepted equal	
Wall Mounted Bathroom Fan 70 cfm @ 0.1" SP	Panasonic Company or equal	
	Accepted equal	

B. Fans furnished shall operate throughout their full submitted curve range driven by motors of horsepowers and full load amperages specified below and shown on Plans. Fans requiring larger motor than specified or shown are unacceptable in absence of written statement from Owner electrical infrastructure, drives and switchgear can support increased amperage.

C. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to local building code authorities. Electrical components, devices and accessories shall be marked for use intended.

D. Air movement and control products shall comply with performance requirements and shall be labeled with and licensed to use AMCA Certified Ratings Seal.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Comply with California Energy Code Title 24 Building Efficiency Standards.

C. Environmental factors are as follows"

ITEM	DESCRIPTION	
Fans Installed Indoors	Ambient Air Temperature	40°F to 110°F
	Relative Humidity	20%-80%
Fans Installed Outdoors	Ambient Air Temperature	30°F to 120°F
	Relative Humidity	10%-100%

D. Wall Exhaust Fans shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Propeller Fan Housing and Mounting Collar	Galvanized Steel Sheet	Apply baked enamel or epoxy finish coat after assembly
Fan Wheel	Galvanized Steel	Axial type
Fan Propeller Shaft	Carbon Steel	
Fan Housing	Galvanized Steel	
Fasteners	Stainless Steel	AISI Type 304
Inlet Screen	Galvanized Steel	½" x ½" galvanized welded wire

E. Sidewall fans shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Propeller Fan Housing and Mounting Collar	Aluminum	Flanged edges Integral orifice ring
	Galvanized Steel Sheet	Flanged edges Integral orifice ring Apply baked enamel or epoxy finish coat after assembly.
Propeller Fan Hub	Aluminum	
Propeller Fan Blades	Aluminum	Formed blades riveted to heavy gage spider.
Fasteners	Stainless Steel	AISI Type 304
Wire Blade Guard	Aluminum	

F. The following product design criteria, options and accessories are required for Wall Exhaust Propeller Fan

ITEM	DESCRIPTION	
Fan Assembly	Fan Type	Direct-drive 24" x 24" modular sidewall fan with automatic controlled louvers
	Fan Blades	Airfoil design Statically and dynamically balanced at factory
	Drive	Direct-drive
	Speed	Constant - See Fan Schedule
	Performance	See Fan Schedule
	Service factor	1.4 based on fan motor
	Noise Level	Less than 10 sones per AMCA 300
	Bearing Life	ANSI/ABMA 9 L_{10} of 50,000 hours
	Coating	Epoxy Coating
Accessories	Screen	Outlet Screen
Motor Mounting	Isolation	Isolate motor and drives from airstream.
	Power	Provide flexible leads from motor to externally mounted junction box and disconnect switch permitting service without disconnecting field wiring. Fan supplied with HOA switch Automatic thermostat controlled
Fan Motors ½ HP and larger	Type	Squirrel cage induction motor
	Windings	Copper
	Frame	TEFC
	Design	NEMA MG1 Design B TEFC
	Duty	Continuous
	Sizing	Size for 110% of driven horsepower
	Efficiency	Premium efficiency
	Insulation	Class F
	Duty	Continuous
	Sizing	Size for 110% of driven horsepower
	Efficiency	Standard efficiency
	Insulation	Class F
Fan Housing	Mounting	Provide prepunched mounting holes. Provide inside flanges to mount damper.
	Duct Mounting Collars	Heavy gauge mounting flanges or collars at fan inlet and outlet for connection to adjacent ductwork.
	Access Door	Gasketed hinged access door providing access to fan must swing out for cleaning, inspection or service without dismantling fan Entire drive assembly shall be removable without removing fan assembly from ductwork
	Wire Guard	Protective welded steel wire guard shall completely protect drive side of wall

ITEM	DESCRIPTION	
Fan Housing (continued)	Fan Inlet	Venturi throat
	Gravity shutters	Aluminum blades in aluminum frame interlocked blades with nylon bearings
	Unit-mounted disconnect switch	Required on housing Provide flexible conduit connecting disconnect to motor.of sufficient length to permit access to drive assembly without disconnecting wiring

G. The following product design criteria, options and accessories are required for Bathroom Wall Exhaust Fan:

ITEM	DESCRIPTION	
Fan Assembly	Fan Type	Exhaust
	Drive	Direct-Drive
	Speed	See Fan Schedule
	Performance	See Fan Schedule
	Service factor	1.4 based on fan motor
	Fan shaft	Turned, ground & polished steel keyed to wheel hub
	Shaft bearings	Permanently lubricated, permanently sealed, self aligning ball bearings
	Bearing Life	ANSI/ABMA 9 L_{10} of 50,000 hours
Fan Motors ½ HP and larger	Type	Squirrel cage induction motor
	Windings	Copper
	Frame	TEFC
	Design	NEMA MG1 Design B TEFC
	Duty	Continuous
	Sizing	Size for 110% of driven horsepower
	Efficiency	Premium efficiency
	Insulation	Class F
Fan Motors smaller than ½ HP	Type	Squirrel cage induction motor
	Frame	TEFC
	Design	NEMA MG1 Design B
	Duty	Continuous
	Sizing	Size for 110% of driven horsepower
	Efficiency	Standard efficiency
	Insulation	Class F
Fan Wall Housing	Construction	Galvanized steel
	Mounting	Provide heavy gauge mounting flanges. Provide prepunched mounting holes. Provide inside flanges to mount damper.
	Wire Guard	Protective welded steel wire guard shall completely protect drive side of wall
	Exhaust Hood	Backdraft damper and screen

H. The following electrical design criteria are required for equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Nonhazardous
Power Supply	Motor Circuits ½ HP and larger	120VAC – 1 phase – 60Hz
	Motor Circuits smaller than ½ HP	120VAC – 1 phase – 60Hz

I. Sound power level ratings shall comply with AMCA 301. Factory test fans according to AMCA 300.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install ventilation equipment before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Coordinate size and location of structural steel support members.

C. Correct conditions detrimental to timely and proper completion of Work. Do not proceed until unsatisfactory conditions are corrected.

D. Provide flashing including base flashing and counter flashing where items of this section penetrate roof, outer walls or waterproofing of any kind.

3.2 Installation

A. Refer to Section 01 73 00 and 01 73 24 for basic execution and installation requirements.

B. Install ventilation equipment to allow maximum possible headroom unless specific mounting heights are shown.

C. Install equipment to facilitate service, maintenance and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Mechanical Code Chapter 5 "Exhaust Systems"

4. Other applicable fire, mechanical and electrical code requirements

5. NFPA 90A Installation of Air Conditioning and Ventilating Systems

E. Refer variances between Manufacturer's installation instructions and Contract Documents to Owner's Representative.

F. Install ventilation equipment to tolerances recommended by Manufacturer. Unless otherwise shown, install ventilation equipment true and level using precision gauges and levels.

G. Cut fit and place miscellaneous mechanical supports accurately in location, alignment and elevation to support and anchor HVAC materials and equipment.

H. Install fans and ventilators level and plumb with clearances for service and maintenance. Provide seismic restraint as required by CBC. Lubricate and balance fans per Manufacturer's requirements.

I. Align motors, bases, shafts of motor driven equipment. Tension belts according to Manufacturer's installation instructions.

J. After completing installation, internally clean fans according to Manufacturer's instructions. Remove foreign material and construction debris. Vacuum fan wheels and cabinets. Inspect exposed finish. Remove burrs, dirt and construction debris and repair damaged finishes.

K. Provide thermostats with fans where shown. Set thermostat to 80°F.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fans	Startup Checks	Verify shipping blocking & bracing are removed. Verify unit is securely mounted and connections to ducts and accessories are complete. Verify thermal overload protection is installed on motors. Verify thermostat set point and fan operation at set point Verify operation of fans when activated by wall switch and alarms. Verify cleaning & adjusting are complete With fan drive disconnected, verify proper motor rotation and fan free wheel rotation and bearing operation. Reconnect fan drive system.	All fans	Contractor	Contractor
	Starting Procedures	Energize motor & adjust fan to indicated rpm. Measure & record motor voltage & amperage. After energizing electrical circuitry, start units to confirm proper motor rotation and unit operation. Test and adjust controls and safeties. Shut unit down and reconnect automatic temperature control operators. Lubricate bearings.	All fans	Contractor	Contractor
	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	Balancing	Comply with applicable sections of Section 23 05 93.			
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 Scope Of Work

A. Provide labor, materials, equipment, transportation and perform operations necessary or incidental to the proper execution and completion of the electrical work, whether specifically mentioned or not, and as directly indicated or reasonably implied by the Drawings and Specifications.

B. Work specified in these divisions:

1. Section 26 05 19: 600-Volt Power Conductors and Cables
2. Section 26 05 26: Grounding and Bonding for Electrical Systems
3. Section 26 05 33: Raceway and Boxes for Electrical Systems
4. Section 26 05 53: Identification for Electrical Systems
5. Section 26 24 16: 600-Volt Rated Panelboards & CB
6. Section 26 27 26: Wiring Devices
7. Section 26 50 00: Interior Lighting
8. Section 26 56 00: Exterior Lighting

C. Work specified in other divisions:

1. Section 33 71 73: Electric Utility Services
2. Section 40 67 16: Control Panel and Devices

1.2 Work Not Included

A. In any case, cooperate with the other trades who may or may not be party to this Contract for the purpose of coordinating the electrical requirements and installation of equipment, materials, and furnishings provided by those other trades, including the Owner.

1.3 Codes And Standards

A. Provide equipment and materials which conform to, and perform the installation thereof in accordance with the following codes and industry standards. The applicable version of each shall be that in effect as of the date of the Contract:

1. California Electrical Code (CEC).
2. Titles 8, 19 and 24 of the California Code of Regulations (CCR).
3. American National Standards Institute (ANSI).
4. California State Fire Marshal (CSFM).
5. Underwriters' Laboratories (UL).
6. National Electrical Manufacturers' Association (NEMA).
7. Institute of Electrical and Electronics Engineers (IEEE).
8. National Electrical Safety Code (NESC).
9. Electrical Safety Orders.
10. Other applicable local codes and ordinances.

B. Where the authority-having-jurisdiction makes an interpretation or decision, as is their prerogative in accordance with the Code, such direction shall be considered a part of these Contract Documents as if contained herein. With respect to completing the intent of the Contract Documents, comply with any and all requirements of the authority-having-jurisdiction and utility company field inspectors, at no additional cost.

C. The above referenced codes and standards are considered to be absolute minimum requirements. The Drawings and Specifications shall take precedence over the above referenced codes and standards where materials or workmanship of higher quality or larger size is indicated. Nothing in these Drawings or Specifications shall be construed to allow work not conforming to the applicable codes and standards.

1.4 Review Of Contract Documents

A. Examine all relevant Contract Documents including Drawings, Specifications, and Shop Drawings in order to become acquainted with the Work of other installers whose activities will adjoin or be affected by the Electrical Work.

1.5 Permits, Licenses, And Fees

A. Procure and pay for all permits, licenses and fees that are required to carry out and complete the Electrical Work.

B. Pay for building department or utility company imposed inspection fees.

C. Pay utility company charges for normal or after hours shutdowns, service calls, repairs, and cable locating that are directly related to the installation of the Electrical Work.

1.6 Site Verification Of Information

A. Visit the project site prior to submitting a bid and verify the condition, location and dimensions of buildings, equipment, and facilities. Become acquainted with conditions under which the Work is to be performed and which may affect the cost thereof.

B. Verify at the project site, the accuracy of information shown on the Drawings regarding existing equipment, materials, and facilities. This includes but is not limited to: size, type, rating, quality, age, and serviceability. No allowance will be made on behalf of the Contractor for extra expenses resulting from the failure to discover conditions affecting the Work.

1.7 Working Space

A. Maintain adequate work space around, and access to, electrical and mechanical equipment in strict accordance with the applicable Codes. Verify during the course of construction that sufficient space will be available for the installation equipment, fixtures, etc.

1.8 Materials And Substitutions

A. Materials shall be new, high quality, free from defects, of standard make, and of the brand or grade as shown on the Drawings or specified herein. Specific trade names are used in the Drawings and Specifications in order to establish the standard grade and

characteristics of said items. This does not imply the right upon the part of the Contractor to use other materials or methods without the approval of the owner

B. Electrical materials and equipment shall bear the label of, or be listed by, the Underwriters' Laboratories (UL) wherever standards have been established and label service is regularly furnished by that agency. Comply with the installation and application requirements of UL as documented in their published directories.

C. Unless specifically noted, equipment and systems shall be the product of a manufacturer who has been in the manufacture of, and has nationally distributed catalogs covering the ratings and specifications of, said equipment or systems, for a period of not less than five (5) years.

D. Maintain uniformity throughout the Project by making use of only one make or brand of material for each material used.

E. Substitutions of materials or methods will only be allowed if such items are approved in writing by the owner as equal in quality and utility to the specified items. Submit a list of proposed substitutions within thirty (30) days of the award of the Contract. Include on the list the original manufacturer's name and model number, the proposed manufacturer's name and model number, catalog cut sheets, ratings, sizes, performance curves, shop drawings, and other data as may be required to demonstrate equality to the specified item.

F. The approval of a substitution does not authorize any deviation from the utility, size, function, or durability of the specified item unless specifically pointed out and requested in the proposed substitution list, and said deviation is approved in writing by the owner. Responsibility of the Contractor for dimensional considerations or space conflicts is not relieved by the approval of a substitution.

G. If requested by the owner, submit samples of materials and equipment for approval prior to installation.

1.9 Electrical Submittals

A. See the General Conditions for conditions of submittal approval and general requirements for submission of shop drawings.

B. Submit a minimum of five copies (or more as required by the General Conditions) of electrical shop drawings and manufacturer's cut sheets for equipment and materials as noted in each Division 26 specification section. Bind the submittals as complete volumes according to classification of equipment such as power, lighting, fire alarm, etc. When possible, make all electrical submittals at the same time.

C. Submit shop drawings and supporting data as instruments of the Contractor. Stamp each item in the submittal documents with the Contractor's stamp, thereby stating that the equipment meets all requirements and conditions of the Drawings and Specifications. In particular, certify that the items shown on the shop drawings conform to the dimensional, environmental, and space restrictions as pertains to all work under this Contract and the work of other parties in conjunction with this Project.

D. Provide a blank space on the title page of each submittal classification for the owner's or Engineer's approval stamp and comment field. The minimum size of such space shall be eight inches wide by five inches high.

E. Arrange panelboard submittals to show bussing, circuit numbering, and branch circuit protective devices similar the schedules on the Drawings. Show elevations of switchboards, motor control centers, and distribution centers indicating the layout of devices, meters, handles, etc. Provide device ratings, circuit numbers, and nameplate descriptions in table form. Include terminal strip mounting arrangements on elevations for terminal cabinets.

1.10 Drawings And Specifications

A. The data and information contained on the Drawings is as accurate as was reasonably possible at the time they were produced, but absolute accuracy is not guaranteed. Exact locations, distances, elevations, etc., will be dictated by the actual building and the conditions at the site.

B. The layout of electrical equipment, wiring, and accessories is shown in a diagrammatic fashion (not pictorially) in order to achieve clarity and legibility. Although the size and location of electrical equipment is drawn to scale wherever possible, refer to all data in the Contract Documents and field verify this information as the project progresses. Examine architectural, structural, mechanical, and other drawings to determine the exact location of conduits, outlets, fixtures, and equipment and to note any conditions which may affect the electrical work.

C. The Drawings and Specifications may be superseded by later detail drawings and specifications prepared by the owner. Conform to such detail drawings, specifications, addenda, change orders, other reasonable changes as if they are contained herein. See the General Conditions for change order cost considerations.

D. Because the Electrical Drawings may be distorted for clarity of representation, it may be necessary to field verify the exact location of electrical outlets, lights, switches, etc. in order to conform to the architectural elements. The owner reserves the right to make minor changes to the locations of equipment, devices, and wiring shown on the Drawings, at no additional cost, providing the changes are ordered before the rough-in of conduit, boxes, or related items is completed, and no extra material are required.

E. For dimensional and locational purposes, the Architectural Drawings take precedence over the Electrical Drawings. Determine the appropriate location of lighting fixtures, outlets, wall-mounted devices, etc. by studying the reflected ceiling plans, building sections, and interior elevations. Report conflicting conditions to the Architect before rough-in for adjustments to the locations.

F. Conduit quantities, sizes, termination points, and wiring are depicted on the Electrical Drawings. However, not all conduit bends or routing details are necessarily shown. Route conduit so as to conform to the structural conditions, avoid obstructing other trades, maintain space restrictions and keep circulation areas and access openings clear.

G. Thoroughly examine the Contract Documents prior to submitting a bid in order to determine electrical requirements which are not necessarily indicated on the Electrical Drawings. Include sufficient allowance in the bid sum to cover the costs of these other requirements.

H. Should the Contractor perceive that the Drawings and Specifications do not sufficiently define the intent of electrical work, contact the Architect for clarification or additional information. The absence of such contact will be considered as evidence of understanding, on the part of the Contractor, of the intended Electrical Work and the required installation thereof.

1.11 Workmanship

A. Constantly supervise the work personally or through an authorized and competent representative. Keep the same foreman or supervisor on the project from commencement through completion.

B. Perform the Electrical work using the highest caliber craftsman available. Workmanship shall be first class and of the best quality available to insure a long and trouble free service life. Allow only experienced and competent workmen on the job.

1.12 Cooperation And Coordination

A. Consult with the other installers and trades in coordinating the Work so as to avoid conflicts, omissions and delays. Cooperate with other contractors, third parties, and the Owner in order to expedite the project and provide for the proper execution of the building as a whole. Work performed without regard to other trades or the overall project scheme, may necessarily be required to be moved at the Contractor's expense.

1.13 Manufacturer's Directions

A. Adhere to the manufacturer's directions regarding the proper installation and configuration of electrical equipment where those directions cover points not included in these Drawings and Specifications.

1.14 Protection And Storage

A. Deliver electrical materials to the site new, and in unbroken packages. Provide for the temporary storage of such materials, equipment, and construction tools in accordance with the General Conditions. Protect electrical equipment and materials during transit, storage and handling to prevent damage, soiling and deterioration.

B. During shipping storage and handling protect electrical materials from damage of any type including dust, water, over-spray, and temperature. Avoid damage during construction to the work and materials of other trades as well as the electrical work and material. Repair or replace, at the Contractor's expense, defective or damaged items such that the entire Work is completed in a condition satisfactory to the owner.

1.15 Excavation, Cutting, Patching, And Repair

A. Perform excavation and backfill required for the installation of electrical sub-structures. Restore grounds, walkways, roadways, curbs, walls, and other existing underground facilities to their original condition.

B. Cut, core-drill, and demolish existing walls, floors, ceilings and other building surfaces as required for the installation of Electrical Work. Obtain the approval of the owner prior to performing any operation which may affect any structural elements of the building.

C. Patch and repair wood, plaster, tile, or concrete surfaces which have been damaged by the installation of the Electrical Work so that the finished surface matches the surrounding conditions.

1.16 Flashing, Waterproofing And Sealing

A. In general, install in an approved watertight manner, Electrical Work which pierces exterior walls or waterproofing membranes. Flash and counter-flash roof and wall penetrations in a manner described in other applicable sections of this Specification and as approved by the owner.

B. Fit conduits passing through finished walls with steel escutcheon plates of brass, chrome, or painted finish as directed by the owner. Grout penetrations of floor slabs, concrete or masonry walls with an approved grout or silicone elastomeric caulk.

1.17 Cleaning, Adjusting, And Touch-Up

A. Remove on a daily basis electrical debris, scraps, packaging material and other rubbish. Dispose of such items off-site in an approved manner and debris. Maintain the site free from physical hazards at all times in accordance with OSHA regulations. See the General Conditions for additional requirements.

B. After installation, completely clean electrical equipment, fixtures, and materials of excess paint, over-spray, plaster, cement, insulating products, and other foreign matter. Leave the Electrical Work in a clean, finished, dry, level, like new condition.

C. Touch-up paint scratches and scuffs on electrical equipment and lighting fixtures with paint recommended by the manufacturer and matching the original item finish.

D. Make setting, adjustments, and programming in accordance with the manufactures' operating and installation instructions. Settings and program variables will be issued by the owner prior to commissioning of the electrical system.

1.18 As-Built Drawings

A. Throughout the project, maintain accurate and current record documents. Show on the record drawings deviations from the Electrical Drawings, locations of underground conduits and pull-boxes, and concealed equipment which is not readily apparent. Dimension the record drawings using permanent, readily identified benchmarks such as column or wall lines.

B. At the completion of the project, present one clearly legible set of the record drawings to the owner.

1.19 Inspections And Testing

A. Arrange for the inspection of the Work at various stages of completion by the Authority Having Jurisdiction, utility company representatives, and the owner. Comply with all directions and remedial measures issued thereby. Any objections to these orders on the part of the Contractor must be presented to the owner in writing within forty eight (48) hours of the inspection report.

B. Coordinate the installation of the Work so that observation of all rough-in, concealed, or underground Work can take place by the owner. Provide a minimum of seventy two (72) hour notice to the owner prior to covering up the work. Uncover Work that has not been properly observed and make repairs to restore the Work and adjoining surfaces to their proper condition at no additional cost.

C. Perform tests of the electrical system during the course of the project and at project completion to ensure safe and proper function in accordance with the Contract Documents, manufacturers' recommendations, and applicable codes. Provide complete documentation of all test results to the owner prior to project completion. Testing shall include, but not necessarily be limited to, the following:

1. Test for short circuits, open circuits, neutral leakage, and improper grounds on feeders and branch circuits. Perform this test with mains in disconnect from feeders, branch circuits closed, fixtures and devices permanently connected, lamps removed from sockets and wall switches closed.
2. Provide insulation resistance tests of all phase and neutral circuit conductors using a 500 Volt Megger for circuits of 240 Volt rating and below, and a 1000 Volt Megger for circuits of 277 volts and above. Minimum acceptable insulation resistance is one (1) megohm.
3. Perform a ground resistance test of each main grounding electrode system, ground rod, and supplemental grounding electrode. Utilize a calibrated, direct reading, earth ground test set and make the tests using the "Three-terminal, Fall-of-Potential" method. The maximum allowable earth ground resistance is 25 ohms.
4. Test for proper phase-to-phase and phase-to-neutral operating voltage on the main service and on each separately derived system. Perform this test at full load and at no load. With all circuits at full operating conditions, test the phase and neutral load currents using a clamp-on ammeter.
5. Tests as required by other sections of these Specifications.
6. Tests as prescribed by individual equipment manufacturers whether or not described in these Specifications.

D. At project completion, demonstrate to the owner that the entire installation is complete, in proper operation condition and that the Contract has been properly and fully executed. Activate all circuits, lights, devices, and controls under full load and normal operating conditions. Identify faulty items and immediately replace or repair defective equipment, workmanship, and materials to like new condition and retest in the presence of the owner.

E. At the completion of the Project, demonstrate to the owner that the entire electrical system is free from short circuits and improper grounds, or upon request of the owner anytime, make necessary tests under the observation of the owner which will ensure that electrical equipment, materials and installation methods are as specified.

1.20 Guarantee

A. In accordance with Division 1 requirements.

1.21 Warranties, Certificates, And Operating Manuals

A. Properly fill out and deliver to the owner, all warranties, guarantees, certificates, etc. for equipment and materials that are furnished and installed under this Section of the Work.

The effective date on each item shall be the date of acceptance of the work by the Owner.

B. Deliver to the owner, a minimum of two (2) copies of the manufacturers' operating and maintenance manuals for major items of equipment.

END OF SECTION

SECTION 26 05 19
LOW VOLTAGE CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 Summary

A. wire and cable, This section covers all labor, material, tools, equipment and services required to install power conductors, control cables, wiring connectors and connections.

1.2 Related Sections

A. Section 26 05 00: General Electrical Provisions

B. Section 26 05 26: Grounding and Bonding for Electrical Systems

C. Section 26 05 33: Raceways and Boxes for Electrical Systems

D. Section 26 05 53: Identification for Electrical Systems

1.3 Reference Specifications, Codes And Standards

A. ASTM B 3 Soft or Annealed Copper Wire

B. ASTM B 496 Compact Round Concentric-Lay-Stranded Copper Conductors

C. ASTM B 8 Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

D. ANSI C 2 National Electrical Safety Code – latest edition

E. IEEE 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

F. IEEE 399 Recommend Practice for Industrial and Commercial Power System Analysis.

G. NECA (National Electrical Contractors Association) - Standard of Installation.

H. NEMA WC-26 Wire and Cable Packaging

I. NETA ATS National Electrical Testing Association Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

J. NFPA 70 National Electrical Code – latest edition.

K. UL 83 Thermoplastic-Insulated Wires and Cables.

L. UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.

M. UL 510 Polyvinyl Chloride, Polyethylene and Rubber Insulating Tapes.

1.4 System Description

A. The applications for cable, wire and connectors required, but not limited to, are as follows:

1. Power distribution circuitry.
2. Lighting circuitry.
3. Appliance and equipment circuitry.
4. Wiring for motors of mechanical equipment
5. Wiring from the motor(s) of mechanical equipment to the disconnect switches or junction boxes, including wiring for pushbuttons, pilot lights, interlocks and similar devices as directed, shown, or specified.
6. Wiring from the motors of mechanical equipment to motor starters, including other auxiliary wiring as may be required, directed, or shown.
7. Line voltage wiring as required by other Divisions 2 thru 15, and interlocking to motor starters.
8. Control wiring for motors, mechanical equipment, relays and switches, and similar mechanical-electrical devices.
9. Line voltage wiring to thermostats, alarm systems and other miscellaneous equipment.

1.5 Project Conditions

A. All wire and cables shall be minimum No. 12 AWG copper conductor unless otherwise shown on drawings.

B. All conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is diagrammatic unless dimensioned.

a. Route wire and cable as required complementing project conditions.

D. The contractor shall be responsible for any and all raceways and raceway/cable supports in accordance with all other sections of these specifications.

1.6 Regulatory Requirements

A. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories, Inc. (ETL), or other recognized, acceptable testing and listing agencies as suitable for the purpose specified and shown.

1.7 Contractor Submittals

A. Product Data:

1. Submit manufacturer's catalog cuts and technical data for building wire and cables.

B. Field Test Report:

1. Measure overall insulation resistance to ground. Provide certified test report for Engineer's Review.

1.8 Closeout Submittals

A. Provide project record documents showing actual locations of components and circuits.

B. Submit final certified test reports of all insulation resistance tests.

1.9 Qualifications

A. Manufacturer shall be a Company specializing in manufacturing products specified in this section with a minimum of five (5) years experience.

1.10 Delivery, Storage, And Handling

A. Deliver, store, protect, and handle products on site in accordance with Division 1 requirements.

B. Accept cable and accessories on site in manufacturer's packaging. Inspect for damage.

C. Store and protect cable and accessories from the environment in accordance with manufacturer's published instructions. Provide adequate heating and ventilation to prevent condensation.

D. Damaged items shall be replaces at no additional cost to Owner.

1.11 Coordination

A. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

B. Wire and cable routing indicated is approximate unless dimensioned. Include wire and cable lengths within 10 feet of length shown.

PART 2 - PRODUCTS

2.1 Building Wire And Cable

A. Building wire and cable shall be UL83 compliant, insulated, single conductor, copper, solid or stranded, rated for 600-volts AC. The insulation shall be thermoplastic material rated for 90 degrees Celsius dry locations, 75 or 90 degrees Celsius wet locations, THW, THHN/THWN, RHW or XHHW, per ANSI/NFPA 70.

B. For Interior Dry Location: Use only building wire, THHN/THWN insulation rated 90 degree Celsius, in raceway.

C. For Exterior Wet or Dry Locations: Use only XHHW insulation rated for 90 degree Celsius, in raceway.

D. For Underground Dry or Wet Locations: Use only XHHW insulation rated 90 degree Celsius, in raceway.

E. For connections to electrical equipment, coordinate wire type with equipment manufacturer.

F. Manufacturer: Aetna, General Cable, Okonite Company, Southwire

2.2 Instrumentation Cable

A. Single Pair (600 Volt No.16 AWG Twisted, shielded pair instrumentation Cable, Type TC):

1. General: Single pair instrumentation cable designed for noise rejection for process control, computer, or data log application. Suitable for installation in cable tray,

conduit, data approved raceways. Minimum cable temperature rating shall be 90°C dry locations, 75°C wet locations

2. Individual Conductors: Soft annealed copper, Class B, 7-strand concentric per ASTM B8, 22 AWG, 7-strand copper tinned drain wire.
3. Insulation and Jacket: Each conductor PVC / Nylon insulation. Pair conductors pigmented black and white. Jacket flame-retardant and sunlight and oil resistant PVC with 45 mils nominal thickness. Shield aluminum/Polyester overlapped to provide 100 percent coverage.
4. Dimension: 0.345 inch nominal OD.
5. Manufacturer: Alpha Wire Corporation, Belden, General Cable, the Okonite Company, Lake Cable

B. Single Triad (600 Volt No.16 Twisted, Shielded Triad Instrumentation Cable, Type TC):

1. General: Single triad instrumentation cable designed for noise rejection for process control, computer, or data log application. Suitable for installation in cable tray, conduit or other approved raceways. Minimum cable temperature rating shall be 90°C dry locations, 75°C wet locations.
2. Conductors: Soft annealed copper, Class B, 7-strand concentric per ASTM B8, 22 AWG, 7-strand copper tinned drain wire.
3. Insulation and Jacket: Each conductor, PVC/Nylon insulation. Triad conductors pigmented black, red, and white. Jacket flame-retardant and sunlight and oil retardant PVC with 45 mils nominal thickness. Shield aluminum/Polyester, overlapped to provide 100 percent coverage
4. Dimensions: 0.360-inch nominal OD5.
5. Manufacturers: Aplpha Wire Corporation, Belden, General Cable, the Okonite Company, Lake Cable

C. Multi-conductors, Multi-pairs, or Multi-triads not acceptable, unless used for cable tray application. Cable runs that are partially or totally run in cable tray shall be of multi-conductor type for wire sizes that are required in the NEC.

2.3 Equipment Grounding Conductors:

A. Provide stranded copper conductors, as indicated or as required by NEC, for equipment grounding. All grounding conductor shall be stranded copper.

B. Provide conductors with green Type THHN insulation with minimum thickness of 1/32-inch.

2.4 Wiring Connectors

A. Split Bolt Connectors:

1. FCI Burndy Corp.
2. Cooper Crouse Hinds.
3. O.Z./Gedney Co.
4. Thomas & Betts Co.
5. 3-M Co.

B. Solderless Pressure Connectors:

1. FCI Burndy Corp.
2. Ideal Industries Co.
3. Thomas & Betts Co.

4. 3-M Co.

C. Spring Wire Connectors:

1. Ideal Industries Co.
2. 3-M Co.

D. Compression Connectors:

1. FCI Burndy Corp.
2. Thomas & Betts Co.
3. 3-M Co.

2.5 Wire Color Code

A. Color-code all conductors:

1. Wire sizes No. 10 AWG and smaller shall have integral color-coded insulation.
2. Wire sizes No. 8 AWG and larger may have black insulation but shall be identified by color-coded electrical tape at all junction, splice, pull, or termination points.
3. Color tape shall be applied to at least 3 inches of the conductor at the termination ends and in junction or pull boxes or where readily accessible.
4. Conductors for all systems shall not change color at splice points.
5. Where there are two or more neutrals in one conduit, each shall be individually identified with the proper circuit.
6. For No. 4 AWG and larger ground conductors, identify with green tape at both ends and all visible points, included in all junction boxes.

B. Each phase wire shall be uniquely color-coded as indicated below:

1. 120/240-Volts

a. Phase A – Black
b. Phase B – Red
c. Neutral - White
d. Ground - Green

2. 120/208-Volts

a. Phase A – Black
b. Phase B – Red
c. Phase C – Blue
d. Neutral – White
e. Ground – Green

3. 277/480-Volts

a. Phase A - Brown
b. Phase B - Orange
c. Phase C – Yellow
d. Neutral - White or Natural Gray
e. Ground – Green

4. Isolated Grounds: Green with Yellow Stripes

PART 3 - EXECUTION

3.1 Examination

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire and cable has been completed.

C. Verify that raceway installation is complete and supported as required by the specifications.

3.2 Preparation

A. Test raceway with a mandrel and thoroughly swab out to remove foreign material before pulling cables.

B. For conduits sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel.

C. For conduits sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. Then draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel.

3.3 Installation

A. General:

1. Install wire and cable in accordance with manufacturer's instructions and NECA “Standard of Installation”.
2. Route wire and cable as required to meet project conditions.
3. Identify and color code wire and cable. Identify each conductor with its circuit number or other designation indicated.
4. Protect exposed cable from damage.
5. Pull all conductors into raceway at same time.
6. Use suitable wire pulling lubricant for building wire No. 4 AWG and larger. Lubricant shall not be deleterious to the cable sheath, jacket or outer covering.
7. Do not exceed cable manufacturer’s recommended pulling tension limits when installing wire or cable.
8. Support cables above accessible ceiling using standard support methods to support cables from structure. Do not rest cable on ceiling panels.
9. Neatly train and lace wiring inside boxes, equipment, and panelboards

B. Cable and Wire Size:

1. Conductor sizes are based on copper unless specifically indicated as aluminum or “AL”.
2. Use conductor no smaller than No. 12 AWG for power and lighting circuits.
3. Use conductor no smaller than No. 14 AWG for control circuits.
4. Use No. 10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 75 feet.
5. Use No. 10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 200 feet.
6. Use stranded conductor for all feeders, branch and control circuits.

C. Cable Identification

1. Identify all wires and cables as specified in other Sections of these Specifications.

D. Special Techniques - Wiring Connections:

1. Clean conductor surfaces before installing lugs and connectors. Where an anti-oxidation lubricant is used, apply liberally, coating all exposed conductor surfaces.
2. Use suitable cable fittings and connectors.
3. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
4. Use split bolt connectors for copper conductor splices and taps, No. 8 AWG and larger.
5. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, No. 8 AWG and smaller.
6. Tape un-insulated conductors and connector with two layers of half-lapped rubber insulating compound tape and two layers of half-lapped, 7-mil electrical tape, Scotch 33+, or equal.
7. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, No. 10 AWG and smaller.
8. Stranded conductors for control circuits shall have fork or ring terminals crimped on for all device terminations. Bare stranded conductors shall not be placed directly under the screws.

3.4 Field Quality Control

A. Field inspection and test shall be performed under provisions of NETA ATS section 7.3 (2) - Low Voltage Cables, 600-Volt Maximum as follows.

1. Visual and Mechanical Inspection:

a. Compare cable data with drawings and specifications.
b. Inspect exposed sections of cable for physical damage and correct connection in accordance with single-line diagram.
c. Inspect all bolted electrical connections for high resistance using one of the following methods:
    1) Use of low-resistance ohm-meter in accordance with NETA section 7.3.2.2 (Electrical Tests).
    2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data from NETA ATS Table 10.12.

d. Inspect compression-applied connectors for correct cable match and indentation.
e. Verify cable color coding with applicable specifications and National Electrical Code.

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 one minute.

b. Perform resistance measurements through all bolted connections with low-resistance ohmmeter, if applicable, in accordance with Section 7.3.2.1 (Visual and Mechanical Inspection).
c. Perform continuity test to insure correct cable connection.
d. Correct malfunctions and/or deficiencies immediately as detected at no additional cost to the District, including additional verification testing.
e. Subsequent to final wire and cable terminations, energize all circuitry and demonstrate functional adequacy in accordance with system requirements.

3. Test Values

a. Compare bolted connection resistance to values of similar connections.
b. Bolt-torque levels should be in accordance with NETA ATS Table 10.12 unless otherwise specified by the manufacturer.
c. Micro-ohm or milli-volt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
d. Minimum insulation-resistance values should not be less than 50 meg-ohms.
e. Investigate deviations between adjacent phases.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes: Grounding systems and equipment.

B. Section includes grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.

1.3 Action Submittals

A. Product Data: For each type of product indicated.

1.4 Informational Submittals

A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.

B. Qualification Data: For qualified testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.5 Closeout Submittals

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features at test wells and ground rings based on NFPA 70B

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.6 Quality Assurance

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 Conductors

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm**)** in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 Connectors

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 Grounding Electrodes

A. Ground Rods: Copper-clad, round type; 3/4 inch by 10 feet (19 mm by 3 m) in diameter.

2.4 Applications

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

E. Comply with IEEE C2 grounding requirements.

2.5 Equipment Grounding

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Three-phase motor and appliance branch circuits.
5. Armored and metal-clad cable runs.
6. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

7. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch (6.3-by-100-by-300-mm) grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

2.6 Installation

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

1. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Boxes and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

2. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

F. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column extending around the perimeter of building

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.

G. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70; use a minimum of 20 feet (6m) of bare copper conductor not smaller than No.4 AWG.
1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

H. Labeling

1. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

2. Install labels at the telecommunications bonding conductor and at the grounding electrode conductor where exposed.

a. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

2.7 Field Quality Control

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 25 ohms.

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 Definitions

A. EMT: Electrical metallic tubing.

B. RMC: Rigid metal conduit.

1.4 Performance Requirements

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 Action Submittals

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings :Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.

4. Equipment supports.

1.6 Informational Submittals

A. Welding certificates.

1.7 Quality Assurance

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.8 Coordination

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 Support, Anchorage, And Attachment Components

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Allied Tube & Conduit.
      b. Cooper B-Line, Inc.; a division of Cooper Industries.
      c. ERICO International Corporation.
      d. GS Metals Corp.
      e. Thomas & Betts Corporation.
      f. Unistrut; Tyco International, Ltd.
      g. Wesanco, Inc.
      h. Or approved equal.
   2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   5. Channel Dimensions: Selected for applicable load criteria.
   6. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical

conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
      5) Or approved equal.
2. Mechanical-Expansion Anchors: Insert-wedge-type, or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.
      6) Or approved equal
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 Fabricated Metal Equipment Support Assemblies

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 Application

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps

3.2 Support Installation

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
5. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 Installation Of Fabricated Metal Supports

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 Concrete Bases

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa) , 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section Cast-in-Place Concrete"

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 Painting

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 Section for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.3 Definitions

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 Action Submittals

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 Metal Conduits, Tubing, And Fittings

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.

10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

F. FMC: Comply with UL 1; zinc-coated steel or aluminum.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 Nonmetallic Conduits, Tubing, And Fittings

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. Electri-Flex Company.
8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. ENT: Comply with NEMA TC 13 and UL 1653.

D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

E. LFNC: Comply with UL 1660.

F. Rigid HDPE: Comply with UL 651A.

G. Continuous HDPE: Comply with UL 651B.

H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.

I. RTRC: Comply with UL 1684A and NEMA TC 14.

J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

K. Fittings for LFNC: Comply with UL 514B.

L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

M. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 Boxes, Enclosures, And Cabinets

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Adalet.
2. Cooper Technologies Company; Cooper Crouse-Hinds.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a Pentair company.
7. Hubbell Incorporated; Killark Division.
8. Kraloy.
9. Milbank Manufacturing Co.
10. Mono-Systems, Inc.
11. O-Z/Gedney; a brand of EGS Electrical Group.
12. RACO; a Hubbell Company.
13. Robroy Industries.
14. Spring City Electrical Manufacturing Company.
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
16. Thomas & Betts Corporation.

17. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)

L. Gangable boxes: are prohibited.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

2.4 Handholes And Boxes For Exterior Underground Wiring

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Oldcastle or comparable product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation; Hubbell Power Systems.
    d. NewBasis.
    e. Synertech Moulded Products; a division of Oldcastle Precast, Inc.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC."
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.
9. SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

C. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 Raceway Application

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: PVC-CoatedGRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC, concrete encased under trafficable areas.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed: GRC.
2. Concealed in Ceilings and Interior Walls and Partitions: RNC, Type EPC-40-PVC.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: PVC-Coated GRC.
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 Installation

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Complete raceway installation before starting conductor installation.

C. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. A. Support conduit within 12 inches (300 mm) of enclosures to which attached.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

N. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

1. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

P. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

Q. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires**,** equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

T. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat

surface for a raintight connection between box and cover plate or supported equipment and box.

V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

W. Locate boxes so that cover or plate will not span different building finishes.

X. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Z. Set metal floor boxes level and flush with finished floor surface.

AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 Installation Of Underground Conduit

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.
7. Underground Warning Tape: Comply with requirements in Division 26 Section "Identification for Electrical Systems."

3.4 Installation Of Underground Handholes And Boxes

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 Sleeve And Sleeve-Seal Installation For Electrical Penetrations

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 Protection

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.3 Action Submittals

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 Quality Assurance

A. Comply with ANSI A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 Coordination

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 Power Raceway Identification Materials

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.
3. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 Armored And Metal-Clad Cable Identification Materials

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.
3. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 Power And Control Cable Identification Materials

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 Conductor Identification Materials

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 Floor Marking Tape

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 Underground-Line Warning Tape

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type I:

1. Pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility**,** compounded for direct-burial service.
2. Thickness: 4 mils (0.1 mm).
3. Weight: 18.5 lb/1000 sq. ft. (9.0 kg/100 sq. m).
4. 3-Inch (75-mm) Tensile According to ASTM D 882: 30 lbf (133.4 N), and 2500 psi (17.2 MPa).

D. Tag: Type II:

1. Multilayer laminate consisting of high-density polyethylene scrim coated with pigmented polyolefin, bright-colored, continuous-printed on one side with the inscription of the utility**,** compounded for direct-burial service.
2. Thickness: 12 mils (0.3 mm).
3. Weight: 36.1 lb/1000 sq. ft. (17.6 kg/100 sq. m).
4. 3-Inch (75-mm) Tensile According to ASTM D 882: 400 lbf (1780 N), and 11,500 psi (79.2 MPa).

E. Tag: Type ID

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 70 lbf (311.3 N), and 4600 psi (31.7 MPa).

F. Tag: Type IID

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, [continuous-printed on one side with the inscription of the utility,]compounded for direct-burial service.
2. Overall Thickness: 8 mils (0.2 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 34 lb/1000 sq. ft. (16.6 kg/100 sq. m).
5. 3-Inch (75-mm) Tensile According to ASTM D 882: 300 lbf (1334 N), and 12,500 psi (86.1 MPa).

2.7 Warning Labels And Signs

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.8 Instruction Signs

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.9 Equipment Identification Labels

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm) .

2.10 Cable Ties

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.11 Miscellaneous Identification Products

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 Installation

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 Identification Schedule

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 30-foot (10-m) maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.

   a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
   b. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.

   c. Colors for 480/277-V Circuits:

      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.

   d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

J. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: [Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
b. Outdoor Equipment: Engraved, laminated acrylic or melamine label
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
b. Enclosures and electrical cabinets.
c. Access doors and panels for concealed electrical items.
d. Switchgear.
e. Switchboards.

f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
g. Substations.
h. Emergency system boxes and enclosures.
i. Motor-control centers.
j. Enclosed switches.
k. Enclosed circuit breakers.
l. Enclosed controllers.
m. Variable-speed controllers.
n. Push-button stations.
o. Power transfer equipment.
p. Contactors.
q. Remote-controlled switches, dimmer modules, and control devices.
r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 Work Included

A. Testing, commissioning and startup of electrical system wiring, equipment and grounding.
B. In general inspection, testing and startup is described in the relevant sections of the specifications.
C. Field tests of grounding and bonding systems are described in Section 26 05 26.
D. Field tests for low voltage conductors and cables are described in Section 26 05 19.
E. Factory and Field tests for Motor Control Centers are described in Section 26 24 19.
F. Field inspection and testing for Lighting is described in Sections 26 50 00 and 26 56 00.
G. Field tests for radio data transmission is described in Section 27 05 13.
H. Field tests for control panels and devices are described in Section 40 67 16.
I. Field and Factory Testing for programmable remote terminal unit and control panel assembly are described in Section 40 94 43.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 73 00: Execution
E. Section 01 75 00: Starting and Adjusting
F. Section 01 78 23: Operation and Maintenance Data
G. Section 01 78 36: Project Warranties
H. Section 26 05 10: Common Work Results for Electrical
I. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables
J. Section 26 05 26: Grounding and Bonding for Electrical Systems
K. Section 26 24 19: Motor Control Centers
L. Section 26 50 00: Interior Lighting
M. Section 26 56 00: Exterior Lighting
N. Section 27 05 13: Radio Data Transmission
O. Section 40 67 16: Control Panels and Devices
P. Section 40 94 43: Programmable Remote Terminal Unit

1.3 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Testing of installed equipment shall result in acceptable test results. Equipment for which acceptable test data has not been submitted, or has been submitted but rejected, shall be deemed as not meeting Contract Requirements.

C. Repair or replace items not passing tests.

1.4 References

A. California Electrical Code (CEC)
B. NETA ATS 1995 Acceptance Testing Specifications for Electric Power Distribution Equipment and Systems

C. NFPA 70 National Electric Code (NEC)

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Pre-Test Submittals	Submit at least 7 days before testing
	Submit test personnel qualifications (resumes)
	Submit equipment testing schedule
	Equipment Manufacturer's instructions for testing manufactured products
	Submit test data forms
Post-Test Submittals	Submit summary of testing for Work including date and time of all tests
	Submit description of equipment tested
	Submit description of tests and test procedures
	Submit test results
	Submit conclusions and recommendations
	Submit completed test forms in appendix, including witness's signatures.
	Submit list of test equipment in appendix including calibration documents
	Submit tabulated data for each piece of equipment tested, including circuit number, equipment or motor name and tag number (where applicable), nameplate full-ampere rating, motor service factor, motor ambient temperature rating, overload relay rating, measured full load current, and measured discharge pressures (where applicable)
	Note or indicate wiring deviations from Contract Documents on Project Record Documents.
Deviations from Contract Documents	

B. Refer to Section 01 33 00 for definition of requirements for submittals.

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Testing Firms

A. Retain qualified engineering appraisal and testing firm to perform inspections, tests, and evaluation to determine equipment designated herein is installed and adjusted for successful energization and operation.

B. Testing firm shall meet Federal OSHA criteria for accrediting testing laboratories, Title 29, Part 1910.7, and have a work history and qualifications acceptable to Owner.

C. Appraisal and testing firm shall have at least 2 years experience in appraising and testing equipment of nature to be tested.

D. Managing or supervising representatives of appraisal and testing firm shall have extensive knowledge of products involved and at least 2 years hands-on experience conducting appraisals and tests. Conduct all testing under supervision of managing or supervising representatives.

E. Testing technicians shall be trained and experienced in type of testing to be performed.

F. Testing firm shall use comprehensive report forms to document engineering appraisal and test results on all equipment and products tested. Upon testing completion, managing or supervising engineering representative shall sign forms prior to inclusion in final report.

G. Obtain written acceptance from Owner of testing firm prior to beginning testing. Testing service or personnel may be accepted or rejected based on, but not limited to testing equipment intended to be used, qualifications of firm, completeness of testing forms, and experience and reputation of personnel.

H. Acceptable manufacturers of testing equipment include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
3-Point Fall-of-Potential Ground Testing Equipment	Associated Research, Inc.	Lake Forest, IL
	Biddle-Megger	Chandler, AZ
	Accepted equal	

PART 3 - EXECUTION

3.1 Preparation

A. Notify Owner's Representative at least 3 days before tests to allow Owner to witness testing.

B. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

3.2 Testing

A. Refer to Sections 01 73 00 for basic execution requirements.

B. The following testing standards shall be followed:

1. NETA (National Electrical Testing Association) standards
2. Manufacturer's installation and warranty requirements
3. Applicable OSHA and Cal OSHA regulations
4. California Electrical Code
5. Other applicable ANSI, ASTM, and NEMA standards.

C. Refer variances between above documents and Contract Documents to Owner's Representative.

D. Perform tests to assure electrical equipment will safely operate within industry and Manufacturer's published tolerances and warranty requirements.

E. Record test result data to be used as baseline for future tests.

F. Report any items failing to pass tests promptly to Owner's Representative.

G. Coordinate work to expedite project schedule.

3.3 Field Quality Control

A. Field testing shall include the following, in addition to any other requirements specified in other sections of the specification:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Electrical Work	Installation Examination	Verify Work is free from improper grounds, short circuits and overloads.	1 inspection	Contractor	Contractor
		Verify correctness of wiring by visual comparison of conductor connections with connection diagrams.		Contractor	Contractor
		Make individual circuit continuity checks using electrical circuit testers.		Contractor	Contractor
	3-Point Fall-of-Potential Ground Test	Use accepted test equipment and test per Manufacturer's instructions	1 test each ground	Contractor	Contractor
	Circuit Insulation Resistance	Insulation resistance between conductors and between each conductor and ground shall be at least 25 megohms.	1 test each circuit before energizing	Contractor	Contractor
	Project Equipment Testing	Test the following electrical equipment items • MCC. • Molded Case Circuit Breakers. • Motors. • VFDs • Grounding Electrode Systems and Equipment Grounding System • 3-Phase Power Transformers.	1 test each piece of project electrical equipment, including 600 volt electrical distribution equipment, motor control centers, and grounding	Contractor	Contractor
	Motor Operating Test – Insulation Resistance, Continuity, Rotation	• Perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment including all motors ½ hp and larger before and in addition to tests performed by test laboratory. Supply suitable and stable source of test power to test laboratory at each test site. Test laboratory shall specify requirements. Notify test laboratory when equipment becomes available for acceptance tests. Perform all testing in presence of Owner's Representative. Test laboratory shall be responsible for implementing all final settings and adjustments on protective devices and tap changes. Test laboratory shall record all test results and upon completion, assemble and certify final test report		Contractor	Contractor
	Motor Operating Test - Current	Record current in each phase of each motor ½-hp and larger and include in O&M manual. Repair or replace motor or motor-driven equipment if current exceeds motor nameplate FLC value.	Each phase of each motor	Contractor	Contractor
	Power Company	When installation is complete and facility is in operation, check voltage at		Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
	Voltage Test	point of termination of Electric Utility supply to project. Check voltage amplitude and balance between phases for loaded and unloaded conditions. If unbalance as defined my NEMA exceeds 1%, or if voltage varies throughout day and from loaded to unloaded conditions my more than +5% nominal, make written request to Electrical Utility to either correct condition or provide written statement voltage variations and/or unbalance are within their normal standards.			
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturers' printed Literature	1 test	Contractor	Contractor

END OF SECTION

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SECTION 26 24 19
MOTOR-CONTROL CENTERS

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section includes MCCs for use with ac circuits rated 600 V and less and having the following factory-installed components:

1. Incoming main lugs and OCPDs.
2. VFDs.
3. Low Voltage Transformers
4. Lighting Panelboard
5. Feeder-tap units.
6. TVSS.
7. Instrumentation.
8. Auxiliary devices.

1.3 Definitions

A. RTU: Remote Terminal Unit.CE: Conformite Europeene (European Compliance).

B. CPT: Control power transformer.

C. EMI: Electromagnetic interference.

D. GFCI: Ground fault circuit interrupting.

E. IGBT: Insulated-gate bipolar transistor.

F. LAN: Local area network.

G. LED: Light-emitting diode.

H. MCC: Motor-control center.

I. MCCB: Molded-case circuit breaker.

J.MCP: Motor-circuit protector.

K. NC: Normally closed.

L. NO: Normally open.

M. OCPD: Overcurrent protective device.

N. PCC: Point of common coupling.

O. PID: Control action, proportional plus integral plus derivative.

P. PT: Potential transformer.

Q. PWM: Pulse-width modulated.

R. RFI: Radio-frequency interference.

S. SCR: Silicon-controlled rectifier.

T. TDD: Total demand (harmonic current) distortion.

U. THD (V): Total harmonic voltage demand.

V. TVSS: Transient voltage surge suppressor.

W. VFD: Variable-frequency Drive.

1.4 Performance Requirements

A. Seismic Performance: MCCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 Action Submittals

A. Product Data: For each type of controller and each type of MCC. Include shipping and operating weights, features, performance, electrical ratings, operating characteristics, and furnished specialties and accessories.

1. Shop Drawings: For each MCC, manufacturer's approval drawings as defined in UL 845. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

2. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Each installed unit's type and details.
b. Factory-installed devices.
c. Enclosure types and details.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of complete MCC, and for bus structure and each unit.
f. Features, characteristics, ratings, and factory settings of each installed controller and feeder device, and installed devices.
g. Specified optional features and accessories.

3. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring for each installed controller.
4. Nameplate legends.
5. Vertical and horizontal bus capacities.
6. Features, characteristics, ratings, and factory settings of each installed unit.

B. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFD input filtering to limit TDD and THD(V) at each VFD to specified levels.

1.6 Informational Submittals

A. Standard Drawings: For each MCC, as defined in UL 845.

B. Production Drawings: For each MCC, as defined in UL 845.

C. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around MCCs where pipe and ducts are prohibited. Show MCC layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Seismic Qualification Certificates: For MCCs, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For qualified testing agency.

F. Product Certificates: For each MCC, from manufacturer.

G. Source quality-control reports.

H. Field quality-control reports.

I. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

J. Warranty: Sample of special warranty.

1.7 Closeout Submittals

A. Operation and Maintenance Data: For MCCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's Record Drawings: As defined in UL 845. In addition to requirements specified in UL 845, include field modifications and field-assigned wiring identification incorporated during construction by manufacturer, Contractor, or both.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage, solid-state controllers.

5. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
6. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.8 Maintenance Material Submittals

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Indicating Lights: Two of each type and color installed.
4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.9 Quality Assurance

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain MCCs and controllers of a single type from single source from single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

E. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces.

1.10 Delivery, Storage, And Handling

A. Deliver MCCs in shipping splits of lengths that can be moved past obstructions in delivery paths.

B. Handle MCCs according to the following:

1. NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers Rated Not More Than 600 Volts."
2. NECA 402, "Recommended Practice for Installing and Maintaining Motor Control Centers."

C. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside MCCs; connect factory-installed space heaters to temporary electrical service.

1.11 Project Conditions

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
2. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
3. Humidity: Less than 95 percent (noncondensing).
4. Altitude: Exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.

B. Interruption of Existing Electrical Service or Distribution Systems: Do not interrupt electrical service to, or distribution systems within, a facility occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Indicate method of providing temporary electrical service.
3. Do not proceed with interruption of electrical service without [Construction Manager's and Owner's written permission.
4. Comply with NFPA 70E.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for MCCs, including clearances between MCCs and adjacent surfaces and other items.

1.12 Coordination

A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

B. Coordinate features of MCCs, installed units, and accessory devices with remote pilot devices and control circuits to which they connect.

C. Coordinate features, accessories, and functions of each MCC, each controller, and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

1.13 Warranty

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace TVSS VFDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Manufactured Units

A. Basis-of-Design Product: Subject to compliance with requirements, provide Motor Control Center or comparable product by one of the following:

1. Rockwell Automation, Inc.; Allen-Bradley Brand.

2. Or approved equal.

B. General Requirements for MCCs: Comply with NEMA ICS 18 and UL 845.

2.2 Functional Features

A. Description: Modular arrangement of main units, controller units, control devices, feeder-tap units, instruments, metering, auxiliary devices, and other items mounted in vertical sections of MCC.

B. Controller Units: Combination controller units.

1. Install units up to and including Size 3 on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
2. Equip units in Type B and Type C MCCs with pull-apart terminal strips for external control connections.

C. Feeder-Tap Units: Through 225-A rating shall have drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.

D. Future Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of draw out units.

Spare Units: Installed in compartments indicated "spare."

2.3 VFDs

A. Make and Model: The variable frequency drive shall be an Allen-Bradley Powerflex 70 enhanced control drive.

B. General Requirements for VFDs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C

C. Application: variable torque

D. VFD Description: Variable-frequency power converter (rectifier, dc bus, and IGBT PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
4. Listed and labeled for single-phase use by an NRTL acceptable to authorities having jurisdiction.

E. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

F. Output Rating: Three-phase; Minimum range 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFD input voltage rating.
2. Input AC Voltage Unbalance: Not exceeding 3 percent.
3. Input Frequency Tolerance: Plus or minus 3 percent of VFD frequency rating.
4. Minimum Efficiency: 97 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.
6. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
7. Starting Torque: Minimum of 100 percent of rated torque from 3 to 60 Hz.
8. Speed Regulation: Minimum 0.5% with slip compensation.
9. Output Carrier Frequency: Selectable; 0.5 to **10** kHz.
10. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

H. Inverter Logic: Microprocessor based, 16 or 32 bit, isolated from all power circuits.

I. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0 to 3600 seconds.
4. Deceleration: 0 to 3600 seconds.
5. Current Limit: 30 to a minimum of 150 percent of maximum rating.

J.Self-Protection and Reliability Features:

1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
2. Loss of Input Signal Protection: Selectable response strategy including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
3. Under- and overvoltage trips.
4. Inverter overcurrent trips.
5. VFD and Motor Overload/Over temperature Protection: Microprocessor-based thermal protection system for monitoring VFDs and motor thermal characteristics, and for providing VFD over temperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.
6. Critical frequency rejection, with three selectable, adjustable dead bands.
7. Instantaneous line-to-line and line-to-ground overcurrent trips.
8. Loss-of-phase protection.
9. Reverse-phase protection.
10. Short-circuit protection.
11. Motor over temperature fault.

K. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

L. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

M. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

N. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

O. Integral Input Disconnecting Means and OCPD: NEMA AB 1, instantaneous-trip circuit breaker with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFD input current rating.
2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFD input current rating, whichever is larger.

2.4 VFD Controls And Indication

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

a. Control Authority: Supports at least four conditions: Off, local manual control at VFD, local automatic control at VFD, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Running log of total power versus time.
2. Total run time.
3. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display mounted flush in VFD door and connected to display VFD parameters, including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).

5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

   a. A minimum of two programmable analog inputs: [0- to 10-V dc] [4- to 20-mA dc]
   b. A minimum of six multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the RTU :

   a. 0- to 10-V dc.
   b. 4- to 20-mA dc.
   c. Potentiometer using up/down digital inputs.

3. Output Signal Interface: A minimum of one programmable analog output signal(s) 4- to 20-mA dc which can be configured for the following:

   a. Motor speed (rpm).

4. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

   a. Motor running.
   b. Fault and warning indication (over temperature or overcurrent).

5. VFD LINE CONDITIONING AND FILTERING

F. Input Line Conditioning: Based on the harmonic analysis study and report, provide input filtering, as required, to limit TDD at input terminals of VFDs to less than 5percent and THD(V) to 10 percent.

G. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2 .

2.5 Nonautomatic Transfer Switches

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Contactor Transfer Switches:

   a. AC Data Systems, Inc.
   b. Caterpillar; Engine Div.
   c. Emerson; ASCO Power Technologies, LP.
   d. Generac Power Systems, Inc.
   e. GE Zenith Controls.
   f. Kohler Power Systems; Generator Division.
   g. Onan/Cummins Power Generation; Industrial Business Group.
   h. Russelectric, Inc.
   i. Spectrum Detroit Diesel.

j. Eaton

B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.

C. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
2. Switch Action: Double throw; mechanically held in both directions.
3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where four-pole switches are indicated, provide neutral pole switched simultaneously with phase poles

H. Neutral Terminal: Solid and fully rated, unless otherwise indicated.

I. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.

J. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

K. Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternate Source." In addition, removable manual handle provides quick-make, quick-break manual-switching action. Switch shall be capable of electrically or manually transferring load in either direction with either or both sources energized. Control circuit disconnects from electrical operator during manual operation.

L. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.

M. Nonautomatic Transfer-Switch Accessories:

1. Pilot Lights: Indicate source to which load is connected.

2. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and alternate-source sensing circuits.

    a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    b. Emergency Power Supervision: Red light with nameplate engraved "Alternate Source Available."

3. Unassigned Auxiliary Contacts: One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.

2.6 Optional VFD Features

A. Damper control circuit with end of travel feedback capability.

B. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFD resumes normal operation.

C. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.

D. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.

E. Remote digital operator kit.

F. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer

2.7 Low Volatge Transformer

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ACME Electric Corporation; Power Distribution Products Division.
2. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
3. Controlled Power Company.
4. Eaton Electrical Inc.; Cutler-Hammer Products.
5. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
6. General Electric Company.
7. Hammond Co.; Matra Electric, Inc.
8. Magnetek Power Electronics Group.
9. Micron Industries Corp.
10. Myers Power Products, Inc.
11. Siemens Energy & Automation, Inc.
12. Sola/Hevi-Duty.
13. Square D; Schneider Electric.
14. Or approved equal

B. General Transformer Requirements

1. Description: Factory-assembled and –tested, air-cooled units for 60 Hz service.
2. Cores: Grain-oriented, non-aging silicon steel.
3. Coils: Continuous windings without splices except for taps.

    a. Internal Coil Connections: Brazed or pressure type.
    b. Coil Material: Copper

C. Distribution Transformers

1. Comply with NEMA ST 20, and list and label as complying with UL 1561.
2. Cores: One leg per phase
3. Taps for Transformers: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity
4. Insulation Class: 220 degC, UL-component-recognized insulation system with a maximum of 80 degC rise above 40 degC ambient temperature.
5. Energy efficiency for the transformer

    a. Complying with NEMA TP 1, Class 1 efficiency levels.
    b. Tested according to NEMA TP 2.

6. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree designated K-factor.

    a. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
    b. Indicate value of K-factor on transformer nameplate.

7. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

    a. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
    b. Include special terminal for grounding the shield .
    c. Shield Effectiveness:

        1) Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
        2) Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
        3) Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.
        4) Fungus Proofing: Permanent fungicidal treatment for coil and core.
        5) Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91

2.8 Lighting Panelboard

A. Enclosures: Surface mounted cabinets.

1. Rated for environmental conditions at installed location.

    a. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

6. Finishes:

    a. Panels and Trim: Stainless Steel or galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Back Boxes: Same finish as panels and trim.
    c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

B. Incoming Mains Location: Bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

H. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

I. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

J. Mains: Circuit breaker or lugs only.

K. Branch Overcurrent Protective Devices Bolt-on circuit breakers, replaceable without disturbing adjacent units.

L. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

M. Disconnecting and overcurrent protective devices:

1. Basis-of-Design Product: Subject to compliance with requirements, provide disconnecting and overcurrent protective devices comparable product by one of the following:

   a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   c. General Electric Company; GE consumer& Industrial–Electrical Distribution
   d. Liebert Corporation
   e. Siemens Energy & Automation, Inc.
   f. Square D; a brand of Schneider Electric
   e. Or approved equal

2. Molded-Case circuit breaker (MCCB): Comply with UL489, with interrupting capacity to meet available fault currents. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level Overload, and instantaneous magnetic trip element for short circuits.

3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads, Type HID for feeding fluorescent and high- intensity discharge (HID) lighting circuits

N. Panelboard Suppressors

1. Basis-of-Design Product: Subject to compliance with requirements, provide panelboard suppressor or comparable product by one of the following:

   a. Current Technology; a subsidiary of Danahar Corporation.
   b. Eaton Electrical Inc.; Culter-Hammer Business Unit.
   c. General Electric Company; GE consumer& Industrial–Electrical Distribution
   d. Liebert Corporation
   e. Siemens Energy & Automation, Inc.
   f. Square D; a brand of Schneider Electric
   e. Or approved equal

2. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:

   a. Accessories:

      1) Fuses rated at 200-kA interrupting capacity.
      2) Fabrication using bolted compression lugs for internal wiring.
      3) Integral disconnect switch.
      4) Redundant suppression circuits.
      5) Redundant replaceable modules.

6) Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7) LED indicator lights for power and protection status.

b. Peak Single-Impulse Surge Current Rating: 120kA per mode/240 kA per phase

c. Minimum single-impulse Surge Current Rating: 120 kA per mode/240 kA per phase
d. Minimum single-impulse current ratings, using 8-by-20-mic. Sec. waveform described in IEEE C62.41.2:

1) Line to Neutral: 70000 A
2) Line to Ground: 70000 A
3) Neutral to Ground: 50000 A

e. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
f. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120V, three-phase, four wire circuits shall be as follows:

1) Line to Neutral: 400V for 208Y/120
2) Line to Ground: 400V for 208Y/120
3) Neutral to Ground: 400V for 208Y/120

2.9 Transient Voltage Suppression Devices

A. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, bolt-on, solid-state, parallel-connected, modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the MCC short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Redundant suppression circuits.
5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status.

B. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase

C. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

D. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277, three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 800 V.
2. Line to Ground: 800 V.
3. Neutral to Ground: 800 V.

E. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. PTs: IEEE C57.13; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.

2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; bar or window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. CPTs: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

F. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Listed or recognized by a nationally recognized testing laboratory.
2. Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
3. Switch-selectable digital display of the following values with the indicated maximum accuracy tolerances:

    a. Phase Currents, Each Phase: Plus or minus 1 percent.
    b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    d. Three-Phase Real Power (Megawatts): Plus or minus 2 percent.
    e. Three-Phase Reactive Power (Megavars): Plus or minus 2 percent.
    f. Power Factor: Plus or minus 2 percent.
    g. Frequency: Plus or minus 0.5 percent.
    h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
    i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
    j. Contact devices to operate remote impulse-totalizing demand meter.

4. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

G. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.

1. Meters: 4-inch (100-mm) diameter or 6 inches (150 mm) square, flush or semiflush, with antiparallax 250-degree scale and external zero adjustment.
2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

H. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and phase-to-neutral voltages where a neutral is included.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondaries in a closed-circuit condition at all times.

I. Feeder Ammeters: 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for feeder circuits, unless otherwise indicated.

J. Watt-Hour Meters and Wattmeters:

1. Comply with ANSI C12.1.
2. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.

3. Suitable for connection to three- and four-wire circuits.
4. Potential indicating lamps.
5. Adjustments for light and full load, phase balance, and power factor.
6. Four-dial clock register.
7. Integral demand indicator.
8. Contact devices to operate remote impulse-totalizing demand meter.
9. Ratchets to prevent reverse rotation.
10. Removable meter with draw out test plug.
11. Semiflush mounted case with matching cover.
12. Appropriate multiplier tag.

K. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from CPT.

L. Control Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

M. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.10 Enclosures

A. Indoor Enclosures: Freestanding steel cabinets unless otherwise indicated. NEMA 250, Type 12 unless otherwise indicated to comply with environmental conditions at installed location.

B. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in MCC.

C. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

1. Compartments: Modular; individual lift-off doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.

D. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in MCC; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.

E. Wiring Spaces:

1. Vertical wire ways in each vertical section for vertical wiring to each unit compartment; supports to hold wiring in place.
2. Horizontal wire ways in bottom of each vertical section for horizontal wiring between vertical sections; supports to hold wiring in place.

2.11 Auxiliary Devices

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy -duty, oiltight type.

   a. Push Buttons: Shrouded types; momentary contact unless otherwise indicated.
   b. Pilot Lights: LEDtype; Red and Green .
   c. Selector Switches: Rotarytype.

2. Elapsed-Time Meters: Heavy duty with digital readout in hours nonresettable .
3. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy with selector switches having an off position.

B. Reversible NC/NO contactor auxiliary contact(s).

C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

D. Space heaters, with NC auxiliary contacts, to mitigate condensation in enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

E. Terminals for connecting power factor correction capacitors to the load side of overload relays.

F. Spare control-wiring terminal blocks**;** unwired.

G. Spare-Fuse Cabinet: Identified cabinet with hinged lockable door.

2.12 Characteristics And Ratings

A. Wiring: NEMA ICS 18, Class II-S, Type B-D, for starter Size 3 and below.

B. Control and Load Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

C. Nominal System Voltage: 480Y/277 V, three phase, four .

D. Short-Circuit Current Rating for Each Unit: Fully rated; 65kA.

E. Short-Circuit Current Rating of MCC: Fully rated with its main overcurrent device; 65kA.

F. Environmental Ratings:

1. Ambient Temperature Rating: Not less than 0 deg F (minus 18 deg C) and not exceeding 104 deg F (40 deg C), with an average value not exceeding 95 deg F (35 deg C) over a 24-hour period.
2. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
3. Humidity Rating: Less than 95 percent (noncondensing).
4. Altitude Rating: Not exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.

G. Main-Bus Continuous Rating: 400 A.

H. Vertical-Bus Continuous Rating: 600A.

I. Horizontal and Vertical Bus Bracing (Short-Circuit Current Rating): Match MCC short-circuit current rating .

J. Main Horizontal and Equipment Ground Buses: Uniform capacity for entire length of MCC's main and vertical sections. Provide for future extensions from both ends.

K. Vertical Phase and Equipment Ground Buses: Uniform capacity for entire usable height of vertical sections, except for sections incorporating single units.

L. Phase and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, silver plated.

M. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables.

N. Ground Bus: Minimum size required by UL 845, hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit equipment grounding conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

O. Front-Connected, Front-Accessible MCCs:

1. Main Devices: Draw out mounted.
2. Controller Units: Draw out mounted.
3. Feeder-Tap Units: fixed mounted.
4. Sections front and rear aligned.

P. Bus Transition and Incoming Pull Sections: Matched and aligned with basic MCC.

Q. Pull Box on Top of an MCC:

1. Adequate ventilation to maintain temperature in pull box within same limits as MCC.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers forming top, front, and sides. Top covers at rear easily removable for drilling and cutting.
4. Insulated bottom of fire-resistive material with separate holes for cable drops into MCC.
5. Cable supports arranged to facilitate cabling and adequate to support cables, including those for future installation.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

R. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of unit.

S. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

T. Fungus Proofing: Permanent fungicidal treatment for OCPDs and other components including instruments and instrument transformers.

2.13 Source Quality Control

A. MCC Testing: Inspect and test MCCs according to requirements in NEMA ICS 18

B. VFD Testing: Test and inspect VFDs according to requirements in NEMA ICS 61800-2 .

1. Test each VFD while connected to a motor that is comparable to that for which the VFD is rated.
2. Verification of Performance: Rate VFDs according to operation of functions and features specified.

C. MCCs will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 Examination

A. Examine areas and surfaces to receive MCCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Harmonic Analysis Study

A. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFD input filtering to limit TDD and THD(V) at the defined PCC to specified levels.

B. Prepare a harmonic analysis study report complying with IEEE 399 and NETA Acceptance Testing Specification.

3.3 Installation

A. Coordinate layout and installation of MCCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Floor-Mounting Controllers: Install MCCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in Division 03 Section "Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible switch.

E. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

F. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

H. Install power factor correction capacitors. Connect to the load side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.

I. Comply with NECA 1.

3.4 Identification

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" for identification of MCC, MCC components, and control wiring.

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label MCC and each cubicle with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.
4. Mark up a set of manufacturer's connection wiring diagrams with field-assigned wiring identifications and return to manufacturer for inclusion in Record Drawings.

B. Operating Instructions: Frame printed operating instructions for MCCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of MCCs.

3.5 Control Wiring Installation

A. Install wiring between enclosed controllers and remote devices and facility's control panel]. Comply with requirements in Division 26 Section "Low Voltage Conductors and Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
2. Connect selector switches within enclosed controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 Connections

A. Comply with requirements for installation of conduit in Division 26 Section "Raceway and Boxes for Electrical Systems." Drawings indicate general arrangement of conduit, fittings, and specialties.

B. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 Field Quality Control

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment**.**
2. Test insulation resistance for each enclosed controller element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at controller locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Construction Manager and Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:

    a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multipole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
    b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multipole enclosed controller 11 months after date of Substantial Completion.
    c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
10. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.8 Startup Service

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.9 Adjusting

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Construction Manager and Owner before increasing settings.

C. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage, solid-state controllers.

D. Program microprocessors in VFDs for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

3.10 Protection

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.11 Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers**,** and to use and reprogram microprocessor-based, reduced-voltage, solid-state controllers.

END OF SECTION

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SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Wall-switch and exterior occupancy sensors.
4. Communications outlets.

1.3 Definitions

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 Action Submittals

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 Informational Submittals

A. Field quality-control reports.

1.6 Closeout Submittals

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 – PRODUCTS

2.1 Manufacturers

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 General Wiring-Device Requirements

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

D. Connectors shall comply with UL 2459 and shall be made with stranding building wire.

E. Devices shall comply with the requirements in this Section.

2.3 Straight-Blade Receptacles

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Cooper; 5351 (single), CR5362 (duplex).
2. Hubbell; HBL5351 (single), HBL5352 (duplex).
3. Leviton; 5891 (single), 5352 (duplex).
4. Pass & Seymour; 5361 (single), 5362 (duplex).

2.4 GFCI Receptacles

A. General Description:

1. Straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; VGF20.

b. Hubbell; GFR5352L.

c. Pass & Seymour; 2095.

d. Leviton; 7590.

C. Weather-Resistant and Tamper-Resistant Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; TWR270.

b. Hubbell; RR155WRTR.

c. Leviton; TWR15.

d. Pass & Seymour; 3232TRWR.

2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.

D. Telephone Outlet:

1. Products: Subject to compliance with requirements, provide one of the following, or similar approved:

a. Cooper; 3560-6.

b. Leviton; 40649.

2. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

2.5 Hazardous (Classified) Location Receptacles

A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper Crouse-Hinds.

b. EGS/Appleton Electric.

c. Killark; Division of Hubbell Inc.

2.6 Wall Plates

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material: Smooth, high-impact thermoplastic.

3. Material for Damp Locations: Smooth, high-impact thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

2.7 Finishes

A. Device Color: White, unless otherwise indicated or required by NFPA 70 or device listing.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 – EXECUTION

3.1 Installation

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 Gfci Receptacles

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 Identification

A. Comply with Division 26 Section "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes

3.4 Field Quality Control

A. Perform the following tests and inspections:

1. Test Instruments: Use instruments that comply with UL 1436.

2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits
2. Spare-fuse cabinets.

1.3 Action Submittals

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 Closeout Submittals

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.5 Maintenance Material Submittals

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

1.6 Quality Assurance

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.7 Project Conditions

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 Coordination

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 Cartridge Fuses

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 Examination

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Fuse Applications

A. Cartridge Fuses:
   1. Control Circuits: Class CC, fast acting, time delay.

3.3 Installation

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuse holders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

3.4 Identification

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

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SECTION 26 50 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 Summary

A. Section Includes:
1. Interior luminaires and accessories.
2. Building mounted exterior luminaires.
3. LED lighting fixtures, including drivers and light engine modules
4. Exit signs.
5. LED driver modules.
6. Lamps.
7. LED modules.
8. Luminaire accessories.

B. Related Documents and Sections:
1. Section 01 33 00: Submittal Procedures
2. Section 26 05 00: Common Work Results for Electrical.
3. Section 26 05 34: Outlet and Junction Boxes for Electrical Systems.
4. Section 26 05 33: Raceways and Boxes for Electrical Systems.

1.2 References

A. ANSI/NFPA 101 - Life Safety Code.

B. International Electrotechnical Commission (IEC)
1. IEC 801-2 Electrostatic Discharge Testing Standard.
2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.

C. Illuminating Engineering Society of North America (IESNA)
1. LM-79 – Electrcial and Photometric Measurements of Solid State Lighting Products.
2. LM-80 – Measuring Lumen Maintenance of LED Light Sources.

D. International Organization for Standardization (ISO)
1. 9001 – Quality Management Systems.

E. National Electrical Manufacturer's Association (NEMA)
1. SSL-1 – Electronic Drivers for LED Devices, Arrays, or Systems.

F. Underwriters Laboratories, Inc. (UL)
1. 8750 – Light Emitting Diode (LED) Light Sources for Use in Lighting Products
2. 844 – Electric Fixture Hangers for Hazardous Locations
3. 1598 – Luminaire

1.3 Submittals

A. Submit under provisions of Section 01 33 00.

B. Product Data
   1. Provide manufacturer dimensions, ratings, and performance data. Identify fixtures by luminaire schedule number. Show all required features and options; include data relative to lenses for security fixtures.
   2. Submit lighting level performance data where indicated as required or where an approval of a listed fixture is requested. Provide all assumptions. Indicate whether calculated or measured.

C. Shop Drawings
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

D. Samples
   1. Submit samples of security fixtures.

E. Quality Assurance/Control Submittals
   1. Manufacturers' Instructions
      a. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.
      b. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Closeout Submittals
   1. Operation and Maintenance Data
      a. Submit under provisions of Division 1.
      b. Include replacement parts list.

1.4 Quality Assurance

A. Regulatory Requirements
   1. Conform to requirements of CEC.
   2. Conform to requirements of CBC.
   3. Furnish products listed and classified by UL, or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.5 Warranty

A. Provide warranty under provisions of Section 01 78 36.

B. Warrant lenses in writing to CDCR Representative to provide satisfactory performance for 20 years without objectionable discoloration.

PART 2 - PRODUCTS

2.1 Luminaires - General

A. Furnish products as specified in schedule.
   1. GENERAL: Lighting fixtures as hereinafter specified are identified by type as noted on drawings. Fixture specifications are based on construction and performance. Manufacturer's catalogue numbers are of general nature and indicate level of quality

required, but do not necessarily reflect complete options as specified. Approval must be based on description and specification of fixture as well as catalogue number indicated. See specifications for fixture, lens, lamp and ballast requirements. Verify ballast voltage requirements with circuitry indicated on drawings.
2. Luminaires with self-contained emergency battery packs to be U.L. labeled as "EMERGENCY LIGHTING UNITS".

B. Substitutions: Submit performance calculations for proposed substitutions.

C. Install ballasts, drivers, and specified accessories at factory.

D. Provide standard plaster frame for all recessed lighting fixtures installed in plaster walls or ceilings.
1. Design, finish and fabricate material to preclude possibility of rust stain in plaster.

E. Coordinate fixture types with ceiling construction.

F. Provide pendant fixtures with swivel hangers which will allow fixture to swing in any direction but will not permit stem to rotate.
1. Provide hangers with enclosure rating (NEMA 1, 4, or 7) equal to enclosure requirements of area in which they are installed.
2. Swivel hangers for fixtures in mechanical equipment areas: Shock absorbing type.

G. Pendant mounted fixtures in continuous rows must be supported by conduit. Fasten fixtures to each other or mount on continuous metal channel similar to Unistrut. Provide reflector alignment clips on all industrial fixtures mounted in continuous rows.

H. Pendant mounted fixtures individually mounted to be stem mounted with swivel hangers; 2 for fixtures 1 foot wide and narrower, four for fixtures over 1 foot wide.

2.2 LED Light Fixtures

A. General:
1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be a factory assembled luminaire including all required driver and light engine modules integral to and within a single houseing. Lead lengths between driver and light engine shall not exceed 3 feet. Remote luminaire/driver installations are not acceptable.
3. LED light fixtures shall be Reduction of Hazardous Substances (RoHS) compliant.
4. LED light fixtures to be installed in hazardous areas shall be certified for Class 1 Div 1, Groups C, D and also shall be of the type 4X and IP 66 minimum

B. LED Driver Modules
1. Description: Universal voltage switching-mode LED driver module with a rated lifetime of not less than 50,000 hours when operated at an ambient temperature of less than 60-degrees C.
2. LED drivers shall be capable of producing adequate output current to produce the specified light levels. Compatibility of driver and LED light engine must be tested and ensured by driver manufacturer.
3. Minimum efficiency: 85% at full load.
4. Minimum Operating Ambient Temperature: -20° C (-4° F).

5. Input Voltage: 120V to 277V (±10%) AC at 60Hz. Drivers that require DC input shall include an integral converter that accepts standard line voltage AC.
6. Power Factor: ≥ 0.9.
7. Total Harmonic Distortion: ≤ 20% and meet ANSI C82.11 maximum allowable THD requirements
8. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.
9. Electrolytic capacitors to operate at least 20 degrees C below the capacitor's maximum temperature rating when the driver is under fully-loaded conditions and case temperature is 62 degrees C.
10. Maximum inrush current of 2 amperes for 120-Volt and 277-Volt drivers.
11. Withstand up to a 4,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
12. Inaudible in a 27 dBA ambient.

C. LED Light Engine Modules:
1. Minimum CRI: 80.
2. Color Temperature: 3000K, unless otherwise noted.
3. Minimum Rated Life: 50,000 hours as per LM79.

2.3 Emergency Led Lighting

A. Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.

B. Lamp Ratings: 80 lumens

C. Battery: Sealed nickel cadmium type, rated for 5 year life.

D. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled luminaire.

2.4 Lamps

A. Fluorescent Lamps:
1. Manufacturers:
   a. General Electric Company.
   b. Sylvania.
   c. Philips.
   d. CREE
   e. LITHONIA
   f. Cooper

B. Provide lamp type compatible with luminaire.

C. Reflector Lamp Beam Patterns: ANSI C78.379.

PART 3 - EXECUTION

3.1 Examination

A. Site Verification of Conditions
1. Examine substrate and supporting grids for luminaires.

2. Examine each luminaire to determine suitability for lamps specified.

3.2 Installation - General

A. Install in accordance with manufacturers' instructions.

B. Mount lighting fixtures at heights indicated. Where not indicated mount:
   1. Exit lights - 90 inches above floor. Center in space over door frame where applicable.
   2. Bracket light above lavatory - 80 inches minimum above floor.

C. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

E. Install wall mounted luminaires and exit signs at height as indicated on Drawings.

F. Install accessories furnished with each luminaire.

G. Connect luminaires, and exit signs to branch circuit outlets provided under Section 26 05 33 using flexible conduit as indicated.

H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Install specified lamps in each luminaire, emergency lighting unit and exit sign.

K. Where a switched fixture with battery backup is used, connect an unswitched lead to the emergency ballast.

3.3 Field Quality Control

A. Site Tests
   1. Test under provision of Division 1.
      a. Operate each luminaire after installation and connection.

B. Inspection
   1. Inspect for proper connection and operation.

3.4 Adjusting

A. Adjust Work under provisions of Division 1.

B. Aim and adjust luminaires as indicated on Drawings as directed.

C. Adjust exit sign directional arrows as indicated.

D. Relamp or replace luminaires that have failed lamps at Substantial Completion.

3.5 Cleaning

A. Clean Work under provisions of Division 1.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.6 Demonstration

A. Provide systems demonstration under provisions of Division 1.

B. Provide minimum of two hours demonstration of luminaire operation.

3.7 Fixture Schedule

A. Fixture schedule is located on the drawings.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 Summary

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.
4. Luminaire lowering devices.

B. Related Sections:

1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 Definitions

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.4 Structural Analysis Criteria For Pole Selection

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.

1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 90 mph (40 m/s).

    a. Wind Importance Factor: 1.0
    b. Minimum Design Life: 25 years.
    c. Velocity Conversion Factors: 1.0 .

1.5 Action Submittals

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

    a. Testing Agency Certified Data: For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Photoelectric relays.
7. Ballasts, including energy-efficiency data.
8. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
9. Materials, dimensions, and finishes of poles.
10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
11. Anchor bolts for poles.
12. Manufactured pole foundations.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples: For products designated for sample submission in the Exterior Lighting Device Schedule. Each Sample shall include lamps and ballasts.

1.6 Informational Submittals

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.7 Closeout Submittals

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.8 Maintenance Material Submittals

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: One for every 100 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.9 Quality Assurance

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.10 Delivery, Storage, And Handling

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.11 Warranty

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than 3 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Manufacturers

A. Products: Subject to compliance with requirements, provide product indicated on Drawings] [provide one of the products indicated on Drawings .

2.2 General Requirements For Luminaires

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
2. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
3. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected from manufacturer's standard catalog of colors.
    b. Color: Match Architect's sample of manufacturer's standard color.
    c. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.

3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

    a. Color: Light bronze.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

    a. "USES ONLY" and include specific lamp type.
    b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
    c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
    d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
    e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
    f. CCT and CRI for all luminaires.

2.3 Luminaire-Mounted Photoelectric Relays

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff**.**

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 General Requirements For Poles And Support Components

A. Structural Characteristics: Comply with AASHTO LTS-4-M.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.5 Steel Poles

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: Square, straight.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

B. Steel Mast Arms: Davit type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with galvanized-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

F. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

G. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

H. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

I. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.

J. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

K. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

L. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As indicated by manufacturer's designations.

2.6 Pole Accessories

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. Recessed, 48 inches (1219 mm)above finished grade.
2. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, color to match pole**,** that when mounted results in NEMA 250, Type 4X enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover.

C. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

D. Transformer Type Base: Same material and color as pole. Coordinate dimensions to suit pole's base flange and accept ballast.

1. EXECUTION

2.7 Luminaire Installation

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

2.8 Pole Installation

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m) .
3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

1. Raise and set poles using web fabric slings (not chain or cable).

2.9 Corrosion Prevention

A. Steel Conduits: Comply with Division 26 Section "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

2.10 Grounding

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

2.11 Field Quality Control

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
d. IESNA LM-64, "Photometric Measurements of Parking Areas."
e. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

2.12 Demonstration

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION

SECTION 27 05 13
TWO WAY RADIO DATA TRANSMISSION SYSTEM

PART 1 - GENERAL

1.1. Summary

A. Section includes Radio Data Transceiver System, Antennas, and accessories

1.2. Related Sections

A. Section 40 94 43: Programmable Remote Terminal Unit

1.3. References

A. EIA ANSI/EIA/TIA-232-F: Interface between Data Terminal Equipment and Data Circuit Terminating Equipment Employing Serial Binary Data Interchange.

B. NFPA 780: Standard for the Installation of Lightning Protection Systems

C. FEDERAL COMMUNICATIONS COMMISSION (FCC) FCC Part 15: Radio Frequency Devices (47 CFR 15)

1.4. System Description

A. General: A two-way radio system for wireless data transmission from point to point within the SCADA system shall be provided for a fully functional system.
   1. The two-way radio data transmission system shall consist of wireless communication links, antenna systems.

B. Environmental Requirements: Equipment shall be rated for continuous operation under ambient environmental conditions of -5 to 49 degrees C (23 to 120 degrees F) dry bulb and 10 to 95 percent relative humidity, non-condensing.

C. Electrical Requirements: The equipment shall operate from the voltage source as shown on the project plans or as indicated elsewhere.

D. Communication Link Surge Protection: Communications equipment shall be protected against surges induced on any communications link.
   1. Cables and conductors which serve as communications links shall have surge protection circuits installed at each end. Protection shall be furnished at equipment and additional triple electrode gas surge protectors rated for the application on each circuit shall be installed within 1 meter 3 feet of the cable entrance. Surge protection shall meet the requirements of NFPA 780.

E. Power Line Surge Protection: Equipment connected to AC circuits shall be protected from power line surges. Equipment shall meet the requirements of IEEE C62.41.1 and IEEE C62.41.2. Fuses shall not be used for surge protection.

1.5. Submittals

A. Shop Drawings: Provide shop drawings indicating the arrangement and layout of equipment and component mounting. Indicate electrical characteristics and connection requirements, including layout of completed assemblies, interconnecting cabling, dimensions, weights, and external power requirements.

B. System Design Data:
   1. Data Transmission System block diagram.
   2. Radio System component installation and wiring diagrams.
   3. Radio System physical layout and schematics.
   4. Details of connections to power sources, including grounding.
   5. Details of surge protection device installation.
   6. Details of cable splicing and connector installations.

C. Product Data: Submit catalog data for each component specified showing electrical characteristics and connection requirements.

D. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

E. Installer Field Reports: Indicate activities on site, adverse findings, and recommendations.

F. Performance Verification Test: The Contractor shall prepare and submit test procedures for the performance verification test. The test procedures shall describe the applicable tests to be performed and other pertinent information such as specialized test equipment required, and shall include expected duration of performance verification tests.
   1. The test procedures shall explain in detail, step-by-step actions and expected results to demonstrate compliance with the project requirements. Receiver input signal voltages and S/N ratios as required by the RF area coverage report shall be verified as adequate for system operation. Performance verification test procedures shall be submitted by the Contractor and approved by the City in writing prior to commencing verification testing.

1.6. Closeout Submittals

A. Project Record Documents: Record actual locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information, and terminal block layouts in controller cabinets. Include copy of as-built drawings.

B. Operation and Maintenance Data:
   1. Submit bound copies of operating and programming instructions, and include card replacement, adjustments, and preventive maintenance procedures and materials.
   2. Provide Compact Disk (CD) containing all programming code to City upon project closeout.

1.7. Qualifications

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

B. Supplier: Authorized distributor of specified manufacturer with minimum five (5) years' experience.

C. Integrator: Company specializing in installing, programming and servicing products specified in this section with minimum five (5) years documented experience.

1.8. Environmental Requirements

A. Conform to specified service conditions during and after installation. Maintain area and equipment free of dirt and dust during and after installation of products.

1.9. Maintenance Service

A. Furnish service and maintenance of radio communications system for two (2) years from date of acceptance.

1.10. Warranty

A. Furnish two (2) year warranty, including all parts and labor for warranty period. Third party warranties shall not be permitted.

B. The stated performance requirements shall be part of the warranty.

PART 2 - PRODUCTS

2.1. Radio Transceiver

A. Radio Transceiver Requirements:
   1. Manufacturer
      a. Motorola XTL2500 Radio

   2. Operate on a frequency band of 380-.520 MHZ.
   3. Compliant with FCC Part 15.

B. Site Antenna Mounting Requirements
   1. Provide all hardware as required to provide a fully functional system.

C. UHF 450-460 MHZ Antenna Requirements:
   1. Product Description: Antenna shall be mounted on the structure specified and as necessary to maintain the transmission characteristics for the installation.
      a. Mount using manufacturer provided heavy duty listed mast bracket.

   2. Antenna Requirements:
      a. System cabling shall be installed to provide adequate system gain.
      b. Antenna shall be capable of withstanding the environmental conditions of 125 mph wind without failure.
      c. Antenna grounding conductors shall be minimum 32-strand, No. 10AWG copper.

   3. Manufacturer
      a. Sinclair Technologies
      b. Terrawave Solutions
      c. L-com
      d. Kathrein-Scala
      e. Or equal

D. Antenna Cable
   1. Antenna Cable Requirements:
      a. Transmission cable shall be one continuous section without splices or connectors other than at the ends.
      b. Manufacturer:
         1) Times Microwave
         2) L-Com
         3) Or equal

2. Antenna cable Connectors
    a. Connectors shall be solderless connectors that are either clamped or crimped to the transmission cable.
    b. The connector contact shall be gold or silver plated.
    c. The entire connector shall be manufactured from corrosion resistant material.
    d. Connectors are to be supplied by the transmission cable manufacturer or recommended by the cable manufacturer.

3. Antenna Cable Grounding:
    a. Provide antenna cable grounding kits where cable grounding is required.
    b. Manufacturer
        1) Commscope, SureGround series
        2) Or equal

2.2. Radio Source Quality Control

A. Test fully assembled unit at factory prior to delivery to job site.

PART 3 - EXECUTION

3.1. Installation

A. General:
    1. Perform a radio path analysis prior to purchasing equipment, to confirm equipment will be suitable.
    2. System components and appurtenances shall be installed in accordance with the manufacturer's instructions and as indicated within the contract documents.
    3. Ground and bond all system components in accordance with IEEE Standard 142.
    4. Establish network communications over SCADA network.
    5. Verify intended system function and performance. Debug system as necessary so that system functions as intended.
    6. Penetrations shall be sealed to maintain enclosure ratings.

B. Radio Transceiver:
    1. Install radio system components as indicated within the contract documents.
    2. Connect and configure radio transceivers and required sub components

C. Antenna:
    1. Install antenna as indicated within the contract documents.
    2. Tubular radiator elements shall be plugged to prevent wind vibration fatigue.
    3. Vertical tubular elements shall have drain holes near the bottom.
    4. Exterior connections shall be snug, filled with silicone grease, and properly sealed with heat-shrink wrap suitable for installation in specified ambient conditions.

3.2. Field Quality Control.

A. Perform operational testing on control systems to verify proper operation and field wiring connections.

3.3. Demonstration And Training

A. Submit and obtain approval of the field test plan for each phase of testing before beginning that phase of testing. Provide written notification of planned testing at least 30 days prior to

test. Notification shall be accompanied by the proposed test procedures. In no case will the Contractor be allowed to start testing without written approval of test plan.

B. Demonstrate compliance of the Radio Data Transceiver System with the contract documents. Furnish personnel, equipment, instrumentation, and supplies necessary to perform site testing. Ensure that test personnel are regularly employed in the testing and calibration of radio data transmission systems. Testing shall include field testing and performance verification tests.

C. Furnish four (4) hours of instruction, to be conducted at project site. Coordinate with City for times and locations of training. Training times and locations shall be as directed by the City.

END OF SECTION

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SECTION 31 05 16
AGGREGATE AND ROCK PRODUCTS FOR EARTHWORK

PART 1 - GENERAL

1.1 Work Included

A. Materials and installation of rock, stone, crushed rock, rock dust, gravel and sand.

B. Materials used for concrete aggregate are specified in Section 03 30 00.

C. Except as modified herein, aggregate and rock products shall conform to Standard Specifications for Public Works Construction (Greenbook) Section 200.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 02 41 14: Paving Removal and Resurfacing
H. Section 03 30 00: Cast-in-Place Concrete
I. Section 04 05 00: Masonry Mortaring and Grouting
J. Section 31 23 00: Excavation and Fill
K. Section 32 13 13: Concrete Paving

1.4 Quality Assurance

A. Rock products shall be clean, hard, sound, durable, uniform in quality, and free of any detrimental quality of soft, friable, thin, elongated or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.

B. Plant testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Crushed Rock and Rock Dust	Sieve Analysis	California Test Method 202 Meet requirements below in Part 2	1 each source for each gradation used	Contractor	Contractor
	Fractured Faces	Meet requirements below in Part 2	1 each sieve test	Contractor	Contractor
	Gravel	Meet requirements below in Part 2	1 each sieve test	Contractor	Contractor
Crushed Rock	Percentage Wear	ASTM C131 Meet requirements below in Part 2	1 each sieve test	Contractor	Contractor
Caltrans Class 2 Aggregate Base	Sieve Analysis	California Test Method 202 Meet requirements below in Part 2	1 each source for each gradation used	Contractor	Contractor

C. All percentages referred to herein shall be by weight.

1.5 References

A. ASTM C127 Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
B. ASTM C131 Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine
C. ASTM C136 Sieve Analysis of Fine and Coarse Aggregates
D. ASTM D1556 Density and Unit Weight of Soil in Place by SandCone Method
E. ASTM D4253 Maximum Index Density and Unit Weight of Soils Using Vibratory Table
F. ASTM D4254 Maximum Index Density and Unit Weight of Soils and Calculation of Relative Density
G. ASTM D6938 In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
H. California Test Method 202 Sieve Analysis of Fine and Coarse Aggregates
I. California Test Method 216 Relative Compaction of Untreated and Treated Soils and Aggregates
J. California Test Method 217 Sand Equivalent
K. California Test Method 227 Cleanness Value
L. California Test Method 229 Durability Index
M. California Test Method 301 Resistance "R" Value of Treated and Untreated Bases, Subbases and Basement Soils by Stabilometer
N. California Test Method 302 Film Stripping
O. California Test Method 548 Evaluation of Aggregate for Lean Concrete Base (LCB)
P. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 200 “Rock Materials”

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Test Results	Required for all rock products

B. Refer to Section 01 33 00 for definition of requirements for catalog data and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Rock products shall be clean, hard, sound, durable, uniform in quality and free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance. Unless otherwise specified, products shall meet requirements of Section 200 of Standard Specifications for Public Works Construction (Greenbook) and the following:

ITEM	DESCRIPTION	
Crushed Rock and Rock Materials (See Standard Specifications for Public Works Construction (Greenbook) Table 200-1.2.1 (B)	Percentage Wear per ASTM C131	Abrasion loss < 15% after 100 revolutions Abrasion loss < 52% after 500 revolutions
	Fractured Faces	At least 50% of particles retained on ⅜" sieve shall have 3 or more fractured faces Less than 5% shall show no fractured faces
	Gravel	Less than 10% of particles passing ⅜" sieve but retained on No 4 sieve shall be gravel
Crushed Aggregate Base (See Standard Specifications for Public Works Construction (Greenbook) Table 200-2.2.3 (A)	R-Value per California Test Method 301	80 minimum
	Sand Equivalent per California Test Method 217	50 minimum
	Percentage Wear per ASTM C131	Abrasion loss < 15% after 100 revolutions Abrasion loss < 52% after 500 revolutions
	Durability Index per California Test Method 229	40 minimum
	Specific Gravity Per ASTM C127	2.58 minimum
Crushed Miscellaneous Base (See Standard Specifications for Public Works Construction (Greenbook) Table 200-2.4.3 (A)	R-Value per California Test Method 301	78 mInimum
	Sand Equivalent per California Test Method 217	35 minimum
	Percentage Wear per ASTM C131	Abrasion loss < 15% after 100 revolutions Abrasion loss < 52% after 500 revolutions
	Durability Index per California Test Method 229	40 minimum
	Gravel	Less than 15% of particles passing ⅜" sieve but retained on No 4 sieve shall be gravel
	Brick Per California Test Method 202	Less than 3% brick by weight No brick particles shall be retained on No. 4 sieve
Gravel	Fractured Faces.	No particles shall have more than one fractured face.
Sand	Composition	Natural or manufactured granular material or combination thereof, free of deleterious amounts of inorganic material, mica, loam, clay and other substances unsuitable for sand's intended purpose.
Aggregate for Portland Cement Concrete	See Section 03 30 00	
Aggregate for Mortar Sand	See Section 04 05 00	

C. Owner's Representative may waive percentage wear requirements in table above provided durability index requirements shown are met.

D. Crushed rock and rock materials shall meet the following gradations: (from Standard Specifications for Public Works (Greenbook) Table 200-1.2.1 (A))

PERCENTAGE PASSING SIEVES BY WEIGHT							
SIEVE SIZE	**1" CRUSHED ROCK**	**¾" CRUSHED ROCK**	**½" CRUSHED ROCK**	**⅜" CRUSHED ROCK**	**¼" CRUSHED ROCK**	**3/16" CRUSHED ROCK**	**ROCK DUST**
1½"	100%						
1"	90-100%	100%					
¾"	30-60%	90-100%	100%				
½"	0-20%	30-60%	90-100%	100%			
⅜"		0*20%	20-60%	90-100%			100%
¼"					100%		
No. 4	0-5%	0-5%	0-15%	30-60%	75-100%	100%	90-100%
No. 8			0-5%	0-10%	0-25%	40-75%	
No. 16					0-5%	0-10%	
No. 30							20-60%
No. 200					0-2%	0-2%	5-20%
ASTM C131 Test Grading	A	B	B	C	D	D	

E. Where called for on Plans, "Caltrans Class 2 Aggregate Base" shall conform to gradation below. Contractor may choose from either 1½"-Maximum or ¾"-Maximum grading, but once a grading is selected, it shall not be changed without written authorization from Owner's Representative. If on any day, material furnished meets contract compliance requirements but falls outside of operating range, material placement may continue for remainder of that day, after which substitute material shall be furnished complying with requirements for "Operating Range" to Owner's Representative's satisfaction.

PERCENTAGE PASSING SIEVES BY WEIGHT				
SIEVE SIZE	**1½" MAXIMUM CLASS 2 AGGREGATE BASE**		**¾" MAXIMUM CLASS 2 AGGREGATE BASE**	
	OPERATING RANGE (MOVING AVERAGE)	**CONTRACT COMPLIANCE (SINGLE TEST)**	**OPERATING RANGE (MOVING AVERAGE)**	**CONTRACT COMPLIANCE (SINGLE TEST)**
2"	100%	100%		
1½"	90-100%	87-100%		
1"			100%	100%
¾"	50-85%	45-90%	90-100%	87-100%
No. 4	25-45%	20-50%	35-60%	30-65%
No. 30	10-25%	6-29%	10-30%	5-35%
No. 200	2-9%	0-12%	2-9%	0-12%

F. Where called for on Plans, Greenbook Crushed Aggregate Base shall conform to gradation below: (from Standard Specifications for Public Works (Greenbook) Table 200-2.2.2)

PERCENTAGE PASSING SIEVES BY WEIGHT	
SIEVE SIZE	**CRUSHED AGGREGATE BASE GRADATION**
1½"	100%
¾"	90-100%
⅜"	50-80%
No. 4	35-55%
No. 30	10-30%
No. 200	2-9%
ASTM C131 Test Grading	B

G. Where called for on Plans, "Crushed Miscellaneous Base" or "Processed Miscellaneous Base" shall conform to gradation below: (from Standard Specifications for Public Works (Greenbook) Table 200-2.4.2 (A))

PERCENTAGE PASSING SIEVES BY WEIGHT		
SIEVE SIZE	**"COARSE" CRUSHED MISCELLANEOUS BASE GRADATION**	**"FINE" CRUSHED MISCELLANEOUS BASE GRADATION**
2"	100%	
1½"	85-100%	100%
¾"	50-85%	85-100%
⅜"		55-75%
No. 4	25-45%	35-60%
No. 30	10-25%	10-30%
No. 200	2-9%	2-9%
ASTM C131 Test Grading	A	B

PART 3 - EXECUTION

3.1 Installation

A. Refer to Section 01 73 00 for execution and installation requirements.

B. Furnish and install aggregate and rock products at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Requirements of contract-referenced soils reports and investigations.

2. Applicable OSHA and Cal OSHA regulations

3. Other applicable building code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

3.2 Field Quality Control

A. Owner's Representative will provide continuous inspection of rock products as placed and compacted.

B. Owner's Representative will observe and test fills and based on laboratory results will determine whether fills have been placed in accordance with Contract Documents.

C. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Backfill or Soil Prepared in Place	Sampling	ASTM D75	As directed	City	City
	Sieve Analysis	ASTM C136 or California Test Method 202	As directed	City	City
	Sand Equivalence	California Test Method 217	As directed	City	City

D. Allow sufficient time for testing and evaluation of results before material is needed. Owner's Representative will be sole and final judge of suitability of all materials.

E. Do not use materials in question pending test results.

F. Contractor shall remove unsatisfactory material, recompact, adjust moisture or compaction methods, place new material, and perform other operations necessary to meet Contract requirements as directed by Owner's Representative.

END OF SECTION

SECTION 31 05 50
PROTECTING EXISTING UTILITIES

PART 1 - GENERAL

1.1 Work Included

A. Materials and procedures to protect existing underground utilities.

B. Materials and procedures to connect to existing underground utilities.

C. See Section 02 41 15 for procedures for work around asbestos-cement pipe, including snap cutting, removal, and legal disposal. Procedures for wet (hot-tap) connections to existing asbestos-cement pipe are included herein.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 73 00: Execution
C. Section 02 05 00: Basic Civil Engineering Requirements
D. Section 02 41 15: Utility Line Removal
E. Section 26 05 00: Common Work Results for Electrical
F. Section 26 05 53: Identification for Electrical Systems
G. Section 33 71 73: Electrical Utility Services

1.3 References

A. ASCE 38 Standard Guidelines for the Collection and Depiction of Existing Subsurface Data
B. ASTM C143 Slump of Hydraulic Cement Concrete
C. ASTM C425 Compression Joints for Vitrified Clay Pipe and Fittings
D. ASTM C700 Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated
E. California Administrative Code Title 22 Section 64572
F. California Government Code Section 4215-4216

1.4 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings for Supporting Pipe and Utilities Crossing Trenches	Required when utilities to be supported exceed 16” diameter or any transverse dimension.
	Required when requested in writing by Owner's Representative
Engineering Calculations	Submit for pipe supports for existing utilities greater than 24” in any dimension. If concrete beams are used as supports, calculations shall take into account concrete strength based on days elapsing between placing concrete and trenching beneath concrete beams. Do not use 28-day strength unless concrete will be at least 28 days old when beam is placed in service.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings and engineering calculations.

1.5 Project Conditions

A. Design Engineer has attempted to show approximate location of buried utilities on drawings pursuant to Utility Quality Level C (QLC) as defined in ASCE 38. These approximate locations are based on:

1. Record maps requested and received during design from utilities identified through an inquiry to Underground Service Alert and utilities.

2. Comments received from Utilities after their review of preliminary plans showing record drawing information.

3. Field surveying and plotting of locations of readily visible surface features including manhole covers, valve covers, utility boxes, marking posts, pavement repair strips, and culvert end sections which might indicate presence of buried utilities.

4. Design Engineer's professional judgment in correlating record map information to surveyed surface features.

B. Utility locations on Plans are based solely on the above. Plotted locations may not accurately reflect subsurface conditions.

C. Prior to excavation, and prior to submittal of cut sheets for pre-engineered pipe, Contractor shall pothole and determine precise locations of all utilities which are:

1. Shown on plans

2. Identified by Underground Service Alert

3. Evident from readily visible surface features including manhole covers, valve covers, utility boxes, marking posts, pavement repair strips, and culvert end sections which might indicate presence of buried utilities.

4. Identified by Contractor by walking alignment using a reliable electronic pipe finder.

D. Power trench excavating equipment may only be used when and where all the following conditions exist.

1. Contractor has notified Underground Service Alert and all known Utility Owners at least 2 working days before excavating.

2. Contractor has thoroughly searched entire excavation route using a reliable electronic pipe finder and has pre-marked horizontal locations of conflicts.

3. Utilities shown on Plans have been potholed 1,300' in advance of excavation as needed to verify locations.

4. No pipelines carrying gas, petroleum, explosives, hazardous materials, or other regulated contaminants are believed to be within 5' of area to be excavated.

5. Owner's Representative is continuously present during excavation.

E. Power equipment specifically designed and manufactured for potholing existing utilities is exempt from the above restrictions.

F. Hand excavation shall be used

1. In areas where buried gas, petroleum, explosives or hazardous material piping is known to be present

2. In areas where electrical, fiber optic or communications conduit is known to be present.

3. In first 5' below existing grade where drilling or auguring equipment is used.

G. Pursuant to Section 4215 of California Government Code,

1. Owner will be responsible *"for timely removal, relocation, or protection of existing main or trunk line utility facilities located on the site"* if such utilities are not identified by Owner in Contract Documents.

2. Owner will compensate Contractor for documented *"costs of locating, repairing damage not due to the failure of the Contractor to exercise reasonable care, and removing or relocating such utility facilities not indicated in the plans and specifications with reasonable accuracy, and for equipment on the project necessarily idled during such work."*

3. "Contractor shall not be assessed liquidated damages for delay in completion of the project when such dlay was caused by the failure of the public agency or the owner of the utility to provide for removal or relocation of such utility facilities."

H. Pursuant to Section 4216 of California Government Code, Owner's liability shall be limited to reimbursement of costs due to utility facilities either not shown on Contract Documents, or shown on Contract Documents at locations more than 2' vertically or 5' horizontally in error from field locations, except where location of said utilities are evident from surface features or staked correctly by Underground Service Alert.

I. Owner will not indicate presence of existing service laterals or appurtenances when presence of utilities on Project site can be inferred from presence of other visible facilities, such as buildings, meters and junction boxes, on or adjacent to Work site. Owner will identify main or trunk lines in Contract Documents. Contractor shall make their own investigations, including exploratory investigations, to determine or verify locations and type of existing service laterals or appurtenances when their presence can be inferred from presence of other visible facilities.

J. Immediately notify Owner and Utility in writing if Contractor discovers:

1. Utility facilities not shown on Plans

2. Utility facilities in field locations different than shown on plans.

K. Pursuant to California Administrative Code Title 22 Section 64572 and intent of Plans, separations shall be maintained between new and existing utilities as follows:

REQUIRED WALL-TO-WALL SEPARATIONS FOR PARALLEL PIPELINES			
NEW UTILITY	**SEPARATION FROM EXISTING**	**HORIZONTAL SEPARATION**	**VERTICAL SEPARATION (not required if horizontal separation** > 10')
Water Mains	Sewers	≥ 10' horizontal	New invert 12" above top of sewer
Sewers or Nonpotable Pipelines	Potable Water Mains at pressures < 5 psi	≥ 25' horizontal	New soffit 12" below pipe invert
	Potable Water Mains	≥ 10' horizontal	New soffit 12" below pipe invert
REQUIRED WALL-TO-WALL SEPARATIONS FOR WATER MAINS CROSSING BELOW PIPES			
Water Mains	Sewers	No joints on 8' either side	≥ 12" vertical separation
Sewers or Nonpotable Pipelines	Potable Water Mains	No joints on 8' either side	≥ 12" vertical separation
REQUIRED WALL-TO-WALL SEPARATIONS FOR WATER MAINS CROSSING ABOVE PIPES			
Water Mains	Sewers	No joints on 8' either side	≥ 12" vertical separation
Sewers or Nonpotable Pipelines	Potable Water Mains	No joints on 8' either side	≥ 12" vertical separation

L. Lesser separations may be used under California Administrative Code Title 22 Section 64551(c) when Separations required under Section 64572 are not feasible, when inverts of potable water mains are above soffits of parallel sewers and nonpotable pipelines, and when:

1. Sewers or storm drains are not under pressure or used as force mains, and are constructed of :
    a. ASTM F894 spirally-reinforced HDPE pipe with gasketed joints,
    b. ASTM C700 VCP sewer with compression joints
    c. ASTM C428 ACP sewer pipe Class 4000 Type II with rubber gasket joints
    d. ASTM D3064 PVC sewer pipe with rubber gasket joints
    e. AWWA C151 DIP pipe with compression joints
    f. AWWA C302 RCP pipe with compression joints or
    g. AWWA C906 fusion-bonded HDPE pipe with fusion-welded joints,

or

2. Fuel and oil lines are constructed of:
    a. AWWA C151 DIP pipe with compression joints or
    b. AWWA C200 ¼"-wall welded steel water pipe dipped and wrapped

or

3. Water, raw water, or recycled water mains operate at pressures >5 psi and are constructed of:
    a. AWWA C151 DIP water pipe with compression joints and hot-dip bituminous coating
    b. AWWA C200 ¼"-wall welded steel water pipe dipped and wrapped
    c. AWWA C300, C302, or C303 reinforced concrete pressure pipe
    d. AWWA C400 Class 200 ACP Type II water pipe
    e. AWWA C900 or C905 PVC DR14 water pipe with compression joints or
    f. AWWA C906 fusion-bonded HDPE water pipe with fusion-welded joints,

4. In which case separations shall be maintained between constructed and existing utilities as follows:

REQUIRED WALL-TO-WALL SEPARATIONS FOR PARALLEL PIPELINES			
NEW UTILITY	**SEPARATION FROM EXISTING**	**HORIZONTAL SEPARATION**	**VERTICAL SEPARATION**
Water Mains	Sewers	≥ 4' horizontal	New invert 12" above top of sewer
Sewers or Nonpotable Pipelines	Potable Water Mains	≥ 4' horizontal	New soffit 12" below pipe invert
REQUIRED WALL-TO-WALL SEPARATIONS FOR WATER MAINS CROSSING BELOW PIPES			
Water Mains	Sewers	No joints on 10' either side	≥ 4" vertical separation
Sewers or Nonpotable Pipelines	Potable Water Mains	No joints on 10' either side	≥ 4" vertical separation
REQUIRED WALL-TO-WALL SEPARATIONS FOR WATER MAINS CROSSING ABOVE PIPES			
Water Mains	Sewers	No joints on 8' either side	≥ 4" vertical separation
Sewers or Nonpotable Pipelines	Potable Water Mains	No joints on 8' either side	≥ 4" vertical separation

M. Costs, and Work to be done by Contractor in locating, removing, relocating, protecting or temporarily maintaining such utility facilities shall be covered by written change order conforming to provisions herein pertaining to changes in Work. Owner may make changes in alignment and grade of Work to obviate need to remove, relocate, protect or temporarily maintain utility facilities or to reduce costs of Work involved in removing, relocating, protecting or temporarily maintaining such utility facilities. Changes in alignment and grade will be ordered in accordance with provisions pertaining to changes in Work.

N. Damage to underground utilities, pipelines or other facilities shown on Plans or identified by field staking or markings shall be immediately brought to attention of Owner's Representative and affected Utility, and repaired at Contractor's expense. Exact determination of location of these utilities, pipelines or other facilities shall be Contractor's responsibility. Contractor shall be solely and directly responsible for damage, injury, expense, loss, inconvenience, delay, suits, actions or damage that may result from Contractor's failure to verify or locate utilities whose existence is indicated. Costs incurred for protection of these lines or costs incurred due to presence of lines, whether or not they lie within trench prism, shall be borne in full by Contractor.

O. When it is necessary to remove, relocate, protect or temporarily maintain a utility other than

1. existing mains or trunk-line facilities not originally shown on Plans with sufficient accuracy to allow Work to proceed according to Contract Documents or;

2. existing service laterals or appurtenances whose presence cannot be inferred from presence of other visible facilities, such as buildings, meters and junction boxes, on or adjacent to Work site;

Contractor shall bear all expenses incidental to Work on utility or damage thereto. Work on utility shall be done in manner satisfactory to Utility Owner. Utility Owner will have option of doing such Work with their own forces, or permitting Work to be done by Contractor.

P. No representations are made that obligations to remove, relocate, protect or temporarily maintain a utility and to pay cost thereof is not required to be borne by utility. Contractor shall investigate, to find out whether or not said cost is required to be borne by Utility Owner.

Q. Liquidated damages will not be assessed for damages in delay in completion of Work, when such delay was caused by failure of Owner, Owner's Representative, Design Engineer and Utility Owner to provide for removal or relocation of utility facilities. Right is reserved to governmental agencies and to Utility Owners to enter at any time upon any street, alley, right of way or easement for purpose of making changes in their property made necessary by Work and to maintain and make repairs to their property.

1.6 Unit Prices

A. Payment for locating, potholing, exposing, and protecting existing utilities will be included in price bid for Work items for which such Work is appurtenant.

B. Payment for abandoning or removing existing utilities will be included in the price bid for Work items for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Replacement Materials

A. Unless otherwise shown or specifically authorized in writing by Owner's Representative, reconstruct damaged utilities with new materials of same size, type and quality as that removed.

B. Vitrified clay pipe sewer crossings 8" in diameter and under shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Replacement of Vitrified Clay Sewer Pipe 8" Diameter or Less	Plain-End VCP	ASTM C700 (At least two lengths of sewer pipe shall be used to cross trench section.)
Replacement of Vitrified Clay Sewer Pipe Couplings 8" Diameter or Less	Compression Coupling	ASTM C425; Band seal couplings or accepted equal

PART 3 – EXECUTION

3.1 Preparation

A. Section 4216 of California Government Code states Contractors *"planning to conduct any excavation shall contact the appropriate regional notification center at least two working days but not more than 14 calendar days, prior to commencing excavation."*

B. In Southern California, the appropriate regional notification center is Underground Service Alert of Southern California (DigAlert) (1-800-422-4133) or 811.

C. Contractor shall be responsible for damage done to public or private property shown on Plans or marked or staked in field.

D. Construction Plans will be provided to Utilities by Owner.

E. Construction schedule shall be provided to Utilities by Contractor. Coordinate construction schedule with Utility Owner's requirements.

F. Notify Utility Owner 2 working days in advance of utility crossing construction. Coordinate construction schedule with utility service requirements.

G. Expose all utilities 1,300’ ahead of pipe and conduit laying operations to allow for adjustment in alignment or grade line, to verify pipe and utility location and depths, types materials, conditions and sizes for ordering proper transition and/or tie-in fittings, and so Owner's Representative may verify that no buried utilities interfere with proposed construction. Identify true location and depth, type, material, condition and size of utilities and service connections. Where potholing or exposure is not done, repair or replacement of damaged utilities and necessary horizontal and vertical realignments shall be paid for entirely by Contractor.

H. Electrical utilities may maintain energized underground electrical power lines in immediate vicinity of Work. These power lines represent an extreme hazard from electrical shock to construction personnel or equipment coming in contact with them. State law requires parties planning excavations in public right of way to contact Utilities for locations of their underground facilities. Contractors, their employees, and other personnel working near underground power lines must be warned to take adequate protective measures. (See: OSHA Std. 1926-651(A)). Notify electrical Utility to arrange, if possible, to have these lines de-energized when Work reaches their immediate vicinity. Cost of such temporary arrangements shall be borne by Contractor.

I. Electrical utility companies may maintain energized aerial electrical power lines in immediate vicinity of Work. Do not consider these lines to be insulated. Construction personnel working near these lines are exposed to an extreme hazard from electrical shock. Contractors, their employees and construction personnel working on this project must be warned of the danger and instructed to take adequate protective measures, including maintaining a minimum of 10’ clearance between lines and construction equipment and personnel. (See OSHA Std. 1926.550(A)15). As an additional safety precaution, call electrical utility company to arrange, if possible, to have these lines de-energized or relocated when Work reaches their immediate vicinity. Cost of such temporary arrangements shall be borne by Contractor.

J. It shall not be the responsibility of either Owner or their Representative to verify need for electrical Utility shutdowns, nor to verify shutdowns have taken place.

3.2 Protection

A. Protect existing active services and utilities in place against damage from construction.

B. Maintain existing services and utilities in service. Do not shut down active services or utilities except where previous written authorization has been obtained from Owner's Representative and Utility.

C. Use pipe and duct supports as needed to protect utilities.

D. Notify Utilities in writing at least 3 working days before authorized shutdown.

E. Unauthorized shutdowns shall only be made where necessary, as an emergency measure, to protect property or human life until proper authorization can be obtained.

3.3 Removal and Reconstruction

A. Utilities relocated or rebuilt for Contractor's convenience, shall be relocated or rebuilt at Contractor's expense. Repair, replacement or relocation of buried utilities shall be completed at Contractor's expense by either Utility's forces, or by a contractor accepted by Utility in writing and properly licensed to perform Work.

B. Utility relocation or reconstruction shall conform to applicable Standard Details and Specifications. Provide temporary service for disconnected Utility.

C. Replace damaged or removed utilities in kind, except as otherwise shown or authorized by Owner's Representative. Reconstruct utilities with new material of same size, type and quality as that removed.

3.4 Backfill and Compaction

A. Backfill and compact under and around utilities so no voids are left.

B. Before replacing a utility, backfill trench and compact to elevation 1 foot above top of ends of utility. Excavate cross trench of proper width for utility.

C. Sand-cement slurry may be used as backfill to ease compaction. Sand-cement slurry shall consist of one sack (94 pounds) Portland cement per cubic yard of slurry. Add sufficient moisture for workability without exceeding 6” slump. Submit specific methods and procedures to Owner's Representative prior to construction.

3.5 Abandoned Utility Lines

A. Remove and dispose of abandoned utilities within trench per Section 02 41 15.

3.6 Servicing Electrical Utilities

A. Protect and interface with servicing Electrical Utility per Section 33 71 73.

3.7 Connecting to Existing Water Mains

A. Contact Water Utility Owner 72-hours before connecting to existing mains.

B. Comply with all Utility requirements for tapping existing lines, including field directives from Utility inspectors.

C. Wet connections (hot taps) shall be made as follows:

1. Tap existing lines while under pressure.

2. Schedule tapping procedure with Water Utility so as not to interfere with normal operation of existing pipe line.

3. Cut tapped pipe in presence of Water-Utility-designated inspector to full nominal diameter of tapping valve.

D. Dry connections shall be made as follows:

1. Schedule tapping procedure with Water Utility so as not to interfere with normal operation of existing pipe line.

2. Coordinate with Water Utility to minimize downtime.

3. Arrange for presence of Water Utility inspector.

4. Water Utility shall operate valves to isolate main.

5. Verify Water Utility pipeline is isolated and relieved of pressure before cutting main.

6. Cut tapped pipe in presence of Water-Utility-designated inspector to full nominal diameter of tapping valve.

7. Place 2 ounces of HTH in pipe at each point where existing main is cut.

8. Swab new pipe and fittings internally with an accepted chlorine solution.

3.8 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Cement-Sand Slurry Backfill	Slump (6" Maximum)	ASTM C143	1 each batch	Owner	Contractor
Connection to Existing Water Line	Verification of Proper Connection	Make cut in presence of Owner's Representative and present coupon to Owner's Representative Coupon shall match full valve nominal size.	1 each connection	Contractor	Contractor

END OF SECTION

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SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 Work Included

A. Clearing, grubbing, stripping, and preparing site for construction operations.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 31 23 00: Excavation and Fill

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Building Code (CBC)
B. California Fire Code (CFC)

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Preparation

A. Inspect site as to nature, location, size and extent of vegetative material to be removed.

B. Before beginning work, consult with Owner's Representative, Identify limits of clearing, grubbing and stripping and mark in field with, fencing, stakes and string, paint, chalk or other method acceptable to Owner's Representative.

C. Limits of clearing, grubbing and stripping shall include excavation and embankment areas required to be disturbed to construct improvements shown on Plans. Limits shall also include stockpile areas accepted by Owner's Representative.

D. Provide clearing, grubbing and stripping at locations shown on Plans and submittals and as required to accommodate Work.

E. Preservation of trees, shrubs and other plant material shall occur as follows:

1. Locate and tag trees and shrubs shown on Plans to be preserved.

2. Save and protect tagged plant materials and trees, shrubbery and plants beyond limits of clearing, grubbing and stripping from damage resulting from Work.

3. Do not fill, excavate, trench or stockpile materials within drip-line of plant materials required to be preserved.

4. Drip-line is defined as vertical projection to ground from outermost branches of plant or group of plants, or the shadow a plant would cast were sun directly overhead.

5. To prevent soil compaction within drip-line area. Do not move or store equipment within this area.

6. When trees are close together, restrict entry to area within drip line by fencing.

7. Where no fence is erected, protect trunks of trees 2 inches or greater in diameter by encircling tree trunk with boards held securely with 12-gauge wire and staples. This protection shall extend to 6 feet above ground.

8. Cutting and removal of tree branches where such cutting is necessary to permit construction operation shall be done by a certified arborist. Arborist shall remove branches other than those required to accomplish work if required to provide a balanced appearance of any tree.

9. Treat sears resulting from removal of branches with a tree sealant.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. The following installation standards shall be followed:

1. Manufacturer’s installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Other applicable building and fire code requirements.

C. Clearing shall proceed as follows:

1. Remove and legally dispose of trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth.

2. Remove all evidence of their presence from surface including sticks and branches greater than 1-inch diameter or thickness.

3. Remove and legally dispose of trash piles and rubbish.

4. Protect structures, piping and equipment above and below ground, trees, shrubs, vegetative growth and fencing not designated for removal.

D. Grubbing shall proceed as follows:

1. Remove and legally dispose of wood or root matter below ground remaining after clearing, including stumps, trunks, roots, or root systems greater than 1-inch diameter or thickness to a depth 12 inches below existing or finished grade, whichever is lower.

E. Stripping shall proceed as follows:

1. Remove and legally dispose of all organic sod, topsoil, grass and grass roots and other objectionable material remaining after clearing and grubbing from areas designated to be stripped.

2. Stockpile and retain topsoil material onsite for dressing backfill areas before planting.

F. Do not burn combustible materials. Remove cleared, grubbed and stripped material from site (excluding topsoil) and dispose of in accordance with local laws, codes and ordinances.

END OF SECTION

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SECTION 31 23 00
EXCAVATION AND FILL

PART 1 - GENERAL

1.1 Work Included

A. Structural and trenching excavation activities as required to complete Work under wet and dry conditions in whatever material or class of material is encountered, including:

1. Contacting and notifying underground utilities, no less than 48-hours before excavating in accordance with Section 31 05 50.

2. Compliance with State and Federal safety regulations.

3. Designing, furnishing, placing, and removing all sheeting, shoring and bracing needed to safely support sides of excavations.

4. Compliance with applicable agencies' permit conditions for work in public or railroad right-of-way, and for work on private property.

5. Loosening, excavating, removing, loading, and transporting excess soil from excavations.

6. Stockpiling, exporting and importing material.

7. Pumping, ditching, draining, and other required measures to remove or exclude water.

8. Supporting and protecting structures above and below ground.

9. Maintaining trees which are not permitted to be removed.

10. Preparing and stabilizing subgrade for pipe, paving and structures.

11. Backfilling around structures and all backfilling of trenches and pits.

12. Transporting, depositing, and compacting fill where required.

13. Compaction testing (where stipulated as a Contractor responsibility in Section 3.3).

14. Rough and fine grading, and preparation of right-of-way.

15. Soil sterilant application.

16. Legal disposal of cleared, grubbed and excess excavated materials.

17. Cleaning up debris, papers and loose rocks.

18. Restoring fences and other disturbed property.

19. All other incidental earthwork and supplementary operations needed to complete Work.

B. Excavations for appurtenant structures including manholes, vaults, valve boxes, thrust blocks, and wet well shall be considered as trench excavation.

C. Excavation shall include removal of all water and materials of any nature which interfere with construction work. Removal of water to levels below structure subgrade will be necessary only where required by Contract Documents.

D. Excavation for pipe and conduit work shall be by open trench unless otherwise shown. Should Contractor elect to tunnel or jack any portion not so specified, they shall first obtain acceptance from Owner's Representative, and payment will be limited to prices bid for open trench work.

E. Except as modified herein, earthwork shall conform to Standard Specifications for Public Works Construction (Greenbook) Section 300.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 01 73 33: Mechanical Identification
I. Section 03 30 00: Cast-in-Place Concrete
J. Section 31 05 16: Aggregate and Rock Products for Earthwork
K. Section 31 05 50: Protecting Existing Utilities
L. Section 31 10 00: Site Clearing
M. Section 31 23 19: Dewatering
N. Section 32 13 13: Concrete Paving
O. Section 32 90 00: Landscaping
P. Section 33 05 26: Utility Identification

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASTM C12 Installing Vitrified Clay Pipe Lines
B. ASTM C143 Slump of Hydraulic Cement Concrete
C. ASTM C136 Sieve Analysis of Fine and Coarse Aggregates
D. ASTM D1556 Density and Unit Weight of Soil in Place by SandCone Method
E. ASTM D1557 Laboratory Compaction Characteristics of Soil Using Modified Effort
F. ASTM D4253 Maximum Index Density and Unit Weight of Soils Using Vibratory Table
G. ASTM D4254 Maximum Index Density and Unit Weight of Soils and Calculation of Relative Density
H. ASTM D6938 In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
I. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances
J. AWWA C605 Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
K. AWWA M9 Concrete Pressure Pipe
L. AWWA M23 PVC Pipe – Design and Installation
M. AWWA M41 Ductile Iron Pipe and Fittings
N. AWWA M55 PE Pipe – Design and Installation

O. California Test Method 202 Sieve Analysis of Fine and Coarse Aggregates
P. California Test Method 216 Relative Compaction of Untreated and Treated Soils and Aggregates
Q. California Test Method 217 Sand Equivalent
R. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 300 "Earthwork"
S. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 306-1 "Open-Trench Excavations"

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required for soil sterilants per catalog data requirements.
Permits	Copies of permits obtained for excavation, grading, etc. required by state and local governing authorities
Certificate of Compliance	Submit affidavit of compliance with California Construction Safety Order requirements prior to beginning excavation on any trench or excavation. Affidavit shall certify compliance with all shoring, bracing, sloping or other protective system provisions required by California Construction Safety Orders for worker protection from hazard of caving ground during excavation.

B. Refer to Section 01 33 00 for definition of requirements for catalog data and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

B. Volumes of excavation and backfill used to compute additional payments or deductions shall be as follows:

1. Trench widths for pipe: Use maximum width specified, measured at top of pipe.

2. Trench widths for cast-in-place structures or cast-in-place foundations for precast structures: Use outside width of structure or foundation plus 3'.

C. In absence of pay items for contaminated soils, Contractor shall be entitled to payment as Extra Work for documented costs incurred by Contractor for removing, segregating, covering, and legally disposing of contaminated soils. Contractor shall not be entitled to payment for imported material to replace contaminated soils.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Soil Sterilant	Elanco "Surflan"	Greenfield, IN
	Bayer Aventis Crop Science (formerly Rhône-Poulenc) "Ronstar G 50 WP"	Leverkusen, NRW, GE
	Rainbow Technology "Weedkiller"	Pelham, AL
	Accepted equal	
Buried Pipe Warning-Locating and Identification Tape	See Section 33 05 26	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Refer to Section 31 05 16 for basic requirements for aggregate and rock products.

C. The following definitions shall apply to soil and backfill:

ITEM	MATERIAL	SPECIFICATION
Granular Material	Sand or Gravel	California Test Method 217 minimum sand equivalence of 30 Not more than 20% of material shall pass through 200-mesh sieve.
Imported Sand	Sand	California Test Method 217 minimum sand equivalence of 30
Suitable Structural Backfill Material (per Greenbook 300-3.5)	Imported or Excavated Material Meeting Specification	California Test Method 217 minimum sand equivalence of 20 35-100% passing No 4 sieve 20-100% passing No 30 sieve Material free from shale, sod, stones, concrete and clods over 4" diameter, roots, trash, lumber, organic material, ashes and other debris considered unsuitable by Owner. Material shall have no unusual color or sulfide odor. Compact to specified densities.
Suitable Soil Material	Imported or Excavated Material Meeting Specification	Material free from shale, sod, stones, concrete and clods over 4" diameter, roots, trash, lumber, organic material, ashes and other debris considered unsuitable by Owner. Material shall have no unusual color or sulfide odor. Compact to specified densities.
Unclassified Fill	Imported or Excavated Material Meeting Specification	Material free from shale, sod, stones, concrete and clods over 6" diameter, roots, trash, lumber, organic material, ashes and other debris considered unsuitable by Owner. Material shall have no unusual color or sulfide odor. Compact to specified densities.
Cement-Sand Slurry	Cement (94-lb sacks per cubic yard of mix)	1 sack per cubic yard minimum, and not less than that required by applicable agency encroachment permits
	Maximum Slump	Maximum 6" per ASTM C143
Native Material	Material obtained from required site excavations When native material is unsuitable for use in backfill, it shall be disposed of off-site and suitable material capable of being compacted to required relative density shall be furnished by Contractor at their expense.	
Import Material	Owner-accepted material obtained from off-site borrow areas.	
Buried Pipe Warning-Locating and Identification Tape	See Section 33 05 26. See section on appropriate utility pipe or conduit material for required message	
Soil Sterilant	Combination of sodium chlorate and borates	

D. Soil and backfill materials for pipelines and utilities shall be prepared to the following specifications:

ITEM	MATERIAL	SPECIFICATION
Backfill for Over-Excavation Beneath Pipes	Cement-Sand Slurry	Cement-sand slurry mix specified above
	Suitable Soil Material (where cement-sand slurry not required)	90% compaction per ASTM D1557 or California Test Method 216
Backfill of Tunnels beneath Concrete Flatwork	Sand	90% compaction per ASTM D1557 or California Test Method 216
Pipe Zone Material (Material from 4"-6" below pipe to plane 12" above top of pipe)	Native or Imported Granular Material	Place buried identification tape where specified 95% compaction per ASTM D1557 or California Test Method 216 or California Test Method 217 Minimum sand equivalence of 30 Material shall also be suitable soil material as defined above. Maximum lifts vary with equipment. See below.
Trench Zone Material (Material in Pipe Trench above Pipe Zone and below any Street Zone)	Cement-Sand Slurry	Cement-sand slurry mix specified above
	Suitable Soil Material (where cement-sand slurry not required)	90% compaction per ASTM D1557 or California Test Method 216 Maximum lifts vary with equipment. See below. May contain stones, asphalt pavement or concrete of up to 6" in largest dimension so long as such solids are completely surrounded by fines so no voids are present in backfill as placed. No material >2" in any dimension shall be placed within one foot of any pipe, valve, or structure. All backfill within 24" of ductile-iron fittings or valves shall be clean, washed sand. Provide buried pipe warning and locator tape in pipe trench 18" above pipe.
Street Zone Material (Base material in pipe trench below pavement subgrade to depth of 30" below finished road surface.	Crushed Aggregate Base Material	95% compaction per ASTM D1557 or California Test Method 216 Conform to Section 200-2.2, crushed aggregate base of SSPWC Contractor may substitute on-site materials conforming to Section 200-2.5, Processed Miscellaneous Base of SSPWC Maximum lifts vary with equipment. See below. Material shall also be suitable soil material as defined above. Stones concrete and clods smaller than specified limit may not exceed 20% of backfill volume over any pipe segment. Place in 8" maximum lifts.
Surface Zone Material (upper 12" of trench to finish surface in unimproved or landscaped areas)	Topsoil per Section 32 90 00	80% compaction per ASTM D1557 or California Test Method 216 Maximum lifts vary with equipment. See below.

E. Soil and backfill materials for site grading and general excavation shall be prepared to the following specifications:

ITEM	MATERIAL	SPECIFICATION
Backfill for Over-Excavation Beneath General Excavation	Suitable Soil Material	90% compaction per ASTM D1557 or California Test Method 216
Loose Ground Remaining After Stripping	Suitable Soil Material	90% compaction per ASTM D1557 or California Test Method 216
Fills Below Ground	Suitable Soil Material	90% compaction per ASTM D1557 or California Test Method 216 Place in 4' maximum lifts
Embankments	Suitable Soil Material	90% compaction per ASTM D1557 or California Test Method 216 Place in 8" maximum lifts 2:1 maximum embankment slope
Surface Zone Material (upper 12" below finish surface in unimproved or landscaped areas)	Topsoil per Section 32 90 00	80% compaction per ASTM D1557 or California Test Method 216 Maximum lifts vary with equipment. See below.

F. Soil and backfill materials for paving shall be prepared to the following specifications:

ITEM	MATERIAL	SPECIFICATION
Backfill for Over-Excavation Beneath Paving	Cement-Sand Slurry	Cement-sand slurry mix specified above
	Suitable Soil Material (where concrete slurry not required)	90% compaction per ASTM D1557 or California Test Method 216
Roadway/Paving Fills > 3' Below Base	Suitable Soil Material	95% compaction per ASTM D1557 or California Test Method 216 Place in 4' maximum lifts
Top 3' of Roadway/Paving Fills Below Base	Suitable Soil Material	95% compaction per ASTM D1557 or California Test Method 216 Place in 8" maximum lifts
Roadway/Paving Base	Crushed Aggregate Base Material	95% compaction per ASTM D1557 or California Test Method 216 Conform to Section 200-2.2, crushed aggregate base of SSPWC Contractor may substitute on-site materials conforming to Section 200-2.5, Processed Miscellaneous Base of SSPWC Maximum lifts vary with equipment. See Section 32 13 13 for concrete paving

G. Soil and backfill materials for structures shall be prepared to the following specifications:

ITEM	MATERIAL	SPECIFICATION
Backfill for Over-Excavation Beneath Structures	Concrete	Section 03 30 00 Class A
Backfill of Tunnels Beneath Concrete Flatwork	Sand	90% compaction per ASTM D1557 or California Test Method 216
Structural Fills > 5' Below Foundation	Suitable Structural Backfill Material (per Greenbook 300-3.5)	90% compaction per ASTM D1557 or California Test Method 216 Place in 8" maximum lifts
Top 5' of Structural Fill	Suitable Structural Backfill Material (per Greenbook 300-3.5)	95% compaction per ASTM D1557 or California Test Method 216 Place in 8" maximum lifts
Structural Bedding Beneath Footings, Slabs and Sand Blanket	Crushed Aggregate Base Material	95% compaction per ASTM D1557 or California Test Method 216 Conform to Section 200-2.2, crushed aggregate base of SSPWC If plans are silent regarding thickness, provide 8" layer of aggregate beneath 4" sand layer
Sand Blanket Beneath Slabs	Sand	90% compaction per ASTM D1557 or California Test Method 216 If plans are silent regarding thickness, provide 4" sand layer with10-mil PVC vapor barrier with sealed laps in center of sand layer.

PART 3 - EXECUTION

3.1 Preparation

A. Contractor's attention is directed to possible existence of pipe and other underground improvements which may or may not be shown on Plans. Preserve and protect any such improvements whether shown or not. Where necessary to remove and replace or to relocate such improvements to prosecute Work, improvements shall be removed, maintained, and permanently replaced by Contractor at their expense, except as otherwise provided in Contract Documents.

B. Section 4216 of the California Government Code states Contractors *"planning to conduct any excavation shall contact the appropriate regional notification center at least two working days but not more than 14 calendar days, prior to commencing excavation."*

C. Preparation for fill shall proceed as follows:

1. Areas to receive fill shall first be cleared and grubbed per Section 31 10 00.

2. Areas shall then be scarified to provide a bond between existing ground and fill material to be deposited thereon.

D. Control of runoff and groundwater shall comply with the following:

1. Control grading to prevent water running into excavations. Do not obstruct surface drainage. Provide swales, gutters temporary drains or other means of channeling flow without interruption around excavations.

2. Preserve existing drainage patterns except as otherwise shown. Where construction methods cause temporary obstruction of drainage patterns, provide temporary facilities adequate for expected flows and a means of emergency removal of obstruction.

3. Procure permit from appropriate Regional Water Quality Control Board for all groundwater dewatering operations.

4. Provide and maintain ample means and devices and promptly remove and properly dispose of all water from any source entering excavation or other parts of Work. Dewatering methods shall ensure preservation of final lines and grades of bottoms of excavations. Said methods may include well points, sump points, suitable rock or gravel placed below required bedding for drainage and pumping purposes, temporary pipelines, and other means that will not be detrimental to proposed construction. Contractor is responsible for obtaining all water discharge permits required.

5. Dewatering for structures and pipelines shall commence when groundwater is first encountered and shall continue until water can be allowed to rise in accordance with provisions of this section.

6. Jetting, where permitted shall be performed without softening embankments and in manner not impounding excess water.

7. Do not place concrete footings or floors in water. Do not allow water to rise over Work until concrete or mortar has set at least 8 hours. Do not allow water to rise unequally against walls for 28 days. Do not allow groundwater to rise around pipe until jointing compound in joints has set hard.

8. Dispose of water in suitable manner without damage to adjacent property. Do not drain water into Work built or under construction without prior consent of Owner's Representative. Dispose of water according to permits and in such manner as not to be a menace to public health and public or private property.

E. Remove and reconstruct concrete paving improvements per Section 32 13 13.

F. Obtain written permission from Owner prior to any blasting or use of explosives. Explosives, if used, shall be of such quantity and power and shall be used in such locations as to minimize opening of seams and disturbing of material outside prescribed excavation limits. As excavation approaches its final limits, reduce depths of holes for blasting and quantity of explosives used for each hole so to minimize disturbance of underlying or adjacent material.

G. Protection open excavations, complying with latest revision of rules, orders and regulations of Division of Industrial Safety of State of California. Nothing contained in these Contract Documents shall be construed as relieving Contractor of full responsibility for providing shoring, bracing, sloping or other provisions adequate to guarantee worker protection and safety.

    1. Vertical supports including steel H-beams and piles shall be drilled into place, except final 4' may be driven.

    2. Where drilling is impracticable because of rocks or running sand, Owner's Representative may accept placing of vertical supports by means other than drilling, provided Contractor assumes sole responsibility to protect existing surface and subsurface improvements in place.

    3. If sheeting is used for trench support, no sheeting shall remain in trench upon project completion except where removal of portions of said sheeting is impracticable in opinion of Owner's Representative.

    4. Access ladders shall be provided within 25 feet of all workers as required by OSHA regulations.

H. No material shall cause undue interference with public travel. Provide free access to all fire hydrants, water valves, meters, and private drives, or other property or facilities that may have routine or emergency use.

I. Do not deposit backfill against new concrete structures until concrete has developed specified 28-day compressive strength.

3.2 Installation

A. Refer to Sections 01 73 00 and 01 73 33 for basic execution and installation requirements.

B. Furnish and install excavation and fill at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Requirements of contract-referenced soils reports and investigations.

2. Manufacturer's installation and warranty requirements

3. Applicable OSHA and Cal OSHA regulations

4. California Building Code Chapter 18 "Soils and Foundations."

5. Standard Specifications for Public Works Construction (Greenbook) Section 300 "Earthwork"

6. Standard Specifications for Public Works Construction (Greenbook) Section 306-1 "Open Trench Excavations"

7. Other applicable building code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Earthwork within public rights-of-way controlled by a state, county or city, or earthwork within railroad rights-of-way shall be in accordance with requirements and provisions of permits issued by those agencies for construction within their respective rights-of-way. Such permit requirements and provisions which are more restrictive than those specified herein, shall take precedence and supersede provisions of Contract Documents.

F. Should contaminated soil be encountered, Contractor shall perform the following activities:

1. Promptly notify Owner's Representative contaminated or potentially contaminated soil has been encountered so Owner may identify party legally responsible for disposal of contaminated soil and properly direct Contractor how to proceed.

2. Conduct work in contaminated areas in accordance with applicable OSHA and Cal OSHA regulations.

3. Segregate and cover contaminated soils prior to removal from site.

4. Dispose of contaminated soils as directed by Owner and as required by law.

G. Should excavation be carried below lines and grades shown, refill excavated space to proper elevation with material as specified in Part 2 above for correction of faulty grades after overexcavation.

H. Site grading and general excavation shall proceed as follows:

1. Stripping: Strip all vegetation such as roots, brush, heavy sods, heavy growth or grass, and all decayed vegetable matter, rubbish, and other unsuitable materials within area of Work prior to starting excavation or embankment. Trees and other natural growths outside actual lines of construction operations shall not be destroyed and such measures as are necessary shall be taken by Contractor, at their own expense, for protection thereof.

2. Excavation: After stripping, excavation of whatever substances are encountered within grading limits of Work shall be carried to lines and grades shown. All suitable excavated material shall be used to meet embankment requirements of Work. Material in excess or not suitable for embankment shall be disposed of as specified herein.

3. Embankment: After stripping, areas to receive embankment or fill shall be benched, if sloping, and scarified to a depth of 6“, then compacted as specified.

4. If ground is in loose, uncompacted condition after stripping, it shall be compacted as specified. Do not deposit unsuitable material in fill areas where compaction is required.

5. Unless special material is required, material for embankments or roadway fills may consist of excavated material from structures or a mixture of excavated materials and materials borrowed off-site. Leaves, grass, roots, stumps, sludge, and other organic matter shall not be deposited in any embankment or fill. Off-site sources of fill must be designated and are subject to evaluation and approval by Owner’s Representative.

6. Do not place material beyond sloping lines of embankment unless so ordered by Owner’s Representative. Material allowed to be placed beyond embankment lines shown shall be compacted as required above unless otherwise authorized by Owner’s Representative.

7. Compact material for embankments or roadway fills by rolling with power rollers weighing at least ten tons, with sheepsfoot rollers, with vibrating rollers, or with pneumatic tire rollers, as appropriate for soil type being compacted, and as required to accomplish Work. As each layer is deposited, apply water in sufficient amounts to ensure optimum moisture to secure compaction specified. If excess moisture is encountered in fill, manipulate each layer so as to dry out excess moisture. Water shall be uniformly incorporated with fill material in amount sufficient to ensure required density after compaction.

8. Use of trucks, carryalls, scrapers, tractors, or other heavy hauling equipment shall not be considered as rolling in lieu of rollers, but traffic of such equipment shall be distributed over fill in such manner as to use compaction afforded thereby as an addition to compaction by rollers.

9. Excavate and fill to lines and grades shown with maximum slope not exceeding that shown.

10. Plan haul routes to avoid passing heavy off-highway equipment over pipelines with less than 4’ cover. Where crossings must be made, provide concrete encasement or accepted bridging.

11. Finish: All areas covered by Work, including excavated and filled sections and transition areas, shall be uniformly graded to elevations shown. Finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. Round edges of spoil and borrow areas to blend into natural contours. Degree of finish ordinarily obtainable from a blade grader will be satisfactory for open areas, but hand grading and raking will be required around structures and walkways. Finished surface shall be not more than 0.1-foot above or below established grade and sloped to prevent ponding.

I. Structural excavation shall proceed as follows:

1. Excavation of all material of whatever nature necessary for construction of structures and foundations shall be carried out to lines and grades shown, and as required to provide working clearance and safe construction slopes and to emplace shoring, sheeting, bracing, and other Work required.

2. Except when concrete is authorized to be placed directly against excavated surfaces, establish clear space at sides of excavation to facilitate form construction and removal and provide for excavation protective support system.

3. Where concrete is to be placed on original ground without subgrade preparation, do not use machinery using teeth nearer than 3” from any finished subgrade. Remove last 3” without disturbing subgrade.

4. Do not place backfill until structure footings or other portions of structure or facility have been inspected by Owner’s Representative and accepted for backfilling.

5. Place backfill in horizontal layers, moistened and tamped, rolled or otherwise compacted.

6. Water settling will not be permitted. Place backfill so no additional unbalanced loading occurs during placing.

7. Take care when backfilling to obtain adequate compaction beneath pipes and to avoid injury or displacement of such pipes.

J. Trench excavation and backfill for pipelines, pipeline structures, and conduits shall proceed as follows:

1. Alignment and grade for pipe shall be as shown. When flow line is shown, it shall be invert or interior bottom of pipe. When top of pipe is shown, it shall be exterior of pipe barrel. In absence of such profile grade, pipe shall be laid on straight grade to permit complete drainage and to provide at least 36” of cover to finish ground or street subgrade unless otherwise shown.

2. Where natural ground above pipeline trench has been overexcavated and/or pipeline is to be placed in new embankment, place and compact embankment material to elevation at least 12” above top of pipe prior to trench excavation.

3. Except where specified otherwise in Contract Documents or permits or where documented acceptance is obtained from Owner's Representative; maximum length of open trench shall be 500', or distance necessary to accommodate amount of pipe installed in one day, whichever is greater. Distance is collective length at any location, including open excavation, pipe laying, and appurtenance construction and backfill which has not been temporarily resurfaced.

4. Except where documented acceptance is obtained from Owner's Representative, maximum length of open trench in any location where concrete structures are cast in place shall be that necessary to permit uninterrupted progress. Pursue construction as follows:

    a. Excavate

    b. Set steel reinforcement

    c. Place floor slab,

    d. Place walls,

    e. Place cover slab, roof or arch.

    f. Allow concrete to cure.

    g. Backfill

    Each operation shall follow in sequence, and no operation shall precede a subsequent operation by more than 200'.

5. Failure of Contractor to comply with specified limitations may result in order to halt work until such time as compliance is achieved.

K. Unless otherwise shown, minimum and maximum pipe trench width measured at top of pipe zone (12" above pipe crown) shall be as shown below, where D=nominal pipe diameter.

GRAVITY PIPE MATERIAL	**APPLICABLE SPECIFICATION**	**NOMINAL PIPE SIZE (INCHES)**	**SIDE CLEARANCE (INCHES)**	
			MINIMUM	**MAXIMUM**
Vitrified Clay Pipe	ASTM C12 Section 6	All sizes	6" or as shown on Plans	as shown on Plans
PRESSURE PIPE MATERIAL	**APPLICABLE SPECIFICATION**	**NOMINAL PIPE SIZE (INCHES)**	**SIDE CLEARANCE (INCHES)**	
			MINIMUM	**MAXIMUM**
Ductile Iron Pipe	AWWA C600 Section 4.3.2.3 and AWWA M41	All sizes	12"	as shown on plans
PVC Pressure Pipe	AWWA C605 AWWA M23	≤ 16"	8"	12"
		18"-30"	6"+D/8	18"
		> 30"	As shown on plans	

L. If maximum trench width is exceeded on either side of pipe, provide one of the following remedial measures at no additional cost to Owner.

1. Backfill trench with material specified for "Backfill for Over-Excavation" in Part 2 above to cradle pipe to spring line, or

2. Modify bedding based on calculations accepted by Owner's Representative to accommodate wider trench width, or

3. Substitute higher-strength pipe based on calculations accepted by Owner's Representative to accommodate wider trench width.

M. Trench bottom preparation shall proceed as follows:

1. Grade trench bottom to provide smooth, firm, and stable foundation at every point throughout length of pipe. Transfer construction stake grades into trench as needed to ensure trench bottom is accurately graded. Place any special bedding required by Contract Documents.

4. Prepare pipe subgrade at trench bottom for specific type of pipe material being installed in accordance with Specifications for said pipe.

5. Should large gravel and cobbles be encountered at trench bottom or pipe subgrade, remove such items from beneath pipe and replace with granular material compacted to provide uniform support and a firm foundation.

6. Whenever trench bottom does not afford a sufficiently solid and stable base to support pipe or appurtenances, excavate below normal trench bottom and replace it with crushed rock or gravel of sufficient thickness to form an unyielding foundation.

7. If excessively wet, soft, spongy, unstable, or similarly unsuitable material is encountered at subgrade, remove unsuitable material and replace with crushed rock or gravel of sufficient thickness to form an unyielding foundation.

8. Accurately shape pipe subgrade to fit pipe bottom using drag template or other suitable method. At each pipe joint, recess trench bottom to relieve pipe bells, couplings or flanges of all load.

9. Payment for removal of material and additional backfill required shall be in accordance with Contract Documents. However, if necessity for such additional bedding material has been occasioned by an act or failure to act on part of Contractor, Contractor shall bear expense of additional excavation and backfill to required depth.

10. Contractor's attention is called to their responsibilities in maintaining adequate dewatering procedures to ensure an otherwise stable foundation will not be rendered unfit due to accumulation of water in trench.

11. Where rock is found, removed rock below grade and backfill trench with clean imported sand to provide a compacted foundation cushion with a minimum allowable thickness of 6" under outside diameter of pipe barrel and a clear space of 4" under pipe bell. Payment for removal of rock and additional backfill shall be in accordance with Contract Documents.

N. Backfill over pipe shall proceed as follows:

1. After pipe has been properly laid, exterior joints grouted and inspected, begin backfilling operations using material as specified above.

2. Contractor will be held responsible for any displacements of pipes or other structures, any damage to them or any instability caused by improper depositing of backfill material or improper use or handling of tools or equipment.

3. Backfill pipe located in public traveled right-of-way at end of each day's operations in accordance with applicable permit requirements. Remove spoil piles from traffic lanes by end of working day.

4. Mechanical densification or compaction of backfill shall use rolling, vibrating or impact means, or a combination thereof. Method or methods used shall result in obtaining compaction of backfill in various specified zones and within maximum lifts specified. Densification or compaction method or methods used shall not damage pipe, adjacent ground, existing improvements, or improvements installed as part of Work.

5. Place material for mechanically compacted backfill in lifts which, prior to compaction, shall not exceed depths specified for various types of equipment.

TYPE OF COMPACTION EQUIPMENT	MAXIMUM LIFT DEPTH
Hand-directed mechanical tampers	≤ 6" in pipe zone, ≤ 8" elsewhere.
Impact, free-fall, or "stomping" equipmen	≤ 36" (Do not use over concrete pipe, cement-mortar lined pipe or PVC.
Vibratory equipment with smooth contact surface	≤ 24"
Rolling equipment, including, vibratory-interrupted surface equipment	≤ 12"

6. Contractor is advised water settling in pipe zone triggers requirement under AWWA C651 paragraph 5.1.2 to perform bacteriologic testing at 200-foot intervals instead of 1200-foot intervals. Should Contractor elect to use water settling for potable water pipelines, Contractor shall perform additional disinfection required under AWWA C651 at no additional cost to Owner.

7. Water settling may be used in pipe zone and trench zone in lieu of mechanical compaction, only where material being backfilled is sufficiently sandy and permeable so specified compaction is achieved. Densification by saturation shall be accomplished by inserting a pipe, through which water is being supplied under pressure, to bottom of lift of material to be consolidated, and applying to each square yard or lesser surface area in this manner sufficient water to completely saturate overlying backfill and cause obvious settlement. Where water settling is used, exercise care to prevent pipe from floating. Do not use water settling in street zone.

8. Contractor may use densification by saturation only when it has been determined it will not result in damage to adjacent ground, existing improvements or improvements installed for Work, and that it is appropriate to obtain specified compaction. Some encroachment permits limit methods of densification or compaction. In addition, use of densification by saturation is subject to all the following requirements.

    a. Apply water in manner, quantity and rate sufficient to saturate thickness of lift being densified.

    b. Vibrating compacting equipment may be necessary to supplement water saturation process where required densities cannot be attained by saturation alone.

    c. Lift thickness of backfill shall not exceed that which can be readily densified by saturation procedure. In no case shall undensified lift exceed 5-feet.

d. Character of material excavated from trench may be generally, or in zones, unsuitable or densification with water. In this case, Contractor may, at no additional cost to Owner, import suitable material for saturation, or densify excavated material by mechanical compaction. If water does not readily drain from trench, it shall be removed by sump pump.

9. Control of Trench Backfill by Zones: Whether mechanical compaction or densification by water saturation is employed, backfill shall be constructed by zones, and compaction requirement for each zone followed unless otherwise specified.

O. Backfill in pipe zone shall occur as follows:

1. Hand-place backfill simultaneously on each side of pipe for full trench width, moistened as required to achieve specified compaction.

2. In placing and compacting backfill, give particular attention to underside of pipe and fittings to provide firm support along full pipe length.

3. Place warning and locator tape at distance above top of pipe specified above.

4. Take care in backfilling to avoid damage to pipe coating, locating tape and any conduits that may be installed in pipe zone. Complete pipe zone compaction before covering it with trench zone material.

P. Backfill in trench zone shall use either mechanical compaction or water settling, depending on nature of material. Complete trench zone compaction before covering it with street zone material.

Q. Backfill in street zone shall occur as follows:

1. Backfill in traveled ways and public streets shall be in accordance with right-of-way agreement, encroachment permit or applicable regulations of agency having jurisdiction over traveled way. In absence of such provisions, compact soil by accepted hand-, pneumatic or mechanical-type tampers.

2. Water consolidation will not be permitted.

3. Construct pavement section in accordance with Contract Documents.

R. Soil sterilant shall be applied as follows:

1. Treat finished subgrade of specified areas with accepted soil sterilant. Apply sterilant in liquid or dry form at uniform rate of not less than 8 ounces of dry sterilant per square yard in accordance with Manufacturer's directions. At option of Owner’s Representative, area shall then be lightly sprinkled with water to prevent loss of sterilant or scuffing.

2. Areas to receive soil sterilant include all areas to receive asphalt concrete or Portland cement concrete structures and pavement, including embankments, walkways, slabs, drainage structures, parking, and road areas.

3. Other areas requiring soil sterilant are storage reservoir or pond surfaces to receive any lining material of less than 3” in thickness and lining perimeter areas to distance of 5’ from edge of lining material.

4. Install soil sterilant and other products according to manufacturer's installation and warranty requirements. Manufacturers requirements for installation, application, and use of products shall be strictly followed.

5. Refer variances between Manufacturer's application instructions and Contract Documents to Owner's Representative.

3.3 Field Quality Control

A. Owner's Representative will provide continuous inspection of fill and will field test fill and earth backfill as placed and compacted, and inspect excavations and subgrade before concrete is placed and provide periodic inspection of open excavations, embankments, and other cuts or vertical surfaces of earth.

B. Owner's Representative will observe and test fills and based on laboratory results will determine whether fills have been placed in accordance with Contract Documents.

C. Owner's Representative may require deepening of footings and order such deepening based on uncovered soil conditions.

D. Whenever excavated material is not suitable for backfill, Contractor shall at their expense arrange for and furnish suitable imported backfill material which is capable of attaining specified relative density. Contractor shall also arrange for removal and off-site disposal of unsuitable excavated material at their own expense.

E. Special inspection and field testing required by Chapter 17 of CBC (Table 1704.7) for controlled fill shall be completed by an ICBO-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Subgrade Beneath Controlled Fill	Preparation of Site Beneath Fill	CBC Section 1704.7 and Soils Report	Periodic per CBC Table 1704.7	Owner	Owner
Controlled Fill	Classification and Testing of Controlled Fill Materials				
	Materials, Densities and Lift Thicknesses		Continuous per CBC Table 1704.7		

F. Special inspection and field testing required by Chapter 17 of CBC (Table 1704.7) for subgrade beneath structures, footings and foundations shall be completed by an ICBO-certified special inspector selected by Owner and shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Subgrade Beneath Structures and Footings	Material and Bearing Capacity Verification	CBC Section 1704.7 and Soils Report	Periodic per CBC Table 1704.7	Owner	Owner
	Excavation Depth and Material Verification				

G. Additional field testing of earthwork shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Backfill or Soil Prepared in Place	Sampling	ASTM D75	As directed	Owner	Owner
	Sieve Analysis	ASTM C136 or California Test Method 202	As directed	Owner	Owner
	Sand Equivalence	California Test Method 217	As directed	Owner	Owner
	Trench Width	Width specified in Part 2 above	As directed	Owner	Owner
	Bedding Thickness	Depth specified in Part 2 above	As directed	Owner	Owner
	Rock Size in Backfill	Size specified in Part 2 above	As directed	Owner	Owner
	Compaction (Laboratory Density Relations)	ASTM D1557 or California Test Method 216	As directed	Owner	Owner
	Field Density of Soil in Place	ASTM D1556 or ASTM D6938	As directed 300-foot maximum interval in trenches	Owner	Owner
	Field Density of Cohesionless Soils	ASTM D4253 and D4254	As directed	Owner	Owner
	11-Month Warranty Inspection	Demonstrate no visible pavement sags above pavement cut	1 inspection	Owner	Owner
Concrete Slurry	Slump (6" maximum)	ASTM C143	1 each batch	Owner	Owner

H. For testing purposes, percentages shall be determined by weight.

I. Make all necessary excavations for compaction and other soils tests as directed by Owner's Representative.

F. "Relative compaction" is ratio, expressed as percentage, of in-place dry density to laboratory maximum dry density.

G. Compaction shall be deemed to comply with Contract Documents when no more than one test of any 3 consecutive tests falls below specified relative compaction. Failing test shall be no more than 3 percentage points below specified compaction. Contractor shall pay costs of any retesting of Work not conforming to Contract Documents.

J. Allow sufficient time for testing and evaluation of results before material is needed. Owner's Representative will be sole and final judge of suitability of all materials.

K. Do not use materials in question pending test results.

L. Contractor shall remove unsatisfactory material, recompact, adjust moisture or compaction methods, place new material, and perform other operations necessary to meet Contract requirements as directed by Owner's Representative whose decisions and directions will be considered final on these matters.

M. Owner's Representative will not provide and is not being paid to provide directions or submittal review regarding Contractor's excavation safety procedures. Any questions or concerns of Owner's Representative will be referred to CAL/OSHA whose decisions or directions shall be considered final.

3.4 Adjusting and Cleaning

A. Make necessary arrangements for and remove and dispose of all surplus excavated material off-site, unless otherwise provided for in Contract Documents. All costs for disposal of surplus waste material shall be borne by Contractor.

B. Dispose of all surplus material not required for backfill or fill. Disposal shall occur outside limits of public rights-of-way and/or easements. Disposal shall comply with applicable ordinances and regulations of governmental agencies having jurisdiction and shall be done at no cost or liability to Owner.

C. Do not deposit excavated material on private property unless written permission from property owner is secured by Contractor. Before Owner will accept Work as being completed, Contractor shall file written release signed by all property owners with whom they have entered into agreements for disposal of surplus excavated material absolving Owner from any liability connected therewith.

D. Do not deposit excess material in water courses or other locations where disposed material will interfere with natural drainage.

E. After backfill is completed, dress site smooth and leave site in neat and presentable condition, free of all cleared vegetation, rubbish and other construction wastes. Haul away and legally dispose of surplus rock or other excavated material which cannot be used for backfill. Areas next to structures where blade-type equipment cannot reach shall be hand raked.

END OF SECTION

SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 Work Included

A. Dewatering and disposal of groundwater.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 31 23 00: Excavation and Fill

1.3 System Description

A. The Wet Well for this project will be constructed in an area where there is significant groundwater. The referenced geotechnical reports and test I(1.5 D) indicate a groundwater elevation at 20-ft+/-(bgs). The wet well planned depth is 36'-8"+/- (bottom of base). It will be necessary to provide continuous control of water throughout construction including weekends and holidays, and during work shutdowns. It is noted that groundwater may now be higher due to the wet winter.

B. The wet well shall be constructed in a dry condition.

C. Comply with applicable permit conditions and design criteria as set forth in these contract documents.

D. Dewater, treat and dispose of water so as not to cause injury or nuisance to public or private property.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. Regional Water Quality Control Board Discharge Permit Requirements, http://www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/los_angeles_ms4/2016/OrderR4-2012-0175_corrected_120216.pdf
B. County Flood Control District Permit Discharge Requirements
C. Project Geotechnical Report by NMG Geotechnical, June 29, 2015 and Well Installation and Slug Test Report, February 27, 2015.

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Water Control Plan Water Control Plan (cont.)	Submit water control plan as informational submittal no less than 60 days after notice to proceed or 30 days before installation of water control systems. Review will be solely for conformance to requirements of this section with no warranty of whether reviewer believes the plan will work. Include the following: • Applicable permit requirements • Equipment proposed • Methods proposed • Engineering calculations showing as a minimum, the following: • Drawdown and lateral zone effected • Proposed dewatering rate • Estimated settlements effecting any other proposed or existing piping facilities • Monitoring well (if needed) • Standby equipment proposed • Capacities of pumps, motors and engines, including standby equipment • Power supply • Standby power • Pollution control (groundwater discharge) facilities • Proposed discharge locations • Provisions for immediate temporary water supply • Water control schedule • Operation procedures • Equipment removal and/or abandonment procedures
Preconstruction Photographs	Before dewatering, photograph and document existing cracks of concrete and masonry surfaces which may subsequently be attributed to dewatering operations.
Amended Water Control Plan	Required if system is modified during installation or operation
Catalog Data	Submit for treatment equipment, pumps, prime movers and metering and monitoring equipment proposed
Shop Drawings	Show locations, dimensions and relationships of elements of each system including well points, piping, silt/sand traps, sumps, discharge lines, monitoring points treatment equipment and discharge points
Engineering Calculations Require **SWPPP**	Required engineering calculations. Demonstrate adequacy of proposed dewatering systems and components.
Flow Data	Submit flow measurements daily for previous 24 hours (midnight to midnight)

B. Refer to Section 01 33 00 for definition of requirements for shop drawings and engineering calculations.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum amount for which such Work is appurtenant.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed for dewatering before submitting water control plan. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Do not begin installing dewatering equipment until submittals have been accepted by Owner's Representative.

C. Provide adequate backup systems to control water. Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

D. Electrical service used for dewatering shall be dedicated solely for groundwater control.

E. Provide 100% emergency power backup generator with automatic startup and switchover in event of power failure.

F. Install monitoring well if needed to indicate settlement from disturbance from groundwater drawdown.

G. A pre-bid meeting will be held with all bidders required attendance. Minutes of the meeting will be taken and distributed to all bidders to be included with bid submittal.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

3.3 Dewatering

A. Comply with requirements of Regional Water Quality Control Board and County Flood Control District.

B. Continuously control water throughout construction, including weekends, holidays and work stoppages.

C. Do not shut down dewatering without written permission from Owner's Representative.

D. Maintain excavations free of water, regardless of water's source, and until excavations are backfilled to final grade.

E. Design and operate dewatering systems with proper size and capacity:

1. To permit excavating, pipe laying, concrete work and all other construction in the dry.

2. To lower groundwater two feet below lowest excavation point.

3. To prevent hydrostatic uplift forces until backfill is in place.

4. To allow concrete to reach its 28-day compressive strength in the dry.

5. To prevent loss, caving, loosening or softening of ground as water is removed.

6. To avoid inducing settlement or damage to existing facilities, completed Work or adjacent property.

7. To relieve artesian pressures and resultant uplift of excavation bottom.

F. Do not expose concrete plugs or work slabs appurtenant to boring work to hydrostatic pressure until concrete strength is sufficient to resist uplift pressure with a 1.5 factor of safety or greater.

G. Modify water control system after installation and while in operation if it causes or threatens damage to adjacent property, structures or utilities.

H. Control surface drainage and prevent it from entering excavations as follows:

1. Intercept and divert runoff away from Work using dikes, curb walls, ditches, sumps, sand bags or other means.

2. Design surface drainage system to minimize erosion on or off the site.

I. Provide supplemental ditches and sumps for groundwater only as needed to collect water from local seeps and from pipe zone backfill of utilities intersecting the excavation. Do not use ditches and sumps as primary dewatering means.

J. Do not convey groundwater in open ditches or trenches.

K. Upon receiving written authorization from Owner's Representative, remove dewatering system as follows:

1. Abandon monitoring points in conformance with applicable regulatory requirements.

2. Dewatering system components shall remain Contractor's property.

3. Upon completion of dewatering, restore ground surfaces to preconstruction conditions.

3.4 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Water Volume Removed	Water Volume Removed Daily	Use metering device or procedure accepted by Owner's Representative and calibrated within previous 60 days	Continuous metering	Contractor	Contractor
Water Volume Added	Monitor Water Volume Introduced	Use metering device or procedure accepted by Owner's Representative and calibrated within previous 60 days	Continuous monitoring	Contractor	Contractor
Quality of Disposed Water	Water Quality	Regional Water Quality Control Board and County Flood Control District permit requirements	As required by permit	Contractor	Contractor

3.5 Protection

A. Disposal of water shall not cause erosion, flooding or silting at discharge point.

B. Disposal of water shall not damage existing facilities, completed work or adjacent property.

C. Do not cause flooding by overloading or blocking flow of discharged water.

D. Any structure, paving or utility that becomes unstable or vulnerable to settlement or cracking that may be attributed to dewatering shall be supported immediately using procedures such as bracing, underpinning or compaction grouting.

END OF SECTION

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SECTION 32 12 16
ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 Work Included

A. Construct asphalt concrete pavements for roads, parking areas, aprons, sidewalks, and other Work involving asphalt concrete, all as shown. Asphalt concrete shall conform to all requirements of Standard Specifications for Public Works Construction (SSPWC) and requirements herein.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 02 41 14: Paving Removal and Resurfacing
H. Section 09 90 00: Painting and Coating
I. Section 31 05 16: Aggregate and Rock Products for Earthwork
J. Section 31 23 00: Excavation and Fill
K. Section 32 13 13: Concrete Paving

1.3 System Description

A. Furnish and install complete asphalt paving system including subgrade preparation, aggregate base, prime coat, asphalt concrete paving, seal coat, striping and all appurtenant Work.

B. Completed asphalt paving system shall meet all permit requirements and requirements of city or agency having jurisdiction over paving and right-of-way.

C. Where new pavement is placed over existing pavement, provide tack coat.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory (batch plant) testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Crushed Aggregate Rock	Gradation	ASTM C136	Once prior to beginning work, Quarterly thereafter	Contractor	Contractor
Liquid Asphalt	Asphalt Properties	SSPWC Table 203-2.4(A) for slow curing products	Once for each supplier and each type (grade) of liquid asphalt	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Asphalt Concrete Mix	Uniformity of Distribution Binder	ASTM D2172	As directed	Contractor	Contractor

1.5 References

A. Asphalt Institute MS4 The Asphalt Handbook
B. ASTM C136 Sieve Analysis of Fine and Course Aggregates
C. ASTM D2041 Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
D. ASTM D2172 Quantitative Extraction of Bitumen for Bituminous Paving Mixtures
E. ASTM D2950 Density of Bituminous Concrete in Place by Nuclear Methods
F. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 200 "Rock Materials"
G. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 203 "Bituminous Materials"
H. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 301 "Treated Soil, Subgrade Preparation, and Placement of Base Materials"
I. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 302 "Roadway Surfacing"

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required for all soil sterilants per catalog data requirements
Certificate of Compliance	Submit report from testing laboratory certifying that aggregate material is asbestos-free and conforms to specified gradations or characteristics.
Mix Design	Provide mix design in format consistent with requirements shown in SSPWC
Rubber Blend Certification	Submit certification showing source of rubber materials and mix design
Test Record Transcripts	Submit certified materials test reports for liquid asphalt and uniformity of distribution of binder per test record transcript requirements.
Delivery Tickets	Required for all asphalt used.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, certificates of compliance and test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of asphalt concrete and related products shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Bituminous products shall be constructed of the following materials.

ITEM	MATERIAL	SPECIFICATION
Aggregate Base Course	Crushed Aggregate Base	Conform to Section 200-2.2, crushed aggregate base of SSPWC Contractor may substitute on-site materials conforming to Section 200-2.5, Processed Miscellaneous Base of SSPWC
Prime Coat	Liquid Asphalt	Grade SC-250 as specified in SSPWC Section 302-5.3 Application rate: 0.25 gallons per square yard
Asphalt Concrete Pavement Base Course	Aggregate	¾-inch mineral aggregate conforming to SSPWC Section 203-6.3.2 using Class B dense medium-coarse grading mixed with bitumen content of 4.5% to 5.8% of dry mineral aggregate weight.
		In small hand-rolled areas, Class D1 or D2 fine grading may be substituted at discretion of Owner's Representative to improve workability.
	Bitumen	PG 64 -10 paving asphalt per SSPWC Section 203-1
Asphalt Concrete Pavement Surface Course	Aggregate (Public-Right of-Way)	½-inch mineral aggregate conforming to SSPWC Section 203-6.3.2 using Class C2 medium coarse grading mixed with bitumen content of 4.6 % to 6.0% of dry mineral aggregate.
	Bitumen	PG 64 -10 paving asphalt per SSPWC Section 203-1
Seal Coat in Arterial Highways, Collector, and Interior Streets	Asphalt Emulsion	SS-1h Application rate: 0.10 gallons per square yard
	Asphalt Emulsion – Rapid Setting where Permitted by Owner's Representative	CQS-1H cationic Quick-set per SSPWC Table 203-5.2 (A) with 2.50% latex by weight Application rate: 0.10 gallons per square yard
	Aggregate and Composition	SSPWC Table 203-5.3 Type I Application Rate 8-10 lbs/square yard or SSPWC Table 203-5.3 Type II Application Rate 12-15 lbs/square yard Moisture content equal to or less than 4.0% by weight.

C. Asphalt concrete sand shall conform to gradation below from Standard Specifications for Public Works (Greenbook) Table 200-1.5.54(A):

PERCENTAGE PASSING SIEVES BY WEIGHT	
SIEVE SIZE	ASPHALT CONCRETE SAND GRADATION
⅜"	100%
No. 8	75-100%
No. 200	0-8%

D. Asphalt concrete paving within public (City, County or State) rights-of-way, railroad rights-of-way, or on private property shall comply with permit requirements and other stipulations of applicable property owners.

E. Install redwood header along all edges of asphalt concrete paving not otherwise abutting hardscape surfaces such as gutters, buildings, concrete pads, vaults, asphalt concrete pavement, Portland cement concrete pavement, paved sidewalk, paved driveway approach, etc.

PART 3 - EXECUTION

3.1 Preparation

A. Scarify 6-inches below subgrade, bring to optimum moisture content, and compact to relative dry density of 90%.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Products shall be furnished and installed by Contractor at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Permit requirements of agencies having jurisdiction over streets.

2. Applicable OSHA and Cal OSHA regulations

3. Standard Specifications for Public Works Construction Section 301 “Treated Soil, Subgrade Preparation, and Placement of Base Materials”

4. Standard Specifications for Public Works Construction Section 302 “Roadway Surfacing”

D. Refer variances between above documents and Contract Documents to Owner’s Representative.

E. Aggregate base material shall be furnished, placed and compacted for asphalt concrete pavements as shown. Spread and compact per SSPWC Section 301-2.

F. Prime coat of liquid asphalt shall be pressure-spray applied as shown above after completing subgrade. If aggregate base is specified, apply prime coat after completing base course. Prevent liquid asphalt from spraying on adjacent ground, structures, curbing and fencing.

G. Asphaltic concrete pavement shall be spread in one course by using Barber-Greene paving machine, or accepted equal. Spread to depth to achieve compacted thickness shown. Thoroughly compact completed surface smooth and true to grade and cross-section, and free from ruts, humps, depressions and irregularities.

H. Apply seal coat of mixing type emulsion liquid asphalt to all asphaltic concrete pavements. Apply emulsion as shown above. Contractor shall have option of closing sealed area to traffic for at least 7-days or blotting with sand and sweeping with area being open to traffic as soon as cover material is laid.

I. Adjust all valve box rings and covers to grade within 30 days after final paving of each street in which pipelines are installed.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Subgrade	Compaction	Section 31 23 00	As directed	Owner	Contractor
Roadway/ Paving Base	Compaction	Section 31 23 00	As directed	Owner	Contractor
Asphalt Concrete	Compaction	95% per ASTM D2950	As directed	Owner	Contractor
Finished Pavement and Slurry Seal	Rolling	When straight edge is laid on finished surface parallel to centerline, surface shall vary <⅛-inch in 10-feet.	As directed	Owner	Contractor
	Drainage	Flood paved areas sufficiently to demonstrate absence of ponding and "bird-baths"	As directed	Owner	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 Work Included

A. Portland cement concrete pavements for roads, parking areas, aprons, sidewalks, and other Work involving concrete paving, as shown, and in accordance with Standard Specifications for Public Works Construction (SSPWC) and requirements herein.

B. Fly ash will not be permitted in Portland cement concrete pavements.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 02 41 14: Paving Removal and Resurfacing
H. Section 03 10 00: Concrete Forming
I. Section 03 20 00: Concrete Reinforcing
J. Section 03 30 00: Cast in Place Concrete
K. Section 07 92 00: Joint Sealants
L. Section 09 90 00: Painting and Coating
M. Section 31 23 00: Excavation and Fill

1.3 System Description

A. Furnish and install complete Portland cement concrete paving system including subgrade preparation, aggregate base, prime coat, Portland cement concrete paving, seal coat, striping and all appurtenant work.

B. Completed Portland cement concrete paving system shall meet all permit requirements and requirements of city or agency having jurisdiction over paving and right of way.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory (batch plant) testing of aggregate shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Aggregate	Ratio of Silica Released to Reduction in Alkalinity	ASTM C33	As directed	Owner	Contractor
	Loss with Sodium Sulfate	ASTM C33	As directed	Owner	Contractor
	Sieve Analysis	ASTM C136	1 each trial batch	Owner	Contractor
Coarse Aggregate	Abrasion Loss	ASTM C33	As directed	Owner	Contractor
Fine Aggregate	Sand Equivalent	ASTM D2419	As directed	Owner	Contractor
	Organic Impurities	ASTM C40	As directed	Owner	Contractor
	Color of Supernatant on Washing	ASTM C33	As directed	Owner	Contractor

C. Factory (batch plant) testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Concrete	Certification of Mix Design	ACI 301 certified by independent testing laboratory	1 per mix	Contractor	Contractor
Portland Cement Concrete	Portland Cement Concrete Properties	See Section 03 30 00.	Once for each supplier and each type (grade) of Portland cement concrete	Contractor	Contractor

1.5 References

A. ASTM A820 Steel Fibers for Fiber-Reinforced Concrete
B. ASTM C136 Sieve Analysis of Fine and Course Aggregates
C. ASTM C1116 Fiber-Reinforced Concrete
D. ASTM D2041 Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
E. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 200 “Rock Materials”
F. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 201 “Concrete, Mortar, and Related Materials”
G. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 301 “Treated Soil, Subgrade Preparation, and Placement of Base Materials”
H. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 302 “Roadway Surfacing”
I. SSPWC Standard Specifications for Public Works Construction (Greenbook) Section 303 “Concrete and Masonry Construction.”

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required for all soil sterilants per catalog data requirements
Certificate of Compliance	Submit report from testing laboratory certifying that aggregate material is asbestos-free and conforms to specified gradations or characteristics.
Mix Design	Required for concrete mix design per engineering calculations requirements sealed by California-licensed Civil Engineer.
	In addition to original mix design, provide new mix design if change in brand or type of cement or change in source or gradation of aggregates is permitted or if defective concrete occurs.
Brand and Type of Cement/Source of Aggregate	Submit brand and type of cement and source of aggregates to allow sampling and testing by Owner's Representative.
Test Record Transcripts	Submit certified materials test reports for liquid Portland cement concrete and uniformity of distribution of binder per test record transcript requirements.
Delivery Tickets	Required for ready-mix concrete as needed to document delivery quantities. In accordance with ASTM C94 Sections 16.1 and 16.2, each ticket shall show • Name of ready-mix batch plant, • Serial number of ticket, • State certified equipment used in preparing mix, • Truck number.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for Catalog Data, Certificates of Compliance and Test Record Transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of Portland cement concrete and related products shall be strictly followed.

C. Storage of materials shall conform to requirements of ACI 301 or SSPWC.

D. Do not use any aluminum materials for handling concrete.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Detectable Warning Surfaces on Curbs and Curb Access Ramps	ADA Solutions, Inc.	North Billerica, MA
	Accepted equal	
Joint Filler	DFC "Denver Foam"	
	Sonneborn Building Producte, Inc. "Sonofoam"	
	Accepted equal	

B. Use only one brand of cement.

C. All admixtures shall be compatible and by one Manufacturer capable of providing qualified field service representation.

D. Refer to Section 03 30 00 for acceptable Manufacturers for specialty materials.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Portland cement concrete paving products shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Aggregate Base Course	Crushed Aggregate Base	Conform to Section 200-2.2, crushed aggregate base of SSPWC Contractor may substitute on-site materials conforming to Section 200-2.5, Processed Miscellaneous Base of SSPWC
Portland Cement Concrete Pavement	Materials for "Class B" Street Paving and Site Paving	See Section 03 30 00.

C. Portland cement concrete paving within public (City, County or State) rights-of-way, railroad rights-of-way, or on private property shall comply with permit requirements and other stipulations of applicable property owners.

D. Install redwood header along all edges of Portland cement concrete paving not otherwise abutting hardscape surfaces such as gutters, buildings, concrete pads, vaults, asphalt concrete pavement, Portland cement concrete pavement, paved sidewalk, paved driveway approach, etc.

PART 3 - EXECUTION

3.1 Preparation

A. Scarify 6" below subgrade, bring to optimum moisture content, and compact to relative dry density of 95%.

B. Spread soil sterilant uniformly on prepared subgrade at rate of 4-pounds of chemical per 100-square feet, subject to Manufacturer's recommendations, from outside of curb to opposite outside of curb for full width of roadways or parking area to be paved or surfaced.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Apply soil sterilant per Section 31 23 00 before paving.

C. Products shall be furnished and installed by Contractor at location shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Permit requirements of agencies having jurisdiction over streets.

2. Applicable OSHA and Cal OSHA regulations

3. Standard Specifications for Public Works Construction Section 301 “Treated Soil, Subgrade Preparation, and Placement of Base Materials”

4. Standard Specifications for Public Works Construction Section 302 “Roadway Surfacing”

5. Standard Specifications for Public Works Construction Section 303 “Concrete and Masonry Construction.”

E. Refer variances between above documents and Contract Documents to Owner’s Representative.

F. Aggregate base material shall be furnished, placed and compacted for Portland cement concrete pavements as shown. Spread and compact per SSPWC Section 301-2.

G. Adjust all valve box rings and covers to grade within 30 days after final paving of each street in which pipelines are installed.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Subgrade	Compaction	Section 31 23 00	As directed	Owner	Contractor
Roadway/ Paving Base	Compaction	Section 31 23 00	As directed	Owner	Contractor
Portland Cement Concrete	Slump	Section 03 30 00	As directed	Owner	Contractor
	28-day strength	Section 03 30 00	As directed	Owner	Contractor
Finished Pavement	Rolling	When straight edge is laid on finished surface parallel to centerline, surface shall vary <⅛” in 10’.	As directed	Owner	Contractor
	Drainage	Flood paved areas sufficiently to demonstrate absence of ponding and “bird-baths”	As directed	Owner	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer’s printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 32 31 11
GATE OPERATORS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of motor-operated gates for vehicle access.

B. Motor-operated gate shall automatically move entrance gate and control its position in both open and closed directions.

C. Gate operators shall be heavy-duty industrial type openers as specified herein, and shown on Drawings.

D. Gate operator entry system shall be initiated via radio system as specified herein.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 05 12 00: Structural Steel Framing
I. Section 05 50 00: Metal Fabrications
J. Section 09 90 00: Painting and Coating
K. Section 10 14 00: Signage
L. Section 26 05 00: Common Work Results for Electrical
M. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables
N. Section 26 05 26: Grounding and Bonding for Electrical Systems
O. Section 26 05 33: Raceway and Boxes for Electrical Systems
P. Section 26 05 53: Identification for Electrical Services
Q. Section 26 08 00: Commissioning of Electrical Systems
R. Section 32 31 13: Chain Link Fences and Gates
S. Section 32 31 20: Ornamental Steel Fences
T. Section 33 71 73: Electrical Utility Services

1.3 System Description

A. Furnish and install complete operating motor-operated gate including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

B. Motor-operated gate shall open when remotely activated from exterior of fenced area or when vehicle on interior of fenced area triggers exit loop.

C. Motor-operated gate control system shall output a continuous signal when the gate is open for any reason.

D. Motor-operated gate shall remain open until reverse loop on opposite side of gate signals vehicle has cleared gate.

E. For swing-type motor-operated gates, a phantom loop shall detect presence of vehicle within swing radius of gate. When phantom loop safety sensor detects presence of a vehicle in gate opening, gate shall remain shut until vehicle clears gate-swing radius.

F. Following a preset time delay, gate shall close automatically if safety sensor does not detect presence of vehicle.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Operator	Proper Function	Demonstrate smooth quiet operation in compliance with Manufacturer's printed literature	1 test each operator	Contractor	Contractor
Control Inputs and Safety Features	Proper Function	Demonstrate proper functioning	1 test each gate system	Contractor	Contractor

1.5 References

A. NEMA/ANSI 250 Enclosures for Electrical Equipment
B. NFPA 70 National Electric Code (NEC)
C. UL325 Door, Drapery, Gate, Louver, and Window Operators and Systems
D. UL 991 Testing of Safety-Related Controls Employing Solid-State Devices

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for gates, tracks, rollers and drive chain or rack per equipment shop drawing requirements. Show weight of gate, size and required pull force. Shop drawings shall be site specific, showing existing interferences including neighboring fencing, gates and paved, native or landscaped surfaces and how the gate system will avoid interference from these features.
	Electrical drawings required for gate operator per electrically controlled equipment shop drawing requirements. Electrical drawings shall show gate size, gate weight and pull force associated with submitted motor operator.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements. Include gate operator safety literature and required warning signs.
Material Samples	Required for finish color
Motor Data	Required per motor data requirements of Section 26 05 00.
Warranty	Furnish 3-year warranty from date of final acceptance. Exclusions on warranty shall be limited to physical damage to gate from collision or vandalism. All other conditions shall be covered.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of motor-operated gates shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

1.9 Warranty

A. Furnish industrial grade gate operator that is maintenance free for 3 years from date of final acceptance. Provide gate and gate operator from single Manufacturer who will accept responsibility for and provide full parts-and-labor warranty for all on-site labor and materials. Exclusions on warranty shall be limited to physical damage to gate from collision or vandalism.

B. Choice of system furnished may be either worm gear or hydraulic, chain operated or rack and pinion, provided required warranty is furnished for operating system selected.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

Comment [MT1]: Provide Hirsch Radio Operator Model Number if available

A. Acceptable Manufacturers include the following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Motor Wormgear Drive Slide Gate Operators	Hirsch by Identiv	Santa Ana, CA
	Accepted equal	
Motor Swing Gate Operators	Hirsch by Identiv	Santa Ana, CA
	Accepted equal	

B. Operator unit supplier shall provide all required operator accessories and appurtenances, including vehicle sensing loops, entry systems, and anti-entrapment sensors to ensure compatibility between accessories and provide sole-source responsibility.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Work shall comply with UL 325, UL 991 and the National Electrical Code.

C. Motor-operated gates shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Gate Frame	Tubular Steel	16 gauge 1⅛" square galvanized picket Welded rigid and watertight connections, Provide diagonal braces and truss rods as needed for stability and preventions of sags and twist. Match other gates furnished under this contract in style and finish. Weight shall be compatible with gate operator furnished.
Gate Operator Cover and Safety Guards	Steel	16 gauge minimum
Warning Signs	Steel Sheet	Comply with UL325 and Section 10 04 00

D. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Gate	Style	Double-Leaf Sliding Gate or Double-Leaf Swing Gate as shown on plans
Sliding Gate Operator	Cycles per day	0-10 gate openings per day
	Class	UL325 Class III Industrial with Limited Access
	Gate Dimensions	See plans
	Drive System	20:1 heavy-duty gear-reduction worm gear with solenoid-activated brake system to prevent back driving. 1-inch minimum solid steel output drive shaft Heavy-duty ball bearings Roller-chain and drive sprocket with chain guide(s) and gate attachment brackets.
	Pull Force	75 lbf
	Operating Speed	<12 inches per second
	Variable Speed	Provide variable speed feature to avoid "jerking" of gate
Swing Gate Operator	Cycles per day	0-10 gate openings per day
	Class	UL325 Class III Industrial with Limited Access
	Gate Dimensions	See plans
	Drive System	20:1 heavy-duty gear-reduction worm gear with solenoid-activated brake system to prevent back driving. 1-inch minimum solid steel output drive shaft Heavy-duty ball bearings
	Variable Speed	Provide variable speed feature to avoid "jerking" of gate
Hardware	Stops	Provide for each gate
	Keepers	Provide for each gate
	Padlocks	Not required
Gate Closing Safety Features	Covers and Safety Edges	Provide covers on all rotating rollers or equipment. Provide elastomeric safety edge on gate edge to minimize chance of injury
	Sensors Required	Reverse Loop (1 each side) Exit Loop
		Noncontact photoelectric sensors for anti-entrapment protection, including separate transmitter and receiver units, mounting arms, wiring and appurtenances
		Phantom Loop on Swing Gates to detect obstructions / External Obstruction Sensor on Slide Gates to detect obstructions
	Sensor Type	Optical Sensor
	Timer to Close	Settable from 0-180 seconds to reset upon receiving additional open commands

ITEM	DESCRIPTION	
	Maximum Run Time	Limit run time to 120 seconds to protect gate and operator from damage.
	Emergency Stop	Provide stop button in weather-tight enclosure to halt gate operation in emergency situation.
	Entrapment Warning Alarm	UL325-compliant audible alarm beginning 3 seconds before gate movement and continuing through full gate operation
	Magnetic Lock Control Relay	Required to activate magnetic lock to secure gate
Gate Controls	Gate Opening	Hirsch Radio Control
	Gate Closing	Automatic with settable timer (0-60 seconds)
	Limit Switches	Adjustable precision snap-action type limit switches to control gate position
	Manual Release	Provide manual release on interior
	Control Circuit	Solid state control board Provide power input “On/Off” switch Provide adjustable timers Provide LED indicators and self-diagnostics Provide adjustable motor current sensing to detect obstructions, with separate adjustments for opening and closing directions. Protect low-voltage control inputs from external spikes and surges providing for control wiring runs up to 1000 feet.
	RF Receiver	Tune to 315 MHz
Warning Signs		Comply with UL 325.

E. The following electrical design criteria are required for equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Nonhazardous
Enclosures – Outdoor or Wet Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 4X – Watertight, Corrosion-Resistant, Stainless steel
All Enclosures	Construction	Lockable Enclose manual disconnect, controller, and adjustable limit switches Galvanealed steel cabinet With powdercoat epoxy finish on steel
Control Panel Mounting	Local Mount	Surface-mount on wall See plans
Power Supply	Motor Circuit	120VAC – 1 phase – 60Hz
	Control Panel	120VAC – 1 phase – 60Hz
	Battery Backup	Required
	Convenience Outlet	Built-in 120VAC – 1 phase – 60Hz duplex power receptacle for accessories
	Accessories	Provide transformer for low voltage power Provide fuse-protected 24-VAC and 24 VDC secondary power available on terminal strip for operator accessories including radio receiver and loop detectors

F. The following product design criteria, options and accessories are required for motors:

ITEM	DESCRIPTION	
Motors	Motor Type	Squirrel cage induction with built-in overload protection
	Operating Frequency	60 Hz with variable speed drive
	Synchronous Speed	3600 rpm (two-pole) / 1800 rpm (4-pole) / 1150 rpm (6-pole) / 900 rpm (8-pole)
	Speed Control Range	0.1-220 rpm +/-0.1 rpm throughout range Paced by 4-20mA input
	Motor Horsepower	½-hp for gates up to 1100 lbs and 25 feet in length / 1-hp for gates up to 1700 lbs and 35 feet in length
	Efficiency	Premium Efficiency
	Starting Code	Manufacturer's standard for motors smaller than 15 hp
	Duty	Intermittent Duty
	Temperature Rise	NEMA Design B Rated for Operation at 50°C (122°F)
	Operating Elevation	24 feet ±
	Service Factor	1.15
	Insulation	Class F (155°C)
	Overtemperature Protection Motor Windings (motors <200hp)	Provide automatic reset normally closed thermal overloads in each phase of motor windings per NEMA MG-1
	Control Leads on Overtemperature Protection Devices	Color code control leads and terminate in separate conduit box.
	Other Requirements	Insulate and brace windings for full voltage operation.
	Space Heaters (outdoor applications)	Not required
Motor Bearings	Bearing Life	ANSI/ABMA 9 L_{10} of 100,000 hours
Motor Enclosure	Enclosure	WP1
	Description	Drip proof and splash proof
Motor Terminal Boxes	Markings	Permanently mark motor leads in agreement with connection diagram

Comment [MT2]: Require Model Number to select Speed.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install motor-operated gates before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Provide conduits with weatherproof metallic electrical junction box adjacent to gate operator as shown on Plans. Provide PVC-coated flexible conduit between junction box and gate opener.

C. Sawcut pavement at dimensions and depths recommended by loop detector manufacturer, and install loop detector systems specified.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install motor-operated gates at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install motor-operated gates to tolerances recommended by Manufacturer. Unless otherwise shown, install motor-operated gates true, plumb, and level using precision gauges and levels.

F. Install all provided warning signs securely within view of both sides of gate as required by Manufacturer and UL325.

G. Prior to equipment operation, provide initial lubrication of all mechanical components. Check all shafts, gears, pulleys, belts, chains, and other moving parts for alignment and tolerances in accordance with Manufacturer's installation instructions.

3.3 Field Quality Control

A. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Gate and Gate Operator	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	Running amperage	Record amperage draw and compare to rated motor FLC	1 test	Contractor	Contractor
Gate Operator	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed Literature	1 test	Contractor	Contractor
	Entrapment Protection Provisions	Test each entrapment protection provision separately with other entrapment protection provisions defeated.	1 test each entrapment protection provision	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Provide services of factory-authorized representative on-site to provide:

1. Installation assistance, inspection and startup of complete motor-operated gate system.

2. Field testing and adjustment.

3. Instruction of Owner's personnel in operation and maintenance. Although maintenance is covered by warranty for first 3 years, Owner reserves right to perform itemized scheduled maintenance functions listed on factory operations and maintenance manuals.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of chain link fences and gates.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 05 12 00: Structural Steel Framing
I. Section 05 50 00: Metal Fabrications
J. Section 09 90 00: Painting and Coating
K. Section 32 31 11: Gate Operators

1.3 System Description

A. Furnish and install complete fencing system where shown including appurtenant footings, hardware, mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. APWA Standard Plans for Public Works Construction Detail 600
B. ASTM A121 Zinc-Coated (Galvanized) Steel Barbed Wire
C. ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
D. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
E. ASTM A193 Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
F. ASTM A194 Carbon and Alloy Steel Nuts for High-Pressure and High Temperature Service
G. ASTM A325 Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
H. ASTM A392 Zinc-Coated Steel Chain Link Fence Fabric
I. ASTM A490 Heat-Treated Steel Structural Bolts 150ksi Minimum Strength
J. ASTM A824 Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
K. ASTM A1011 Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
L. ASTM B6 Zinc
M. ASTM F626 Fence Fittings
N. ASTM B633 Electrodeposited Coatings of Zinc on Iron and Steel
O. ASTM F668 Poly(Vinyl Chloride) (PVC)-Coated Steel Chain Link Fence
P. ASTM F1043 Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework

Q. ASTM F1083 Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded for Fence Structures
R. AWS D1.1 Structural Welding Code – Steel
S. SSPWC Standard Specifications for Public Works Construction (Greenbook) 206-6 "Chain Link Fence"

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for fabricated items such as gates
Catalog Data	Required for all manufactured products per catalog data requirements.
Installation Instructions	Required per installation instruction requirements
Test Record Transcripts	Submit for factory tests upon request per foundry or test record transcript requirements.
Material Samples	Submit for three 12"-square samples in Owner-selected fabric colors.
Welder Qualification Certificates	Required for all welders performing work on this project. Also submit certifications of procedure qualifications for each welding procedure used.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, test record transcripts and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of fencing materials shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Chain Link Fence	Alcorn Fence Company	Riverside, CA
	Accepted equal	
Fence and Gate Hardware	Builders Fence Company (BFC)	Sacramento, CA
	Accepted equal	
Concrete Anchors – Epoxy Adhesive Anchor Systems	Hilti Corp.	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Simpson Strong Tie Co. "Epoxy-Tie"	Pleasanton, CA
	Accepted equal	
Powder Actuated Fastening Systems	Hilti Corp.	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Structural steel shall conform to Section 05 12 00.

C. All steel or malleable iron parts and accessories with exception of fasteners, washers, tie wire, barbed wire and razor wire, shall receive 6 mils minimum coating of either polyvinyl-chloride or polyester after fabrication.

D. Chain link fences and gates shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Bolts (Connection Bolts and Anchor Bolts	High-Strength Carbon Steel – Galvanized	ASTM A325 or ASTM A 490 With self-locking nuts or lock-washers and plain nuts
	Galvanized Coating	ASTM A153 - 2.1 mil thickness - 1.30 ounce/ft^2
Washers	Carbon Steel – Galvanized	Square or rectangular smooth beveled washers, tapered in thickness
	Galvanized Coating	ASTM A153 - 2.1 mil thickness - 1.30 ounce/ft^2
Concrete Anchors – Epoxy Adhesive Anchor Systems	Stainless Steel	SAE Type 316
Concrete Anchors – Expansion Bolt Systems	Stainless Steel	SAE Type 316
Powder Actuated Fastening Systems	Steel	AISI 1061 Hardness 52-58 Rockwell C
	Galvanized Coating	ASTM B633 - 2.1 mil thickness - 1.30 ounce/ft^2
Fencing, Barbed Wire	Galvanized Steel Barbed Wire	ASTM A121 Four-point pattern Two strands of 12½ gage galvanized steel wire Barbs 5" on center
	Galvanized Coating	ASTM A121 - 1.7 mil thickness - 0.50 ounce/ft^2
Fencing, Extension Arms for Barbed Wire	Galvanized Steel to Match Posts	ASTM F626 Design to attach to posts and carry barbed wire as shown below.
Fencing and Gates, Chain Link	Chain Link Fence Fabric	ASTM A392 9 gage 2" mesh Knuckled finish on top edge, barbed finish on bottom edge
	Galvanized Coating	ASTM A392 - 2.0 mil thickness - 1.20 ounce/ft^2
Fencing and Gates, Tension Wires	Galvanized Steel Wire	ASTM A824 7-gauge minimum thickness galvanized coil steel spring wire
Fencing and Gates, Tension Bars at End and Corner Posts and Gates	Galvanized High-carbon Steel Bar	ASTM F626 3/16" minimum thickness ¾" minimum width
Fencing and Gates, Truss or Tension Rods	Galvanized Steel Rod	⅜" diameter Adjustable with galvanized turnbuckles or other suitable tightening devices
Fencing and Gates, Fabric Ties	Galvanized Steel Wire	11-gauge minimum thickness galvanized steel wire or 6-gauge minimum thickness aluminum wire
Fencing End, Corner and Slope Posts, Steel Pipe	Steel Pipe – Galvanized	ASTM F1083 Schedule 40 galvanized 2½" NPS (2⅞" actual) outside diameter 5.79 lbs/ft ±5%
Fencing Line Posts, Steel Pipe	Steel Pipe – Galvanized	ASTM F1083 Schedule 40 galvanized 2" NPS (2⅜" actual) outside diameter 3.65 lbs/ft ±5%
Fencing Gate Posts, Steel Pipe	Steel Pipe – Galvanized	ASTM F1083 Schedule 40 /galvanized Gates 7' wide – 13' wide per leaf – 3½" NPS (4.0" actual) outside diameter and 9.11 lbs/ft ±5%

ITEM	MATERIAL	SPECIFICATION
Post Caps	Steel Pipe – Galvanized	Required and shall fit securely over posts except for "C" or "H" section posts Shall carry top rail where shown
Fencing Top Rails and Braces, Steel Pipe	Steel Pipe – Galvanized	ASTM F1083 Schedule 40 galvanized 1¼" NPS (1.660" actual) outside diameter 2.27 lbs/ft ±5%
Gate Frames, Steel Pipe	Steel Pipe – Galvanized	ASTM F1083 Schedule 40 galvanized 1½" NPS (1.90" actual) outside diameter 2.72 lbs/ft ±5%
Gate Stiffeners, Steel Pipe	Steel Pipe – Galvanized	ASTM F1083 Schedule 40 galvanized 1¼" NPS (1.660" actual) outside diameter 2.27 lbs/ft ±5%
Fittings and Hardware	Couplings for Top Rail	Outside-sleeve type 7" minimum length Bore sufficiently true to maintain adjacent rail lengths in alignment
	Galvanized Coating	ASTM A123 - 3.4 mil thickness - 2.00 ounce/ft^2
Welding Electrode - Steel	Steel Electrodes	AWS D1.1 E70xx except E7024 rods or electrodes shall not be used

E. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Fence Fabric and Hardware	Height	8' to top of fabric 3 strands barbed wire
	Maximum Post Spacing	10'
	Minimum Post Bury	3'
	Other Construction Details and Dimensions	See APWA Standard Plans for Public Works Construction Detail 600
	Finish	Galvanized
	Color	Owner to select from white / beige / gray / dark blue / light blue / green / olive green / brown / or black to match existing
	Barbed Wire	3 wires at 45° to vertical Top wire shall extend 18" out from plane of fence fabric.
Gates	Height and Barbed Wire	Match adjacent fence
	Finish and Color	Match adjacent fence
	Type	180° swing
	Accessories	Provide stops, keepers, and padlocks, heavy pattern hinges
	Latches	Forked latch on gates up to 8' Plunger bar on gates wider than 8'

F. Zinc coatings shall be applied by hot-dipped or electro-depositing process. Zinc shall comply with ASTM B6.

G. Welds made after galvanizing shall be ground smooth and wire brushed to remove loose or burned zinc coating, after which cleaned areas shall be prepared and neatly coated with 50-50 solder. Repairs to abraded or damaged coating shall be done in similar fashion.

H. Before leaving shop, all steel not shown or specified to be galvanized or stainless shall receive one coat of pigmented primer recommended by Manufacturer of final paint system. Parts inaccessible after assembly shall be given a second coat of same primer. Final painting shall be as specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to fabricate and install metal fabrications before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Ground surface irregularities shall be graded to maintain not more than 2” clearance between ground and bottom of fence fabric.

C. Clean surfaces of metalwork to be in contact with concrete, removing all rust, dirt, grease and other foreign substances before concrete is placed.

D. All embedded metalwork shall be secured accurately in position when concrete is placed to prevent displacement or undue vibration during or after placement of concrete.

E. Where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Division 3 Concrete.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install fencing materials at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer’s installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building and fire code requirements

4. SSPWC (Greenbook) Section 304-3

D. Refer variances between above documents and Contract Documents to Owner’s Representative.

E. Install fencing materials to tolerances recommended by Manufacturer. Unless otherwise shown, install metal fabrications true, plumb, and level using precision gauges and levels.

F. Footings shall be Class C 2500-lb concrete and crowned at top to shed water. Line post footings shall be 36” deep and 8” diameter. All other footings shall be 36” deep and 12” diameter.

G. Welding shall comply with Section 05 12 00. Permanent connections shall be continuously welded along entire area of contact.

H. Bolting shall comply with Section 05 12 00. Fastenings shall be concealed whenever possible.

I. Built-up parts shall be free of warp.

J. Exposed ends and edges of metal shall be slightly rounded.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Chain Link Fences and Gates	No bends, twists or open joints No projecting edges or corners at intersections	Visual inspection	All fencework	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 32 31 20
ORNAMENTAL STEEL FENCES AND GATES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of ornamental steel fences and gates.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 03 60 00: Grouting
I. Section 05 12 00: Structural Steel Framing
J. Section 05 50 00: Metal Fabrications
K. Section 09 90 00: Painting and Coating
L. Section 31 23 00: Excavation and Fill
M. Section 32 31 11: Gate Operators

1.3 System Description

A. Furnish and install complete fencing system where shown, including appurtenant footings, hardware, mountings, or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
B. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
C. ASTM A193 Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
D. ASTM A194 Carbon and Alloy Steel Nuts for High-Pressure and High Temperature Service
E. ASTM A325 Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
F. ASTM A490 Heat-Treated Steel Structural Bolts 150ksi Minimum Strength
G. ASTM A653 Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process
H. ASTM A924 Steel Sheet, Metallic-Coated by the Hot Dip Process
I. ASTM A1011 Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength and High-Strength Low-Alloy with Improved Formability
J. ASTM B6 Zinc
K. ASTM B117 Operating Salt Spray (Fog) Apparatus
L. ASTM B633 Electrodeposited Coatings of Zinc on Iron and Steel
M. ASTM D523 Specular Gloss

N. ASTM D822 Tests on Paint and Related Coatings and materials Using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus
O. Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
P. Calculation of Color Differences from Instrumentally Measured Color Coordinates
Q. Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
R. AWS D1.1 Structural Welding Code – Steel

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for fabricated items such ornamental steel fencing and gates
Catalog Data	Required for all manufactured products per catalog data requirements.
Installation Instructions	Required per installation instruction requirements
Certificate of Compliance	For fence work, submit coating system and application certification per certificate of compliance requirements.
Foundry or Test Record Transcripts	Submit for factory tests upon request per foundry or test record transcript requirements.
Material Samples	Required on request
Welder Qualification Certificates	Required for all welders performing work on this project. Also submit certifications of procedure qualifications for each welding procedure used.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, certificates of compliance, foundry or test records and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of fencing materials shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Concrete Anchors – Epoxy Adhesive Anchor Systems	Hilti Corp.	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Simpson Strong Tie Co. "Epoxy-Tie"	Pleasanton, CA
	Accepted equal	
Concrete Anchors – Expansion Bolt Systems	Hilti Corp."Kwik Bolt II"	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Simpson Strong Tie Co. "Wedge-All"	Pleasanton, CA
	Accepted equal	
Powder Actuated Fastening Systems	Hilti Corp.	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL

ITEM	MANUFACTURER	MANUFACTURER LOCATION
	Accepted equal	
Ornamental Steel Fences and Gates	All-Cities Fence	Ontario, CA
	Ameristar Fence Products Aegis II Invincible	Tulsa, OK
	Ameristar Fence Products Montage Plus	Tulsa, OK
	Built Rite Fence Company	Bellflower, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Structural steel shall comply with requirements of Section 05 12 00.

C. Ornamental steel fences and gates shall be constructed of the following materials:

	Galvanized Coating	ASTM B633 - 2.1 mil thickness - 1.30 ounce/ft^2
Fencing	Tubular Steel	Galvanized ASTM A1011 for material galvanized after forming ASTM A924 for material galvanized prior to forming
		Minimum yield strength 50 ksi
	Welding Electrode - Steel	AWS D1.1 E70xx except E7024 rods or electrodes shall not be used
	Picket Dimensions	14-gauge 1" square 4" maximum on center
	Picket Retaining Rods	⅛" diameter
	Picket Rail Intersections	Provide PVC Grommets to seal openings
	Rail Dimensions	14-gauge 1¾" square Minimum of 3 rails
	Post Dimensions	12-gauge 3" square 8 foot nominal maximum span
	Fence Height	8 feet minimum above ground
	Applied Design Load	Panels shall support 600-lbf load at midspan without permanent deformation.
Gates	Tubular Steel	Fabricate of same material with same dimensions and design as fencing panels. Weld rail and upright intersections.
Gate Posts	Tubular Steel	12-gauge 4" square 6-foot nominal maximum span
Galvanized Coating after	Zinc	0.45 oz/ft^2 minimum weight

ITEM	MATERIAL	SPECIFICATION
Forming		0.3 mil minimum thickness
Galvanized Coating prior to Forming	Zinc	ASTM A653 0.90 oz/ft^2 minimum weight Coating designation G90
Powder Epoxy Coating	Base Coat	Zinc-rich epoxy powder coating 2.0-mil minimum thickness Gray
	Top Coat	Polyester powder coat 2.0-mil minimum thickness Black
	Top Coat Performance Requirements	Adhesion >90% per ASTM D3359 Method B Corrosion resistance > 3500 hours per ASTM B117 & ASTM D1654 Impact resistance >60 in-lbf per ASTM D2794 Weathering resistance >1000 hours per ASTM D822, D2244, and D523 (60% method)
Hardware – Steel including castings, rolled, pressed and forged articles	Steel Hardware	ASTM A153
	Galvanized Coating	ASTM A123 - 3.4 mil thickness - 2.00 ounce/ft^2

D. Zinc coatings shall be applied by hot-dipped or electro-depositing process. Zinc shall comply with ASTM B6.

E. Welds made after galvanizing shall be ground smooth and wire-brushed to remove loose or burned zinc coating, after which cleaned areas shall be prepared and neatly coated with 50-50 solder. Repairs to abraded or damaged coating shall be done in similar fashion.

F. Before leaving shop, all steel not shown or specified to be galvanized, powder epoxy coated or stainless shall receive one coat of pigmented primer recommended by Manufacturer of final paint system. Parts inaccessible after assembly shall be given second coat of same primer. Final painting shall be as specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to fabricate and install metal fabrications before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Clean surfaces of metalwork to contact concrete, removing all rust, dirt, grease and other foreign substances before concrete is placed.

C. Secure all embedded metalwork accurately in position when concrete is placed to prevent displacement or undue vibration during or after placement of concrete.

D. Where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack grout in conformance with Section 03 60 00.

3.2 Installation

A. Refer to Section 01 73 00, for basic execution and installation requirements.

B. Furnish and install fencing and gate materials at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

    1. Manufacturer's installation and warranty requirements

    2. Applicable OSHA and Cal OSHA regulations

    3. Applicable building and fire code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install fencing and gates according to Manufacturer's installation and warranty requirements.

F. Fencing and gate materials shall be furnished and installed by Contractor at locations shown on Plans and Submittals.

G. Install fencing and gate materials to tolerances recommended by Manufacturer. Unless otherwise shown, install fencing true, plumb, and level using precision gauges and levels.

H. Footings shall be Class C 2500-lb concrete crowned at top to shed water. Line post footings shall be 36" deep and 8" diameter. All other footings shall be 36 inches deep and 12-inches diameter.

I. Welding shall comply with Section 05 12 00. Permanent connections shall be continuously welded along entire area of contact.

J. Bolting shall comply with Section 05 12 00. Fastenings shall be concealed whenever possible.

K. Joints in fencing and gates shall have a close fit with corner joints coped or mitered and in true alignment.

L. Built-up parts shall be free of warp.

M. Exposed ends and edges of metal shall be slightly rounded.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Ornamental Steel Fences and Gates	No Bends, Twists or Open Joints No Projecting Edges or Corners at Intersections	Visual inspection	All fencework and gates	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 32 84 00
IRRIGATION SYSTEMS

PART 1 - GENERAL

1.1 Description

A. Work Included:

1. Provide all labor, materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with furnishing, delivery, and installation of a fully functioning irrigation system.

1.2 Related Work

A. Section 32 90 00: Landscape Planting
B. Section 32 97 00: Landscape Maintenance

1.3 Material Standards

A. American Society for Testing and Materials (ASTM International):

1. ASTM 1784 Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) compounds.
2. ASTM 1785 Standard Test Method for Permeability of Granular Soils (Constant Head)
3. ASTM D221 Standard Specification for Poly (Vinyl Chloride) Insulation for Wire and Cable, 60 Degrees C Operation.
4. ASTM D2220 Standard Specification for Poly (vinyl chloride) Insulation for Wire and Cable 75 Degrees C Operation.
5. ASTM D2241 Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure -Rated Pipe (SDR Service).
6. ASTM D2464 Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
7. ASTM D2466 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
8. ASTM D2467 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
9. ASTM D2468 Standard Specification for Acrylonitrile-Butaoliene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40.
10. ASTM D2855 Standard Practice for Making Solvent-Cemented Joints with poly (Vinyl Chloride) (PVC) Pipe and Fittings.

B. Local Plumbing Code

C. Uniform Plumbing Code

D. National Sanitation Foundation (NSF)Manual

E. Underwriters Laboratories (UL): Electrical wiring, controls, motors, and devices shall be U.L. listed, and so be labeled

1.4 Quality Assurance

A. Work Force

1. Experience: The landscape irrigation installation company shall have a full time foreman assigned to the job for the duration of the contract. He shall have a minimum of four (4) years' experience in landscape establishment supervision shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.

2. Labor force: The landscape irrigation installation company's labor force shall be thoroughly familiar and trained in the work to be accomplished and perform the task in a competent, efficient manner acceptable to the Owner's Authorized Representative / Project Engineer.

3. Supervision: The foreman shall directly employ and supervise the work force at all times. Notify The Owner's Authorized Representative / Project Engineer of all changes in supervision.

4. Identification: Provide proper identification at all times for landscape irrigation Installation Company's labor force. Be uniformly dressed in a manner satisfactory to the Owner's Authorized Representative / Project Engineer.

B. Ordinances and Regulations: All local and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made part of these Specifications. Nothing contained in these Specifications shall be construed to conflict with any of the aforementioned rules, regulations, or requirements. However, when these Specifications describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, then these Specifications shall take precedence.

C. Discrepancies:

1. Verify scaled dimensions and quantities prior to start of work.

D. Permit and Fees: The Contractor shall obtain and pay for any and all permits and all inspections required by permits.

1.5 Submittals

A. Make submittals no later than 30 calendar days prior to start of work to which they apply.

B. Irrigation Material Submittal List and Descriptive Literature

1. Submit for review and distribution to Owner's Authorized Representative / Project Engineer. Include manufacturer's name and model numbers for all materials required under this Contract, together with two (2) copies of descriptive literature for each of the items listed below. The Contractor shall commence no work prior to receiving statement of acceptance of irrigation material submittal list and descriptive literature from the Owner's Authorized Representative / Project Engineer. Submit items as follows:

a. Automatic Irrigation Controller

b. Master valve

c. Flow meter

d. Gate/ Ball valves

e. Quick coupling valves and key

f. Automatic remote control valves

g. Wire and connectors

h. Plastic pipe and pipe fittings

i. Plastic pipe primer and solvent cement

j. Tracer/warning tape

k. Check valves

l. Valve boxes

m. Unions

n. Valve identification tag

C. Record Drawings:

1. Provide and keep up-to-date Record Drawings, which shall be up-dated daily to indicate the exact “as-built” locations of equipment. Prints for these purposes may be obtained from the Owner’s Authorized Representative / Project Engineer at cost. Record drawings shall be kept on the site at all times.

2. The Contractor shall make neat and legible notations on the record drawing progress sheets daily, showing the work as actually installed.

3. Record Drawings shall serve as work progress sheets and shall be the basis for measurement and payment for work completed. Drawings shall be available at all times for review and shall be kept in a location designated by the Owner’s Authorized Representative / Project Engineer. Should the record black digital bond print drawing progress sheets not be available for review or not be up-to-date at the time of any review, it will be assumed no work has been completed and the Contractor will be assessed the cost of that site visit at the current billing rate of the Owner’s Authorized Representative / Project Engineer . No other reviews shall take place prior to payment of that assessment.

4. In addition to Record Drawing progress, dimension shall be taken prior to backfilling of trenches and accurately from two (2) permanent points of reference (building corners, sidewalk, or road intersections) showing the location of the following items:

   a. Meter and Backflow

   b. Routing of irrigation mainline (dimension) maximum 100’-0” along routing

   c. Controller

   d. Routing of control wiring

   e. Gate valves

   f. Remote Control Valves

   g. Quick coupling valves

   h. Sleeving

   i. Other related equipment as directed by the Owner’s Authorized Representative / Project Engineer.

5. Before the date of the final inspection, the Contractor shall transfer all information, drafted by Contractor, from the “As-Built” to a CAD or PDF file format. All drafted work including dimensions shall be neat, easy to read, in ink

and shall be approved by the Owner's Authorized Representative / Project Engineer prior to the making of the Controller Chart.

D. Controller Charts:

1. Provide two (2) controller charts for the controller showing the area covered by the automatic controller. Chart size to be the maximum size the controller door will allow, if possible.
2. The chart is to be a reduced drawing of the actual "as-built" system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
3. The plan shall be in black ink with a different color ink used to show area of coverage for each valve station.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils. thickness.
5. These charts must be completed and approved prior to final inspection of the irrigation system.

E. Operation and Maintenance Manuals shall be prepared and delivered to the Owner, prior to completion of construction.

1. All required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two individually bound copies of the operation and maintenance manual (loose leaf binders are acceptable). The manual shall describe the material installed and shall be in sufficient detail to permit operation personnel to understand, operate and maintain all equipment.
2. Spare parts lists and related manufacturer information shall be included for each equipment item installed. Each complete, bound manual shall include the following information:
    a. Index sheet stating the Contractor's address and telephone number. Duration of guarantee period.
    b. List of equipment with names and addresses of local manufacturer representatives.
    c. Complete operating and maintenance instructions on all major equipment.
3. Equipment to be furnished:
    a. As part of this contract: upon completion of work for this section of the contract the Contractor shall supply the following items to the Owner's Authorized Representative / Project Engineer
        1) One, 5 foot valve key for operation of shut-off valve.
        2) 2 keys for the automatic controller and cabinet.
        3) Key and Hose Swivel for Quick Coupler (QC).
        4) One (1) Remote Control Valve (RCV).
        5) Five (5) Bubblers.

1.6 Product Delivery, Storage, and Handling

A. Exercise care in handling, loading, uploading and storage of pipes and fittings.

B. Transport pipes in a vehicle allowing the length of pipe to lie flat so as not to subject it to undue bending or concentrated external load at any point.

C. Any section of pipe that has been dented or damaged will be discarded and, if installed, shall be replaced with new piping.

D. Permission to store materials on site shall be obtained from the Owner.

1.7 Observation

A. Notify the Owner's Authorized Representative / Project Engineer 48 hours prior to time of the following required Observations:

1. Pressure supply line installation and testing.
2. Automatic controller and wire installation.
3. Lateral line and irrigation installation.
4. Coverage test.

B. Notify the Owner's Authorized Representative / Project Engineer 7 days prior to the time of the punch walk and final observation. Controller shall be fully operational before any controller observation is scheduled.

1.8 Existing Utilities

A. Exercise care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by Contractor's operations or neglect. Check existing utilities drawings for existing utility locations. Contractor to verify all existing utilities through Dig Alert (800)-227-2600, two days before beginning construction.

B. Protect in place utilities and plant materials not designated for removal or modification against damage resulting from work of this Contract.

C. Repair or replace existing improvements not designated for removal, which are damaged or removed as a result of Contractor's operations. When a portion of a existing irrigation system must be removed, the remaining lines shall be capped. Remaining system shall be functional and connected to a existing or new controller. Repairs and replacements shall be at least equal to existing improvements, and shall match them in finish and dimension.

D. Costs for protecting, removing, and restoring existing improvements shall be included in Contractor's Bid.

1.9 Verification Of Dimensions and Quantities

A. Verify scaled dimensions and quantities prior to start of work.

B. Notify the Owner's Authorized Representative / Project Engineer of discrepancies between Specifications and actual job site conditions that would affect the execution of the irrigation work. Do not work in areas where discrepancies occur until instructed by the Owner's Authorized Representative / Project Engineer.

1.10 Water and Power Service

A. Meter and backflow for use with irrigation system shall be as shown on Engineer's Drawings unless otherwise directed by the utility company.

1.11 Coordination

A. Coordinate the irrigation installation with other Sub-Contractors including paving, utilities, site backfilling, landscape grading and landscape work.

1.12 Guarantee and Repairs

A. The manufacturer shall warrant materials against manufacturing defects for a period of one year from date of Substantial Completion. The Contractor shall guarantee workmanship for one year after the approval of the inspection to be held at the completion of the specified maintenance period.

B. The Contractor shall be responsible for coordinating material warranty items with manufacturer and distributor. The Contractor will be on call to replace or repair any faulty equipment or installation within 24 hours after notification by the Contracting Officer during the maintenance period.

C. The Owner has the right to make temporary repairs as necessary to keep the irrigation equipment in operating condition. The exercise of this right by Owner will not relieve the Contractor of responsibilities under the terms of the guarantee.

D. Expenses due to vandalism during construction and the maintenance period shall be the responsibility of the Contractor. Maintenance period is as specified in Section 32 97 00, Landscape Maintenance.

E. A copy of the guarantee shall be in the operations and maintenance manual.

F. The Contractor shall be responsible for one (1) year from the date of the substantial completion for the following tasks:

1. Replacement or repair of any broken or malfunctioning parts installed under this Contract, including heads, valves, and controllers.
2. Settling of backfilled trenches, which may occur during guaranty period, shall be repaired by Contractor at no expense to the Owner, including complete restoration of finish grade treatment.

1.13 Conference Prior to Commencement of Work

A. Immediately upon awarding of Contract and prior to commencing work, the Contractor shall confer with the Owner's Authorized Representative / Project Engineer regarding the general details of the Work involved in this Contract.

PART 2 - PRODUCTS

2.1 General Materials

A. Use new materials of the best grade, for each respective item, and of the same manufacturer for all items of one (1) type. Owner may provide Contractor with a preferred irrigation equipment list, Owner's list will supersede any material requirements noted herein.

B. P.O.C. per Engineer's Drawings.

C. Plastic pipe and fittings to be used with potable water source.

1. Upstream of remote control valves (main lines): For pipe sizes up to and including 2" pipe use Schedule 40 PVC. For 2 1/2" pipe up to and including 4" pipe use Class 315 PVC pipe.
2. Downstream of remote control valves (lateral lines):
    a. For pipe sizes up to and including 1-1/2" pipe use Schedule 40 PVC pipe.
    b. For 2" through 4” pipe size use Class 315 PVC pipe. Pipe sizes larger than 4” shall be Class 200 PVC.
3. No bell-end pipes allowed.
4. Extrude from 100% virgin normal impact unplasticized polyvinyl chloride (PVC) Type I, Grade I resin.
5. Pipe homogeneous throughout, free from visible cracks, holes or foreign materials. The pipe shall be free from blisters, dents, wrinkles or ripples, die and heat marks.
6. Supplier shall be responsible to certify that manufactured pipe meets the stated levels of quality. Continuously and permanently mark pipe with manufacturer's name or trademark, kind and size (IPS) of pipe, material, manufacturer's lot number, schedule or type, ASTM qualifying designation, and NSF seal of approval.
7. Testing of pipe. The Contractor shall show written certification by supplier that polyvinyl chloride pipe has successfully passed the following tests:
    a. Acetone test. Immerse a sample of pipe in 99% pure anhydrous acetone for 15 minutes; at the end of this time there should be no evidence of flaking or delamination on the inner or outer walls of the pipe. Evidence of softening and swelling shall not constitute failure.
    b. Flattening. Cut a test specimen two inches long from each end of the pipe sample. Flatten each test specimen between parallel plates of a press until the distance between the plates, in inches, is equal to sixty (60) percent of the pipe O.D. and there shall be no evidence of cracking, splitting or breaking.
8. Plastic pipe fittings and connections
    a. Rigid polyvinyl chloride (PVC) virgin Type I, Schedule 80 with working pressure no lower than that of pipe. Sockets to be tapered conforming to the outside diameter of the pipe, as recommended by ASTM standards. All fittings are to withstand the 15 minute acetone test, as for pipe, and shall be approved.
    b. Molded fittings shall be marked with manufacturer's name or trademark, type PVC, size, ASTM qualifying designation and NSF seal of approval. Extruded couplings to be produced from NSF rated raw materials and meet ASTM Standards. Supplier shall be responsible to certify that extruded fittings and connections meet the stated levels of quality.
9. Plastic pipe primer and solvent cement as recommended by pipe manufacturer per Accessories, N.2. No clear primer and solvent cement may be used

D. Master Valve and Remote Control Valves type and model per contract drawing legend.

1. The electric remote control valve shall be a normally closed 24 VAC 50/60 Hz (cycles/sec) solenoid actuated globe pattern with a balanced pressure diaphragm design. The valve pressure rating shall not be less than 200 psi (13,8 Bars).

2. The valve body and bonnet shall be constructed of heavy cast red brass, diaphragm shall be of nylon reinforced nitrile rubber or nylon reinforced EPDM rubber. All other internal parts shall be made of bronze, brass, and stainless steel to ensure corrosion resistance.

3. The valve shall have both internal and external manual open/close control (internal and external bleed) for manually opening and closing the valve without electrically energizing the solenoid. The valve shall have internal manual bleed to prevent flooding of the valve box.

4. The valve shall house a fully-encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning. This 24 VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 200 PSI (13,8 Bars). At 24 VAC, average inrush current shall not exceed .41 amps. Average holding current shall not exceed 0.28 amps.

5. The valve shall have a stainless steel flow control stem and cross handle for regulating or shutting off the flow of water. The valve must open or close in less than one minute at 200 PSI (13,8 Bars) and less than 30 seconds at 20 PSI (1,38 Bars).

6. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

7. The valve shall have a contamination proof (CP) self-flushing nylon screen located at the valve inlet to filter out grit and prevent clogging of hydraulic control ports and assure reliable operation.

E. Flow Meter type and model per contract drawing legend.

F. Gate Valve type and model per contract drawing legend.

1. Gate valves shall be the same size as the pipe lines in which they are installed and shall open "left." All valves shall be packed with an approved brand of graphite braided stem packing.

a. For sizes 2" and smaller shall be 150 pound saturated steam rated. Include a Bronze body. ASTM B-62, Screwed joints, Non-rising stem, Screwed bonnet, Solid disc, Equipped with hand wheel.

G. Ball Valve type and model per contract legend.

H. Quick-Coupling Valve type and model per contract drawing legend.

1. Valves shall be of Industrial-strength brass, red brass construction for long life and reliable performance. with built in flow control and self-closing. Reliable operation with strong corrosion-resistant stainless steel spring.

a. Valves shall be a locking metal cover, two-piece body, strong corrosion-resistant stainless steel spring, thermoplastic cover, pressure: 5 to 125 psi (0,35 to 8,63 bar), a flow rate 10 to 125 GPM (2,27 to 28,38 m3/h; 0,63 to 7,88 l/s).

I. Concrete Valve Boxes in parkway planting:

1. Rectangular Valve Boxes: shall be 12 inches wide by 17 inches long, constructed of Concrete.

2. Round Valve Boxes: shall be 10 inches in diameter constructed of Concrete. Valve Box Covers: shall be full construction of Cast Iron.

a. Full Cast Iron Valve box covers shall be locking covers.

3. Valve cover shall be sintered with valve identification information.

   a. Sintered identification letters or numbers shall be 2-inches high and shall be accomplished the DMLS process. Valve Identification shall be as indicated below:

   b. Remote Control valve box shall be rectangular. Sinter lid with the letters “RCV” and the appropriate program and station number.

   c. Quick Coupler valve box shall be round. Sinter lid with the letters “QCV”.

   d. Master Valve, box shall be rectangular, Sinter lid with the letters “MV”.

   e. Gate valve box shall be round. Sinter lid with the letters “GV”.

   f. Flow meter box shall be rectangular. Sinter lid with letters “FM”.

   g. Wires Splice boxes shall be rectangular. Sinter lid with letters “SB”.

J. Valve Accessories:

1. Identification Tags:

   a. Identification tags for electrical remote control valves shall be manufactured from polyurethane Behr Desopan. Standard tag hot stamped with black letters on yellow background. The tags shall be numbered to match programming. Provide one (1) tag of each electric remote control valve.

2. Waterproof Wire Connectors type and model per contract drawing legend.

3. Control Wires: U.L. approved direct burial type U.F., per contract drawing legend.

4. Detectable Underground Warning Tape:

   a. Consists of a minimum “Blue” 4.5 mil (.0045”) overall thickness by 3” wide with a solid aluminum foil core. The imprinted warning message is “Caution Buried Irrigation Line Below” to prevent ink rub-off, and is impervious to acids, alkalis and other destructive elements found in the soil. The imprint is as such that it allows for total reflectivity. A tape must be visibly seen before it can be read. APWA Color coded.

5. Gravel for use under valve boxes shall be washed crushed gravel of approximately ¾ inch size. No pea gravel shall be used.

6. Welded Wire Mesh shall be 1/3” square, 20 gauge, galvanized, to be placed below valve boxes, between gravel and irrigation equipment.

K. Vine Bubblers type and model per contract drawing legend.

L. Controller type and model per contract drawing legend.

1. Automatic Controller:

   a. Controller(s) shall be as indicated on the drawings, and shall be manufactured by Calsense, Inc. Controller shall be installed per manufacturer's specifications, as shown on the drawings, and as specified herein.

      1) All controllers shall be the Calsense CS3000 series

   b. The irrigation controller shall have a 10-year, limited warranty.

   c. The irrigation controller shall have a large 5.7 inch backlit, ¼ VGA, LCD, sunlight readable display where information can be viewed on the same screen, and with a scrolling side menu design that makes programming intuitive and easy to follow.

d. The controller shall be available in multiple station counts including 8, 16, 24, stations. If less than 48 stations are purchased initially, additional stations can be added at any time in the field as 8-station kits.

e. The controller shall support up to 128-stations when using 2-Wire. This can be either 128, 2-Wire stations or a combination of conventional-wired stations and 2-Wire stations.

f. Controller software upgrades shall occur via the internet transparently and at no charge.

g. The controller shall have unlimited programs known as Station Groups which can water individually or concurrently to maximize irrigation system capacity and reduce watering time.

h. The controller shall have the ability to assign landscape details as plant material, head type, soil type and exposure to each Station Group to simplify programming of stations with similar characteristics. Each group shall include a variety of other settings including irrigation schedules, percent adjust factor, line-fill times and on-at-a time rules.

i. The controller shall support up to four mainlines simultaneously for managing flow.

j. The controller shall support up to 12 points of connection shared among controllers.

k. The controller shall support up to 3 flow meters and 3 master valves in a by-pass configuration so as to accurately measure and read the overall range of station flow rates from the lowest flowing station in GPM to the highest flowing station in GPM, using the 2-Wire option and the 2-Wire, POC decoders for the second and third flow devices and master valves.

l. The controller shall automatically calculate cycle and soak scheduling to water each station for a fixed cycle time and allow the water to soak in between cycles, maximizing infiltration and minimizing runoff.

m. The controller shall have a water budget feature that displays monthly water volume allotments in either HCF or gallons for each of the 12 calendar months labeled as January thru December. This monthly guideline shall be calculated three ways, either directly entered, calculated by the controller using a yearly budget and dividing that out to the 12 months proportionately using built-in historical ET, or by calculating the monthly numbers using total square footage and a user selected percent of historical ET.

n. The water budget shall be available per POC controlled. If the expected water use for the month exceeds the monthly budget, the user shall be notified with an alarm before the month ends so changes to the program can be made. The controller shall not terminate irrigation automatically in this process, or if selected as an option, the controller shall proactively and automatically decrease the scheduled irrigation gradually upon approaching the set water budget limit with notification of said action.

o. The controller shall have a wide range of water reports and diagnostics available directly at the controller and shall include:

    1) A summary of all usage for each irrigation mainline

    2) Usage for each point of connection connected to the mainline

    3) Station-by-station usage

4) A complete station-by-station history which includes the date and start time of each cycle, programmed minutes, programmed inches, number of cycles, actual flow rate, expected flow rate, and any alerts or issues that occurred during irrigation.

5) Unscheduled water usage and non-controller water usage including quick coupler use and bleeding valves manually.

p. The irrigation controller shall have three separate mainline break settings available for proper flow detection of catastrophic issues without interfering with standard irrigation practices and shall be programmed for

1) During irrigation

2) Master valve override functions

3) All other times

q. The controller shall have flow management capability as a standard feature whereas the controller shall learn each station's expected GPM flow rate automatically at night over several irrigations, and use the mainline GPM capacity programmed, to operate up to six (6) valves at the same time to shorten the water window.

r. The controller shall have the ability to accommodate multiple types of irrigation schedules including irrigating even days, odd days, prescribed days of the week, and interval scheduling ranging from every other day up to every four weeks.

s. Several controllers, up to twelve shall be able to share one or multiple points of connection with multiple flow meters and master valves. This option shall allow several controllers without the use of a central control computer to share the irrigation programs and flow information for:

1) Monitoring of system flows.

2) Shortening water windows by maximizing the number of valves on without exceeding system flow capacity.

3) Turning OFF valves with excessive flow rates due to broken lateral lines.

4) Tracking water usage and comparing to a water budget.

5) Eliminating relays when sharing pumps and master valves.

t. When more than one controller is sharing one or multiple points of connection and the controllers are communicating to each other through hardwire or radio, the data shall be distributed as changes occur making the data available from any controller on the FLOWSENSE™ chain so that the user shall be able to view and program a controller's information from any other controller in the group.

u. The controller shall provide permanent memory stores of all controller programming and setup data, including date and time, in non-erasable memory.

v. The controller shall have the ability to create and program an unlimited number of manual programs which allow the user to schedule stations

to run for a preset time, up to 6 –times per day, for hydro-seeding, new planting and fertilization scheduling.

w. Electrical alerts, such as short circuits and no currents, shall be standard to help the user troubleshoot field wiring and solenoid problems.

x. The irrigation controller shall provide an optional lights feature to be used to operate up to four light, gate or water feature relays.

2. Controller Wall Mount Installation

   a. The wall-mounted gray box shall be a completely assembled unit, pre-mounted with the designated controller. The box shall be constructed of weather- and vandal=resistant stainless steel.

   b. The wall mount unit shall come complete with transient and lightning protection board and factory-labeled terminals.

   c. The transient protection board shall be pre-mounted in the wall mount unit and shall support field replaceable modules which include terminal strips for the connection of irrigation field wires, 2-Wire cable.

   d. The wall mount unit shall feature a security-tight locking mechanism, louvered vents, with splash guards, and bee/wasp screens.

   e. All wall mount units shall come with a 10 year limited warranty and shall be fully UL approved.

3. Controller Grounding

   a. Grounding shall consist of one 5/8-inch x 8-foot copper rod installed per irrigation controller and where multiple controllers are not connected to the same ground rod.

   b. The top of each rod shall be installed inside a 10-inch round valve box, with the rod installed as close as practical to the controller. If a pedestal enclosure is used, the ground rod may be installed through the pedestal base. Under no circumstances shall the rods be shortened.

   c. A #6 AWG solid copper wire shall be used to connect from the ground lug of the transient protection board to the copper rod. Brass clamps specifically designed to secure the copper wire to the grounding rod shall be used. There shall be no kinks or sharp bends in the wire.

      Each wire may be wrapped around the rod and brazed in place as an alternative to clamping. Braze the wire to the rod for at least one circumference of the rod.

4. Controller 2-Wire Path & Decoders

   a. The 2-Wire option shall provide support for up to one-hundred and twenty-eight (128), 2-Wire stations connected to a single controller and shall provide support for up to 6 points of connection (POC's).

   b. The 2-Wire cable shall either be Paige P7354D or Regency's Hunter® Decoder cable with a maximum length of 7,000 ft.

   c. A ground rod, 5/8 inch x 8-ft solid copper shall be required every 300-feet along the 2-Wire path as well as a single ground rod at the end of the cable run.

   d. The station decoder shall be a 2-station decoder and shall be able to operate up to 2-solenoids using unique colored wires for each.

   e. A single controller shall be able to operate up to 70, 2-station decoders and it shall be intended that all wire runs between valves and 2-Wire decoders shall be direct pulls and have no splices except at the decoder location.

   f. All electrical connections must be waterproof and moisture-resistant and shall be done with 3M™ Scotchcast™ 3570G Connector Sealing Packs.

g. The 2-Wire decoders shall use #14 AWG direct burial wire to connect to remote control valves and the maximum wire run between the decoder and the valve shall be 100-feet.

h. The POC decoder shall operate a single master valve and flow meter (model FM). A single controller shall be able to operate up to six POC decoders with a maximum of 12-POC's in a chain, controllers using FLOWSENSE™ technology.

i. The maximum wire run between the POC decoder and flow meter shall be 20-feet while the maximum wire run between the decoder and the master valve shall be 100-feet

5. Controller Weather Monitoring

a. The manufacturer of the central control system shall provide real-time ET through the internet known as WEATHERSENSE, to any location within the United States using aggregated data from more than 25,000 weather stations combined with high-resolution modeled, near-surface weather conditions, ensuring current conditions are accurate even in areas of localized microclimates, all without subscription charges.

b. The controller shall be able to interface with an on-site ET gage able to measure daily localized, evapo-transpiration and log the amount of inches lost each day without the use of a central computer.

c. The ET measuring device shall be powered by the selected field controller. ET is measured directly in 0.01" increments and pulses from the gage are sent directly to the field controller.

d. The controller shall be able to store and display daily, on-site ET in a 28-day table which is updated every 24 hours.

e. The user shall be able to view over 100 selections of built-in historical ET tables or program monthly historical ET data for a given area directly, to be used as a backup for that night's calculation in case the ET gage malfunctioned or the real-time value sent normally through the Internet failed.

f. The user shall be able to cap the amount of daily ET used by the controller for that night's calculation by selecting a percent of historical ET for the given area to be used instead of the actual ET received.

g. The irrigation controller shall have the capability to calculate station run times using the average of the last 7 days of ET instead of using a single ET value to calculate the next scheduled, station run times.

h. The controller has the optional function to interface directly in the future with a Tipping Rain Bucket and shall accurately measure rainfall in 0.01" increments by means of a tipping and emptying device mounted below the center of the collection dish.

i. The rain-measuring device shall be wired using the 25-feet of 2-conductor cable supplied with the Tipping Rain Bucket to the selected field controller. The controller shall have a weather option able to interface with the device. The cable shall be installed in conduit and the connections are to be made at a terminal strip inside the enclosure. Maximum length of cable run shall be 1000 feet using Paige P7171D communication cable when necessary. 18-gauge multi-conductor irrigation wire in conduit may be used for runs under 100-feet. Runs shall be direct pulls without splices.

j. The irrigation controller shall provide the following programming parameters for rain:

1) Stop Irrigation after x.xx inches

2) Maximum Rain in One Hour is x.xx inches

3) Maximum Rain in 24 Hours is x.xx inches

k. Wind speed shall be monitored by the irrigation controller with the weather option interface and the wind gage installed. The controller shall pause irrigation once the wind speed exceeds a user-set limit. As wind subsides, the controller shall resume irrigation where it left off. Winds from 0-to 135-MPH shall be accurately read. Data from one wind gage shall be shared amongst a group of controllers making up a FLOWSENSE™ chain.

l. The wind gage device shall be wired using the 60-feet of 2-conductor cable supplied with the device to the selected field controller. The cable shall be installed in conduit and the connections are to be made at a terminal strip inside the enclosure. Maximum length of cable run shall be 1000 feet using Paige P7171D communication cable when necessary. 18-gauge multi-conductor irrigation wire in conduit may be used for runs under 100-feet. Runs shall be direct pulls without splices.

6. Flow Meter:

a. The flow meter used shall be supplied by the same manufacturer as the irrigation controller.

b. The flow meter shall wired back to the irrigation controller using two #14 AWG wires, one red, and one black in 1” PVC conduit to connect to the irrigation controller. The maximum wire run between flow meter and controller shall be 2000 ft. The flow meter shall send low voltage digital pulses back to the controller and therefore all electrical connections must be waterproof and be resistant to any moisture entry.

It is intended that all wire runs between the controller and flow meter shall be direct pulls and have no splices. If wire splices are unavoidable, they must be installed in a valve box with Spears DS-100 connectors with Spears sealant or 3M Scotchlok No. 3570 connector sealing pack used.

c. Each flow meter shall have the following characteristics:

1) Housing to be a Sch 80 polyvinyl chloride tee or bronze tee

2) Have a pulsing output that operates at 9VDC and a pulse rate that is proportionate to the GPM

3) Fully compatible with the internal interface at each field controller

4) Powered by the controller

5) Replaceable metering insert

6) Shall feature a six-bladed design with a proprietary, non-magnetic sensing mechanism

d. The irrigation controller shall include native support for Bermad 900-M Reed Switch and Netafim Pulse Reed Switch series hydrometers. Allowable hydrometer sizes shall range from 1.5” to 10”. Reed Switches that are supported include 1-pulse per 1-gallon and 1-pulse per 10-gallon switches. Currently only one hydrometer mentioned shall be able to interface with the controller.

7. Controller's Central Control Communication Options

    a. The field controller(s) shall be capable of utilizing a single mode or a combination of communication modes such as 3.5G cellular radio, Ethernet, wireless Ethernet, point-to-point Spread Spectrum radio, and hardwire communication cable for central control of irrigation via cloud-based, Command Center Online web software.

    b. The controller shall be able to utilize a wireless, 3.5G cellular radio in remote areas where an Ethernet or WiFi connection is not possible for direct communication back to a desktop, tablet, or laptop computer via the Internet. Service plans for single and multiple controllers utilizing a 3.5G cellular modem shall be available through the manufacturer as 1-year or 5-year plan.

    c. The controller shall be able to utilize an Ethernet communication, CAT5 or CAT6 cable path as part of a district's or campus network system. An Ethernet (RJ45) connection shall be supplied at the controller location, with the network set to have access to this connection. IP reservations with DHCP are preferred along with the hard coded MAC address from the Ethernet device supplied. The secondary preference shall be a static IP address with additional programming requirements. The controller shall utilize connect to an existing WiFi, wireless Ethernet network on a city maintained project. IP reservations with DHCP are preferred along with the hard coded MAC address from the Ethernet device supplied.

    d. The controller shall be able to utilize a short-range, Spread-Spectrum radio to communicate with other controllers in line-of-sight proximity providing a reliable communication link instead of a hardwire communication path when sharing data. The spread-spectrum radio option does not require FCC licensing, and offers a secure error correcting frequency hopping radio link immune to outside interference.

8. Controller's Command Center Online Web Software

    a. The central control software shall be a cloud-based package designed to provide complete irrigation control through a web application, without the purchase of proprietary software loaded on a dedicated, desktop computer.

    b. The fully-featured web application shall provide communication using a variety of internet-connected options including Ethernet, Wireless Ethernet (WiFi), and 3.5G Cellular Radio.

    c. The web application shall allow the user to monitor and program controllers, as well as run various water usage reports from any internet-connected device including PC's, tablets, and smart phones. Weather data collected from an ET Gage, Tipping Rain Bucket, or WEATHERSENSE can be shared to any controller on the system.

    d. Engineered for easy and reliable access, all that is needed to get started using the software shall be a user name and password to obtain data from controllers in the field. Each customer's service shall be unique and password protected so data is secure.

    e. User accounts shall be issued and managed by an administrator account so that only authorized users can access controller information.

    f. The cloud-based software shall include the ability to turn stations On and Off remotely using any internet-connected device including PC's and tablets, and a smart phone app. User shall be able to turn on up to six valves simultaneously and view real-time flow information, details if a

mainline break occurs, and real-time weather data when using on-site weather devices such as daily ET and rainfall in inches.

g. The web software shall allow a customer to create their own custom dashboard as the home page, providing a snapshot of the most important water and labor management graphs and reports depicting easily the most current status of each controller at each specific project location.

h. System reports shall include complete records of the details for every irrigation cycle, water usage versus water budget amounts, the gallons and percentages of water savings, and what events and changes have occurred at the controller. System administrators shall have management reports listing sites and user for their company.

i. System requirements shall be a broadband internet connection such as DSL, cable, or mobile broadband.

j. Supported web browsers shall include:

1) Microsoft Windows Internet Explorer® 8.0 or higher

2) Google® Chrome™ 34 or later

3) Mozilla Firefox™ 28 or higher

4) Apple® Safari™ 5.1.7 or higher

9. Controller Warranty, Service & Training

The manufacturer shall provide after-sale support that is a no charge service whereas on-going training and education shall be provided by factory direct personnel to the end user(s) at both the field controller(s) and using the cloud based, web software for central control of irrigation.

a. The central control manufacturer shall warrant to the purchaser of its manufactured products against defects in material and workmanship for a period of ten (10) years from the date of original purchase by the owner.

b. All peripheral, accessory, and RF equipment such as radio and 3.5G cellular radio modems, ET gages, flow meters, and rain buckets (but not limited to) and used in conjunction with central irrigation controllers, shall have distinct warranties of their own and should be noted separately from this warranty.

PART 3 - EXECUTION

3.1 General Installation

A. Perform minor adjustment in location or alignment of new work, to avoid existing utilities, signs, trees and etc. as directed without additional cost.

B. Prior to installation, stake out pressure supply line routing and locations of vine bubblers and irrigation system lines.

C. Perform work on the irrigation system, including hydrostatic and coverage tests, preliminary operational test of the automatic control system, and the backfill and densification of trenches and other excavations after topsoil work and before planting.

D. Make the irrigation system operational with uniform coverage of the areas to be irrigated, prior to planting.

E. Notify Owner's Authorized Representative / Project Engineer in writing at least 48 hours before testing will be conducted Conduct tested in presence of the Owner's Authorized Representative / Project Engineer.

3.2 Trench Excavation and Backfilling

A. Excavate trenches for pipe and conduit. Schedule work so excavations shall be open and exposed for a minimum period of time.

B. After piping and conduit are laid in place, tested and approved backfill as soon as possible with excavated material or approved imported soil.

3.3 Irrigation Pipe Installation

A. Pipe size from main line to control valves to be as the same size as the largest line downstream of the control valve.

B. When two (2) pipes are placed in the same trench provide a minimum of 6" space between pipes. Parallel lines shall not be installed directly over one another.

C. Plastic Pipe:

1. Main lines (upstream of RCV). Install 18" below grade (minimum 24" under roadways), as measured from top of pipe.
2. Lateral lines (downstream of RCV). Install 12" below grade (minimum 18" under roadways), as measured from top of pipe.
3. The bottom of the trench shall be free of rocks, clods and other sharp-edged objects. If rocks over 1" size are encountered at the bottom of the trench or within backfill at 4" above pipe, Contractor shall have the option of removing rocks or placing 4" of sand below and above PVC pipe.
4. Place No. 12 gauge copper identification wire at bottom of trench for all mainline PVC pipe. This is to provide a continuous electrical conductor between gate valves. Wrap each end around the valve body and bring up inside the valve box to the ground surface and loop back with 2'-0 of wire free. Place "Detectable" tracer/warning tape in trench 12" above the pipe while backfilling to show location of buried mainline PVC pipe.
5. Plastic Pipe Assembles:
    a. Join pipe using solvent weld. Use a non-synthetic bristle brush to spread filler cement applied from cans no larger than pint size. Clean and refill container each day. Primer and solvent cement used shall be as recommended by pipe manufacturer.
    b. Cut pipe square. All burrs shall be removed inside of pipe end. Chamfer outside end of pipe 10 degrees to 15 degrees.
    c. Clean and dry pipe and fitting socket. Check dry fit of pipe and fitting. Pipe should enter fitting socket about 1/3 to 3/4 depth.
    d. Dissolve inside socket surface by brushing with primer. Use a scrubbing motion to assure penetration.
    e. Dissolve surface of male end of pipe to be inserted into socket to depth of fitting socket by brushing liberal coat of primer. Be sure entire surface is well dissolved.
    f. Brush inside socket surface with primer. Then, without delay apply solvent cement liberally to male end of pipe.

g. Apply solvent cement lightly to inside of socket, using straight outward strokes to keep excess filler solvent out of socket. Time is important at this stage. Apply a second coat of cement to the pipe end. The solvent cement should be applied deliberately but without delay.

h. While both the inside socket surface and the outside surface of the male end of the pipe are soft and wet with solvent cement, forcefully bottom the male end of the pipe in the socket, giving the male end a 1/4 turn if possible. The pipe must go to the bottom of the socket. Hold the joint together until both soft surfaces are firmly gripped for at least 30 seconds.

i. After assembly, wipe excess cement from the pipe at the end of the fitting socket. A properly made joint will normally show a bead around its entire perimeter. Any gaps at this point may indicate a defective assembly job due to insufficient cement, or use of light bodied cement on large diameter where heavy bodied cement should have been used. Do not disturb joint for 30 minutes until initial setup of the cement occurs.

j. Provide a firm, uniform bearing for the entire length of each pipe line, to prevent uneven settlement.

k. Snake pipe from side to side of trench bottom to allow for expansion and contraction. One (1) additional foot per 100'-0 of pipe is the minimum allowance for snaking. Never lay PVC pipe when there is water in trench or when temperature is 32 degrees Fahrenheit or below.

l. Center load pipe with small amount of backfill to prevent arching and whipping under pressure. Leave joints exposed, for inspection during pressure test. No water will be permitted in the pipe until the above has been accomplished and a period of at least 24 hours has elapsed for solvent weld setting and curing.

6. Plastic Pipe Fittings and Connections:

a. Use Schedule 40 female adaptor with Schedule 80 threaded nipple one end in connecting solvent weld pipe to threaded joints.

b. Use 45 degree fittings at all changes in depth of pipe. Couplings to be of same material and wall thickness as pipe used.

c. Use Teflon tape on all threaded joints. Screw hand tight and 1/2 turn by wrench. On PVC to steel connections, work the steel connections first.

d. Minimum length of PVC nipple shall be 4".

3.4 Installation of Valve Boxes, Valves and Special Equipment

A. Valve Boxes:

1. Locate valve boxes near paved walk/surfaces where possible. Edge of valve boxes shall be set square and 12” from edge of pavement, walk or concrete curb.

2. Set valve boxes to finish grade on a minimum 12 inch deep layer of gravel and set valves at depth to provide clearance between the cover and valve handle or key when the valve is in the fully open position. Do not cover valve with gravel.

B. Gate Valves:

1. Install shutoff valves.

2. Install valves and equipment in a normal upright position, unless otherwise recommended by the manufacturer, and make readily accessible for operation, maintenance, and replacement.

3. Install valves of the same size as the pipeline in which they are installed.

4. Install shut-off valves and sectional automatic control valves using brass or bronze unions with copper or brass seats, below ground.

5. Install quick-coupler valves projecting above grade 1 foot from curbs, pavement, and walks when possible.

6. Install a line sized shut-off valve on the pressure side of all sectional remote control valve.

7. Install a line size shut–off valve in a 10 inch diameter valve box on the up-stream side of main lines crossing streets.

C. Quick-Coupling Valves

1. Install 1" quick-coupling valves.

2. Within 10'-0 of where a quick-coupling valve is installed, Contractor shall paint a 3" diameter "yellow-spot" as approved on paving, curb or mow strip.

D. Master Valve and Flow Meter Installation:

1. Install per manufacturers recommendations and county regulations.

E. Automatic Remote Control Valve Assembly:

1. Provide a valve box for each automatic control valve.

2. Wiring methods

a. Wiring installed in concrete, masonry or where exposed to moisture, weather or damage, shall be installed in a rigid steel conduit.

b. Material shall be new and shall be listed by or bear the U.L. label, where subject to such approval.

c. Polyvinyl chloride (PVC) conduit shall be Schedule 40 and shall have a round, smooth bore, and couplings, bends, elbows, adapters and other fittings and materials, including jointing cement, shall be the project of, or as approved by conduit manufacturer.

d. Conductors shall be NEC standard annealed copper wire with NEC 600 volt insulation. THW, THWN or TW insulation.

e. All conduits shall be 1-1/4” in diameter unless otherwise noted.

f. Grounding and bonding connect to existing grounding system or furnish and install a complete grounding and bonding installation as required by California Electrical Code and as otherwise shown. The irrigation controller shall be grounded to metal cold water pipe or where underground cold water main service is non-metallic or underground steel cold water system is wrapped; grounding for equipment shall be connected to two driven ground rods installed not less than 6'-0 apart. Rods shall be 5/8" diameter minimum and driven a minimum of 8'-0 below grade. Location as determined by the Owner’s Authorized Representative / Project Engineer. Rod shall be copper clad steel.

3.5 Vine Bubbler Installation and Adjustment

A. Flush and pressure test mains and laterals, and risers before installing irrigation vine bubblers and before performing water coverage test to the complete satisfaction of the Owner’s Authorized Representative / Project Engineer.

B. Location, Elevation and Spacing:

1. Spacing of bubbler heads shall be one (1) bubbler per vine.

C. Vine Bubblers

1. Bubbler assembly shall be located in in landscape areas/ vine pockets.
2. Top of the bubbler assembly shall be installed two (2) inches above finished grade.
3. Install each bubbler assembly as shown on Detail and Contract plan drawing.

D. Irrigation Head Adjustment:

1. When irrigation heads are installed and the irrigation system is operating, adjust and balance each section or unit with section control valves fully open to obtain uniform and adequate coverage.
2. Flush and adjust all irrigation bubbler heads for optimum performance and to prevent runoff onto walks, and roadways, as much as possible. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, make such adjustments prior to planting.
3. At no time shall the irrigation water runoff on to pavement and structures.

3.6 Controller System Installation

A. Locate automatic irrigation controller(s) per Owner's Authorized Representative directive.

1. Install controller per manufacturer's instructions. Contractor shall have 5 years of experience installing Rainbird Controllers. Remote control valves shall be connected to controller in numerical sequence as shown on the drawings.
2. Control system to be certified by Calsense. Submit certification to the Owner. Contact Mark Huntzinger at Calsense at 760-580-1827. Certification shall state the Controller is connected and is sending and receiving information from all necessary irrigation equipment especially the Flow Meter and Master Valve.
3. Install a complete automatic irrigation control system, including the 120 Volt electrical service, automatic controller, automatic control valves and wiring, and necessary accessories and utility service connections as required by the controller manufacturer.
4. Install the automatic controller outside of the coverage pattern of the irrigation system at the location designated on Drawings or as directed by the Owner's Authorized Representative in accordance with the details.
5. Install a separate disconnect switch between the source of power and the controller. Fuse control components in the controller and ground the chassis.
6. Install service wiring at a minimum depth specified, in galvanized steel electrical conduit from the service point to the controller. The minimum service wire shall be No. 12 AWG copper 600 volt type THW/THWN insulation, or as required by the controller manufacturer. Locate splices only in specified pull boxes and make splices with a waterproof packaged kit approved for underground use. Set top of pull boxes flush to finish grade on a 12 inch deep layer of ¾ inch gravel.
7. House control wiring in a conduit between the controller and an electrical pull box at the base of the controller. House control wire under paved areas in a Schedule 40 PVC pipe sleeve. Other wiring issuing from the electrical pull box shall be direct burial, installed in the main or lateral waterline trenches wherever practicable.

8. Color code common wire white with control wire any color except white. Make splices in control wire with approved waterproof connectors in accordance with the requirements for service wire. Leave at least 2 feet of coiled slack at each splice and point of connection inside the valve boxes.

9. Test wiring for continuity, open circuits, and unintentional grounding prior to connection to equipment.

A. Leave the control system in operating condition with an operational chart mounted within the controller cabinet upon completion of the work

3.7 Flushing and Testing

A. After completion, and prior to the installation of terminal fittings, flush the entire pipeline system through strainer until there is no longer any evidence of debris. After flushing, conduct the following tests in the sequence listed below. Provide equipment, materials, and labor necessary to perform the tests. Conduct tests in the presence of the Owner's Authorized Representative / Project Engineer.

B. Pipeline Pressure Test: Perform a water pressure test on pressure mains before couplings, fittings, valves, and the likes are concealed. Cap open ends after the water is turned on to the line so that the air will be expelled. Test pressure mains with control valves to lateral lines closed. The constant test pressure and the duration of the test are as follows:

C. Pressure line (Mainline): 4 hours at 150 psi.

D. Coverage Test: Perform the coverage test in the presence of a Owner's Authorized Representative / Project Engineer after irrigation heads have been installed and before groundcover has been planted, to demonstrate that each section or unit in the irrigation system is complete and balanced to provide uniform and adequate coverage of the areas serviced. Correct deficiencies in the system.

E. Operational Test: Evaluate the performance of components of the automatic control system for manual and automatic operation. During the maintenance period, and at least 15 days prior to final inspection, set the controller on automatic operation so that the system will operate during such period. Make repairs, replacements, and adjustments until equipment, electrical work, controls, and instrumentation are functioning as specified.

3.8 Final Inspection Prior to Acceptance

A. Inspections to be performed in the presence of the Owner's Authorized Representative / Project Engineer:

1. Marker locations for placement of all irrigation heads prior to installation.

2. Inspections during installation.

3. Leakage test before backfilling.

4. Coverage test shall be performed at the completion of irrigation installation, and prior to the start of any landscaping. Necessary adjustments and additional work will be completed prior to the start of landscape work. Controller shall be operational and ready for automatic cycling.

5. Contractor shall not schedule inspection until the entire irrigation system has been flushed clean and all heads and other irrigation equipment have been adjusted for proper operation.

6. Before acceptance of irrigation system, controller must operate on automatic operation. System must operate on complete automatic cycles prior to the start of the maintenance period.

3.9 Clean-Up

A. Completion cleaning. Upon completion of the Work, remove excess material, rubbish, debris, etc., and construction and installation equipment from the site.

B. Contractor to turn over to Owner's Authorized Representative / Project Engineer all irrigation materials and equipment as noted herein prior to final acceptance.

END OF SECTION

SECTION 32 90 00
LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 Description

A. Furnish all labor, material, equipment and services necessary to provide all landscape planting, complete in place, as shown and specified herein, including soil preparation, planting, wood mulch and clean-up.

B. Any plant deemed 'Not Available' shall be noted in the bid. Failure to qualify availability of specified material shall make the Contractor responsible for all supplying of all material. Maintenance period may not begin until specified materials are installed.

1.2 Related Work

A. Landscape Irrigation - Section 32 84 00

B. Landscape Maintenance - Section 32 97 00

1.3 Material Standards

A. American Society for Testing and Materials (ASTM International):

1. ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
2. ASTM D2434 Standard Test Method for Permeability of Granular Soils (Constant Head)

B. State of California Agricultural Code

C. Sunset Western Garden Book

1. Sunset Publishing Corporation, 2013 Edition

D. U.S.A. Standards for Nursery Stocks

1. American Nursery & Landscape Association, ANSI Z60.1-2—4

1.4 Quality Assurance

A. In all cases where observations are required, notify the Owner's Authorized Representative / Project Engineer at least four working days in advance of the time of observation.

B. The Contractor shall schedule and make available the information and materials indicated for review by the Owner as listed herein. Observation by the Owner's Authorized Representative / Project Engineer shall not relieve the Contractor of completing the work in conformance to the Contractor Documents.

1. Material and Workmanship:

a. Observation by the Owner's Authorized Representative / Project Engineer will be made at substantial completion of all materials, construction and installation work required by the Contract Documents prior to commencement of the plant establishment period. The plant

establishment period shall not commence until all deficiencies found by this observation have been corrected and written notice of start of commencement has been received from the Owner's Authorized Representative / Project Engineer. All materials shall be installed prior to this observation with the following exceptions:

1) Items waived by the Owner's Authorized Representative / Project Engineer for this observation for reasons of substantiated unavailability, or in appropriate season or weather.

2) Items which do not affect the health or growth of the plantings.

2. Site Soil Quality:

a. Contractor shall provide agronomic soils test to determine suitability of existing site soil as requested by the Owner's Authorized Representative / Project Engineer to Wallace Laboratories, Attn: Garn Wallace, 365 Coral Circle, El Segundo, CA 90245 @ (310) 615-0116 or an approved laboratory that will provide all of the soils testing required below.

b. Take two (2) representative soil samples from landscape area. Submit with a site map showing sample locations and a contract plan plant legend.

Soil samples shall be tested for pH, alkalinity, total soluble salts, porosity, extractable sodium content, magnesium, boron, chloride, SAR, nitrate, phosphorus, potassium, organic matter, and soil preparation recommendations.

c. Refer to Wallace Laboratories Website (WWW.bettersoils.com) for soil collection procedures. Soil samples shall be tested for pH, alkalinity, total soluble salts, porosity, extractable sodium content, magnesium, boron, chloride, SAR, nitrate, phosphorus, potassium, organic matter, soil preparation, backfill mixtures, and fertilization recommendations.

d. If import soil is required, the Contractor shall identify a source for top soil that will be tested by the following the same lab at an additional cost to the project.

1.5 Submittals

A. Submit qualification data for landscape planting and plant establishment firm employees to Owner.

B. Product Data:

1. Planting Materials:

a. Submit documentation to the Owner's Authorized Representative / Project Engineer within 20 calendar days after date of award of Contract that all plant material is available. The Contractor shall be responsible for all material listed on plant list.

b. Any and all substitutions due to availability shall be requested in writing prior to confirmation of ordering.

c. All materials shall be subject to observation by the Owner's Authorized Representative / Project Engineer at any time after confirmation of ordering.

d. Submit Photos: Within 45 days after Contract award, provide 4 in. x 6 in. color photo of each type of vine. Include the nursery source for all

Contractor-furnished materials. All plant material shall be approved by the Owner's Authorized Representative / Project Engineer either at the nursery or on site prior to installation. See this section, Observation and Approval for more information on requirements.

1) Materials that have not been approved may be rejected, removed, and replaced at Contractor's expense.

2. Top Soil and Soil Amendments:

a. Provide source information, analysis and soil report from Wallace Labs or approved equal for import and existing soil to be used in planting areas for review and approval. Wallace Laboratory, Attn: Garn Wallace 365 Coral Circle, El Segundo, CA 90245, (310) 615-0116

b. Supply the Owner's Authorized Representative / Project Engineer with a sample of all supplied materials within fourteen (14) days after award of contract, accompanied by analytical data from an approved laboratory source or bearing the manufacturer's guaranteed analysis. Amendments may be modified based on analysis provided.

c. Submit manufacturers or vendors certified analysis for all herbicides, fertilizers, and soil amendments.

3. Wood Mulch:

a. Provide manufacturers or vendors certified analysis information and a sample for Wood Mulch.

1.6 Observation and Approval

A. The Owner's Authorized Representative / Project Engineer shall have the right to make periodic observations prior to final inspection. Should plant materials, installation procedures, or other conditions be observed that are not in accordance with the contract drawings or specifications, the Owner's Authorized Representative / Project Engineer shall direct the Contractor to correct by repair and /or replacement as appropriate. The Owner's Authorized Representative / Project Engineer shall be the sole judge of the conditions of quality and acceptability and will direct all corrections to the Contractor. All rejected materials shall be immediately removed from the site and replaced with specified materials at no additional cost to the Owner.

1.7 Project Conditions

A. Field Measurements: Verify actual locations of walls and other construction. Verify scaled dimensions and quantities prior to start of work.

B. Perform actual planting only when weather and soil conditions are suitable and will not be detrimental to the plant material.

C. Notify the Owner's Authorized Representative / Project Engineer of discrepancies between Drawings and Specifications and actual job site conditions which would affect the execution of the landscaping work. Do not work in areas where discrepancies occur until instructed by the Owner's Authorized Representative / Project Engineer.

1.8 Existing Utilities

A. Exercise care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by Contractor's operations or neglect. Check existing utility drawings for existing utility locations. Contractor to verify

all existing utilities through Dig Alert, at (800) 227-2600 a minimum of 2 days prior to construction.

B. Repair or replace existing improvements which are not designated for removal which are damaged or removed as a result of Contractor's operations.

C. Protect existing utilities that are not to be removed from damage or injury. If damaged or removed because of the Contractor's operations, they shall be restored or replaced in, as nearly the original condition and location as is reasonably possible.

1.9 Guarantee

A. All vines shall be guarantee for 6 months from date of final acceptance.

B. Guarantees after completion of maintenance period and final acceptance will be contingent on the Owner's Authorized Representative / Project Engineer proper continuation of maintenance program.

C. The Contractor, in protecting his own interests, is obligated to periodically check work areas during his guarantee period to insure proper maintenance procedures are being implemented.

D. In case of negligent or improper maintenance, the Contractor shall state in writing to the Owner's Authorized Representative / Project Engineer, his observations and recommendation. Any claims not in writing will not be considered.

E. Should soil deficiencies affecting plant health develop within the specified guarantee periods, correct such deficiencies to the satisfaction of the Owner's Authorized Representative / Project Engineer at no additional cost.

1.10 Coordination

A. Coordinate planting installation with other trades. Install vines after other trades.

1.11 Delivery, Storage and Handling

A. Delivery

1. Deliver fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trademark, and compliance with all applicable laws.
2. Deliver all plants with legible identification labels.
3. State correct plant name and size indicated on plant list.
4. Use durable waterproof labels with water-resistant ink, which will remain legible for at least 60 calendar days.
5. Protect plant materials during delivery to prevent damage.
6. The Contractor shall notify the Owner's Authorized Representative / Project Engineer 4 calendar days in advance of delivery of all plant materials and shall submit an itemized list of the plants in each delivery.

B. Storage:

1. Store plant material in the shade and protect plants from weather damage.

2. While planting is on the project site waiting for planting operations to begin contractor is to keep all plants sufficiently watered as seasonal weather and individual planting needs requires.

C. Handling:

1. The Contractor shall exercise care in handling, loading, unloading and storing of plant materials. Plant materials that have been damaged in any way shall be discarded and if installed, shall be replaced with undamaged materials at the Contractor's expense.

PART 2 - PRODUCTS

2.1 **Materials**

A. Soil and Amendments

1. Existing and Imported Top Soil shall conform to recommendations provided in the agronomic soil report by Wallace Laboratories or approved equal.

2. The Owner's Authorized Representative will confirm the suitability of the existing and import soil prior to use based upon analysis provided by the Contractor. Transport import soil from the source to its final position unless stockpiling is called for.

   a. At least 30 days before scheduled use, submit the proposed source of topsoil to the Owner's Authorized Representative for approval. Submit a written request for approval, accompanied by a written report from Wallace Laboratories, Attn: Garn Wallace 365 Coral Circle, El Segundo, CA 90245, (310) 615-0116, or an approved equal soil laboratory which states that the proposed source complies with the Specifications and that the soil is agriculturally suitable. Contractor shall comply with recommendation of the soils testing laboratory and add additional soil amendments, necessary to achieve nutrient levels to support healthy plant growth, at no additional cost to the Owner.

3. The following Top Soil / Planter backfill is for bid pricing only. Top soil/ backfill shall be determined ultimately by the agronomic soil report recommendations:

   a. Imported Top Soil: Silt plus clay content of the Import soil shall not exceed 20% by weight with a minimum 95% passing the 2.0 millimeter sieve. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade. The boron content shall be not greater than 1 part per million as measured on the saturation extract. In order to insure compliance with these specifications, samples of the import soil shall be submitted to an approved laboratory for analysis prior to, and following, backfilling.

   b. Imported Soil/ planter backfill shall be of a uniform composition and structure, fertile and friable sandy loam garden soil character suitable for sustaining and promoting the growth of the plants; and be free of roots, clods and stones, larger than 1-inch in greatest dimension, pockets of coarse sand, noxious weeds, sticks, brush and other litter and not be infested with nematodes or other undesirable insects and plant disease organisms.

4. All soil and fertilizer materials shall be of standard approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer's guaranteed analysis.

5. Soil amendments and fertilizers shall be determined ultimately by the agronomic soils report recommendations. Specific amendments and fertilizer specifications will be made after rough grading operations are complete and soil samples are tested by the Contractor. Refer to Planting Plan for location of soil samples.

6. Soil amendments for all planting areas shall be in accordance with recommendations from the soil test report by Wallace Laboratories. The following soil amendments and fertilizers are to be used for bid pricing only.

   a. Soil Sulfur: Agricultural grade sulfur containing a minimum of 99% sulfur (expressed as elemental).Iron Sulfate: 20% Iron (expressed as metallic iron), derived from ferric and ferrous sulfate, 10% sulfur (expressed as elemental).

   b. Calcium Carbonate Lime: 95% lime as derived from oyster shells.

   c. Gypsum: Agricultural grade product containing 98% minimum calcium sulfate.

   d. Dolomite Lime:

      1) 21% calcium

      2) 11% magnesium

B. Pre- Emergent and Post Emergent Herbicides:

1. The irrigation system, and soil preparation operations, and finish grade shall be approved by the Owner's Authorized Representative prior to weed abatement operations.

   a. If live perennial weeds exist on site at beginning of work, spray with a nonselective translocative herbicide as recommended and applied by an approved licensed pest control advisor and applicator. Leave sprayed plants intact for at least 15 days. Clean and remove these existing weeds by mowing or grubbing off all plant parts at least ¼ inch below the surface of the soil. Do not apply in weather conditions (wind or heavy rain) that can translocate herbicide to new or protected plants.

   b. Upon completion of soil preparation, begin weed abatement program by applying 400 pounds of a commercial fertilizer 12-12-12 per acre, per manufacturer's instructions.

   c. Water all areas four (4) times daily for twenty one (21) consecutive days or until weed seeds have germinated. Cease watering for three (3) days. Spray a nonselective translocated herbicide to eradicate the germinated weeds. Translocation shall be 7-10 days or an approved alternate time period.

   d. Allow herbicide to kill all weeds. Rake or hoe off all dead weeds to a minimum depth of ¼ inch below the surface of the soil. If perennial weeds or grasses still exist, re-water four (4) times daily for fourteen (14) consecutive days, until new growth appears. Reapply herbicide. Remove weeds after herbicide has had sufficient time to kill.

2. Contractor is to check manufacturer's list of ornamental plants to determine toxicity of unintended contact with ornamental plants and grass material used on

this project. Contractor shall replace any plant material damaged by improper application of herbicides.

C. Commercial Fertilizer:

1. Granular product having a chemical analysis of 12-12-12 Nitrogen, Phosphoric acid, and Potash, unless otherwise specified on Contract Drawing and recommended approved agronomic report; free-flowing material mixed by supplier, delivered in unopened sacks. Do not use material which becomes caked or otherwise damaged. The following fertilizer is for bid pricing only, all Fertilizer shall be determined ultimately by the agronomic soils report recommendations:

   a. Planting Fertilizer: Pelleted or granular form shall consist of the following percent by weight and shall be mixed by commercial fertilizer supplier:

      1) 6% nitrogen

      2) 20% phosphoric acid

      3) 20% potash

   b. Nitroform: 38-0-0 slow release organic nitrogen.

   c. Single Super Phosphate, or approved equal: Commercial product containing 18- 20% available Phosphoric Pentoxide

      1) DAP (Di-Ammonium Phosphate): 18-46-0

2. Planting Tablets:

   a. Tablets shall be slow-released type, (crushed) with potential acidity of not more than 5% by weight containing the following percentages of nutrients by weight:

      1) 20.0% nitrogen

      2) 10.0% phosphoric acid

      3) 5.0% potash

      4) 2.6% combined calcium

      5) 1.6% combined sulfur

      6) .35% iron (elemental) from ferrous sulfate

   b. Shall be 21 gram tablets as manufactured by Agriform or approved equal, applied per manufacturer's instructions.

D. Plant Material:

1. Plants shall be in accordance with the California State Department of Agriculture's regulation for nursery inspections, rules and rating. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous and free of insect infestations, plant diseases, sunscalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Any plants unsuitable for planting shall be considered as samples and shall be provided at the expense of the Contractor.

2. The size of the plants shall correspond with that normally expected for species and variety of commercially available nursery stock or as specified on drawings.

3. All plants not in compliance with the requirements herein specified, will be considered defective and such plants, whether in place or not, shall be marked

as rejected and immediately removed from the site of the work and replaced with new plants at the Contractor's expense.

4. Pruning: At no time shall vines or plant materials be pruned, trimmed prior to delivery or after installation. Any alteration of their shape shall be conducted only with the approval and when in the presence of The Owner's Authorized Representative / Project Engineer.
5. Plant material shall be true to botanical and common name and variety as specified in "Sunset Western Garden Book" (current edition).
6. Nursery Grown and Collected Stock:
    a. Plants shall be grown under climatic conditions similar to those in locality of project.

E. Vine Support per detail:
1. Green nursery tape
2. 6" (inch) Eye screw, 12 gauge wire

F. Mulch:
1. Shredded Wood Mulch shall be a minimum 3 inch layer in all vine planter areas.
2. Type: "Forest Floor ½ inch – 1 ½ inch. The mulch shall consist only of moist, fibrous, woody redwood bark mixture of varied particle size such that: Physical Properties: Particle Size ½ inch- 1 ½ inch only

PART 3 - EXECUTION

3.1 Examination

A. Inspect vines for injury, insect infestation and vines for improper pruning. Planting areas shall be free of concrete waste, asphalt, aggregate or other construction materials prior to start of installation.

B. Do not begin planting of vines until deficiencies are corrected or plants replaced.

C. Site Visits:
1. Site visits for review and inspection of work shall be scheduled with the Owner's Authorized Representative / Project Engineer, and shall include, but not be limited to the following times:
    a. Review of completed grading, irrigation and planting.
    b. Review at the completion of the maintenance period.
    c. Review at the completion of the warranty period.

3.2 Preparation

A. Class A Top Soil Preparation:

1. If live weeds exist on site, strip and remove and replace top 1" of soil.
2. After approximate finished grades have been established, soil shall be conditioned and fertilized in the following manner. Soil should be slightly damp, but not muddy during rototilling.

a. Prior to amending, the surface soil shall be cross ripped to a minimum nine (9) inch depth.

b. The following shall be used **for <u>bidding purposes only</u>.** The Contractor shall follow the soil report recommendations for preparing Class A topsoil for planter and backfill soil use.

c. Uniformly broadcast and blend to a six (6) inch depth:

1) Organic amendment - 6 cu. yds.

2) Planting fertilizer - 15 lbs.

3) Agricultural gypsum - 200 lbs.

4) Soil sulfur - 20 lbs.

5) Urea formaldehyde - 8 lbs.

3. At time of planting, the top two inches of all areas to be planted shall be free of stones, stumps, earth clods, or other deleterious matter 1" in diameter or larger, and shall be free from all plastic, wire, plaster, obvious foreign matter or similar objects that would be a hindrance to planting or maintenance. The top 12" of soil shall be free of all stones, stumps or other deleterious matter 3" in diameter or larger.

B. Final Grades:

1. Bring soil to grades as indicated on drawings, importing soils as necessary and anticipating the installation of soil amenders and settling and/or compaction.

2. Finish grading shall insure proper drainage of the site as determined by the Owner's Authorized Representative / Project Engineer.

   All areas shall be graded so that the final grades will be 1-1/2" below adjacent paved areas.

   Surface drainage shall be away from all building foundations.

3. Eliminate all erosion scars prior to commencing maintenance period.

4. Compact all soil in planting areas to final grades: min. 65%, max. 75%, unless otherwise required by soils report or direction from The Owner's Authorized Representative / Project Engineer.

C. Disposal of Excess Soil: Dispose of any unacceptable or excess soil at an off-site location approved by the Owner's Authorized Representative / Project Engineer.

3.3 <u>Installation of Planting</u>

A. General:

1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice.

2. Only as many plants as can be planted on that same day shall be distributed in a planting area. All plants shall be watered within 2 hours of planting.

3. Containers shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and

watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Pre-Plant Weed Control:

1. After soil preparation, irrigate and fertilize all planting areas for approximately 7-14 calendar days to achieve weed germination.
2. If live weeds exist on site after irrigating and at the beginning of work, spray with a non-selective systemic contact herbicide, as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill.
3. Clear and remove all weeds by grubbing off all plant parts at least 1/4" below the surface of the soil to be planted.
4. Repeat process as necessary, or as directed by the Owner's Authorized Representative / Project Engineer.
5. Do not plant until herbicide manufacturer indicates planting will not be affected by herbicide residue.
6. Maintain site weed-free at all times. Degree of acceptability shall be solely determined by Owner's Authorized Representative / Project Engineer.

C. Lay-Out of Plantings: Locations for vines shall be as seen on Contract drawings. If underground construction or utility lines are encountered in the excavation of planting areas, other locations for planting will be selected as approved by the Owner's Authorized Representative / Project Engineer.

D. Planting of Vines:

1. Excavate planting pits at twice the diameter of rootball with roughened surfaces and one and one half times the depth.
2. The top of the plant rootball should be slightly above final grade, approximately three inch (1") for vines.
3. Uniformly blend amended soil mixture to create a class A topsoil blend, per soils report recommendations.
4. Place slow release fertilizer tablets in the upper twelve (12) inches of backfill at manufacturers recommended rates on all vines.
5. Construct a two (2") inch plant basin / water berm around each vine rootball per detail.
6. Install a 3" layer of bark mulch in all planting basins.
7. Cover the rootball with wood mulch. Keep mulch 3" away from vine trunk.
8. Excess soil generated from the planting holes and not used as backfill or in establishing the final grades shall be removed from the site.
9. Protect all areas from excessive compaction when trucking plants or other material to the planting site. Cross rip all compacted areas to a 9 inch minimum depth.
10. Center plant in pit or trench.
11. Face plants with fullest growth into prevailing wind or as directed by The Owner's Authorized Representative / Project Engineer.
12. Set plant plumb and hold rigidly in position until soil has been placed firmly around ball or roots.

13. All plants which settle deeper than the surrounding grade shall be raised to the correct level.

14. Pruning: Pruning shall be limited to the minimum necessary to remove injured twigs and branches. Pruning may not be done prior to delivery of plants.

15. Tie vines per Contract document detail vines on to wall. During plant establishment before maintenance begins, as the vines grow and lengthen continue to train vine on to wall.

E. Watering:

1. Immediately after planting, apply water to each vine by means of a hose.

2. Apply water in sufficient quantities, and as often as seasonal conditions require, to keep the plants healthy at all times. Exercise care to prevent over-watering, flooding or excessive runoff.

3. During the plant establishment period, which can last up to 60 days preceding planting, when planting is acclimating to the project sites climate water, all plantings that cannot be watered efficiently with the water system, or the new Irrigation system controller is not on-line and fully functioning at the time planting operations begin or complete the Contractor shall provide sufficient water to all vines to maintain the health and vigor during the plant establishment period by means of a hose or other potable water source.

F. Weeding

1. Do not apply any post-emergent herbicides for at least 30 days after planting. Refer to the manufacturer recommendations for use on the product.

2. Pull weeds by hand that are located close to vine planting.

3.4 Cleaning-up

A. Leave the site area broom-clean daily leaving the premises in a clean condition. All walks shall be left in a clean and safe condition.
After all planting operations have been completed; remove all trash, excess soil, empty plant containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. Pick up all trash resulting from this work no less frequently than each Friday before leaving the site or the last working day of each week. All trash shall be removed completely from the site.

3.5 Schedules

A. When observations are conducted by someone other than The Owner's Authorized Representative / Project Engineer, show evidence in writing of when and by whom these observations were made.

B. No site visits shall commence without all items herein completed, unless such compliance has been waived by The Owner's Authorized Representative / Project Engineer. Failure to accomplish punch list tasks or prepare adequately for final observations shall make the Contractor responsible for reimbursing The Owner's Authorized Representative / Project Engineer at his current billing rates per hour (plus transportation costs). No further observations shall be scheduled until this charge has been paid and received.

END OF SECTION

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SECTION 32 97 00
LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.1 Description

A. Furnish all labor, material, equipment and services required to maintain the landscape in an attractive condition as specified herein for a period of ninety (90) calendar days.

1.2 Related work

A. Section 32 84 00: Irrigation Systems
B. Section 32 90 00: Landscape Planting

1.3 Quality Assurance

A. Work Force: The Contractor's representative shall be experienced and knowledgeable in landscape maintenance.

1. The field set of “As-Built” drawings shall be available for review at the beginning of maintenance site walk.
2. Prior to date of the final walk-through, produce the final record from the job record set of all changes made to all plans during construction, label said prints "As-Builts" and deliver to Owner’s Authorized Representative or Project Engineer and as required to any Local Agency.
3. All turnover items noted in other specification sections shall be delivered prior to the final walk-through.
4. Supply a monthly record of all herbicides, insecticides, fertilizers, and disease control chemicals with rates and amounts used noted.
5. Soils Report may adjust fertilizer rates and frequencies as noted herein.

PART 2 - PRODUCTS

2.1 Materials

A. All materials used shall either comply with the Landscape Planting Specifications or shall otherwise be acceptable to Owner’s Authorized Representative or Project Engineer.

B. On-grade Maintenance Fertilizer shall consist of the following percentages by weight and shall be mixed by a commercial fertilizer supplier unless otherwise directed by Owner’s Authorized Representative or Project Engineer.

Ammonium Nitrate:
34% nitrogen
0% phosphoric acid
0% potash

C. Green nursery tape- for attaching vines to vine ties.

PART 3 - EXECUTION

3.1 Application

A. Vine Care

1. During plant maintenance, as the vines grow and lengthen continue to train vine on to walls using green nursery tape.

    a. Replace dead, dying and missing plants with plants of a size, condition and variety acceptable to Owner's Authorized Representative or Project Engineer at Contractor's expense.

B. Weed Control: Keep basins and areas between plants free of weeds. Use recommended legally approved herbicides. Avoid frequent soil cultivation that destroys shallow roots. Use mulches to help prevent weed seed germination. All shrub and tree beds shall be kept weed-free.

1. Insect and Disease Control: Maintain a reasonable control with approved materials.

2. Fertilize all on-grade planting areas with the following:

    a. At the end of the first 30 calendar days and at 30 calendar day intervals - 5 lb. per 1,000 square feet of on-grade maintenance fertilizer.

    b. After application, irrigate thoroughly.

    c. Avoid applying fertilizer to the root ball and base of main stem: rather, spread evenly under plant to drip line.

C. Irrigation System Care

1. Before the end of maintenance confirm all required information has been programed into the controller and the controller is a fully functioning smart controller.

2. Check all systems weekly for proper operation. Drip lines shall be flushed out after repair of drip system equipment.

3. Provide Owner's Authorized Representative or Project Engineer a key to controllers and written instructions on how to turn off system in case of emergency.

4. Repair all damage to irrigation system at the Contractor's expense. Repairs shall be made within one watering period.

3.2 Schedules

A. All areas shall be kept free of debris and all planted areas shall be weeded and cultivated at intervals of not more than ten (10) calendar days. Watering, trimming, fertilization, spraying and pest control, as may be required, shall be included within the debris/ siltation removal program. All area drains and drain pipes are to remain free of silt and debris.

B. The Contractor shall be responsible for maintaining adequate protection of the area. Damaged areas shall be repaired at the Contractor expense.

C. Between the 15th calendar day and the 20th calendar day of the maintenance period, replace all materials in areas where normal growth is not evident as determined by Owner's Authorized Representative. After the 20th calendar day, all areas not acceptable to Owner's Authorized Representative or Project Engineer shall be replanted to match adjacent plant types.

END OF SECTION

SECTION 33 01 31
TV INSPECTION AND CLEANING OF SEWER PIPELINES

PART 1 - GENERAL

1.1 Work Included

A. Cleaning of sewer lines and maintenance holes to remove wastewater, settleable solids, roots, soil, mineral scale from groundwater infiltrating cracks and leaks, pieces of broken pipe, bricks, grease, and grit, sand, and other debris, to improve flow and facilitate internal video inspection for sewer evaluation.

B. Cleaning shall also include using high-pressure water jet to prepare maintenance hole wall surfaces for protective coating application.

C. Closed-circuit television (CCTV) inspection of sanitary sewer pipe and maintenance holes to locate and document location of lateral connections and obtain quality videos and inspection reports suitable for Owner's Representative to evaluate sewer repair and rehabilitation requirements.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution

1.3 System Description

A. Clean designated sanitary sewers and maintenance holes using mechanical, hydraulically-propelled or high-velocity sewer cleaning equipment. Contractor shall select processes, equipment and procedures, to clean each sewer segment and adjacent maintenance holes.

B. Cleaning shall accomplish:

1. Removal of all blockages impeding flow.

2. Removal of all settleable solids.

3. Removal of all debris.

4. Removal of all grease.

5. Removal of all roots intruding into pipe.

C. Cleaning which does not substantially accomplish the above, as determined by Owner and Owner's Representative, will not be reimbursed.

D. The following definitions shall apply:

1. Normal Cleaning Equipment: Cleaning devices such as rods, metal pigs, porcupines, root saws, snakes, scooters, sewer balls, kites, and other approved equipment in conjunction with hand-winching devices and gas or electric rod-propelled devices. Also, variable-pressure water nozzles (3,000 psi.)

2. Heavy-Duty Mechanical Cleaning Equipment: Buckets, scrapers, chain-knockers, porcupines, heavy-duty brushes, metal pigs, surfactants, and other debris-removing equipment and accessories used in conjunction with approved power winching machines. Also high- to very-high-pressure water nozzles (10,000 psi.)

3. Survey Cleaning and CCTV Inspection: Video inspection by Contractor of existing sanitary sewers to evaluate lines and determine whether conditions exist, which would require line rehabilitation.

4. Pre-Installation CCTV Inspection: Video inspection by Contractor of sewer lines designated for rehabilitation to confirm cleaning, location of service connections and constructability of line rehabilitation according to Contract Documents.

5. Post-Installation CCTV Inspection: Video inspection by Contractor to determine whether rehabilitation of sanitary sewer has been completed according to Contract Documents.

6. CCTV Inspection Report: A form filled out by each CCTV operator for any CCTV inspection effort submitted to Owner's Representative, on form provided by Owner.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section. Use experienced personnel to operate cleaning equipment, cameras, and all other devices.

B. Acceptance of sewer cleaning work is subject to successful completion of video inspection. If video inspection shows solids, sand, grease, grit, or other debris remaining in pipe, cleaning shall be considered unsatisfactory. Repeat cleaning, inspection, and record new video of pipe at no additional cost to Owner until cleaning is accepted by Owner's Representative.

C. Report overflow or spillage of wastewater to Owner's Representative, immediately.

D. Camera shall meet the following requirements:

1. Radial-view solid-state color with remote control of rotational lens.

2. Capable of viewing complete circumference of pipe and manhole structures including cone section or corbel.

3. Auto-iris type camera lens with remote-controlled manual override.

4. Operative in 100% humidity.

5. Remote-controlled lighting intensity adjusted to minimize reflective glare.

6. Capable of providing in-focus picture of entire pipe periphery indluding lateral connections for all conditions encountered except submergence.

E. Digital video shall meet the following requirements:

1. ISO-MPEG Level 1 coding.

2. Clear, focused and stable image free of electrical interference.

3. Resolution of at least 352 pixels x 240 pixels.

4. Encoded frame rate of 29.97 frames per second.

5. Include both audio and color visual information accurately reproducing inspected pipe conditions of interest around entire pipe periphery.

6. Deliver to Owner on digital storage media acceptable to Owner.

1.5 References

A. California Plumbing Code (CPC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Operation Instructions	Required per operation and maintenance instruction requirements
	Submit equipment Manufacturer's operational manuals and guidelines to Owner's Representative for review. Contractor shall strictly follow such instructions, unless otherwise directed by Owner's Representative.
Videos and Video Inspection Reports	Submit DVDs of quality sufficient for Owner's Representative to evaluate condition of sanitary sewers, locate sewer service connections, and verify quality of Contractor's Work. If Owner's Representative informs Contractor video quality is insufficient, re-video pipe segment and provide new DVD and report at no additional cost to Owner. Camera distortion, inadequate lighting, inadequate ventilation (foggy), inaccurate or confusing digital counter readings of distances during an inspected sewer length, dirty lens and blurred or hazy pictures will be causes for rejection of inspection videos and Work on associated line segment.
	Videos submitted shall become Owner's property.

B. Refer to Section 01 33 00 for definition of requirements for O&M instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

PART 3 - EXECUTION

3.1 Preparation

A. Install rollers or guides to prevent damage to pipe from cleaning equipment.

B. Cleaning devices shall be properly sized for pipe diameter being cleaned.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. The following standards shall be followed:

1. Applicable OSHA and Cal OSHA regulations

C. Before cleaning pipe, verify location of active laterals using smoke and dye testing or other Owner-accepted method.

D. Cleaning shall continue until pipe is deemed sufficiently cleaned.

E. After cleaning, thoroughly flush pipe with clean water to remove remaining debris.

F. Remove remaining water with plunger and winch, followed with swabbing process using foam swabs and compressed air to propel them.

G. Dispose of cleaning water as required by law.

END OF SECTION

SECTION 33 01 39
PVC LINING FOR INTERIOR CONCRETE SURFACES (RIB-LOCK)

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of PVC lining for interior concrete surfaces such as, manholes, and wet wells.

B. Integral locking PVC manhole and structure lining systems shall be constructed by temporarily erecting form inside existing manhole or structure and filling annular space between erected form and existing manhole or structure wall with concrete or other accepted materials resulting in new PVC lined monolithic manhole within old one.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 02 05 00: Basic Civil Engineering Requirements
H. Section 03 30 00: Cast-in-Place Concrete
I. Section 33 39 13: Pre-Cast Manholes
J. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete functional PVC liner including appurtenant structural and/or mechanical mountings or connections required to comply with Manufacturer's installation requirements and applicable building codes and standards.

B. Liner shall provide corrosion-protective barrier embedded to inside wall of structure and conforming to its shape.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Liner Materials	Chemical Resistance	SSPWC Section 211-2	1 each product	Contractor	Contractor
	Pull Test for Locking Extensions	Resist 100 pli applied perpendicular to concrete surface for 1 minute at 70°F to 80°F	1 each product	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Liner Materials (cont.)	Physical Properties Flexible PVC Liner	SSPWC Table 210-2.4.1(A) or paragraph 2.2 below, whichever is stricter	1 each product	Contractor	Contractor
	Physical Properties Rigid PVC Liner	SSPWC Table 210-2.5.1(A) or paragraph 2.2 below, whichever is stricter	1 each product	Contractor	Contractor
	Shop Welded Joint Tensile Strength	2000 psi measured per ASTM D214 using Die B at 77°F±5°F and using measured minimum dimensions of reduced section	1 each procedure (test weld)	Contractor	Contractor
	Pinholes	Spark Test set for 15,000 to 20,000V	All liner	Contractor	Contractor

1.5 References

A. ASTM D256 Izod Pendulum Impact Resistance of Plastics
B. ASTM D412 Tensile Strength Properties of Rubber and Elastomers
C. ASTM D638 Tensile Properties of Plastics
D. ASTM D648 Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
E. ASTM D790 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
F. ASTM D2240 Rubber Property—Durometer Hardness
G. ASTM D4226 Impact Resistance of Rigid Poly(Vinyl Chloride) (PVC) Building Products
H. California Building Code (CBC)
I. SSPWC Standard Specifications for Public Works Construction Section 211-2 “Chemical Resistance (Pickle Jar) Test”
J. SSPWC Standard Specifications for Public Works Construction Section 500-2.4 “Inspection, Testing and Repair of Installed Liner Systems”
K. SSPWC Standard Specifications for Public Works Construction Section 500-2.9 Epoxy Mastic and Flexible PVC Liner System

1.6 Submittals

A. Furnish the following submittals with bid or within 72 hours following bid opening. Failure to submit required information on time will cause bid to be considered non-responsive and rejected.

SUBMITTAL	DESCRIPTION
Subcontractor Qualifications	Submit company history stating years in service
	Submit letter from Manufacturer certifying installers and welders are factory-trained and have each completed 3 successful projects in previous 3 years.
	Submit evidence of factory-authorization or licensing by Manufacturer of lining system to install product
	Submit documentation of employees’ cognizance and ability to comply with all Federal and State OSHA regulations regarding confined space entry.

B. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Debris Containment Plan	Submit plan for removing and disposing of all debris from cleaning operations
Shop Drawings	Submit construction details per structural shop drawing requirements including placement drawings, corner and weld details and material lists

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
Certificate of Compliance	Submit lining system and application certification per certificate of compliance requirements.
	Submit certification or letter from Manufacturer stating all repair, patching, priming, and relining materials are compatible.
	Submit documentation of materials passing chemical resistance (pickle jar) test described in SSPWC Standard Specifications for Public Works Construction Section 211-2.
Warranty	Furnish 3-year warranty from date of final acceptance

C. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of PVC lined or lining materials shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
PVC Lining for New Interior Concrete Surfaces	A-Lok "Duraplate 100" Lining System	Tullytown, PA
	National Oilwell Varco (formerly Ameron Protective Linings Division) "Amer-Plate T-Lock"	Houston, TX
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed / pumped / stored:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Lining system shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Portland Cement Concrete	Class A2 "Premium Non-Structural" Concrete Greenbook 600-C-2500	See Section 03 30 00
Epoxy Mastic Primer on Existing Concrete Surfaces	100% Epoxy	Two-part coating applied to prepared concrete substrate to fill voids, bond with concrete and provide anchorage for PVC liner system.
PVC Liner, Welding Strips and Accessories	Polyvinyl Chloride Resin	99% by weight
Locking Extensions	Polyvinyl Chloride Resin	Integrally bonded, molded or extruded with sheets
Coating Where PVC Lining not Feasible	Elastomeric Polyurethane	100% solids

D. The following product design criteria, options and accessories are required for PVC linings for new concrete surfaces:

ITEM	DESCRIPTION	
PVC Liner Sheets	Minimum Thickness	0.065"
Locking Extensions	Minimum Height	0.375"
	Minimum Web Thickness	0.085"
	Spacing	2½"±¼"
	Quantity	Minimum 1 locking extension embedded in each continuous surface less than 4 inches wide Minimum 2 locking extensions embedded in surfaces 4 inch wide or greater If locking extensions cannot be provided bond material in place.
Flexible Plastic Liner Sheets (Tested at 77°F±5°F) After Pickle Jar Exposure	Tensile Strength (ASTM D412)	2100 psi minimum
	Elongation at Break (ASTM D412)	200% minimum
	Shore Durometer Type D Hardness	1-sec 50-60 10-sec 35-50
	Weight Change	±1.5% with respect to initial test before pickle jar exposure
Rigid PVC Liner Sheets (Tested Before Pickle Jar Exposure Unless Otherwise Noted)	Tensile Strength (ASTM D638)	6500 psi minimum before pickle jar exposure 5200 psi minimum after pickle jar exposure
	Tensile Modulus (ASTM D638)	408,000 psi minimum
	Elongation at Break (ASTM D638)	25% minimum
	Hardness, Shore Durometer Type D (ASTM D2240)	Instantaneous 70
	Flexural Strength (ASTM D790)	13,000 psi
	Flexural Modulus ASTM D790	455,000 psi
	Heat Deflection (ASTM D648)	160°F at 264 psi
	Izod Impact (ASTM D256)	1.2 ft-lbs/inch of notch
	Variable Height Impact Test (ASTM D4226)	See SSPWC Table 210-2.5.1
	Weight Change	±1.5% with respect to initial test before pickle jar exposure
Joint Strip	Minimum Thickness	0.075"
	Width	4"±¼"
	Edges	Bevel edges before application
Weld Strip	Minimum Thickness	0.094"
	Width	1"±⅛"
	Edges	Bevel edges at time of manufacture

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install PVC liners before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

C. Before using product, investigate its compatibility with surfaces, fillers and joints sealants.

D. Use only compatible materials.

E. Implement sewage bypassing as necessary. Flow control shall be Contractor's responsibility.

F. Furnish and install any necessary temporary debris containment devices while maintaining sewage flow.

G. Concrete preparation and installation of coating shall be performed under supervision of factory-authorized Manufacturer's representative.

H. Clean surface to be lined as follows:

1. Inspect host structure for damage and leaks.

2. Remove any protrusions on host structure surface that might interfere with installing lining system.

    a. Grind anchor bolts, pull rings and lifting eyebolts that are damaged or scheduled for removal down to ½" below surface and patch flush.

    b. Promptly repair any damage to manhole structure caused by removal of protrusions, using methods acceptable to Owner and Manufacturer.

3. Clean cracked or soft areas with wire brush.

4. If reinforcing steel is exposed, remove rust particles on steel through thorough cleaning. Allow Owner's Representative to inspect rebar and accept it as clean. Then immediately coat bare steel with protective coating recommended by Manufacturer of manhole lining system.

5. Report any leaks or damage to Owner's Representative.

6. Clean all surfaces to be rehabilitated using one of the following methods:

    a. Water blast concrete interior surface to remove deteriorated concrete, oil, grease, or existing coating and provide clean, contaminate-free, roughened and sound surface. Water blast equipment shall use of a minimum nozzle pressure of 5,000 psi and shall not use detergent or other chemical cleaning solvents. Nozzle output shall be at least 20 gpm. Prior to use of hydroblasting equipment, demonstrate to Owner's Representative specified pressure can be sustained at specified flowrate. Equipment for hydroblasting shall include water tank, auxiliary engine, pumps, nozzle pressure gauge, and hydraulically driven hose reel. Take care not to damage concrete structures with high-pressure water. It is expected hydroblasting will slightly alter concrete surface profile to reach a roughened and sound concrete surface, suitable to receive specified lining systems.

    b. Dry-sandblast concrete interior surface to remove deteriorated concrete, oil, grease, or existing coating and provide clean, contaminate-free, roughened and sound surface. Sandblasting equipment shall supply at least 375 cfm of air and dry sand at minimum 80-psig blast nozzle pressure. Blasting material shall be arsenic-free and pass a No. 16-mesh screen. Abrasive blast nozzles shall have minimum ½" diameter and shall be of venturi or other high velocity type. Air compressors shall be equipped with oil separators immediately downstream of compressor discharge valves and at discharge of blast pot discharges. Prior to use of sandblasting equipment, demonstrate to Owner's Representative specified pressure can be sustained at specified flowrate. Provide ventilation for airborne particulate evacuations to meet all pertinent safety standards and to optimize visibility for both blast cleaning and inspection of substrate during surface preparation work. Brush surface, after dry sandblasting, with clean hair-, bristle- or fiber-brushes. Then blown off with compressed air free of detrimental oil and water, or vacuum to remove trace blast products and abrasives from surface, including pockets and corners. Then wash down surface to remove all dust particles.

    c. Wet-sandblast concrete interior surface to remove deteriorated concrete, oil, grease, or existing coating and provide clean, contaminate-free, roughened and sound surface. Use clean, fresh water in combination with blasting material at minimum of 80-psig nozzle pressure. Blasting material should have maximum particle size no larger than that passing a No.16-mesh screen and shall be arsenic-free. Abrasive blast shall remove all loose materials and open up surface defects. Clean surface, after wet-abrasive blast, by rinsing with fresh water. Supplement cleaning by brushing, if needed to remove any residue. Then wash down surface to remove all dust particles.

    d. Another method recommended by Manufacturer and documented in installation instructions.

    e. Another method submitted to and accepted by Owner's Representative.

    f. For manholes or structures less than one year old Owner's Representative may or partially waive cleaning requirements if manhole or structure is in good condition.

7. Choice of surface preparation method is left to Contractor's discretion, provided prepared surface meets specified condition. If Contractor-selected method fails to produce necessary preparation level, additional methods or corrective action may be directed by Manufacturer or Owner's Representative.

8. Protect host structure from damage by cleaning equipment, pressure and air pressure.

9. Remove and dispose of all debris collected from cleaning operations. Do not allow debris to enter sewer system.

I. Interior surface preparation of concrete surfaces shall proceed as follows:

1. After cleaning and before concrete repair, eliminate all active structure infiltration prior to liner application. Infiltration control will be treated as extra work. Method of stopping these leaks shall be by chemical grout injection as accepted by Owner's Representative and in accordance with NASSCO Specifications, and/or application of hydraulic cement conforming to Section 201-1.2 of Greenbook. For manholes less than one year old, skip this procedure.

2. Air-placed concrete gunite application shall conform to Section 303-2 of Greenbook. Before guniting, insert containment devices accepted by Owner's Representative into manholes as needed to prevent rebound (nonadhering gunite) from entering sewer. Apply gunite to a thickness (minimum one-inch thickness) which will restore original manhole surface. Apply gunite in minimum ½-inch continuous lifts. After guniting, remove containment devices and reinstall manhole cover to provide moist curing environment. Allow gunite to cure 24 hours prior to lining application. For manholes less than one year old, skip this procedure.

3. Prior to installation, repair all irregularities, voids, and deteriorated surfaces to uniform surface using rapid setting repair mortar compatible with lining system.

4. Manufacturer's factory-authorized representative shall field-inspect concrete surface prior to primer coating and provide written statement concrete surface has been prepared properly and is ready for primer coat.

J. After cleaning, confirm inside minimum and maximum size (diameter and/or configuration) of manhole.

K. Do not perform Work involving wet application of protective lining concurrently with or adjacent to sandblasting and water blasting operations. Contamination of surfaces by any means will require clean-up and reapplication to satisfaction of Owner's Representative at no expense to Owner.

L. Acceptably cleaned and prepared surfaces shall be free of laitance, efflorescence, oil, grease, rust and other penetrating contaminants. Surface shall be free of loosely adhering concrete, dirt particles, thin crusts, and bridging voids.

M. Protective lining system shall only be applied to clean sound concrete with adequate profile and porosity to provide strong bond between protective lining system and substrate. Maximum surface profile amplitude allowed when a 3-yard straightedge is contacted on surface in any direction shall be ½". Repair surface profiles deeper than ½" per Section 03 30 00 using patching compound compatible with lining system.

N. Apply mastic or adhesive base for installing liner plate over existing concrete as follows:

1. Etch concrete by sandblasting to develop slightly granular surface.

2. When permitted by Owner's Representative, concrete surface may be acid-etched and neutralized in lieu of sandblasting.

3. After sandblasting, thoroughly clean sandblasted surface of dust. Wash acid-etched surfaces with clean water and allow to completely dry.

4. Apply primer, adhesive and mastic in accordance with Manufacturer's application instructions.

O. Apply non-skid surfaces to PVC lining surfaces as follows:

1. Clean and dry liner surface.

2. Spray with adhesive coating recommended by PVC liner plate.

3. Immediately after applying adhesive, sprinkle clean dry sand passing a Number 30 sieve but retained on a Number 70 sieve.

4. Allow sanded surface to dry.

5. Brush away excess sand.

6. Apply seal coat of adhesive coating over sand in sufficient quantity to coat and bond sand to liner plate.

7. Allow coated sand surface to dry before handling.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install PVC linings at locations shown on Plans and submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Other applicable building code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install PVC linings to tolerances recommended by Manufacturer. Unless otherwise shown, install PVC linings true, plumb and level using precision gauges and levels.

F. Install PVC linings to new concrete surfaces as follows:

1. Line all interior surfaces of concrete manholes or wet wells.

2. Locking extensions shall be run vertical.

3. Lining shall be secured in place against inner forms.

4. Locking extensions shall terminate not more than 1½ inches from end of inside surface of pipe section. Joint flaps, when used, shall extend roughly 4 inches beyond end of inside surface.

5. Concrete placed against inside lining shall be vibrated, spaded or compacted in careful; manner so as to protect lining and produce dense homogeneous concrete securely anchoring locking extensions into concrete.

6. In removing forms, protect lining from damage. Do not use sharp instruments to pry forms from lined surfaces. After forms are removed, any remaining nailholes shall be pulled without tearing lining and resulting holes shall be clearly marked.

7. Patch all nail and tie holes, as well as cut, torn and seriously abraded areas in lining. Patch with welding strip and fuse to liner cover over entire patch area. Larger patched areas may consist of smooth liner sheet applied over damaged area with adhesive. Cover all edges with welding strip fused to patch and sound lining adjoining damaged area.

8. Do not apply hot joint compounds such as coal tar to lining.

9. Repair any damage to installed lining from Contractor's operations.

G. Apply PVC linings to new concrete manhole sections as follows:

1. Upon assembly of precast sections and vacuum testing, mortar and finish joints.

2. Welded PVC liner seams at joints shall then be welded.

3. Secure PVC liner by insertion between uppermost grade ring and manhole cover.

H. Field weld liner sections as follows:

1. Use maximum size plastic liner sheet practical to minimize seams.

2. Liner may be heated to facilitate turning corners but excessive heating of liner shall be avoided.

3. Corner strips may be used at inside and outside corners, or liner may be wrapped around corners.

4. Provide ventilation for all welding operations.

5. Fusion weld welding strips using welders accepted by Owner's Representative.

6. Hot air welding tools shall provide clean effluent air at constant pressure to surfaces to be welded within a temperature range of 500°F and 600°F

7. Overlap vertical and horizontal seams at least ½-inch. Weld with 1-inch strips.

8. Construct Type AL-2 welded field joints of dimensions described above except where other methods are accepted in writing by Owner's Representative.

9. For lap welds, offset welding strip so ⅓ of width is placed on high side of lap and properly fused. A small gap in fusion not to exceed ⅛-inch in width is acceptable at lap.

10. For butt welds, center welding strip over cleaned surfaces to be joined and fuse across its entire width. Incomplete fusion, charred or blistered welds will be rejected.

11. Use only methods and techniques of dimensions shown above and accepted by Owner's Representative. Welding operation on any joint shall be continuous until joint has been completed.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
PVC Linings	Manufacturer's Inspection of Interior Surface Preparation	Visual inspection of manhole surface by Manufacturer's factory-authorized representative before receiving mastic coat	1 inspection	Contractor	Contractor
	Owner's Representative's Inspection of Interior Surface Preparation	Visual inspection of manhole surface before receiving finish coat. Provide safe access for inspection and notify Owner's Representative 2 days in advance of inspection.	1 inspection	Owner	Owner
	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Pull Test of Field Welds	Field welds shall withstand pull test of at least 100 lbs per liner inch applied perpendicularly to concrete surface for one minute, without evidence of cracks or separations. Conduct test at 70-80°F.	1 test of first 100 feet of weld for each welder on project	Contractor	Contractor
	Holiday Test (Spark Test)	Spark test witnessed by Owner's Representative upon completion of lining installation and visual inspection. Use Tinker & Rasor Model AP-W high voltage holiday detector or equivalent specified by coating Manufacturer. Set at 15,000V or 100V per mil of lining thickness, whichever is greater. Mark identified holidays without contaminating lining surface. Repair all imperfections found with materials-in-kind and repeat test until no holidays are found	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Field weld tests and holiday tests shall be accomplished by independent laboratory recommended by Manufacturer. Tester shall place initials and date of test on each surface tested or adjacent to each weld tested.

C. Provide services of factory-authorized representative on-site to provide:

1. Installation assistance and inspection of complete PVC lining system, including site visits at beginning, middle and end of installation process.

2. Observation of field testing and repair.

END OF SECTION

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SECTION 33 05 16
PRECAST CONCRETE UTILITY STRUCTURES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of precast concrete vaults.

B. Precast concrete manholes are covered in Section 33 39 13.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 03 20 00: Concrete Reinforcing
I. Section 03 30 00: Cast-in-Place Concrete
J. Section 03 60 00: Grouting
K. Section 07 72 33: Roof and Floor Hatches
L. Section 07 92 00: Joint Sealants
M. Section 31 23 00: Excavation and Fill
N. Section 33 39 13: Precast Concrete Manholes

1.3 System Description

A. Furnish and install complete precast concrete vault including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

B. Precast concrete vault dimensions shown on Plans are interior dimensions.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Concrete Vault	Concrete Strength	ASTM C31	Submit certified test record on request	Contractor	Contractor

1.5 References

A. ASCE 7 Building Code Requirements for Minimum Design Loads in Buildings and Other Structures

B. ASTM A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C. ASTM C31 Making and Curing Concrete Test Specimens in the Field
D. ASTM C150 Portland Cement
E. ASTM C913 Precast Concrete Water and Wastewater Structures
F. ASTM D1557 Laboratory Compaction Characteristics of Soil Using Modified Effort
G. California Building Code (CBC)
H. CRSI Manual of Standard Practice

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per structural shop drawing requirements
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements
Engineering Calculations	Required for rebar for vaults over 10' deep or with lateral footing loads per engineering calculations requirements sealed by licensed California Civil Engineer. Required to justify designs less than Class 700 specified.
	Required for concrete mix design per engineering calculations requirements sealed by licensed California Civil Engineer.
Test Record Transcripts	Submit for factory tests per test record transcript requirements
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, engineering calculations, and test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of precast concrete vaults shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
	Eisel Enterprises, Inc.	Placentia, CA
	Jensen Precast	Sparks, NV
	J &.R Concrete Products	Perris, CA
	Oldcastle Precast (formerly Utility Vault)	Fontana, CA (800) 626-3860
	Accepted Equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Precast concrete vaults shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Vault	Portland Cement Concrete	See Section 03 30 00 Fly ash not permitted
Steel Reinforcing	Steel	See Section 03 20 00
Hatches, Lids, Frames	Metals	See Section 07 72 33
Joint Sealant	Grout	See Section 03 60 00
	Mortar	One part Portland cement to two parts well-graded sand passing No. 8 sieve per Section 03 30 00.
	Plastic Sealing Compound	See Section 07 92 00

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Pre-Cast Concrete Vault Sections	Design Surcharge and Lateral Earth Pressure	AASHTO H-20 Loading
	Minimum 28-day Compressive Strength f'_c	4000 psi
	Steel Reinforcing Yield Strength f_y	60 ksi
Rectangular Box Wall Design	Wall Design	Class 700, or submit sealed engineering calculations justifying a lesser design.
	Roof Design	Design for H-20 with H-20 surcharge and lateral earth load
	Dimensions	per ASTM C913 Table X1.1
	Reinforcement	per ASTM C913 Table X1.2

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install precast concrete vaults before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Refer to Section 31 23 00 for open trench requirements.

C. Furnish and install precast concrete vaults at locations shown on Plans and submittals.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building code requirements

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. Install precast concrete vaults to tolerances recommended by Manufacturer. Unless otherwise shown, install precast concrete vaults true, plumb, and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Precast Concrete Vaults	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed Literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 05 26
UTILITY IDENTIFICATION

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of buried utility identification systems including markers, warning tape, and trace wires.

B. Above-ground piping, ducts, and conduit utilities shall be identified in accordance with Section 01 73 33.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 01 73 33: Mechanical Identification
I. Section 09 90 00: Painting and Coating
J. Section 26 05 00: Common Work Results for Electrical
K. Section 26 05 53: Identification for Electrical Systems
L. Section 33 71 73: Electrical Utility Services

1.3 System Description

A. Furnish and install complete utility identification products including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building, fire, electrical, plumbing, and mechanical codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Fire Code (CFC)
B. California Mechanical Code (CMC)
C. California Plumbing Code (CPC)
D. NFPA 70 National Electric Code (NEC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
Material Samples	Required
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of utility identification products shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Detectable Warning Tape for Installation within 12" of Surface	Calpico, Inc. "Type II"	South San Francisco, CA
	T Christy Enterprises (714) 507-3300	Anaheim, CA
	Terra Tape Division Reef Industries	Houston, TX
	Accepted equal	
Nondetectable Warning Tape	Calpico, Inc. "Type I"	South San Francisco, CA
	T Christy Enterprises (714) 507-3300	Anaheim, CA
	Terra Tape Division Reef Industries	Houston, TX
	Accepted equal	
Tracer Wire	Copperhead Industries #10CCS High-Strength 600# Break Load	Addington, OK
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Utllity identification products shall identify:

FLUID
Potable Water
Wastewater
OTHER
Electrical Conduit
Telephone Lines
Fiber-optic and Communication Lines
Other Utilities

C. Utility identification products shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Identification Tape	Polyethylene	
Locator Tape	Polyethylene	
Warning Tape	Polyethylene	

D. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Identification Tape	Type	Nondetectable
	Width	6”
	Thickness	4 mils minimum
	Imprint	See Pipe or Utility Specifications
	Location	Attach to pipe
Warning and Locator Tape	Type	Detectable metallic-strip locator tape that can be registered by magnetic field locating device (for plastic pipe and conduit) / Nondetectable for metallic pipe and conduit
	Width	6”
	Thickness	4 mils minimum
	Imprint	See Pipe or Utility Specifications
	Location	18” above pipe

PART 3 - EXECUTION

3.1 Preparation

A. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

3.2 Installation

A. Refer to Section 01 73 00 and 01 73 33 for basic execution and installation requirements.

B. Furnish and install utility identification products at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer’s installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. Other applicable fire, plumbing, mechanical and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner’s Representative.

E. Install utility identification products to tolerances recommended by Manufacturer.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Utility Identification Products	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner

END OF SECTION

SECTION 33 05 31
PIPING JOINT MATERIALS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of piping joint materials including bolts, nuts, washers, flange gaskets, and preparation for pipe welding.

B. Bolts and nuts for flanges, grooved or shouldered couplings, sleeve type couplings and flange coupling adaptors and harnesses shall use materials specified herein.

C. Where dissimilar metals are in contact, flange insulating kits and threaded insulating bushings are required and included in Section 33 05 32.

D. Joint materials for bell and spigot joints and adhesive or solvent-weld joints are covered in applicable sections for pipe material being joined.

E. For pipelines buried in soils containing organic solvents or petroleum products use gaskets and elastomers compatible with soil chemistry.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 13 05 32: Flange Insulating Kits and Threaded Insulating Bushings
I. Section 33 05 33: Couplings, Tie Rods, Flange Connectors, and Unions
J. Section 33 11 19: Mastic and Tape-Wrap Systems for Ferrous Pipe

1.3 System Description

A. Furnish and install bolts, nuts, washers and flange gaskets where required, including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable codes and standards.

1.4 References

A. ASME/ANSI B1.1 Unified Screw Threads
B. ASME/ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings – Class 25, 125, 150 and 800
C. ASME/ANSI B16. 4 Cast Iron Threaded Fittings
D. ASME/ANSI B16.21 Non Metallic Flat Gaskets for Pipe Flanges
E. ASME/ANSI B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings
F. ASME/ANSI B16.42 Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300
G. ASME/ANSI B18.2.1 Square and Hex Bolts and Screws (Inch Series)
H. ASME/ANSI B18.2.2 Square and Hex Nuts (Inch Series)
I. ASME/ANSI B1.20.1 (ANSI B2.1) Pipe Threads – NPT National Pipe Thread Taper
J. ASME/ANSI B31.3 Process Piping

K. ASTM A193 Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
L. ASTM A194 Carbon and Alloy Steel Nuts for High Pressure and High Temperature Service
M. ASTM A307 Carbon Steel Bolts and Studs, 60,000-psi Tensile Strength
N. ASTM A563 Carbon and Alloy Steel Nuts
O. ASTM B98 Copper-Silicon Alloy Rod, Bar and Shapes
P. ASTM F467 Nonferrous Nuts for General Use
Q. ASTM F468 Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
R. ASTM F593 Stainless Steel Bolts, Hex Cap Screws, and Studs
S. ASTM F594 Stainless Steel Nuts
T. AWWA C111 Rubber Gasket Joints for Ductile Iron Pressure Pipe
U. AWWA C115/ANSI A21.15 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
V. AWWA C209 Cold-Applied Tape Coatings for Exterior of Special Sections, Connections and Fittings for Steel Water Pipelines.
W. AWWA C217 Petrolatum and Petroleum Wax Tape Coatings for Exterior of Connections and Fittings for Steel Pipelines

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.

B. Refer to Section 01 33 00 for definition of requirements for catalog data.

1.6 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of bolts, nuts, washers and flange gaskets shall be strictly followed.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 – PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Anti-Seize Compound for Stainless Steel Bolts and Nuts	Bostik Never Seez	
	Henkel North America “”N5000 Loctite”	Irvine, CA
	Husk-It Husky Lube O-Seal	
	Permatex	
	Ramco Antiseize	Huntington Beach, CA
	Ramco TRX-Synlube	Huntington Beach, CA
	T Christy Enterprises “Antiseize” (714) 507-3300	Anaheim, CA
	Accepted Equal	

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Bolts and Nuts	Industrial Threaded Products, Inc.	Brea, CA
	Ocean State Stainless, Inc.	Huntington Beach, CA
	Pacific Coast Bolt	Santa Fe Springs, CA
	Tripac Fasteners Style 2000	Corona, CA
	Western Pacific Products	Corona, CA
	Accepted Equal	
NSF 61-Listed Flange Gaskets	Bluegard Div. Garlock, Inc. Style 98206	Palmyra, NY
	PSI (Pipeline Seal and Insulator, Inc.) "Linebacker 61"	Houston, TX
	U.S. Pipe and Foundry "Flange-Tyte"	Birmingham, AL
	Accepted equal	
Flange Gaskets – Cloth-Inserted	Bluegard Div. Garlock, / Inc. Style 5000	Palmyra, NY
	Buffalo Rubber Matting LLC	Buffalo, NY
	John Crane (Cranite)	Cerritos, CA
	Johns Manville 60	
	Richard Klinger C4400	Sidney, OH
	Tripac Style 5000	Corona, CA
	Western Pacific Products	Corona, CA
	Accepted equal	
Flange Gaskets – Neoprene	Bluegard Div. Garlock, Inc. Style 2000	Palmyra, NY
	Buffalo Rubber Matting LLC	Buffalo, NY
	John Crane (Cranite)	Cerritos, CA
	Johns Manville 60	
	Richard Klinger C4400	Sidney, OH
	Tripac Style 2000	Corona, CA
	Western Pacific Products	Corona, CA
	Accepted equal	

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Unless otherwise specified, bolts, nuts and washers for pipe assembly below ground shall meet the following requirements.

ITEM	MATERIAL	SPECIFICATION
Bolts for Underground Ferrous Installations (Buried or in Underground Structures)	SAE Type 316 Stainless Steel	ASTM A193 B8M T-316 Heavy hexagon series ANSI B1.1 Class 2A fit ¼" to ½" shall project through tightened nut Threading per ANSI/ASME B18.2.1 Bolt-Head Identification Mark – "B8M"
Nuts for Underground Ferrous Installations (Buried or in Underground Structures)	PTFE-Coated SAE Type 316 Stainless Steel	ASTM A194 8M-T316 Heavy hexagon series ANSI B1.1 Class 2B fit ¼" to ½" shall project through tightened nut Threading per ANSI/ASME B18.2.2
Mechanical Joint T-Head Bolts	"Cor-Ten" Steel	Minimum 45-ksi yield strength T-head dimensions per AWWA C111 ANSI B1.1 Class 2A fit Coarse thread series
Mechanical Joint T-Head	"Cor-Ten" Steel	ANSI B1.1 Class 2B fit

ITEM	MATERIAL	SPECIFICATION
Mating Nuts		Heavy hexagon series
Coating System for New Stainless Steel Bolts and Washers on Flanges	Not required	
Coating for New Stainless Steel Nuts on Flanges	Nickel-phosphate Undercoating plus Blue Teflon or Xylan Fluoropolymer Coating	PTFE, Fluorokote #1, Xylan 1424 or Equal Fluoropolymer Coating Dry film thickness of 1.0-1.2 mils
Coating for New Non-Stainless Steel Bolts, Nuts, and Washers on Flanges	Nickel-phosphate Undercoating plus Blue Teflon or Xylan Fluoropolymer Coating	PTFE, Fluorokote #1, Xylan 1424 or Equal Fluoropolymer Coating Dry film thickness of 1.0-1.2 mils
Washers	Washer material shall be same as each bolt.	Provide washer for each nut.
Coating for Buried Nuts and Bolts	Accepted Manufacturer's coating listed above	1.0-1.2-mil MDFT

C. Unless otherwise specified, bolts, nuts and washers for pipe assembly above ground shall meet the following requirements.

ITEM	MATERIAL	SPECIFICATION
Bolts for Above-Ground Ferrous Installations	SAE Type 316 Stainless Steel	ASTM A193 B8M-316 Heavy hexagon series ANSI B1.1 Class 2A fit Class 3A fit may be used for holes tapped for studs. ¼" to ½" shall project through tightened nut. Threads may be either cut or cold-formed Threading per ANSI/ASME B18.2.1 Bolt-Head Identification Mark – "B8M"
Nuts for Above-Ground Ferrous Installations	PTFE-Coated SAE Type 316 Stainless Steel	ASTM A194, Grade 1, 2 or 2H Heavy hexagon series ANSI B1.1 Class 2B fit Threading per ANSI/ASME B18.2.2
Frangible Hollow Metal Bolts at Junction of Hydrant and Hydrant Spool	Carbon Steel	ASTM A307 Grade A Heavy hexagon series ANSI B1.1 Class 2A fit ⅝" bolt with 11/32" hole drilled 2⅜" deep into shank and 100% silicon-filled to prevent internal corrosion ¼"-½" shall project through tightened nut. Threading per ANSI/ASME B18.2.1 Bolt-Head Identification Mark – "A 307 A"
Fire Hydrant Bolt Mating Nuts	Carbon Steel	ASTM A563 Heavy hexagon series ANSI B1.1 Class 2B fit Threading per ANSI/ASME B18.2.1
Coating for New Stainless Steel Bolts and Washers	Not required	
Coating for New Stainless Steel Nuts	Nickel-phosphate Undercoating plus Blue Teflon or Xylan Fluoropolymer Coating	PTFE, Fluorokote #1, Xylan 1424 or equal Fluoropolymer Coating Apply coating system to nut only. Dry film thickness of 1.0-1.2 mils
Coating for New Non-Stainless Steel Bolts, Nuts, and Washers	Nickel-phosphate Undercoating plus Blue Teflon or Xylan Fluoropolymer Coating	PTFE, Fluorokote #1, Xylan 1424 or Equal Fluoropolymer Coating Dry film thickness of 1.0-1.2 mils
Washers	Washer material shall be same as each bolt.	Provide washer for each nut.

D. Unless otherwise specified, flange gaskets shall meet the following requirements.

ITEM	MATERIAL	SPECIFICATION
Flange Gaskets on Metallic Flanges	Standards	ANSI B16.21 Meet NSF 61 for potable water applications
	Material	SBR Styrene Butadiene Rubber Non-asbestos
	Alternate Material	EPDM (ethylene propylene diene monomer)
	Material for Hydrocarbon Applications and Contaminated Soils	FPM (Viton or FLUOREL) fluorocarbon
	Thickness	⅛" minimum (SBR) or other materials
		1/16" minimum (PTFE - Teflon)
	Working Pressure Rating	350 psi at 180ºF
	Style	Full-face type with pre-punched boltholes where both flanges are flat-face.
		Ring flange gaskets extending to inner edge of bolts may be used where raised-face flange is present.
		Steel flange shall be flat-face where adjoining flange is steel.
Flange Gaskets on PVC, CPVC, and Fiberglass Flanges		Full-faced, ⅛"-thick Elastomer, Shore "A" of 70 Durometer Non-creeping PTFE with insert filler Teflon ring or Teflon envelope Suitable for pressures to 150 psi Suitable for temperatures to 120°F Suitable and chemically compatible with conveyed fluid.

PART 3 - EXECUTION

3.1 Preparation

A. Clean and wire brush flange faces of pipe, valves and pipeline equipment before joining to adjacent flanges. Clean flange bolts and nuts by wire brushing. Lubricate threads with oil and graphite. Tighten nuts uniformly and progressively.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install bolts, nuts, washers and flange gaskets at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, and mechanical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Do not force fit or spring pipe, conduit or equipment into place. Corrective measures for cases of poor alignment shall be approved in advance by Owner's Representative.

F. Deflections at joints shall not exceed 80% of Manufacturers' published tolerance limits.

G. Mitered piping joints are not permitted.

H. Nonfabricated pipe bends shall conform to ASME/ANSI B31.3 and be free from wrinkles, creases or corrugations.

I. Water pipe bends shall use approved AWWA fittings, except steel water pipe fittings in vaults or above grade may match API dimensions subject to Owner's approval.

J. Cut pipe threads with sharp dies and made up with approved thread sealing compound. Threads to be seal welded shall be made up dry. Do not use Teflon sealers.

K. Epoxy coated pipe, valves and fittings shall be fabricated and installed without cutting, notching or welding.

L. Threaded pipe joints shall be cleaned by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves.

M. Assemble flanges as follows:

1. Clean flange surfaces to mate with gasket, removing loose dirt, scale and detritus.

2. Repair pits, corrosion, dents or scratches which may make sealing impossible.

3. Inspect gasket to verify gasket is of proper material and style, free of defects or damage.

4. Inspect flange bolts and studs for proper material, size, threading and length.

5. Clean and lubricate bolt threads and nut contact surfaces using lubricant chemically compatible with all materials involved.

6. Center gasket on flange.

7. With gasket in place, align mating flange bolt holes. Make sure mating flange faces are flush against gasket prior to bolt-up.

8. Insert bolts, nuts and washers. Hand-tighten by hand until snug.

9. Before tightening bolts beyond hand-tight, operate adjacent valves through full range of motion to ensure clear unobstructed operation of discs and other internal parts.

10. Do not tighten bolts with impact wrenches. Bolts so tightened will be inspected for galling and shall be replaced if any galling is discovered.

11. Tighten bolts in sequence by 5-lb. increments following a 180° opposing sequence. Begin with the bolt nearest the 12-o'clock position, proceed to the opposing bolt nearest the 6-o-clock position, then to 3-o'clock and 9'oclock and continue tightening in a similar alternating sequence until all bolts are tight.

12. Since gaskets relax after seating, retighten 24 hours after installation and pressure testing to compensate for any relaxation.

13. Flange bolt torques shall be as recommended by valve, appurtenance, or pipe manufacturer:

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pipeline Joint Materials	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. If flanges leak under pressure testing, loosen or remove nuts and bolts, replace flange gasket, reinstall or retighten bolts and nuts and retest joints. Joints shall be watertight.

END OF SECTION

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SECTION 33 05 32
FLANGE INSULATING KITS AND THREADED INSULATING BUSHINGS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of flange insulating kits and threaded insulating bushings.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 22 10 00: Plumbing Piping
I. Section 33 05 31: Pipeline Joint Materials

1.3 System Description

A. Dissimilar metals, when used in conjunction with each other shall have suitable insulation provided between adjoining surfaces to eliminate direct contact and resultant current.

B. Furnish and install threaded insulating bushings where dissimilar threaded piping materials come into contact.

C. Furnish and install flange insulating kit and insulation at locations where flanges of dissimilar metals mate, including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable codes and standards.

D. Dissimilar metal pipe connections shall include all cases below where insulation is required:

	PIPE MATERIAL				
CONNECTING PIPE MATERIAL	Existing Steel Pipe	New Steel Pipe	Cast Iron or Ductile Iron Pipe	Stainless Steel Pipe	Copper, Brass or Bronze Pipe
Existing Steel Pipe	(NR)	Insulation is required	Insulation is required	Insulation is required	Insulation is required
New Steel Pipe	Insulation is required	(NR)	Insulation is required	Insulation is required	Insulation is required
Cast Iron or Ductile Iron Pipe	Insulation is required	Insulation is required	(NR)	Insulation is required	Insulation is required
Stainless Steel Pipe	Insulation is required	Insulation is required	Insulation is required	(NR)	Insulation is required
Copper, Brass or Bronze Pipe	Insulation is required	Insulation is required	Insulation is required	Insulation is required	(NR)

Notes: (NR)=Not required

E. Insulating kits or bushings are not required in the following cases:

1. Where indicated as not required (NR) in table above.
2. Where connecting any pipe material to plastic, fiberglass, clay or concrete pipe.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, and installation instructions.

1.6 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of flange insulating kits shall be strictly followed.

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Flange Insulation Kit Products	APS Advance Products & Systems, Inc	Scott, LA
	Calpico, Inc.	South San Francisco, CA
	CCI Pipeline Systems	Breaux Bridge, LA
	Central Plastics Company	
	Corrpro Corrosion Div Control Products Company	
	Farwest Corrosion Control	Gardena, CA
	PSI (Pipeline Seal and Insulator, Inc.)	Houston, TX
	Accepted equal	
Insulating Reducing Bushings	Christy's	Anaheim, CA
	Accepted equal	
Insulating Gaskets	Calpico, Inc.	South San Francisco, CA
	Johns Manville "No. 71 Dielectric Sheet Packing"	
	Linebacker "Type E"	
	Raybestos-Manhattan "No. 73"	
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Flange insulating kits shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Flange Bolts and Nuts	Various steels	See Section 33 05 31.
Insulating Gaskets	Dielectric Phenolic	500 V/mil dielectric strength 25 ksi compressive strength
Gasket Seal Element	Nitrile	
Insulating Sleeves	Mylar	4000 V/mil dielectric strength <0.8% water absorption
Insulating Washers for Bolts	Phenolic	500 V/mil dielectric strength 33 ksi compressive strength <1.6% water absorption
Steel Washers over Insulating Washers	Stainless Steel	SAE Type 316

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Application	Fluid in Pipe	Potable Water / Sewage
	Fluid Temperature	33°F to 100°F
	Flange insulating kits, sleeves, and gaskets shall be compatible with the above fluids	
Insulating Gaskets	Gaskets	Full faced with bolt holes
	Thickness	⅛" minimum
	Drilling	Match adjacent flanges
Flange Isolation Kits (Use Above-Ground and in Vaults.	Type	Double-insulating (2 steel washers + 2 insulating washers + 1 full-length insulating sleeve per bolt /
Flange Isolation Kits Buried (Use for Working Pressures up to 150 psi and Flanges up to 24" nominal)	Type	One-piece-sleeve and washer (2 steel washers + 1 one-piece isolating sleeve
Insulating Washers for Buried Bolts	Dimensions	⅛" minimum thickness ID of washer shall fit over isolating sleeve
Steel Washers over Insulating Washers	Thickness	⅛" minimum thickness Steel and isolating washer shall have same ID and OD

D. If insulating flange kit is not compatible with tapping valve, provide additional flanged spool or prefabricated insulating joint.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install flange insulating kits before submitting shop drawings or ordering.

B. Clean faces of flange pairs of all dirt, rust, laitance, grease or fouling materials which would interfere with a watertight joint and insulating properties of flange kit.

C. Use alignment pins to properly align flange and gasket.

D. Clean threaded female inlets to receive dielectric bushings.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install flange insulating kits at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable plumbing, mechanical and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install flange insulating kits according to Manufacturer's installation and warranty requirements. Tighten bolts according to Manufacturer's recommended sequence.

F. Center bolt insulation sleeves within insulation washers so that insulating sleeve is not compressed or cracked.

G. Install flange insulating kits to tolerances recommended by Manufacturer. Unless otherwise shown, install flange insulating kits true and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Flange Insulating Kits	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Insulation	Ohmmeter test to demonstrate insulation is functional	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 05 33
COUPLINGS, TIE RODS, FLANGE CONNECTORS, AND UNIONS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of couplings, tie rods, flange connectors, unions, and appurtenant joint and coating systems.

B. Grooved and shouldered (Victaulic) style couplings are covered in Section 33 05 34.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 09 96 56: Epoxy Linings and Coatings
I. Section 22 10 00: Plumbing Piping
J. Section 33 05 31: Pipeline Joint Materials
K. Section 33 05 34: Grooved and Shouldered (Victaulic-Style) Couplings
L. Section 33 11 19: Mastic and Tape-Wrap Systems for Ferrous Pipe

1.3 System Description

A. Furnish and install complete functional coupling, joint or joint-restraint system including appurtenant structural, and mechanical mountings, thrust restraints, or connections and coatings required for compliance with Manufacturer's installation requirements, and compliance with AWWA and other applicable standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with Section 116875 of California Health and Safety Code.

C. Before ordering materials to fit outside diameters of existing pipe of uncertain dimensions, including but not limited to cast iron pipe, pipe over 16" diameter, and pipe over 50 years old, the following procedures shall be followed:

1. Excavate pipe to be joined at location coupling or restraint will be installed.

2. Field measure pipe circumference at that location.

3. Without removing pipe from service, measure outside diameters along x-axis and y-axis.

4. Verify roundness of existing pipe is within Manufacturer's tolerances.

5. If existing pipe roundness is outside coupling or restraint Manufacturer's tolerances, it may be necessary to cut pipe being joined and trace outside diameter template on sheet of butcher paper mounted to plywood board to allow custom fittings to be fabricated to match field pipe geometry.

D. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fusion-Bonded Epoxy Linings	Holidays and Lining Thickness	See Section 09 96 56	1 each item	Contractor	Contractor

1.5 References

A. ASME/ANSI B16.5 Steel Pipe Flanges and Flanged Fittings (Including ratings for Class 150, 300, 400, 600, 900, 1500, and 2500)
B. ASME/ANSI B16.39 Malleable Iron Threaded Pipe Unions
C. ASSE 1079 Dielectric Pipe Unions
D. ASTM A193 Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service
E. ASTM A283 Low and Intermediate Tensile Strength Carbon Steel Plates
F. ASTM A536 Ductile Iron Castings
G. ASTM B61 Steam or Valve Bronze Castings (Do not use for potable water wetted surfaces)
H. ASTM B62 Composition Bronze or Ounce Metal Castings (Do not use for potable water wetted surfaces)
I. ASTM C1173 Flexible Transition Couplings for Underground Piping Systems
J. ASTM D2464 Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings
K. AWWA C105 Polyethylene Encasement for Ductile-Iron Pipe Systems
L. AWWA C207 Steel Pipe Flanges for Waterworks Service – Sizes 4" through 144"
M. AWWA C111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
N. AWWA C219 Bolted Sleeve Type Couplings for Plain End Pipe
O. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
P. AWWA M11 Steel Pipe, A Guide for Design and Installation
Q. Fed Spec WW-F406
R. MSS SP123 Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube
S. NSF/ANSI 61 Drinking Water System Components – Health Effects
T. NSF/ANSI 372 Drinking Water System Components – Lead Content (Formerly NSF/ANSI 61 Annex G)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
	Show lining and coating data and thicknesses on items 4" and larger
Installation Instructions	Required per installation instruction requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, and installation instructions,

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of couplings, and tie rods shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for bolted sleeve type couplings include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Couplings – Steel Bolted Sleeve Type, for Identical Pipe Materials on each side	JCM Industries, Inc. (Style 201) or (Style 202)	Nash, TX
	Romac Industries (400)	Bothell, WA
	Smith Blair, Inc. (Style 411)	Texarkana, TX
	Accepted Equal	
Couplings – Steel Bolted Transition Sleeve Type, for Different Pipe Materials on each side	JCM Industries, Inc. (Style 203)	Nash, TX
	Romac Industries (TC400)	Bothell, WA
	Smith Blair, Inc. (Style 413)	Texarkana, TX
	Accepted Equal	
Couplings – Steel Bolted Reducing Sleeve Type, for Identical Pipe Materials of Different Diameters on Each Side	JCM Industries, Inc. (Style 204)	Nash, TX
	Romac Industries (RC400)	Bothell, WA
	Smith Blair, Inc. (Style 415)	Texarkana, TX
	Accepted Equal	
Couplings – Cast Bolted Sleeve Type System, for Identical or Different Pipe Materials on Each Side	JCM Industries, Inc. (Style 210), (Style 211), or (Style 212)	Nash, TX
	Romac Industries (501) or (XR501)	Bothell, WA
	Smith Blair, Inc. (Style 441) (Omni)	Texarkana, TX
	Accepted Equal	
Couplings – Steel Bolted Sleeve Type, Restrained for Identical Pipe Materials on each side	EBAA Iron (Mega-Coupling Series 3800)	Eastland, TX
	JCM Industries, Inc. (Style 219)	Nash, TX
	Romac Industries (400RG)	Bothell, WA
	Smith Blair, Inc. (Style 473)	Texarkana, TX
	Accepted Equal	
Couplings – Steel Bolted Sleeve Type, Restrained for Identical Pipe Materials of Different Diameters on Each Side	Smith Blair, Inc. (Style 476)	Texarkana, TX
	Accepted Equal	
Couplings – Cast Bolted Sleeve Extended Range Type for Identical or Different Pipe Materials on Each Side	Romac Industries (Macro)	Bothell, WA
	Smith Blair, Inc. (Style 461) (Quantum)	Texarkana, TX
	Accepted Equal	
Couplings – Cast Bolted Sleeve Restrained Extended Range Type for Identical or Different Pope Materials on Each Side	Romac Industries (Alpha)	Bothell, WA
	Smith Blair, Inc.	Texarkana, TX
	Accepted Equal	

B. Acceptable Manufacturers for flanged coupling adaptors include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Couplings – Flanged Coupling Adaptor for Ductile Iron Pipe	JCM Industries, Inc. (Style 301)	Nash, TX
	Romac Industries (FCA 501)	Bothell, WA
	Smith Blair, Inc. (Style 912)	Texarkana, TX
	Accepted Equal	
Couplings – Flanged Coupling Adaptor (Restrained)	EBAA Iron Megaflange Series 2100 3"-48"	Eastland, TX
	Ford Meter Box Company (Restrained Flange Adaptor with UFR 1400) 3"-24"	Wabash, IN
	JCM Industries, Inc. (Style 301 Restrained)	Nash, TX
	Romac Industries (RFCA)	Bothell, WA
	Smith Blair, Inc. (Style 911 "Flange-Lock" DIP, Style 913 "Flange-Lock" Steel or Style 920 PVC) with anchor studs	Texarkana, TX
	Accepted Equal	
Couplings – Flanged Coupling Adaptor Extended Range Restrained	Romac Industries (Alpha)	Bothell, WA
	Smith Blair, Inc.	Texarkana, TX
	Accepted Equal	

C. Acceptable Manufacturers for external harness-style systems include following:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
External Joint Restraint Systems – Restraint Lug and Eyebolt	Romac Industries Duc Lug & 90° Eye-Bolt	Bothell WA
	Star National Products Division Dresser Industries Style 442 Tie-Bolt	Columbus, OH
	Accepted Equal	
External Joint Restraint Systems – Restraint Plate and Tie Rod	Smith Blair, Inc. (Style 907)	Texarkana, TX
	Star National Products Division Dresser Industries Style 441 Tie-Plate	Columbus, OH
	Accepted Equal	

D. Follower-gland-type and harness-type mechanical joint restraints are specified under sections for applicable pipe materials.

E. Acceptable Manufacturers for coupling products for PVC Schedule 40 or Schedule 80 pipe include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Compression Couplings PVC	Spears Manufacturing Company	Sylmar, CA
	Accepted Equal	
Repair Couplings PVC	Spears Manufacturing Company	Sylmar, CA
	Accepted Equal	
Saddles PVC	Spears Manufacturing Company	Sylmar, CA
	Accepted Equal	
Unions (Dielectric Insulating)	Central Plastics	Shawnee, OK
	EPCO Sales. Inc.	Cleveland, OH
	Harrington Industrial Plastics, Inc.	Chino, CA
	Lochinvar Corporation	Lebanon, TN
	Pipe Seal and Insulator Company	Houston, TX
	Pipeline Coating and Engineering Company	
	Smith Blair, Inc.	Texarkana, TX
	Spears Manufacturing Company	Sylmar, CA
	Wilkins Operation of Zurn Industries (DU) Series	Gardena, CA
	Accepted Equal	

F. Acceptable Manufacturers for other coupling products, include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Cam Lock Fittings	Banjo Corporation	Crawfordswville, IN
	Central States Hose, Inc.	Denver, CO
	MMC International Co.	Inwood, NY
	Accepted Equal	
Couplings – C900 PVC High Deflection	Certainteed (High Deflection (HD) Class 200	Valley Forge, PA
	Romac Industries (Alpha)	Bothell, WA
	Accepted Equal	
End Caps – Extended Range Restrained Type	Romac Industries (Alpha)	Bothell, WA
	Accepted Equal	
Polyethylene Encasement for Buried Couplings and Appurtenances	Christy's "AWWA Polywrap"	Anaheim, CA
	Dupont Alathon	Wilmington, DE
	Northtown Company	Huntington Beach, CA
	Trumbull Industries, Inc.	Youngstown, OH
	Accepted Equal	
Repair Clamps (Ferrous)	Dresser Piping Specialties (360 Series)	Bradford, PA
	Ford Meter Box Company	Wabash, IN
	JCM Industries (100 Series)	Nash, TX
	Mueller Co. (500 Series)	Decatur, IL
	Powerseal Pipeline Products Corp (3100 Series)	Wichita Falls, TX
	Romac Industries (SS Series) or (CL Series)	Bothell, WA
	Smith Blair, Inc. (200) Series	Texarkana, TX
	Total Piping Solutions (EZ-Max), (Hydroflex)	Olean, NY
	Accepted Equal	
Unions (Dielectric Insulating)	Harrington Industrial Plastics, Inc.	Chino, CA
	Lochinvar	
	Pipe Seal and Insulator Company	
	Pipeline Coating and Engineering Company	
	Smith Blair, Inc.	Texarkana, TX
	Spears Manufacturing Company	Sylmar, CA
	Wilkins Operation of Zurn Industries (DU) Series	Gardena, CA
	Accepted Equal	
Unions (Noninsulating Brass)	James Jones J-1528	El Monte, CA
	Mueller H-15403	
	Accepted Equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Bolted sleeve type couplings shall comply with AWWA C219 and be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Sleeve	Steel	ASTM A283 Grade C or carbon steel with minimum 30-ksi yield
Coupling and Harness Bolts	Stainless Steel	See Section 33 05 31.
Gasket		AWWA C111
Sleeve Lining (couplings 3" and larger)	Fusion-Bonded Epoxy	See Section 09 96 56. AWWA C550 12-mil minimum DFT Meet NSF 61 for potable water applications
Exterior Finish Coat	Fusion-Bonded Epoxy	See Section 09 96 56.
Polyethylene Encasement for Buried Couplings and Appurtenances	Polyethylene Sheet	AWWA C105 2 layers, 8 mils each

C. Flanged coupling adaptors shall comply with AWWA C219 and be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Flanges Working Pressures 0-150 psi	Ductile Iron	ASME/ANSI B16.42 Class 150 Raised or plain faced
Flanges Sizes 6-60”	Ductile Iron	ASME/ANSI B16.42 Class 300 Raised or plain faced
Flange Alignment	Horizontal Pipelines	Boltholes shall straddle horizontal and vertical centerlines of pipe run to which valves are attached.
	Vertical Pipelines	Boltholes shall straddle plant North-South and plant East-West centerlines of pipe run to which valves are attached.
Sleeve	Steel	ASTM A283 Grade C or carbon steel with minimum 30-ksi yield
Coupling and Harness Bolts	Stainless Steel	See Section 33 05 31.
Gasket		AWWA C111
Sleeve Lining (couplings 3” and larger)	Fusion-Bonded Epoxy	See Section 09 96 56 AWWA C550 12-mil minimum DFT Meet NSF 61 for potable water applications Do not coat sealing areas and bronze or stainless steel parts.
Exterior Finish Coat	Fusion-Bonded Epoxy	See Section 09 96 56.
Polyethylene Encasement for Buried Couplings and Appurtenances	Polyethylene Sheet	AWWA C105 2 layers, 8 mils each

D. Coupling restraint systems for bolted-sleeve-type couplings or flanged coupling adaptors installed on ductile iron or PVC pipe shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Follower Gland	Ductile Iron	ASTM A536 65-45-12
Wedges	Ductile Iron	Single tooth, heat-treated for ductile iron applications
Actuating Bolts	Ductile Iron	ASTM A536 65-45-18
Breakaway Nuts	Carbon Steel	
	Cast Iron	
Tie Rods – Stainless Steel	Stainless Steel	SAE Type 316
Nuts	Match Bolt Material	
Washers	Match Bolt Material	
Coating for New Nuts	Nickel-phosphate Undercoating Blue Teflon or Xylan Fluoropolymer Coating	See Section 33 05 31.
Lubrication for Above-Ground or Vault-Enclosed Steel Tie-Rod or Bolt Threads	Antiseize Lubricant	See Section 33 05 31.
Gland Exterior Finish Coat	Fusion-Bonded Epoxy	See Section 09 96 56.
Coating on Buried Bolts and Nuts	30-mil Mastic Wrap	See Section 33 11 19.
Polyethylene Encasement for Buried Couplings and Appurtenances	Polyethylene Sheet	AWWA C105 2 layers, 8 mils each

E. Repair clamps shall only be used for applications with working pressures not exceeding 150 psi and shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Repair Clamp	Stainless Steel	SAE Type 316

F. Unions shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Insulating Unions (Use restricted to pipe 2½" and smaller with dissimilar metals on each side of union)	Standard	ASSE 1079, ASTM D2464
	Location	Provide where dissimilar pipe materials mate
		Provide within 12" of regulating equipment, water heating, conditioning tanks and similar equipment requiring service by removal in manner facilitating ready removal.
	Material	PVC
	Class	Match Adjacent Pipe
Noninsulating Unions for Potable Water Service (Match adjacent pipe material)	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372 3-part with flared copper end connections where required
	Malleable Iron	ASME/ANSI B16.39
	Stainless Steel	SAE Type 316 Grade B7
Noninsulating Unions not for Potable Water Service (Match adjacent pipe material)	Bronze	ASTM B61 or B62 3-part with flared copper end connections where required
	Malleable Iron	ASME/ANSI B16.39
	Stainless Steel	SAE Type 316 Grade B7

G. Sewer transition couplings shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Transition Coupling - Sewer	Elastomeric with Stainless Steel tension bands	ASTM C1173

H. Where pipeline pressures exceed 150 psi, and where pipe tap for appurtenance into main exceeds 1" diameter, provide a 2½" extra-heavy carbon steel coupling as outlet, and isolate fitting or appurtenance from main using 2" SAE Type 316 stainless steel bushing, 2" SAE Type 316 stainless steel nipple, and 2" type 316 stainless steel ball valve.

I. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Coating on Buried Bolts, Nuts and Tie-Rods	See Section 09 90 00. 2 coats minimum 12-mils MDFT per coat	
Dismantling Joints	Self-contained Restraint Rating	Larger of 250 psi or rating of mating flanges
	Dimensions	No part of restraint system shall extend outside flange diameter
	Tie Rod Diameter	Compatible with mating flange bolt diameter
	Minimum Longitudinal Adjustment	5" inward adjustment, 1" expansion
Harness for Bolted Sleeve Type Couplings and Flange Coupling Adaptors	Design harness and tie rods per AWWA M11 Tie rods shall withstand all pressure without exceeding 50% of yield stress	

J. Flanges shall conform to AWWA C207 requirements and shall mate with adjacent valves or fittings.

K. Internal bore of couplings and joints shall be as close to that of pipe system as is commercially available.

L. All coupling products referenced in this section shall be painted and coated, interior and exterior in accordance with Section 09 90 00 or 09 96 56 as applicable.

M. Small piping coupling materials are covered in Section 22 10 00.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install products before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. On buried couplings and assemblies, lubricate all threaded parts including bolts and compression collars before assembling couplings and joints.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install couplings, tie rods, flange connectors and unions at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing and mechanical code requirements

4. AWWA M11 Steel Pipe, A Guide for Design and Installation

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Couplings, tie rods, flange connectors, and unions shall be furnished and installed by Contractor at location shown on Plans and Submittals.

F. Bolting shall be completed as follows:

1. Wire brush and clean flange before joining flange.

2. Lubricate bolt threads with graphite and oil.

3. Bolt heads and nuts shall rest squarely against metal. Draw bolt heads and nuts tight against Work using suitable wrench not less than 15" long or torque wrench set to provide similar torque. Tap bolt heads with hammer while nut is being tightened. After being tightened, nuts shall be locked.

4. Bolts shall extend entirely through nut projecting at least ¼" but not more than ⅜" beyond outside nut face.

G. Unless otherwise shown, encase all buried couplings and appurtenances with 2 layers of polyethylene wrap.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Couplings, Tie Rods, Flange Connectors, and Unions	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 33 05 34
GROOVED AND SHOULDERED (VICTAULIC-STYLE) COUPLINGS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of grooved and shouldered couplings and appurtenant coating systems.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 09 96 56: Epoxy Linings and Coatings
I. Section 22 10 00: Plumbing Piping
J. Section 33 05 31: Pipeline Joint Materials
K. Section 33 05 33: Couplings, Tie Rods, Flange Connectors, and Unions
L. Section 33 11 19: Mastic and Tape-Wrap Systems for Ferrous Pipe

1.3 System Description

A. Furnish and install complete functional thrust-restraining coupling system including appurtenant coatings required for compliance with Manufacturer's installation requirements, and compliance with AWWA and other applicable standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fusion Bonded Epoxy Linings	Holidays and Lining Thickness	See Section 09 96 56	1 each item	Contractor	Contractor

1.5 References

A. ASTM A47 Ferritic Malleable Iron Castings
B. ASTM A183 Carbon Steel Track Bolts and Nuts
C. ASTM A193 Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service
D. ASTM A283 Low and Intermediate Tensile Strength Carbon Steel Plates
E. ASTM A449 Hex Cap Bolts, Screws, and Studs
F. ASTM A536 Ductile Iron Castings
G. ASTM D2000 Classification System for Rubber Products in Automotive Applications
H. AWWA C105 Polyethylene Encasement for Ductile-Iron Pipe Systems

I. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
J. AWWA C606 Grooved and Shouldered Joints
K. AWWA M11 Steel Pipe, A Guide for Design and Installation
L. NSF/ANSI 61 Drinking Water System Components – Health Effects

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
	Show lining and coating data and thicknesses on items 4" and larger
Installation Instructions	Required per installation instruction requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, and installation instructions,

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of couplings, and tie rods shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for couplings for ductile iron pipe include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Couplings – Grooved Type for Ductile Iron Pipe 3"-36"	Piedmont Pacific Corporation.	Oakland, CA
	Shurjoint Piping Products	Las Vegas, NV
	Star Pipe Products, Inc.	Easton, PA
	Victaulic Company of America, Inc. (Style 31)	Easton, PA
	Accepted Equal	
Polyethylene Encasement for Buried Couplings and Appurtenances	Dupont Alathon	Wilmington, DE
	Northtown Company	Huntington Beach, CA
	T Christy Enterprises "AWWA Polywrap" (714) 507-3300	Anaheim, CA
	Trumbull Industries, Inc.	Youngstown, OH
	V-Bio (Ductile Iron Pipe Research Association) (4"-64")	Birmingham, AL
	Accepted Equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Products shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Coupling Housings (Match adjacent pipe material)	Ductile Iron	ASTM A536 grade 65-45-12
	Steel	
Lining (couplings" 3" and larger)	Fusion-Bonded Epoxy	See Section 09 96 56 AWWA C550 12-mil minimum DFT Meet NSF 61 for potable water applications
Gaskets	Rubber	As recommended by Manufacturer for fluid conveyed AWWA C606 and ASTM D2000 Meet NSF 61 for potable water applications
Bolts and Nuts (Use same material as flange bolts)	Stainless Steel	SAE Type 316
Exterior Finish Coat	Epoxy Urethane	See Section 09 90 00
Polyethylene Encasement for Buried Couplings and Appurtenances	Polyethylene Sheet	AWWA C105 2 layers, 8 mils each

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION
Couplings – Grooved and Shouldered Type on DIP Pipe 4"-24" diameter	Minimum wall thickness of radius-grooved grooved DIP shall be Class 53. Pipe walls for flexible-joint couplings shall be radius-grooved to dimensions shown in AWWA C606 Table 2. Pipe walls for rigid-joint couplings shall be radius-grooved to dimensions shown in AWWA C606 Table 3. Cut grooving will not be accepted.
Coating on Buried Bolts and Nuts	See Section 33 11 19.

D. Internal bore of couplings and joints shall be as close to that of pipe system as is commercially available.

E. All coupling products referenced in this section shall be painted and coated, interior and exterior in accordance with Sections 09 90 00 and 09 96 56.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install products before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. On buried couplings and assemblies, lubricate all threaded parts including bolts and compression collars before assembling couplings and joints.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install couplings at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing and mechanical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Couplings shall be furnished and installed by Contractor at location shown on Plans and Submittals.

F. Bolting shall be completed as follows:

1. Lubricate bolt threads with graphite and oil.

2. Boltheads and nuts shall rest squarely against metal. Draw boltheads and nuts tight against Work using suitable wrench not less than 15" long or torque wrench set to provide similar torque. Tap bolt heads with hammer while nut is being tightened. After being tightened, nuts shall be locked.

3. Bolts shall extend entirely through nut projecting at least ¼" but not more than ⅜" beyond outside nut face.

G. Unless otherwise shown, encase all buried couplings and appurtenances with 2 layers of polyethylene wrap.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Couplings	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 05 37
WALL PIPES, SEEP RINGS AND PENETRATIONS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of steel and cast iron wall pipes, sleeves, wall collars, seepage rings and penetrations.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 03 30 00: Cast-in-Place Concrete
H. Section 09 90 00: Painting and Coating
I. Section 33 05 31: Pipeline Joint Materials

1.3 System Description

A. Furnish and install pipe penetration sleeves, wall pipes, seep rings and rubber hydrostatic annular sealing devices for pipe and conduit penetrations including appurtenant structural, and/or mechanical mountings required for compliance with Manufacturer's installation requirements and compliance with applicable codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fabricated Steel Wall Sleeve or Penetration and Collar Assembly	Pressure Test	Demonstrate water-tight seal between collar and sleeve. Test at 20 psig for 4 hours.	One each size fabricated wall sleeve	Contractor	Contractor

1.5 References

A. API 5L
B. API 5LX
C. ASME/ANSI B31.3 Process Piping
D. ASME/ANSI B36.10 Carbon, Alloy and Stainless Steel Pipes
E. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
F. ASTM A105 Forgings, Carbon Steel for Piping Components
G. ASTM A135 Electric-Resistance-Welded Steel Pipe

H. ASTM A139 Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)
I. ASTM A181 Forgings, Carbon Steel for General-Purpose Piping
J. ASTM A182 Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings and Valves and Parts for High-Temperature Service
K. ASTM F593 Stainless Steel Bolts, Hex Cap Screws, and Studs
L. AWS B3.0 Welding Procedure and Performance Qualification

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per structural shop drawing requirements. Show dimensions and wall thickness. Show proposed coatings including material and thickness. Where flanged-end wall penetrations are used, show flange size and appropriate ANSI or AWWA flange dimensional standard. Where grooved-end wall penetrations are used, show appropriate AWWA C606 grooved-end dimensional standard
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements for rubber annular hydrostatic sealing devices.
Foundry or Test Record Transcripts	Submit results of leakage test for cast-iron sleeves having shrink-fit steel collars or collar halves bottomed in groove and steel sleeves having welded steel collars per foundry or test record transcript requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, and installation instructions,

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of wall pipes, seep rings and penetrations shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
HDPE Pipe Penetration Wall Sleeve with Weep Ring 2"-48"	Pipeline Seal and Insulator, Inc. (PSI) "Century Line" (Type S-316)	Houston, TX
	Accepted equal	
PVC Pipe Penetration Wall Sleeve with Weep Ring	Calpico, Inc.	South San Francisco, CA
	Proco Products Pen-Seal	Stockton, CA
	Accepted equal	

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Steel Pipe Penetration Wall Sleeve with Weep Ring	Calpico, Inc.	South San Francisco, CA
	Pipeline Seal and Insulator, Inc. (PSI) "WS" Steel Wall Sleeve	Houston, TX
	Proco Products	Stockton, CA
	Trumbull Industries	Youngstown, OH
	Accepted equal	

B. Acceptable Manufacturers for rubber annular hydrostatic sealing devices include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
EPDM Rubber Annular Hydrostatic Sealing Devices (Use for water and wastewater or treatment chemical applications)	Calpico, Inc. "Pipe Linx"	South San Francisco, CA
	CCI Pipeline Systems "Wrap-it Link" (Type WL-SS)	Breaux Bridge, LA
	Pipeline Seal and Insulator, Inc. (PSI) "Link Seal" (Type S-316)	Houston, TX
	Proco Products Pen-Seal	Stockton, CA
	Accepted equal	
Nitrile Rubber Annular Hydrostatic Sealing Devices (Use for oil and fuel pipe applications)	Calpico, Inc. "Pipe Linx"	South San Francisco, CA
	CCI Pipeline Systems "Wrap-it Link" (Type WL-SS)	Breaux Bridge, LA
	Pipeline Seal and Insulator, Inc. (PSI) "Link Seal" (Type OS-316)	Houston, TX
	Proco Products Pen-Seal	Stockton, CA
	Accepted equal	

C. Acceptable Manufacturers for foam filler include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Polyethylene Foam Filler for Pipe Penetrations	Sealed Air Corporation "Ethafoam"	Elmwood Park, NJ
	Hercules Inc Plastic Products Group Industrial Systems Department "Minicell"	Middletown, DE
	W R Meadows Sealtight "Deck-O-Foam" Expansion Joint Filler	Hampshire, IL
	Accepted equal	
Closed-Cell Sponge Rubber Foam Filler for Pipe Penetrations	American National Rubber "Rubberlite"	Ceredo, WV
	Armacell "Armaflex"	Munster, NRW, DE
	B F Goodrich Sponge Products, Div	Shelton, CT
	Cypress Sponge Rubber "Rubberite"	Santa Ana, CA
	Monmouth Rubber and Plastics Corp. "Durofoam"	Long Branch, NJ
	RBX Industries "Rubatex Insul-Tube 180"	Roanoke, VA
	Uniroyal Chemical "Ensolite"	Mishawaka, IN
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Wall pipes, seep rings, and penetrations shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Fabricated Steel Wall Sleeves Containing Pipe	Steel Pipe	ASTM A53 Type E or S Grade B or ASTM A135 Grade B or ASTM A139 Grade B or API 5L or 5LX Standard Weight Thickness per ANSI B36.10
Fabricated Steel Wall Sleeves Connecting to Steel Pipe	Steel Pipe	Material and thickness to match connecting pipe. Provide ends as shown for connection to adjacent steel pipe
Wall Collar on Steel Wall	Steel	ASTM A105, A181 or A182

ITEM	MATERIAL	SPECIFICATION
Sleeve		
Polyethylene Foam Filler for Pipe Penetrations	Extruded Closed-Cell Polyethylene Foam Rod or Disc	Rod or disc shall be ½" larger in diameter than annular space.
Painting and Coating of Steel Wall Sleeve	Epoxy	See Section 09 90 00.

C. Rubber annular hydrostatic sealing devices shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Pressure Plate	Carbon Steel or Glass Reinforced Plastic Composite	
Bolts and Nuts for Links	Stainless Steel	ASTM F593 SAE Type 316 Rod shall be ½" larger in diameter than annular space.
Sealing Element	EPDM Synthetic Rubber (Ethylene-Propylene Diene Monomer) for Water, Wastewater or Treatment Chemical Applications	Black
Painting and Coating		See Section 09 90 00.

D. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Fabricated Steel Wall Sleeves	Location	Provide for all penetrations of new concrete walls, footings, floors or roofs including those containing rubber annular hydrostatic sealing devices through which piping passes
	Size	Consult with rubber annular seal Manufacturer
Rubber Annular Hydrostatic Sealing Devices	Design	Modular mechanical type, using interlocking synthetic rubber links shaped to continuously fill annular space between pipe sleeve and passing pipe. Assembled links shall form continuous rubber belt around pipe, with pressure plate under each bolt head and nut.
	Minimum Seating Width	4"
Seepage Ring or Wall Flange	Wall Collar	Provide on wall pipes and sleeves penetrating walls which are to be watertight. Cut welded wall collars from steel ring of size shown.
Seepage Ring or Wall Flange	Welding	Weld collar to steel wall pipe or sleeve with full circle fillet welds. Weld per ANSI B31.3, Chapter V.
Pipe Wrap for Footing Penetrations and Pipe Supports	Insulation Wrap Thickness	⅜-1"pipe – Use 1"-thick insulation 1¼"-4" pipe – Use 1½" thick insulation 6" pipe and larger – Use 2" insulation

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install wall pipes, seep rings and penetrations before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install wall pipes, seep rings and penetrations at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

    1. Manufacturer's installation and warranty requirements

    2. Applicable OSHA and Cal OSHA regulations

    3. Applicable building, fire, plumbing, mechanical and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Wall pipes, seep rings and penetrations shall be furnished and installed by Contractor at location shown on Plans and Submittals.

F. Install wall pipes, seep rings and penetrations to tolerances recommended by Manufacturer. Unless otherwise shown, install wall pipes, seep rings and penetrations true and level using precision gauges and levels.

G. Provide wall pipe or floor pipe and seals at the following locations:

    1. Where explicitly shown on Plans.

    2. Where pipes penetrate concrete walls or slabs below ground or finish floor.

    3. Where pipes penetrate concrete walls or slabs containing water on one or both sides.

    4. Provide floor sleeve wherever plastic pipe, steel or stainless steel pipe 3" and smaller or copper tubing passes through floor or slab. Provide rubber annular sealing device in annular space between sleeve and passing pipe or tubing.

    5. Provide wall sleeves wherever plastic pipe, steel or stainless-steel pipe 3" and smaller, or copper tubing passes through a wall. Provide one rubber annular seal when wall is 8" thick or less. Provide 2 rubber annular seals (one at each end of sleeve) when wall thickness exceeds 8". Pack annular space with polyethylene foam filler and fill ends of penetration with 2" of elastomeric sealant on both sides of structure.

    6. Where sleeves are installed in which water or soil is on one or both sides of channel or wall, provide 2 rubber annular seals (one at each end of sleeve).

    7. Where pipes pass through walls or slabs and no sleeves or wall or floor pipe with seep ring is provided, pack annular space with polyethylene foam filler and fill ends of penetration with 2" of elastomeric sealant on both sides of structure.

H. In existing concrete walls and slabs, core drill holes 2" larger in diameter than diameter of wall flange or collar. Align wall sleeve and collar assembly with connecting or passing piping. Pack void space between sleeve and concrete with grout.

I. In new concrete walls and slabs, install wall pipes in walls before placing concrete. Do not allow any portion of sleeve to touch reinforcing steel. Align wall sleeve and collar assembly with connecting or passing piping.

J. Install wall pipes having flanged end connections as follows:

1. Check alignment before grouting in place or pouring concrete. Realign if sleeve is not properly aligned.

2. Install flanged end wall sleeves or penetrations with bolt holes of end flanges straddling horizontal and vertical centerlines of sleeve.

3. Lubricate flange bolts with oil and graphite prior to installation.

K. Welder qualifications shall be in accordance with AWS B3.0.

L. Install rubber annular hydrostatic sealing devices in accordance with Manufacturer's instructions.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Wall Pipes, Seep Rings and Penetrations	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
		Test hydraulic structure for leakage with wall penetrations in place	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 05 38
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 Work Included

A. This section includes materials, testing, and installation of hangers and supports for pipe, and conduit.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 03 30 00: Cast-in-Place Concrete
I. Section 05 12 00: Structural Steel Framing
J. Section 05 50 00: Metal Fabrications
K. Section 09 90 00: Painting and Coating

1.3 System Description

A. Furnish and install complete functional pipe, and conduit hanger and support systems where shown including appurtenant mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building, mechanical, plumbing, and electrical codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
B. ASTM A193 Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
C. ASTM A194 Carbon and Alloy Steel Nuts for High-Pressure and High Temperature Service
D. ASTM A325 Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength
E. ASTM A490 Heat-Treated Steel Structural Bolts 150 ksi Minimum Strength
F. ASTM B6 Zinc
G. ASTM B633 Electrodeposited Coatings of Zinc on Iron and Steel
H. ASTM D3917 Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes
I. ASTM D4385 Visual Defects in Thermosetting Reinforced Plastic Pultruded Products
J. ASTM E84 Surface Burning Characteristics of Building Materials
K. ASTM F593 Stainless Steel Bolts, Hex Cap Screws and Studs
L. ASTM F594 Stainless Steel Nuts
M. AWS D1.1 Structural Welding Code – Steel
N. MFMA 1 Metal Framing Standards

O. MSS SP58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation
P. MSS SP69 Pipe Hangers and Supports – Selection and Application
Q. California Building Code (CBC)
R. California Electrical Code (CEC)
S. California Mechanical Code (CMC)
T. California Plumbing Code (CPC)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for pipe hangers and supports per structural shop drawing requirements.
Catalog Data	Required for pipe hangers and supports and metal framing systems per catalog data requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data and installation instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of metal fabrications shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Concrete Anchors – Epoxy Adhesive Anchor Systems	Hilti Corp.	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Simpson Strong Tie Co. "Epoxy-Tie"	Pleasanton, CA
	Accepted Equal	
Concrete Anchors – Expansion Bolt Systems	Hilti Corp."Kwik Bolt II"	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Simpson Strong Tie Co. "Wedge-All"	Pleasanton, CA
	Accepted Equal	
Powder Actuated Fastening Systems	Hilti Corp.	Tulsa, OK
	ITW Ramset / Redhead	Wood Dale, IL
	Reynolds Metal Company "ReynoRail II	Richmond, VA
	Accepted Equal	
Metal-to-Metal Epoxy	J B Weld	Sulfur Springs, TX
	Accepted Equal	
Plastic Pipe Hangers	Spears Manufacturing Co. "Clic Top"	Sylmar, CA
	Accepted Equal	

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Steel and Stainless Steel Pipe and Conduit Hangers	Bergen-Power Pipe Supports, Inc.	Woburn, MA
	Carpenter & Paterson Company "C&P"	Woburn, MA
	Cooper B-Line Inc.	Highland, IL
	Elcen Metal Products Company	Rockville, MD
	Empire Industries, Inc.	Manchester, CT
	Globe Pipe Hanger Products, Inc.	Cleveland, OH
	Grinnell Corporation "Anvil"	Cranston, RI
	Kin-Line Inc. Division Cooper B-Line	Highland, IL
	Michigan Hanger Company, Inc.	Mullica Hill, NJ
	Modern Pipe Supports Corporation	Cleveland, OH
	Persing and Company	Nappanee, IN
	PHD Manufacturing, Inc.	Columbiana, OH
	Powerstrut Div Allied Electrical Group	Harvey, IL
	Superstrut Div American Electric, Thomas & Betts, Inc.	Memphis, TN
	Tripac Inc.	Corona, CA
	Unistrut Corporation	Wayne, MI
	Viking Corporation	Hastings, MI
	Wesanco Steel Products, Inc.	La Mirada, CA
	Accepted Equal	
Metal Bolted Framing Strut Systems	Cooper B-Line Inc. Globe-Strut	Corona, CA
	Kindor Div American Electric, FL Industries	Pittsburgh, PA
	Powerstrut Div Allied Electrical Group	Harvey, IL
	Superstrut Div American Electric, Thomas & Betts, Inc.	Memphis, TN
	Tripac Inc.	Corona, CA
	Unistrut Corporation	Wayne, MI
	Wesanco Steel Products, Inc.	La Mirada, CA
	Accepted Equal	
Fiberglass Channel Framing Systems	Aickenstrut Division Allied Electrical Group	Harvey, IL
	Champion Fiberglass "Champion Strut"	Spring, TX
	Strut Tech Engineered Support Systems	Redmond, WA
	Unistrut Corporation	Wayne, MI
	Accepted Equal	

B. Acceptable Manufacturers for foam filler include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Polyethylene Foam Filler for Pipe Support Bearing Pad	Sealed Air Corporation "Ethafoam"	Elmwood Park, NJ
	Hercules Inc Plastic Products Group Industrial Systems Department "Minicell"	Middletown, DE
	W R Meadows Sealtight "Deck-O-Foam" Expansion Joint Filler	Hampshire, IL
	Accepted equal	
Closed-Cell Sponge Rubber Foam Filler for Pipe Support Bearing Pad	American National Rubber "Rubberlite"	Ceredo, WV
	Armacell "Armaflex"	Munster, NRW, DE
	B F Goodrich Sponge Products, Div	Shelton, CT
	Cypress Sponge Rubber "Rubberite"	Santa Ana, CA
	Monmouth Rubber and Plastics Corp. "Durofoam"	Long Branch, NJ
	RBX Industries "Rubatex Insul-Tube 180"	Roanoke, VA
	Uniroyal Chemical "Ensolite"	Mishawaka, IN
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Pipe hangers and supports shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Bolts (Connection Bolts and Anchor Bolts) –Steel	High-Strength Carbon steel – Galvanized	ASTM A325 or ASTM A 490 With self-locking nuts or lock-washers and plain nuts
	Zinc coating	ASTM A153 - 2.1 mil thickness - 1.30 ounce/ft^2
Bolts (Connection Bolts and Anchor Bolts) – Stainless Steel	Stainless Steel	ASTM A193 Grade B8M bolts with ASTM A194 Grade 8M nuts Alternate ASTM F593 Type 316 bolts with ASTM F594 SAE Type 316 nuts Washers – same material as nuts
Bolts – Embedded Eyebolts	Stainless Steel	SAE Type 316 Welded eye type
Concrete Anchors – Epoxy Adhesive Anchor Systems	Stainless Steel	SAE Type 316
Concrete Anchors – Expansion Bolt Systems	Stainless Steel	SAE Type 316
Powder Actuated Fastening Systems	Steel	AISI 1061 Hardness 52-58 Rockwell C
	Galvanized Coating	ASTM B633 - 2.1 mil thickness - 1.30 ounce/ft^2
Fiberglass Channel Framing System	Fiber-Reinforced Plastic	Flame-spread rating of 25 or less per ASTM #84 Dimensional Tolerance per ASTM D3917 and D4385 with Ultraviolet Stabilizer
Pipe and Conduit Hangers (Above Ground)	Steel	
	Galvanized Coating	ASTM A153 - 2.1 mil thickness - 1.30 ounce/ft^2
Pipe and Conduit Hangers (Below Ground or Exposed to Water)	Stainless Steel	SAE Type 316
	Fiberglass	
Washers	Carbon steel – Galvanized	Square or rectangular smooth beveled washers, tapered in thickness
	Galvanized Coating	ASTM A153 - 2.1 mil thickness - 1.30 ounce/ft^2
Welding Electrode – Steel	Steel Electrodes	AWS D1.1 E70xx except E7024 rods or electrodes shall not be used
Welding Electrode – Stainless Steel	Steel Electrodes	Type 347

C. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION
Pipe and Conduit Hangers	Maximum horizontal spacing per California Plumbing Code Table 3-1 and 3-2 or Engineered Calculations except where stricter requirements are shown in Contract Documents.

D. Unless otherwise shown, pipe support hanger rod sizes on horizontal pipe shall be as follows:

PIPE DIAMETER	≤ ½"	¾"	1"	1¼"	1½"	2"	3"	4"	5"-8"	≥10"
Hanger Rod Diameter	⅜								½"	⅝

E. Unless otherwise shown, pipe support spacing on horizontal pipe shall be as follows:

	PIPE DIAMETER									
PIPE MATERIAL	**≤ ½"**	**¾"**	**1"**	**1¼"**	**1½"**	**2"**	**3"**	**4"**	**5"-8"**	**≥10"**
Cast-Iron Hubless Pipe Shielded Coupling Joints	Every other joint unless over 4' If over 4', support each joint									
Copper Tube and Pipe, Soldered or Brazed Joints	6'' maximum spacing					8' maximum spacing				
Ductile Iron Pipe	6' maximum spacing					8' maximum spacing				
Steel and Brass Water or DWV Pipe Threaded or Welded Joints	10' maximum spacing		12' maximum spacing							
Steel, Brass and Tinned Copper Gas Pipe Threaded or Welded Joints	6' max spacing	8' maximum spacing		10' maximum spacing						
Schedule 40 and Schedule 80 PVC and ABS DWV Solvent Cemented Joints (gravity flow)	4' maximum spacing Provide for expansion every 30'									
Schedule 40 and Schedule 80 PVC and ABS DWV Solvent Cemented Joints Under Pressure	3' maximum spacing Provide for expansion every 30'			4' maximum spacing Provide for expansion every 30'						

F. Unless otherwise shown, pipe support spacing on vertical pipe shall be as follows:

	PIPE DIAMETER									
PIPE MATERIAL	**≤ ½"**	**¾"**	**1"**	**1¼"**	**1½"**	**2"**	**3"**	**4"**	**5"-8"**	**≥10"**
Cast-Iron Hubless Pipe Shielded Coupling Joints	Base and each floor not to exceed 15'									
Copper Tube and Pipe, Soldered or Brazed Joints	Each floor not to exceed 10'									
Ductile Iron Pipe	Each floor not to exceed 10'									
Steel and Brass Water or DWV Pipe Threaded or Welded Joints	Every other floor not to exceed 25'									
Steel, Brass and Tinned Copper Gas Pipe Threaded or Welded Joints	6' max spacing	8' maximum spacing		Each floor not to exceed 10'						
Schedule 40 and Schedule 80 PVC and ABS DWV Solvent Cemented Joints	Base and each floor. Provide mid-story guides Provide for expansion every 30'									

G. Zinc coatings shall be applied by hot-dipped or electro-depositing process. Zinc shall comply with ASTM B6.

H. Before leaving shop, all steel not shown or specified to be galvanized or stainless shall receive one coat of pigmented primer recommended by Manufacturer of final paint system. Parts inaccessible after assembly shall receive second coat of same primer. Final painting shall be as specified in Section 09 90 00.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to fabricate and install pipe hangers and supports before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Clean surfaces of metalwork to be in contact with concrete, removing all rust, dirt, grease and other foreign substances before concrete is placed.

C. All embedded metalwork shall be secured accurately in position when concrete is placed to prevent displacement or undue vibration during or after placement of concrete.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for execution and installation requirements.

B. Furnish and install hangers and supports at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, mechanical and electrical code requirements

D. Refer variances between Manufacturer's installation instructions and Contract Documents to Owner's Representative.

E. Welding shall comply with Section 05 12 00.

F. Bolting shall comply with Section 05 12 00.

G. Attach pipe supports to chemical tanks using adhesive methods. No full or partial penetration of tank wall by mechanical fasteners will be permitted.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pipe Hangers and Supports	Support Spacing	California Plumbing Code Table 3-1 and 3-2 and tables herein	All hangers and supports	Owner	Owner
	Snug Fit and Near-Equal	Visual inspection	All hangers and supports	Owner	Owner

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pipe Hangers and Supports (cont.)	Distribution of Load among Supports				
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 33 05 19
MANUAL VALVE OPERATORS

PART 1 - GENERAtrafficL

1.1 Work Included

A. Materials, testing, and installation of manual valve operators.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 09 90 00: Painting and Coating
I. Section 33 12 16: Plug Valves

1.3 System Description

A. Furnish and install complete operating manual valve operator including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building, plumbing, and electrical codes and standards.

1.4 Submittals

A. Include submittals for manual valve operators in submittals for valves to which they are attached.

1.5 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of manual valve operators shall be strictly followed.

1.6 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant thereto.

PART 2 - PRODUCTS

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Valve Boxes and Covers	Christy's G-5	Anaheim, CA
	Eisel Enterprises, Inc.	Placentia, CA
	Jensen Precast	Sparks, NV
	J &.R Concrete Products	Perris, CA
	Accepted Equal	
Valve Extension Stems - Fiberglass	Christy Enterprises, Inc.	Anaheim, CA
	Pipeline Products FP	San Marcos, CA
	Accepted Equal	
Valve Extension Stems - Steel	Pipeline Products SX	San Marcos, CA
	Troy Valve Division Penn-Troy Manufacturing, Inc.	Troy, PA
	Trumbull Industries, Inc.	Youngstown, OH
	Accepted Equal	

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials. Also refer to sections covering valves to which manual operators are attached.

B. Provide all valves complete with operating handwheels, levers, extension stems, gear actuators, operating nuts, and wrenches required for operation. Valves shall open by turning counterclockwise.

C. Gear actuators shall be enclosed, oil-lubricated, with seals on shafts to prevent entry of dirt and water into actuator. Provide stop limiting devices in actuators in open and closed positions. Where possible, actuators shall be self-locking to prevent disc or plug from creeping.

D. Where operating torque requirements for valve actuators are not stipulated by AWWA standards, valves shall open with maximum 80-pound pull on handwheel or lever, and maximum 150-ft-pound torque input when differential pressure across valve is equal to valve rated pressure class.

E. Design actuator components to withstand, without damage, 200-pound pull on handwheel or lever, and maximum 300-foot-pound torque input when operating against stops.

F. Unless otherwise specified, valve boxes shall be H-20 traffic rated and constructed of the following materials.

ITEM	MATERIAL	SPECIFICATION
Valve Boxes	Cast Iron	ASTM A126 Class B 2-piece sliding type
Valve Box Covers	Cast Iron	ASTM A126 Class B Solid skirt 20-lb minimum weight
Extension Pipes	Cast Iron	ASTM A126 Class B

2.2 Equipment

A. Valves shall close drip tight at rated pressures.

B. Valve operators shall be satisfactory for applications involving valve operation after long periods of inactivity.

C. Unless otherwise shown, install valves in horizontal runs of pipe having centerline elevations no higher than 4’ 6” above floor with operating stems vertical. Install buried or submerged operators with nut no more than 4’ below grade.

D. Unless otherwise specified all valves shall be furnished with actuators meeting the following minimum requirements.

ITEM	DESCRIPTION	
Buried Valves and Valves within Manholes or Pipe Trenches	Valve Can and Cover	Provide as shown above except in manholes, vaults, tunnels, or pipe trenches
	Actuator	2” AWWA actuator nut.
	Extension Stem Connector to Actuator	Square socket to fit actuator nut
	Extension Stem	Required on valves where centerline of valve is more than 4’ below grade. Extension stem shall bring nut to within 6” of surface. Use solid, round or square stock of diameter shown below.
	Valve size	**Minimum extension stem diameter**
	3”- 4” 6” 8” 10”-12”	⅞” 1” 1⅛” 1¼”
	Valve Actuator	Provide watertight shaft seals, watertight valve and actuator cover gaskets, and totally enclosed actuator designed for buried service.
	Position Indicator	Design to fit standard 5¼” valve box. Indicator shall show valve position and direction and number of turns required to fully open or close valve.
Submerged Valves	Actuator	2” AWWA actuator nut.
	Extension Stem Connector to Actuator	Square socket to fit actuator nut
	Extension Stem	Provide extension stem on valves where centerline of valve is more than 4’ below high water surface. Extension stem shall bring nut to within 6” of water surface. Extension stem size shall be as shown above for buried valves.
	Valve Actuator	Provide watertight shaft seals, watertight valve and actuator cover gaskets, and totally enclosed actuator designed for submerged service.
Manually Operated Valves 6” and Smaller	Provide hand or lever actuator or handwheel with position indicator.	
Manually Operated Valves 8” and Larger	Provide handwheel with position indicator.	
Manually Operated Valves less than 4’6” above Floor or Finish Surface	Install valves with valve stems vertical.	
Manually Operated Valves on Vertical Pipe near Walls	Install valves with valve stems horizontal and handwheel on side of valve opposite wall.	
Actuators on Manual Butterfly, Ball and Plug Valves 8”-20”	Enclosed worm and gear or enclosed traveling nut type gear actuators with position indicator.	

E. Furnish special tools, wrenches and appliances needed to adjust, operate, maintain or repair valve operators supplied.

PART 3 - EXECUTION

3.1 Preparation

A. Install valves and equipment so as to be easy to operate and service. Where geometry of manufactured valves and equipment and field conditions make it difficult or impossible for average workers to operate or service installed valve or piece of equipment, notify Owner's Representative of conflict before installing valve or item of equipment.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install valve operators on valves at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Other applicable building, fire, plumbing, mechanical and electrical code requirements

D. Install operators and extensions to tolerances recommended by Manufacturer. Unless otherwise shown, install manual valve operators true, plumb, and level using precision gauges and levels.

3.3 Adjusting and Lubricating

A. Valve box cover elevations are not shown on Plans. Determine and set cover elevations in field so finished rim elevations are flush with finished pavement where directed by Owner's Representative.

END OF SECTION

SECTION 33 08 11
PRESSURE TESTING AND FLUSHING OF WATER UTILITIES

PART 1 - GENERAL

1.1 Work Included

A. Field pressure testing and flushing of all potable water mains and force mains intended for conveyance of potable water, and wastewater under pressure.

B. Test all pipelines for water-tightness by subjecting each section to Hydrostatic Pressure and Leakage Tests in accordance with applicable requirements of AWWA C600 or C605, except as modified herein.

C. Plan construction activities to allow and facilitate testing, flushing of all sections of applicable pipelines.

D. Obtain all permits required to complete Work specified herein.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 75 00: Starting and Adjusting
H. Section 33 13 00: Disinfecting of Water Utility Distribution

1.3 System Description

A. Pressure test pipe to AWWA and Contract Document standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. AWWA C600 Installation of Ductile Iron Water Mains and their Appurtenances

B. AWWA C605 Underground Installation of PVC Pipe

C. National Pollutant Discharge Elimination System Permit (NPDES) – Central Coast Regional Water Quality Control Board (CCWQCB) – General National Pollutant Discharge Elimination System Permit and Waste Discharge Requirements for Discharges of Hydrostatic Test Water to Surface Waters.

D. National Pollutant Discharge Elimination System Permit (NPDES) – Colorado River Regional Water Quality Control Board (CRRWQCB) – General National Pollutant Discharge Elimination System Permit and Waste Discharge Requirements for Discharges of Hydrostatic Test Water to Surface Waters.

E. National Pollutant Discharge Elimination System Permit (NPDES) – Los Angeles Regional Water Quality Control Board (LARWQCB) – General National Pollutant Discharge Elimination System Permit and Waste Discharge Requirements for Discharges of Hydrostatic Test Water to Surface Waters in Coastal Watersheds of Los Angeles and Ventura Counties, Los Angeles Region Order No. 97-047, NPDES Permit No. CAG674001 or most recent order or amendment.

F. National Pollutant Discharge Elimination System Permit (NPDES) – Santa Ana Regional Water Quality Control Board (SARWQCB) – General Waste Discharge Requirements for Discharges to Surface Waters that Pose an Insignificant Threat to Water Quality, Santa Ana Region Order No. R8-2003-0061, NPDES Permit No. CAG998001 or most recent order or amendment.

G. National Pollutant Discharge Elimination System Permit (NPDES) – San Diego Regional Water Quality Control Board (SDRWQCB) – General Permit for Discharges of Hydrostatic Test Water and Potable Water to Surface Waters and Storm Drains or Other Conveyance Systems, San Diego Region Order No. R9-2002-0020 or most recent order or amendment.

H. Standard Methods for Examination of Water and Wastewater

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Testing Plan	On Owner's request, submit detailed plan showing how Contractor intends to test and flush pipeline and dechlorinate discharge from flushing operation.
Written Permission to Discharge into Sewer	Required from owner of any sanitary sewer prior to discharge of flushing water into sewer. Submittal shall include any special requirements for treatment of flushing water prior to sewer discharge, estimate of expected maximum discharge rate of flushing flow and analysis of sewer's capacity.
Written Permission to Discharge into Storm Drain	Required from owner of any storm drain prior to discharge of flushing water into storm drain. Submittal shall include any special requirements for treatment of flushing water prior to storm drain discharge, estimate of expected maximum discharge rate of flushing flow and analysis of storm drain's capacity.

B. Refer to Section 01 33 00 for definition of requirements for reports and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for items to which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Furnish all labor, water, and equipment necessary to complete pressure testing and flushing process.

PART 3 - EXECUTION

3.1 Preparation

A. Apply test pressures at approved outlet or fitting located within elevation of 5' of lowest point of each pipe section to be tested. Provide and later securely plug such fittings. Where air valves or other suitable outlets are unavailable, provide approved taps and fittings for air release, and securely plug these later.

B. Flush all mains and services with potable water (or water as otherwise approved by Owner and regulatory agencies) after completion of construction. Provide sufficient number of suitable outlets at end(s) of line(s) being flushed in addition to those shown on Plans to permit flushing of main with water at velocity of at least 2.5-feet per second over its entire length. Outlets provided shall meet requirements for fittings specified for type of main constructed. Velocity through outlets and fittings shall not exceed 25 fps during flushing. Construct drainage facilities such that water lines cannot be contaminated through flushing outlets.

C. Provide sufficient hoses, fittings and equipment to direct flushing water to established point of discharge such as gutter and storm drain inlet or natural drainage channel to prevent damage to public or private property and to prevent creating a public hazard. If flushing water must be discharged into traffic lanes, set up traffic control in accordance with requirements of agency having jurisdiction over public right-of-way. Schedule flushing in or adjacent to public streets during periods of reduced traffic volume.

D. Contractor shall be solely responsible for providing source of water for flushing and methods for discharge of test water, including all associated costs and permits.

3.2 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pipe	4-hour Hydrostatic Pressure Test	AWWA C600 or C605 as amplified below but using test pressures shown in 3.1A above and Contract Documents	All pipe sections	Contractor (Owner's Representative will observe and record results)	Contractor (Owner's Representative will observe and record results)
	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner

B. Allowable leakage shall be as follows:

1. No ductile iron or PVC pipe installation will be accepted if leakage exceeds that determined by the following formula (taken from AWWA C600 or AWWA C605):

$$L = \frac{(SD\sqrt{P})}{148{,}000}$$

in which L = allowable leakage, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches

P = average observed test pressure of pipe being tested, as shown, in pounds per square inch gauge, based on elevation of lowest point in line or section under test and corrected to elevation of test gauge.

2. No gasketed steel pipe installation will be accepted if leakage exceeds that determined by the following formula (taken from AWWA C604):

   L=10 gallons per inch-diameter per mile of pipe per 24 hours

3. When testing against closed valves, an allowance of 0.0078 gallons per hour per inch of nominal valve size may be added to that computed using formulas above to account for leakage around seals.

C. For PVC, ductile iron, or gasketed steel pipe, allowable leakage is tabulated below.

ALLOWABLE LEAKAGE IN PVC OR DUCTILE IRON PIPE (GALLONS PER HOUR PER 1000 FT OF PIPE)					**ALLOWABLE LEAKAGE IN GASKETED STEEL PIPE (GALLONS PER HOUR PER 1000 FT OF PIPE)**	**ADDITIONAL ALLOWABLE LEAKAGE THROUGH SEALS OF CLOSED VALVES (GALLONS PER VALVE)**
PIPE DIAMETER	**TEST PRESSURE**					
	150 psi	**200 psi**	**250 psi**	**300 psi**	**All Pressures**	**All Pressures**
3”	0.25	0.29	0.32	0.35	0.24	0.02
4”	0.33	0.38	0.43	0.47	0.32	0.03
6”	0.50	0.57	0.64	0.70	0.47	0.05
8”	0.66	0.76	0.85	0.94	0.63	0.06
10”	0.83	0.96	1.07	1.17	0.79	0.08
12”	0.99	1.15	1.28	1.40	0.95	0.09

D. For welded steel pipe, no leakage will be permitted.

E. For polyethylene pipe, no leakage will be permitted.

F. Four-hour hydrostatic pressure test shall proceed as follows:

1. After all pipe, appurtenances and permanent thrust blocks have been installed and backfilled sufficiently and temporary plugs, caps, thrust blocks and shoring have been installed for required restraint, they shall be subjected to a hydrostatic pressure test.

2. Test pressure shall be 50 psi in excess of working pressure shown for class of pipe unless test pressure is shown elsewhere in Contract Documents.

3. Conduct pressure tests or retests subsequent to any trench backfill compactive effort that might be performed with heavy duty compacting equipment having overall weight in excess of 100 pounds.

4. Some equipment such as butterfly valves may have maximum working water pressure less than test pressure. Contractor shall apply a minimum back pressure on these closed devices equal to difference between test pressure and rated pressure of device.

5. Complete and pass test prior to connecting any new line with existing pipe and mains. Test shall further be conducted with valves open, and open ends of pipes, valves, and fittings suitably closed. Operate and check valves prior to test period. No leakage shall be allowed when testing across any valves.

6. Maximum length of pipe to be included in any one test shall not exceed 2,500’ or distance between valves, whichever is greater. Provide suitable test bulkheads, blocking, and fittings to permit such sectionalizing.

7. Fill line slowly and maintain at operating pressure for at least 24 hours prior to testing to satisfy any system water absorption. While filling and immediately prior to testing, expel all air from pipeline.

8. Pump pressure in pipeline to specified test pressure following 24-hour soak period. When test pressure has been reached, discontinue pumping until line pressure has dropped 10-psi, at which time line pressure shall again be pumped up to test pressure. Repeat procedure until 4 hours have elapsed from time test pressure was first applied. At end of this period, pump pressure up to test pressure for last time.

9. Leakage shall be computed as total quantity of water pumped into pipeline during test period, including water added to reach specified test pressure for final time. Leakage shall not exceed rate specified for type of pipe tested.

10. Allowable leakage is based on AWWA formulas specific to pipe materials tested. These formulas appear in respective AWWA publications for each type of pressure pipe.

11. Repeat testing until leakage does not exceed specified leakage rate. Repair all visible leaks regardless of amount of leakage.

12. Complete tests in presence of Owner's Representative. Owner’s Representative will record results.

G. Flushing water may be discharged to sanitary sewer system rather than discharging to storm drain, provided Contractor obtains and submits to Owner a copy of written permission to discharge from sanitary sewer owner including supplementary information described above under Submittals. Schedule discharges to sewers during off-peak periods as recommended by sewer owner.

END OF SECTION

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SECTION 33 08 31
LEAKAGE AND INFILTRATION TESTING OF GRAVITY SEWER LINES

PART 1 - GENERAL

1.1 Work Included

A. Materials and labor for field leakage and infiltration testing of all gravity sanitary sewers intended for conveyance of wastewater under gravity flow. Furnish all labor, materials, tools, and equipment necessary to provide and complete field pressure testing and infiltration testing as specified.

B. Plan construction activities to allow and facilitate testing of all sections of gravity sanitary sewers.

C. Leakage tests shall be made on completed pipelines as follows:

PIPE	TEST REQUIREMENT
Roof Drains	Tests not required
Storm Drains	Tests not required
Gravity Sanitary Sewers in service with no bypass available	CCTV inspection. See Section 33 01 31
Pressure Sanitary Sewers (Force Mains)	See Section 33 08 11
Water Pipelines	See Section 33 08 11

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 75 00: Starting and Adjusting
H. Section 33 01 31: TV Inspection of Sewer Pipelines
I. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
J. Section 33 30 21: Vitrified Clay Pipe
K. Section 33 30 31: Polyvinyl Chloride Gravity Sewer Pipe and Fittings

1.3 System Description

A. Complete leakage testing and infiltration testing of gravity sewers in compliance with these specifications.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASTM F1417 Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
B. Standard Specifications for Public Works Construction (Greenbook) Section 306-1.4

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION	
Testing Plan	On Owner's request, submit detailed plan showing how Contractor intends to pressure test sewer.	

1.7 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Furnish all labor, materials, and equipment necessary to complete pressure testing of gravity sewers. Deliver equipment to project site in good working order and ready for use.

PART 3 - EXECUTION

3.1 Preparation

A. Test each section of sewer between two successive manholes or structures for leakage or, at option of Owner's Representative, test for infiltration, or both. Test for leakage on all sections of sewer. Infiltration test shall also be made where groundwater is encountered.

B. Even though a section may have previously passed leakage or infiltration tests, should compacting equipment weighing over 1000 pounds be used on backfill subsequent to tests or should any operations of Contractor or others may have damaged or affected required water-tight integrity of pipe, structure, and appurtenances. test each sewer section subsequent to last backfill compacting operation in connection therewith, wherein,

3.2 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pipe	Leakage	ASTM F1417 or as shown below	1 test per pipe	Contractor	Contractor
	Infiltration	ASTM F1417 or as shown below	1 test per pipe as requested by Owner	Contractor	Contractor
Manholes or Wet Wells	Leakage or Infiltration	Shall not exceed 0.1 gallons per hour per vertical foot for manholes and wet wells	1 test per manhole or wet well	Contractor	Contractor

B. Perform leakage and infiltration tests after placement and compaction of backfill, installation of utilities, and prior to mandrel test and placing of permanent paving. Correct all deficiencies found during leakage and infiltration test at no additional cost to Owner.

C. Complete tests in presence of Owner's Representative. Owner's Representative will record results.

F. Conduct infiltration testing as follows for sewer segments located in natural groundwater table:

1. If groundwater is encountered in construction of section of sewer between structures, close end of sewer at upper structure sufficiently to prevent entrance of water.

2. Discontinue pumping of groundwater for at least 3 days, and then test section for infiltration.

3. Where any infiltration exceeding amounts allowed below is discovered before completion and acceptance of sewer, immediately uncover sewer and perform all Work necessary to reduce infiltration to within specified amount at no expense to Owner. Contractor shall stop any individual leaks that may be observed, even if those leaks are in a quantity less than specified limits for acceptance.

4. Where sewer is not located in natural groundwater table, exfiltration tests or low-pressure air tests shall be used to indicate sewer tightness.

G. Conduct exfiltration (leakage) testing as follows for sewer segments located above natural groundwater table:

1. Plug sewer at lower end of section to be tested with stopper.

2. Plug highest end of sewer to be tested with stopper. Stopper plug shall have suitable air vent to allow trapped air removal.

3. Fill pipe and manhole with water to elevation 4 feet above sewer invert at upper manhole. If groundwater is present, fill pipe and manhole to a point 4 feet above average adjacent groundwater level.

4. Check system for leaks in hoses, plugs, calibrated containers, etc. while filling through positive shutoff valve.

5. After filling sewer, allow one hour for absorption of water.

6. Refill sewer to test elevation.

7. Close input valve and begin test.

8. Record elapsed time to empty container of water and calibrate loss rate in gallons per hour.

9. Where any exfiltration or infiltration exceeding amounts allowed below is discovered before completion and acceptance of sewer, immediately uncover sewer and perform all Work necessary to reduce exfiltration to within specified amount at no expense to Owner. Repair pipe joints or, if necessary, remove and reinstall pipe at Contractor's expense. Sewer will not be accepted until exfiltration and/or infiltration rate, as determined by test, is less than allowable leakage.

F. Allowable exfiltration or infiltration shall not exceed 50 gallons per inch of internal diameter per mile per day, which equates to the following:

PIPE DIAMETER (Inches)	ALLOWABLE EXFILTRATION OR INFILTRATION (Gal/hr/100-ft)
6”	0.24 gal/hr/100’
8”	0.32 gal/hr/100’
10”	0.39 gal/hr/100’
12”	0.47 gal/hr/100’
15”	0.59 gal/hr/100’

H. Air testing shall only be done where Owner’s Representative determines exfiltration or infiltration testing is impractical. Where directed by Owner’s Representative, air testing shall proceed as follows:

1. Conduct air leakage test on all gravity sewers not tested by infiltration or exfiltration testing. Test each section of sewer between two successive manholes or structures.

2. Clean and wet line to be tested.

3. Plug all pipe outlets with suitable test plugs and securely brace each plug.

4. Compressor used to add air to pipe shall have blowoff valve set at 5 psig to ensure internal pipe pressure cannot exceed 5 psig.

5. Constantly monitor pressure in pipeline using gage and hose arrangement separate from hose used to fill sewer with air.

6. Add air slowly to portion of pipe installation under test until internal air pressure reaches 3.0 psig.

7. After 3.0-psig internal pressure is reached, maintain air pressure between 2.5 psig and 3.5 psig for at least 2 minutes to allow air temperature to reach equilibrium with pipe wall temperature. Add only enough air to maintain pressure.

8. Check exposed pipe and plugs for leakage by coating with soap solution. If any failures are observed, bleed off air and make necessary repairs.

9. After 2-minute period, disconnect air supply.

10. When pressure decreases to 2.5 psig, start timing with stopwatch or sweep-second-hand watch.

11. Determine time lapse required for air pressure to drop to 1.5 psig gage pressure.

12. If pressure drop from 2.5 psig to 1.5 psig occurs in less time than values tabulated below, pipe shall be overhauled and, if necessary, replaced and reinstalled until joints and pipe pass air test.

13. Use Greenbook tables in Section 306-1.4.4 to determine minimum time lapse required for air pressure to drop from 2.5 psig to 1.5 psig. With 6" laterals or house connections these values are as follows:

PIPE DIAMETER (Inches)	TIME IN SECONDS FOR PRESSURE DROP FROM 2.5 PSIG TO 1.5 PSIG					
	SEWER LENGTH (ft)	HOUSE CONNECTION LENGTH				
		0'	100'	200'	300'	400'
8"	0'	0	40	80	100	100
	50'	40	70	110	110	110
	100'	70	110	120	110	110
	150'	110	120	120	120	110
	200'	140	130	120	120	120
	300'	140	130	120	120	120
	400'	140	130	130	120	120
10"	50'	50	90	120	120	110
	100'	110	140	130	130	120
	200'	170	150	140	140	130
	300'	170	160	150	140	140
	400'	170	160	150	150	140
12"	50'	80	120	140	130	120
	100'	160	170	150	140	140
	200'	200	180	170	160	150
	300'	200	190	180	170	160
	400'	200	190	180	180	170
15"	50'	120	160	160	150	140
	100'	250	210	190	170	160
	200'	260	230	210	200	190
	300'	260	240	220	210	200
	400'	260	240	230	220	210

END OF SECTION

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SECTION 33 11 11
DUCTILE-IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.1 Work Included

A. Materials and installation of Ductile-Iron Pipe (DIP) and fittings 3”-64”.

B. Do not use ductile iron pipe and fittings under any of the following circumstances:

1. For buried pipelines exposed to seawater.
2. For buried pipelines within 200’ of electrified railways.

1.2 Related Work Described Elsewhere

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 33: Mechanical Identification
H. Section 03 30 00: Cast-in-Place Concrete
I. Section 09 90 00: Painting and Coating
J. Section 09 96 56: Epoxy Linings and Coatings
K. Section 22 10 00: Plumbing Piping
L. Section 31 05 50: Protecting Existing Utilities
M. Section 31 23 00: Excavation and Fill
N. Section 33 05 26: Utility Identification
O. Section 33 05 31: Pipeline Joint Materials
P. Section 33 05 32: Flange Insulating Kits
Q. Section 33 05 38: Hangers and Supports
R. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
S. Section 33 11 19: Mastic and Tape-Wrap Systems for Metal Pipe
T. Section 33 13 00: Disinfecting of Water Utility Distribution

1.3 System Description

A. Furnish and install ductile-iron pressure pipe as shown on Plans including appurtenant fittings and connections in conformance with Manufacturer’s installation requirements and in compliance with applicable construction safety codes and standards.

1.4 Quality Assurance

A. Manufacturer of pipe and fittings shall employ manufacturing methods and material formulations in use for at least 5 years.

B. Owner or Owner’s Representative shall be entitled to inspect pipes and witness manufacturing process.

C. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Fusion-Bonded Epoxy Lining	Visual Inspection	See Section 09 96 56.	See Section 09 96 56.	Contractor	Contractor
	Holidays			Contractor	Contractor
	Lining Thickness			Contractor	Contractor

1.5 References

A. ASME/ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings – Class 25, 125, 250 and 800
B. ASME/ANSI B16.42 Ductile Iron Flanged Fittings – Classes 150 and 300
C. ASTM A377 Index of Specifications for Ductile Iron Pressure Pipe
D. ASTM A536 Ductile Iron Castings
E. ASTM A716 Ductile Iron Culvert Pipe
F. ASTM A746 Ductile Iron Gravity Sewer Pipe
G. ASTM D16 Terminology of Paint, Varnish, Lacquer and Related Products
H. ASTM D471 Test Method for Rubber Property – Effect of Liquids
I. ASTM D1248 Polyethylene Plastics Extrusion Materials For Wire and Cable
J. ASTM D2240 Rubber Property - Durometer Hardness
K. ASTM D4060 Abrasion Resistance of Organic Coatings by Taber Abraser
L. ASTM D4561 Pull-Off Strength of Coatings Using Portable Adhesion Testers
M. ASTM G14 Resistance of Pipeline Coatings (Falling Weight Test)
N. AWWA C104/ANSI A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
O. AWWA C105/ANSI A21.5 Polyethylene Encasement for Ductile-Iron Pipe Systems
P. AWWA C110/ANSI A21.10 Ductile-Iron and Gray-Iron Fittings, 3”-48”, for Water
Q. AWWA C111/ANSI A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
R. AWWA C115/ANSI A21.15 Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
S. AWWA C116/ANSI A21.16 Protective Fusion-Bonded Epoxy Coatings for Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
T. AWWA C150/ANSI A21.50 Thickness Design of Ductile Iron Pipe
U. AWWA C151/ANSI A21.51 Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
V. AWWA C153/ANSI A21.53 Ductile-Iron Compact Fittings, 3”-64”, for Water Service
W. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances
X. AWWA M41 Ductile-Iron Pipe and Fittings
Y. SSPC SP1 Solvent Cleaning
Z. SSPC SP6/NACE 3 Commercial Blast Cleaning
AA. SSPC SP10/NACE 2 Near White Blast Cleaning

1.6 Submittals

A. Furnish the following submittals:

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
	Required for pipe, couplings, fittings, protective coatings, and gaskets.
Installation Instructions	Use AWWA C600 for pipe installation
	Submit supplementary information as needed to cover proprietary methods of joint restraint.
Line Drawings	Line drawings.
	Materials list.

SUBMITTAL	DESCRIPTION
Line Drawings (cont.)	Layout schedule.
	Order of installation.
	Length and location of each pipe section and fitting.
	Dimensional checks.
	Station and elevation of pipe invert at all changes in grade.
	Data on curves and bends for both horizontal and vertical alignment.
Certificate of Compliance	Deliver with pipe affidavit from Manufacturer certifying compliance with requirements of AWWA standards and Contract Documents
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Pack, ship, handle, and store pipe in accordance with Manufacturer's instructions and AWWA C600 and AWWA M41 Chapter 11.

C. Transportation shall be by competent haulers and accomplished in manner to avoid damage to pipe, lining, or coating.

D. Before release of chains, cables and strapping around pipe being delivered, check loads to ensure all chock blocks are secure on both ends of support timbers. If not, provide suitable wedges or chocks to prevent pipe from rolling when other restraints are removed.

E. Unload pipe by mechanical means, such as crane or backhoe, or by nylon slings and skids, as recommended by Manufacturer. In using skids, prevent pipes from striking other pipe. Do not drop pipe from trucks.

F. Store pipe and fittings in accordance with Manufacturer's recommendations to prevent damage and contamination.

G. Carefully handle pipe to prevent damage to lining and coating. Attach cable, rope, or other devices used for lowering fittings into trench around exterior of fitting for handling. Do not attach cable, rope, or other device through fitting's interior for handling.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant, including all Work and materials specified herein and as may be required to install and complete this portion of Work.

B. Payment by linear foot shall be for each diameter and for each pipe strength designation measured horizontally over pipe centerline.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Ductile-Iron Pipe	American Cast Iron Pipe Company (ACIPCO)	Birmingham, AL
	Atlantic States Cast Iron Pipe Company	Phillipsburg, NJ
	Clow Water Systems Company	Coshocton, OH
	Griffin Pipe Products	Council Bluffs, IA
	Pacific States Cast Iron Pipe Co Div. McWane, Inc.	Provo, UT
	U.S. Pipe and Foundry (3”-64”)	Birmingham, AL
	Accepted equal	
Ductile Iron Pipe High-Deflection (Lip-Seal-Gasket) Pipe	U.S. Pipe and Foundry NXT (4”-12”)	Birmingham, AL
	Accepted equal	
Ductile Iron Pipe with Metallic Zinc Coating (Required in pipe below high tide or in corrosive soils having 10 or more corrosion points as defined in AWWA C105)	U.S. Pipe and Foundry (3”-64”)	Birmingham, AL
	Accepted equal	
Ductile-Iron Mechanical-Joint Pipe	American Cast Iron Pipe Company (ACIPCO)	Birmingham, AL
	Atlantic States Cast Iron Pipe Company	Phillipsburg, NJ
	Clow Water Systems Company	Coshocton, OH
	Griffin Pipe Products	Council Bluffs, IA
	Pacific States Cast Iron Pipe Co Div. McWane, Inc.	Provo, UT
	U.S. Pipe and Foundry (4”-12”)	Birmingham, AL
	Accepted equal	
Ductile-Iron Pipe Fittings	American Cast Iron Pipe Company (ACIPCO)	Birmingham, AL
	Clow Water Systems Company	Coshocton, OH
	Griffin Pipe Products	Council Bluffs, IA
	Star Pipe Products	Houston, TX
	Tyler Union Div. McWane, Inc.	Tyler, TX
	U.S. Pipe and Foundry (3”-64”)	Birmingham, AL
	Accepted equal	
Push-on Joints	American Cast Iron Pipe Company (ACIPCO) “Fastite”	Birmingham, AL
	Atlantic States Cast Iron Pipe Company	Phillipsburg, NJ
	Clow Water Systems Company	Coshocton, OH
	Griffin Pipe Products “Fastite or Tyton”	Council Bluffs, IA
	Pacific States Cast Iron Pipe Co Div. McWane, Inc.	Provo, UT
	U.S. Pipe and Foundry “Tyton” (3”-64”)	Birmingham, AL
	Accepted equal	
Restrained Joints	American Cast Iron Pipe Company (ACIPCO) “Flex-Ring”	Birmingham, AL
	Atlantic States Cast Iron Pipe Company	Phillipsburg, NJ
	Clow Water Systems Company “Super-Lock”	Coshocton, OH
	Griffin Pipe Products “Snap-Lok”	Council Bluffs, IA

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Restrained Joints (cont.)	Pacific States Cast Iron Pipe Co Div. McWane, Inc. "Thrust Lock"	Provo, UT
	U.S. Pipe and Foundry "TR-Flex" (4"-64")	Birmingham, AL
	Accepted equal	
Restrained Joints – Locking Gasket Type	American Cast Iron Pipe Company (ACIPCO) "Fast-Grip""	Birmingham, AL
	Griffin Pipe Products "Talon"	Council Bluffs, IA
	Pacific States Cast Iron Pipe Co Div. McWane, Inc. "Sure-Stop"	Provo, UT
	U.S. Pipe and Foundry "Field-Lok" (4"-36")	Birmingham, AL
	Accepted equal	
Restrained Joints for Seismic, Landslide, Thermal Expansion or Valve Removal Applications	U.S. Pipe and Foundry "TR-Xtreme" (4"-12")	Birmingham, AL
	Accepted equal	
Restrained Joint High Deflection Coupling	U.S. Pipe and Foundry "XTRA-Flex"	Birmingham, AL
	Accepted equal	
Tee-Head Bolts and Hex Nuts on Mechanical Joints	NSS Industries Corten	
	Accepted equal	
Shop Coat on Buried Pipe	Koppers 11-S Primer	Pittsburgh, PA
	Accepted equal	
Field Coatings on Buried Pipe	Koppers Bituplastic No 33	Pittsburgh, PA
	Accepted equal	
Polyethylene Encasement	Dupont Alathon	Wilmington, DE
	Northtown Company	Huntington Beach, CA
	T Christy Enterprises "AWWA Polywrap" (714) 507-3300	Anaheim, CA
	Trumbull Industries, Inc.	Youngstown, OH
	V-Bio (Ductile Iron Pipe Research Association) (4"-64")	Birmingham, AL
	Accepted equal	
Tape for Polyethylene Encasement	Berry Plastics "Polyken No 900"	Franklin, MA
	J-M Manufacturing Co., No V-10	Livingston, NJ
	Plicoflex No 340	
	Protecto Wrap No 200	Denver, CO
	Scotchwrap (3M), No 50	St Paul, MN
	Tapecoat Co., CT	Evanston, IL
	Accepted equal	
Third-Party Ductile Iron Pipe Follower-Gland-Type Mechanical Joint Restraints	EBAA Iron Megalug Series 1100 1100 for new MJ fittings 3"-48" 1100SD for existing MJ fittings 3"-48" Megabond coating system	Eastland, TX
	Ford Uni-Flange Series 1300 Restrained End Cap for MJ fittings 4"-16" Series 1400 for MJ fittings 4"-36" E-coat coating system	Wabash, IN
	Romac "RomaGrip" Accepted coating system	Bothell, WA
	Smith Blair, Inc. Cam-Lock 111 Flexicoat coating system	Texarkana, TX

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Third-Party Ductile Iron Pipe Follower-Gland-Type Mechanical Joint Restraints (cont.)	Star Pipe Products "Stargrip" Series 3000 Accepted coating system	Houston, TX
	Accepted equal	
Third-Party Ductile Iron Pipe Restraint Harness for Push-on Bells	EBAA Iron (Series 1700 Megalug) Restraint Harness	Eastland, TX
	Romac 600 Series	Bothell, WA
	Star National Products Division Dresser Industries Style 443 Tie-Anchor	Columbus, OH
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Ductile-iron pipe and fittings shall conform to the following materials and manufacturing requirements:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT	
Pipe	Manufacturing Standards	AWWA C151/ANSI 21.50 for pipe 3"-64"	
	Design Standards	AWWA C150/ANSI A21.50 and AWWA M41	
	NSF Certification	NSF 61 certification required for potable water pipe	
	Material	Ductile-iron	
	Size	As shown on plans.	
	Wall Thickness	4" pipe	Thickness Class 53
		6" pipe	Thickness Class 53
		8" pipe	Thickness Class 53
		Pipe sizes ≥ 14" = Thickness Class 50, unless otherwise specified.	
		OR	
		Pressure class pipe may be substituted for thickness class pipe as follows:	
		4"-14" pipe	not allowed
		16"-18" pipe	Pressure Class 350
		Pipe with Grooved Couplings	Thickness Class 53
	Markings	Per AWWA C151 Section 4.6.	
	Lengths	18' or 20' lengths per AWWA C151/ANSI A21.51, except where shorter lengths are required to fit horizontal or vertical alignment.	
	Coatings	Buried	Shop coat with one prime coat of asphaltic coating approximately 1-mil thick per AWWA C151

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT	
(cont.)	Coatings (cont.)	Galvanic Coating (Required in pipe below high tide or in corrosive soils having 10 or more corrosion points as defined in AWWA C105)	200 g/m^2 99.99% pure metallic zinc Apply by thermal arc spray process to exterior metal surface
		Above ground and in vaults	See Section 09 90 00.
	Cement Mortar Lining	Double thickness cement-mortar lined per AWWA C104 using Type II cement, unless otherwise specified.	
	Cement Mortar Lining Double Thickness Dimensions	3”-12” Pipe	1/8”
		14”-24” Pipe	3/16”
Joints	Standard Push-on Style	AWWA C111/ANSI 21.11	
	Mechanical Joint	AWWA C111/ANSI 21.11	
	Restrained Style	Special push-on type joint providing longitudinal restraint in lieu of concrete thrust block.	
		Boltless, restrained push-on joint design with positive axial locking restrained system capable of deflection after assembly.	
		Use one type of restrained joint exclusively for all Work.	
Joint Gaskets	Material	AWWA C111/ANSI 21.11	
	Gasket Age	<180 days old or <2 years old but retested <60 days prior to installation	
Fittings	Material	Ductile-iron	
	Standards	AWWA C110/ANSI 21.10 or AWWA C153/ANSI A21.53	
	Style	Push-on (standard) or restrained joint (as specified). Mechanical joint fittings not allowed unless otherwise shown on Plans.	
	Marking	Cast letters “DI” or “DUCTILE” into fittings, unless otherwise specified.	
	Coatings	Same coating as adjacent pipe, as described above	
	Linings	Same lining as adjacent pipe, as described above	
Ductile Iron Pipe Joint Restraints	Material	Ductile Iron	
	Style	Gripping Wedge	
	Working Pressure Rating	3”-16”	350 psi
		18”-64”	250 psi
Flanges	Material	Ductile Iron	
	Pressures 0-250 psi	ASME/ANSI B16.42 Class 150 Raised- or plain-faced	
	Screwed-on Type for Pipe	AWWA C115/ANSI A21.15	
	Integrally-cast Type for Fittings	AWWA C110/ANSI A21.10	
	Alignment for Valve Mating	Boltholes shall straddle horizontal centerlines of pipe run to which flanges are attached.	
Flange Bolts, Nuts, and Washers	Various Steels	See Section 33 05 31.	
Flange Gaskets		See Section 33 05 31.	
Grooved Ends	Provide where shown	AWWA C606 Compatible with adjacent coupling	
Shop Coat	Prime Coat	12 mils MDFT Koppers 11-S primer	

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Polyethylene PE Film Wrap for Corrosion Protection	Standards	AWWA C105/ANSI A21.50
	Material	Polyethylene plastic tube
	Thickness	8-mil, single layer on pipe 8-mil double layer on fittings and appurtenances
	Biocide	Infuse inside surface contacting pipe exterior with anti-microbial biocide to mitigate microbial corrosion and volatile corrosion inhibitor to control galvanic corrosion.
	Adhesive tape to connect plastic film tubes and plastic film wrap at fittings and appurtenances	2" wide 10-mil thick polyethylene adhesive tape
Alternate to Plastic Film Wrap for Corrosion Protection	Finish Coat	15 mils MDFT Koppers Bituplastic No 33

D. Provide identification for buried AWWA C151 ductile-iron pipe in the following manner:

PIPE CONTENTS	IDENTIFICATION/ WARNING/ LOCATING	TYPE	MATERIALS/METHOD
Sewage	Pipe Contents Identification	Identification Tape	2" high letters reading "CAUTION: SEWER"
			Color = green with white letters
			Attached to top of pipe with adhesive tape
			Specification – See Section 33 05 26
	Pipe Warning Tape	Warning Tape	2" high letters reading "CAUTION: SEWER BURIED BELOW"
			Color = green with white letters
			Installed in pipe trench 18" above pipe
			Specification – See Section 33 05 26

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install DIP pressure pipe and fittings before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Prior to installing pipe, grade and prepare trench bottom to provide uniform bearing throughout entire length of each pipe joint. Dig bell holes of ample dimension in trench bottom at joint locations to facilitate joining. Form flat or semi-circular trench bottom conforming to grade to which pipe is to be installed.

C. Dewater trench so trench bottom and bedding material are dry.

D. Minimum trench width at crown of pipe shall be as follows based on AWWA M41 Table 11-2:

NOMINAL PIPE OD	MINIMUM BEDDING DEPTH (in below bell)	MINIMUM TRENCH WIDTH B_d (in)	PARALLEL PIPE CLEARANCE (in)
3"	4"	27"	6"
4"	4"	28"	6"
6"	4"	30"	6"
8"	4"	32"	6"
10"	4"	34"	6"
12"	4"	36"	6"
14"	4"	38"	6"
16"	4"	40"	6"

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Refer to Section 31 23 00 for open trench requirements.

C. Furnish and install pipe and fittings at locations shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. Applicable building, fire, plumbing and mechanical code requirements
4. AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances
5. AWWA Manual M41 Ductile-Iron Pipe and Fittings

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. Protect water systems by maintaining separations and using materials described in Section 31 05 50.

G. Excavation and backfill, including pipe bedding, shall conform to provisions of Section 31 23 00, AWWA C600, and AWWA M41, Chapter 11.

H. Accurately place pipe to lines and grades shown. Support fittings independently of pipe.

I. Assemble push-on joints per AWWA C600 and as follows:

1. On long radius curves, excavate trench wider than normal to allow for straight-line assembly before deflection.
2. Cut and machine pipe per AWWA C600, AWWA M41, and Manufacturer's standard procedures.

3. Do not cut pipe with cold chisel, standard iron pipe cutter, or any other method that may fracture pipe or produce ragged, uneven edges.

4. Clean groove and bell socket of pipe or fitting and plain end of mating pipe. Joint shall be dirt-free.

5. Lubricate plain end, socket and gasket using soapy water or accepted pipe lubricant as recommended in AWWA C600.

6. Insert rubber ring into groove making sure ring is completely seated. Lubrication for spigot and instruction for lubricant use shall be supplied by pipe Manufacturer.

7. Spigot and bell shall slide together without displacement of rubber gasket. Where possible install pipe with bell facing in direction of laying.

8. Insert spigot into bell and force slowly into position using large bar lever and wood block across pipe end. For large pipe, a come-along (with padding that will not scratch pipe) may be used.

9. After assembling pipe in straight line, make horizontal or vertical deflections at joints to comply with alignment shown on Plans.

10. Allowable joint deflections for push-on joints shall not exceed the following

PIPE NOMINAL DIAMETER	STANDARD TYTON®-STYLE JOINT		LIP-SEAL GASKET NXT® JOINT	
	ALLOWABLE JOINT DEFLECTION - α PUSH-ON-JOINT	ALLOWABLE JOINT DEFLECTION - α RESTRAINED-JOINT	ALLOWABLE JOINT DEFLECTION - α PUSH-ON-JOINT	ALLOWABLE JOINT DEFLECTION - α RESTRAINED-JOINT
3”	4.0°	n/a	n/a	n/a
4”	4.0°	n/a	n/a	n/a
6”	4.0°	3.2°	8.0°	6.4°
8”	4.0°	3.2°	8.0°	6.4°
10”	4.0°	3.2°	n/a	n/a
12”	4.0°	3.2°	n/a	n/a
14”	2.4°	1.6°	n/a	n/a
16”	2.4°	1.6°	n/a	n/a

11. Values shown above are based on 80% of that recommended by AWWA M41 Table 11-4 and 11-5 or Manufacturer.

12. Minimum radii shall not be less than the following unless pipe lengths shorter than 18’ or 20’ are used:

PIPE NOMINAL DIAMETER	STANDARD TYTON®-STYLE JOINT				LIP-SEAL GASKET NXT® JOINT			
	MINIMUM RADIUS - r PUSH-ON-JOINT		MINIMUM RADIUS - r RESTRAINED-JOINT		MINIMUM RADIUS - r PUSH-ON-JOINT		MINIMUM RADIUS - r RESTRAINED-JOINT	
	18’ SPOOLS	20’ SPOOLS	18’ SPOOLS	20’ SPOOLS	18’ SPOOLS	20’ SPOOLS	18’ SPOOLS	20’ SPOOLS
3”	241’	286’	n/a	n/a	n/a	n/a	n/a	n/a
4”	241’	286’	n/a	n/a	n/a	n/a	n/a	n/a
6”	241’	286’	322’	358’	121’	143’	161’	179’
8”	241’	286’	322’	358’	121’	143’	161’	179’
10”	241’	286”’	322’	358’	n/a	n/a	n/a	n/a
12”	241’	286’	322’	358’	n/a	n/a	n/a	n/a
14”	430’	477’	645’	716’	n/a	n/a	n/a	n/a
16”	430’	477’	645’	716’	n/a	n/a	n/a	n/a

J. Assemble mechanical joints per AWWA C600 and as follows:

1. On long radius curves, excavate trench wider than normal to allow for straight-line assembly before deflection.

2. Cut and machine pipe per AWWA C600, AWWA M41, and Manufacturer's standard procedures.

3. Do not cut pipe with cold chisel, standard iron pipe cutter, or any other method that may fracture pipe or produce ragged, uneven edges.

4. Lubricate plain end, socket and gasket using soapy water or accepted pipe lubricant as recommended in AWWA C600.

5. Insert rubber ring into groove making sure ring is completely seated. Lubrication for spigot and instruction for lubricant use shall be supplied by pipe Manufacturer.

6. Spigot and bell shall slide together without displacement of rubber gasket. Joint shall be dirt free. Where possible install pipe with bell facing in direction of laying.

7. Insert spigot into bell and force slowly into position using large bar lever and wood block across pipe end. For large pipe, a come-along (with padding that will not scratch pipe) may be used.

8. Push gland toward socket and center it around pipe with gland lip against gasket. Insert bolts and hand-tighten nuts.

9. After assembling pipe in straight line, make horizontal or vertical deflections at joints to comply with alignment shown on Plans.

10. Allowable joint deflections for mechanical joints shall not exceed:

PIPE NOMINAL DIAMETER	ALLOWABLE JOINT DEFLECTION - α MECHANICAL-JOINT	ALLOWABLE JOINT DEFLECTION - α RESTRAINED-JOINT
3"	6.6°	n/a
4"	6.6°	n/a
6"	5.7°	3.2°
8"	4.3°	3.2°
10"	4.3°	3.2°
12"	4.3°	3.2°
14"	2.9°	1.6°
16"	2.9°	1.6°

11. Values shown above are based on 80% of that recommended by AWWA M41 Table 11-4 and 11-5 or Manufacturer.

12. After making joint deflection, tighten bolts to normal range of bolt torque recommended by Manufacturer or AWWA M41 Table 11-3.

K. Assemble flanged joints per Section 33 05 31.

L. Provide PE film wrap on ductile iron and cast iron fittings and pipe as follows:

1. Comply with AWWA C105.

2. Wrap PE film snugly around all exterior ferrous surfaces and 8" beyond bells, overlapping at least 2" at each seam.

3. Take care to completely encase pipe and prevent contact between pipe and surrounding soil. Prevent soil or bedding material from becoming trapped between pipe and PE wrap.

4. Do not install PE wrap on pipe sections or fittings to be concrete encased, installed within casing or installed through concrete slope anchors.

5. Leave stainless steel nuts and bolts exposed.

6. Secure PE wrap in place using 2” wide plastic tape.

7. At least 3 circumferential turns of plastic tape shall seal PE wrap ends over pipe and above valve bonnets.

8. Place circumferential wraps of tape at 2-foot intervals along pipe barrel to minimize space between PE wrap and pipe.

9. Repair cuts, tears, punctures or damage to PE wrap with adhesive tape or with short length of PE tube cut open, wrapped around pipe and secured in place.

10. A 15-mil coat of Koppers Bituplastic No 33 may be applied as an alternate to PE wrapping.

M. In addition to PE wrapping ductile iron pipe, wrap service lines of dissimilar metals and attendant corporation stop with PE wrap or suitable dielectric tape for minimum clear distance of 3’ from main.

N. Provide thrust blocks as follows:

1. Place concrete thrust blocks in accordance with Section 03 30 00 as shown using Portland cement concrete containing not less than 5 sacks of cement per cubic yard.

2. Place concrete blocks between undisturbed ground and fittings to be anchored.

3. Quantity of concrete and bearing area of pipe undisturbed soil shall be as shown, unless otherwise determined by Owner's Representative.

4. Place concrete, unless specifically shown otherwise, so pipe joints and fittings remain accessible to repairs.

H. Push-on restrained joints shall incorporate Flex-Ring, split ring or ring segments, and shall be installed in accordance with Manufacturer’s installation instruction for joint design used.

I. Third-party ductile iron pipe restraint systems may also be used.

3.3 Field Quality Control

A. Do not backfill any joint until Owner's Representative has observed it. Leave open sufficient trench space in vicinity of each joint to permit visual observation around entire periphery of joint.

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Ductile Iron Pipe	Pipe Separations	Section 31 05 50.	All new pipe	Contractor	Contractor
	Hydrostatic Test	Section 33 08 11, AWWA C600 and AWWA M41	All new ductile iron pipe	Contractor	Contractor
	Disinfection	Section 33 13 00 and AWWA C651.	All new ductile iron potable water pipe	Contractor	Contractor
	Anchorage and Support of Exposed Pipe	Visual inspection of finished installation. Support per UPC Table 3-1 and 3-2	1 inspection	Owner	Owner
	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

C. Remove damaged pipe or fittings upon discovery and without delay from Project Site.

3.4 Cleaning and Disinfection

A. Clean and disinfect pipe in accordance with Section 33 13 00.

3.5 Protection

A. Close open end of pipe with tight-fitting cap or plug to prevent entrance of foreign matter into pipe at all times when pipe installation is not in progress. These provisions shall apply during noon hour as well as overnight. Do not use pipeline to drain or remove water that has infiltrated into trench. Maintain inside of pipe free from foreign materials and in clean and sanitary condition until acceptance by Owner.

END OF SECTION

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SECTION 33 11 19
MASTIC AND TAPE-WRAP SYSTEMS FOR METAL PIPE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of corrosion-inhibiting mastic and tape-wrap systems for ferrous pipe.

B. Where polyethylene encasement is required by Contract Documents, apply polyethylene encasement in addition to mastic or tape-wrap system specified herein.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 31 23 00: Excavation and Fill
I. Section 33 11 11: Ductile Iron Pipe

1.3 System Description

A. Furnish and install complete operating tape-wrap system for buried ferrous pipe including wrapping of appurtenant flanges, bolts, nuts, tie-rods, turnbuckles, restraint devices, couplings and appurtenances.

B. Comply with Manufacturer's installation requirements and applicable codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. ASTM D4417 Field Measurement of Surface Profile of Blast Cleaned Steel
B. California Plumbing Code (CPC)
C. SSPC SP1 Solvent Cleaning
D. SSPC SP2 Hand Tool Cleaning
E. SSPC SP3 Power Tool Cleaning
F. SSPC SP6/NACE 3 Commercial Blast Cleaning

1.6 Submittals

A. Furnish the following submittals:

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
Names of Tape Applicators	At least 14 days before start of taping operations, submit names and qualifications of workers and supervisors to be employed in coating operation. Supervisors shall have 2 years of continuous current experience. Notify Owner's Representative of changes in personnel assigned to taping.
Installation Instructions	Submit repair procedure for correcting damaged or defective tape application per installation or application instruction requirements.
Certificate of Compliance	Submit test data and quality control results on each batch of tape materials used. Submit coating system and application certification per certificate of compliance requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of tape-wrap systems for steel pipe shall be strictly followed.

C. Support pipe stored alongside of trench on saddles used in transporting pipe, sandbags, or rock-free piles of sand at ¼ points providing at least 36" of bearing surface at each point.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Bituminous Mastic Coating	Hy-Tech Products Bituminous Mastic 50HT	Sunset Beach, CA
	Protecto-Wrap JS160H	Denver, CO
	Accepted equal	
AWWA C216 Heat-Shrinkable Cross-Linked Polyolefin Coatings for Exterior of Special sections, Connections and Fittings	Berry Plastics Corporation CoValence "Water-Wrap"	Franklin, MA
	Accepted equal	
AWWA C217 Petrolatum Primer	Denso North America Div Winn & Coates "Denso-Paste"	Houston, TX
	Tapecoat Company	Evanston, IL
	Tek-Rap, Inc.	Houston, TX
	Trenton Corporation Wax-Tape Primer	Ann Arbor, MI
	Accepted equal	

ITEM	MANUFACTURER	MANUFACTURER LOCATION
AWWA C217 Profiling Mastic Paste	Denso North America Div Winn & Coates "Denso Profiling Mastic"	Houston, TX
	Tapecoat Company	Evanston, IL
	Tek-Rap, Inc.	Houston, TX
	Trenton Corporation	Ann Arbor, MI
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Bituminous mastic coating systems for ferrous pipe shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Bituminous Mastic Coating	Surface Preparation	SSPC SP1 Solvent cleaning. Remove weld spatter, sharp points and edges. On pipe with rust, paint or foreign matter.surface prep per SSPC SP2 Hand-tool cleaning or SSPC SP3 Power-tool cleaning requirements.
	Coating	30-mil minimum thickness

C. Tape-wrap systems for ferrous pipe shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
AWWA C215 Extruded Polyolefin Coatings	Surface Preparation	SSPC SP6/NACE 3 Commercial Blast Cleaning 1-3 mil anchor pattern or profile depth per ASTM D4417
	Coating Application	Conform to AWWA C215 Section 4
AWWA C216 Heat-Shrinkable Cross-Linked Polyolefin Coatings for Exterior of Special Sections, Connections, and Fittings	Surface Preparation	SSPC SP6/NACE 3 Commercial Blast Cleaning 1-3 mil anchor pattern or profile depth per ASTM D4417
	Coating Application	Conform to AWWA C216 Section 4

PART 3 - EXECUTION

3.1 Preparation

A. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

B. Do not walk on pipe except when wearing rubber sole shoes. Do not allow tools or rocks to impact pipe.

C. While laying tape and cement-mortar-coated steel pipe, do not roll or skid pipe in contact with ground at any point.

D. Prepare pipe surface to receive mastic and tape wrap as recommended by mastic and tape wrap Manufacturer.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Refer to Section 31 23 00 for open trench requirements.

C. Furnish and install tape-wrap systems for ferrous pipe at locations shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Other applicable fire, plumbing, mechanical and electrical code requirements

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. In rocky soil, provide 6" sand blanket beneath pipe before lowering pipe into trench.

G. Visually inspect coating immediately before placing pipe in trench, Repair defects in coating prior to lowering pipe into trench per Manufacturer's requirements and applicable AWWA standards.

H. Lower coated pipe or appurtenance into trench using belt sling at least 16" wide. Do not use chains, hooks or other equipment that might damage pipe coating.

I. Lay 18"-wide strip of heat resistant material across top half of pipe on each side of coating holdback during welding to protect coating against weld spatter.

J. If damage to underlying tape coat is suspected Owner's Representative may direct Contractor to remove cement mortar or other coating from area of suspected damage, visually inspect suspect area, and electronically test for holidays in accordance with continuity test requirements described in Section 09 90 00. Repair tape defects per submitted tape Manufacturer's repair procedure. Repair cement-mortar coating defects.

K. If backfill above pipe contains rocks, protect 6" blanket of sand around and over pipe before backfilling remainder of trench.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Mastic and Tape-Wrap Systems for Ferrous Pipe	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 11 21
BRASS AND COPPER PIPE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of brass and copper pipe and brass and bronze fittings.

B. Do not use brass pipe under any of the following circumstances:

1. To convey potable water unless lead-free brass is specified
2. For buried pipe.

1.2 Related Work

B. Section 01 33 00: Submittal Procedures
C. Section 01 40 00: Quality Requirements
D. Section 01 61 00: Common Product Requirements
E. Section 01 65 00: Product Delivery Requirements
F. Section 01 66 00: Product Storage and Handling Requirements
G. Section 01 73 00: Execution
H. Section 01 73 24: Seismic Restraint
I. Section 01 73 33: Mechanical Identification
J. Section 09 90 00: Painting and Coating
K. Section 22 10 00: Plumbing Piping
L. Section 31 05 50: Protecting Existing Utilities
M. Section 31 23 00: Excavation and Fill
N. Section 33 05 26: Utility Identification
O. Section 33 05 31: Pipeline Joint Materials
P. Section 33 05 32: Flange Insulating Kits
Q. Section 33 05 33: Couplings, Tie Rods, Flange Connectors and Unions
R. Section 33 05 38: Hangers and Supports
S. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
T. Section 33 11 19: Mastic and Tape-Wrap Systems for Metal Pipe
U. Section 33 12 22: Bronze Valves 3” and Smaller
V. Section 33 12 31: Water Services and Flowmeter Assemblies
W. Section 33 13 00: Disinfecting of Water Utility Distribution

1.3 System Description

A. Furnish and install complete operating pipe system as shown, including appurtenant structural and/or mechanical mountings or connections required for compliance with Manufacturer’s installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. National Sanitation Foundation marking shall appear on all potable water valves.

C. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with Section 116875 of California Health and Safety Code.

D. Stainless steel products may be substituted for bronze products provided dielectric protection is provided between stainless steel and bronze or copper alloys.

E. National Sanitation Foundation Marking is not required for piping in nonpotable water or drainage service.

1.5 References

A. ASME/ANSI B1.20.1 (ANSI B2.1) Pipe Threads – NPT National Pipe Thread Taper
B. ASME/ANSI B16.15 Cast Bronze Threaded Fittings
C. ASME/ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
D. ASME/ANSI B16.22 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
E. ASME/ANSI B16.23 Cast Copper Alloy Solder Joint Drainage Fittings
F. ASME/ANSI B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings
G. ASME/ANSI B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes
H. ASME/ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings
I. ASME/ANSI B16.50 Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
J. ASME/ANSI B31.3 Process Piping
K. ASME Boiler and Pressure Vessel Code
L. ASTM A193 Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
M. ASTM A194 Carbon and Alloy-Steel Nuts for Bolts for High Pressure and High-Temperature Service
N. ASTM B32 Solder Metal
O. ASTM B42 Seamless Copper Pipe, Standard Sizes
P. ASTM B43 Seamless Red Brass Pipe, Standard Sizes
Q. ASTM B61 Steam or Valve Bronze Castings
R. ASTM B62 Composition Bronze or Ounce Metal Castings (do not use for potable water wetted surfaces)
S. ASTM B75 Seamless Copper Tube
T. ASTM B88 Seamless Copper Water Tube
U. ASTM B135 Seamless Brass Tube
V. ASTM B152 Copper Sheet, Strip, Plate, and Rolled Bar
W. ASTM B251 General Requirements for Wrought Seamless Copper and Copper-Alloy Tube
X. ASTM B280 Seamless Round, Copper Tube
Y. ASTM B302 Threadless Copper Pipe, Standard Sizes
Z. ASTM B306 Copper Drainage Tube (DWV)
AA. ASTM B447 Welded Copper Tube
BB. ASTM B584 Copper Alloy Sand Castings for General Applications
CC. AWWA C800 Underground Service Line Valves and Fittings
DD. California Plumbing Code (CPC)
EE. MSS SP104 Wrought Copper Solder-Joint Pressure Fittings
FF. MSS SP106 Cast Copper Alloy Flanges and Flanged Fittings Class 125, 150 and 300
GG. MSS SP109 Welded Fabricated Copper Solder Joint Pressure Fittings
HH. NSF/ANSI 61 Drinking Water System Components – Health Effects
II. NSF/ANSI 372 Drinking Water System Components – Lead Content (Formerly NSF/ANSI 61 Annex G)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per pipe shop drawing requirements where pipe runs exceed 50'
Catalog Data	Required per catalog data requirements for pipe, flanges, insulators, companion flanges and unions showing metal composition and compliance with industry standards
Certificate of Compliance	Submit certification on request per certificate of compliance requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of copper pipe and fittings shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Copper Pipe and Tubing	Cambridge Lee Industries	Reading, PA
	Cerro Flow Products, Inc.	St Louis, MO
	Halstead Div Mueller Industries	Greensboro, NC
	Mueller Streamline Company	Memphis, TN
	Phelps-Dodge	
	United States Brass and Copper	Downers Grove, IL
	Wieland Copper Products	Pine Hall, NC
	Accepted equal	
Copper Fittings	Apollo Valve Div Conbraco Industries	Matthews, NC
	Mueller Streamline Company	Memphis, TN
	Accepted equal	
Pipe Hangers for Brass and Copper Pipe	Warwick Hanger Company	Westerly, RI
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Potable Water	0.894cP	1.00	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<500 ppm
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Copper pressure pipe and fittings shall conform to the following materials and manufacturing requirements:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT	
Copper Tubing	Standards	ASTM B88 and ANSI B16.22	
	NSF Certification	NSF 61 certification and NSF 372 certification required for potable water pipe	
	Material	Copper (annealed)	
	Size	As shown on plans.	
	Wall Thickness	Type K	
	Lengths	1"	60' to 100' coils (minimum 24" ID) cut to length.
		2"	Flexible tube or 20' rigid lengths cut to length
	Coating	AWWA C209 35 mil cold-applied coal-tar tape, or PVC or PE coating.	
Fittings	Cast Copper Fittings	ASME/ANSI B16.18 Cast Copper Alloy Solder Joint Pressure Fittings	
	Seamless Copper Tube Fittings	ASTM B75 Seamless Copper Tube Fittings	
	Solder-Joint or Flared-Tube Fittings	ASTM B75	
	Wrought Copper Fittings	ASME/ANSI B16.22 and MSS SP104	
Joints	Joints ≤ ⅜"	Flared end or compression joints	
	Joints ≥ ½"	Solder end joints	
	Solder	ASTM B32 Alloy Grade Sb5 (95% tin/5% antimony)	
	Solder Joints	Grade 50B	

D. Brass flanges, gaskets, bolts and nuts shall be constructed of the following materials:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Flanges	Standards	ASTM B62
	NSF Certification	NSF 61 certification and NSF 372 certification required for potable water pipe
	Material	Bronze Tap for iron pipe thread
	Size	As shown on plans.
	Class	ANSI B16.24 Class 125 or Class 150 conforming to adjacent flange
	Style	Solder-end companion flange

Flange Bolts, Nuts, Washers and Gaskets		See Section 33 05 31.
Flange Insulating Kit on Bronze Flanges mating with Ferrous Flanges	Use	Flange insulating kits required where dissimilar cuprous flanges and ferrous flanges mate. See Section 33 05 32.

E. Copper DWV pipe and fittings shall meet or exceed the following materials and manufacturing requirements:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT	
Copper Tubing	Standards	ASTM B306 type DWV	
	Material	Copper (annealed)	
	Size	As shown on plans.	
	Wall Thickness	Comply with ASTM B306	
	Lengths	1”	60’ to 100’ coils (minimum 24” ID) cut to length.
		2”	Flexible tube or 20’ rigid lengths cut to length
	Coating	AWWA C209 35 mil cold-applied coal-tar tape, or PVC or PE coating.	
Fittings	Wrought Copper Fittings	ANSI B16.23 Cast bronze or copper fittings size 1¼”-8” or ANSI B16.29 wrought copper or wrought copper alloy solder joint drainage fittings size 1¼”-4”	
	Wrought Copper Fittings (1¼”-4”)		
Joints	Joints ≤ ⅜”	Flared end or compression joints	
	Joints ≥ ½”	Solder end joints	
	Solder	ASTM B32 Alloy Grade Sb5 (95% tin/5% antimony)	
	Solder Joints	Grade 50B	

F. Provide identification for buried carbon steel pipe in the following manner:

PIPE CONTENTS	IDENTIFICATION/ WARNING/ LOCATING	TYPE	MATERIALS/METHOD
Potable Water	Pipe Contents Identification	Identification Tape	2” high letters reading “POTABLE WATER”
			Color = blue with white letters
			Attached to top of polyethylene wrap on pipe with adhesive tape
			Specification – See Section 33 05 26
	Pipe Warning Tape	Warning Tape	2” high letters reading “CAUTION: WATERLINE BURIED BELOW”
			Color = blue with white letters
			Installed in pipe trench 18” above pipe
			Specification – See Section 33 05 26
Reclaimed (Recycled, Non-Potable) Water	Pipe Contents Identification	Identification Tape	2” high letters reading “CAUTION: RECLAIMED WATER – DO NOT DRINK”
			Color = purple with white letters
			Attached to top of polyethylene wrap on pipe with adhesive tape
			Specification – See Section 33 05 26

PIPE CONTENTS	IDENTIFICATION/ WARNING/ LOCATING	TYPE	MATERIALS/METHOD
Reclaimed (Recycled, Non-Potable) Water Cont.	Pipe Warning Tape	Warning Tape	2" high letters reading "CAUTION: RECLAIMED WATERLINE BURIED BELOW – DO NOT DRINK"
			Color = purple with white letters
			Installed in pipe trench 18" above pipe
			Specification – See Section 33 05 26

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install copper pipe and fittings before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Cut tubing square and remove burrs. Clean both inside and outside of fitting and pipe ends with steel wool and muriatic acid before soldering. Take care to prevent annealing of fittings and tubing when making connections. Do not substitute miter joints for elbows. Do not notch straight runs of pipe in lieu of tees.

C. Service saddles shall be no closer than 18" to valves, couplings, joints, or fittings except at ends of mains.

D. Do not install service saddle on any machined section of asbestos cement pipe.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install brass and copper pipe and fittings at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing and mechanical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Protect water systems by maintaining separations and using materials described in Section 31 05 50.

F. Install brass and copper piping in neat and workmanlike manner, properly aligned and cut from measurements taken at site to avoid interferences with structural members, architectural features, openings, and equipment. Exposed pipes shall afford maximum headroom and access to equipment, and where necessary all piping shall be installed with sufficient slopes for venting or drainage of liquids and condensate to low points.

G. Install pipe without springing, forcing, or stressing pipe or any adjacent connecting valves or equipment.

H. Firmly support and anchor all piping with fabricated or commercial hangers or supports in accordance with Section 33 05 38. Where necessary to avoid stress on equipment or structural members, pipes shall be anchored or harnessed. Provide expansion joints and guides as needed to compensate for pipe expansion due to temperature differences.

I. Threaded Joints shall conform to ANSI/ASME B 1.20.1, and joints shall be full and cleanly cut with sharp dies. Not more than three threads shall remain exposed after installation.

J. Copper pipe shall be installed as follows:

    1. Use silver solder and approved solder joint fittings.

    2. Thoroughly clean surfaces and apply flux before soldering.

    3. Do not connect copper or copper alloy pipe or fittings to ferrous pipe materials except with dielectric coupling expressly made for this purpose and service.

K. Bends in soft copper tubing shall be long sweep. Shape bends with shaping tools. Form bends without flattening, buckling, or thinning tubing wall at any point.

L. Brazing procedures shall be in accordance with Articles XII and XIII, Section IX, of ASME Boiler and Pressure Vessel Code. Solder shall penetrate to full depth of cup in joints and fittings. Solders shall comply with ANSI B31.3, paragraph 328.

M. Install buried piping with slack to provide flexibility in event of load due to settlement, expansion or contraction. Provide minimum cover of 36” below finished grade. Embed and cover tubing with sand or select material.

N. Unless otherwise shown, all connections to fixtures, groups of fixtures, and equipment shall be provided with a shutoff valve and union, unless valve has flanged ends. Unions shall be provided at threaded valves, equipment, and other devices requiring occasional removal or disconnection.

O. Make connections using compression couplings, angle valves, etc. In accordance with Manufacturer’s recommendations and accepted trade practices.

P. Install flange bolts and nuts as follows:

    1. Lubricate bolt threads with graphite and oil prior to installation.

    2. Set flanged pipe with flange boltholes straddling pipe horizontal and vertical centerlines.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Brass and Copper Pipe and Fittings	Pipe Separations	Section 31 05 50.	All new pipe	Contractor	Contractor
	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Hydrostatic Test	Section 33 08 11.	All brass and copper pipe	Contractor	Contractor
	Disinfection	Section 33 13 00 and AWWA C651.	All copper potable water pipe	Contractor	Contractor
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 11 31
PVC PRESSURE PIPE (AWWA C900)

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of PVC pressure pipe and fittings 4"-12" diameter.

B. Do not use PVC AWWA C900 pressure pipe under any of the following circumstances:

1. For pipelines where working pressure > 150 psi.
2. For pipelines where working pressure > 100 psi and pipe wall is not designed to withstand 200-psi test pressure (DR14).
3. For pipelines where normal water temperature > 90°F.
4. For pipelines buried in soils containing organic solvents or petroleum products.
5. For exterior piping exposed to sunlight.
6. For pipeline exposed to changes in temperature where ⅜" per 100'; per 10°F thermal expansion of PVC pipe cannot be accommodated.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 01 73 33: Mechanical Identification
I. Section 03 30 00: Cast-in-Place Concrete
J. Section 09 90 00: Painting and Coating
K. Section 31 05 50: Protecting Existing Utilities
L. Section 31 23 00: Excavation and Fill
M. Section 33 05 26: Utility Identification
N. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
O. Section 33 08 31: Leakage and Infiltration Testing of Gravity Sewer Pipelines
P. Section 33 10 11: Pipeline Joint Materials
Q. Section 33 10 18: Hangers and Supports
R. Section 33 13 00: Disinfecting of Water Utility Distribution
S. Section 33 11 33: PVC Schedule 40 and 80 Plastic Pipe

1.3 System Description

A. Furnish and install PVC pressure pipe as shown on Plans including appurtenant fittings and connections in conformance with Manufacturer's installation requirements and in compliance with applicable construction safety codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Owner or Owner's Representative shall be entitled to inspect pipes and witness manufacturing process.

C. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
PVC Pipe and Fittings	AWWA C900 Verification Testing	AWWA C900 Section 5 Verification	Per AWWA C900	Contractor	Contractor
	Hydrostatic Proof Test	AWWA C900 Section 5 Verification	All pipe, couplings and fittings	Contractor	Contractor

1.5 References

A. ASME/ANSI 21.10 Ductile Iron and Gray Iron Fittings
B. ASTM D1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
C. ASTM D3139 Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals
D. ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
E. ASTM F1674 Test Method for Joint Restraint Products for Use with PVC Pipe
F. AWWA C110 Ductile Iron and Gray Iron Fittings
G. AWWA C153 Ductile Iron Compact Fittings
H. AWWA C605 Underground Installation of PVC Pipe
I. AWWA C900 Polyvinyl Chloride PVC Pressure Pipe 4"-12"
J. AWWA Manual M23 PVC Pipe Design and Installation
K. California Plumbing Code (CPC)
L. NSF 14 Plastics Piping System Components and Related Materials

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
Installation Instructions	Use AWWA C605.for pipe installation
	Submit supplementary information as needed to cover proprietary methods of joint restraint.
	Submit supplementary information on joints, allowable deflections, joint lubricants and approved methods of joining pipe.
	Submit torque information and installation instructions on any service saddles furnished.
Certificate of Compliance	Deliver with pipe an affidavit from pipe Manufacturer documenting compliance with requirements of AWWA C900 and Contract Documents
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Packaging, shipping, handling, and storage of pipe shall be performed in accordance with Manufacturer's instructions.

C. Do not allow surface temperatures on pipe and fittings to exceed 120°F.

D. Use proper care to prevent damage in handling, moving, and placing pipe. Lower (do not drop) pipe from truck. Dropped pipe will be rejected.

E. Unload pipe by hand or mechanical means, such as crane or backhoe, or by rope and skids, as recommended by Manufacturer. In using skids, prevent pipes from striking other pipe.

F. Store pipe and fittings in accordance with Manufacturer's recommendations to prevent damage and contamination.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

B. Payment by linear foot shall be for each diameter and for each pipe strength designation measured horizontally over pipe centerline.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
C900 PVC Restrained-Joint Distribution Pipe	North American Specialty Products, LLC C900/RJ or RJIB	Valley Forge, PA
	Accepted equal	
Ductile Iron Pipe Fittings	American Cast Iron Pipe	Birmingham, AL
	Clow Water Systems Company	Coshocton, OH
	Griffin Pipe Products	Council Bluffs, IA
	Star Pipe Products	Houston, TX
	Tyler Union Div. McWane, Inc.	Tyler, TX
	U.S. Pipe and Foundry	Birmingham, AL
	Accepted equal	
Third-Party PVC Pipe Follower-Gland-Type Mechanical Joint Restraints	EBAA Iron Megalug 2000 Series 2000PV for new MJ fittings 2000SV for existing MJ fittings Megabond coating system	Eastland, TX
	Ford Uni-Flange Series 1500 Circle Lock E-coat coating system	Wabash, IN
	Romac Industries Grip Ring Accepted coating system	Bothell, WA
	Smith Blair, Inc. Cam-Lock 120 Flexicoat coating system	Texarkana, TX
	Star Pipe Products "PVC Stargrip" Series 4000 Accepted coating system	Houston, TX
	Accepted equal	
Third-Party PVC Bell Restraint Harness for Push-on Bells	EBAA Iron Megalug Series 1500 or 1600 Megabond coating system	Eastland, TX
	Romac Industries Series 600 Accepted coating system	Bothell, WA
	Smith Blair, Inc. Series 115 or 165 "Bell-Lock" Flexicoat coating system	Texarkana, TX

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Third-Party PVC Bell Restraint Harness for Push-on Bells (cont.)	Star National Pipe Products Division Dresser Industries Accepted coating system	Columbus, OH
	Star Pipe Products Series 1100 Accepted coating system	Houston, TX
	Accepted equal	
Third-Party PVC Pipe Restraint Harness @ DIP Fittings	EBAA Iron Megalug Series 15PF00 Megabond coating system	Eastland, TX
	Romac Industries Series 600 Accepted coating system	Bothell, WA
	Star National Pipe Products Division Dresser Industries Accepted coating system	Columbus, OH
	Accepted equal	
Bell Stops (where specified to prevent overinsertion)	EBAA Iron Series 5000 “Mega-Stop”	Eastland, TX
	Accepted equal	
Buried Pipe Identification Tape	Calpico, Inc.	South San Francisco, CA
	Terra Tape Division Reef Industries	Houston, TX
	Accepted equal	

B. Manufacturer of pipe and fittings shall employ manufacturing methods and material formulations in use for at least 5 years.

C. Owner may require bell stops for PVC pipe “accepted equal” manufacturers as a condition of acceptance.

2.2 Materials

A. Refer to Section 01 61 00 for delivery storage and handling requirements.

A. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

B. PVC transmission pipe shall conform to the following materials and manufacturing requirements:

MATERIAL/ COMPONENT	PHYSICAL CHARACTERISTICS	SPECIFICATION/REQUIREMENT	
Pipe	Manufacturing Standards	AWWA C900 for pipe 4"-12"	
	Design Standards	AWWA M23 with design stress below	
	Material	ASTM D1784 Cell Class 12454B or better Virgin rigid PVC Conform to NSF 14 See AWWA C900 Section 4.2.	
	Hydrostatic Design Basis (HDB)	≥ 4,000 psi for water at 73.4ºF (23ºC) Apply 2.5 Safety Factor and use 1,600 psi design stress	
	Markings (each pipe)	Per AWWA C900 Section 6.1	
		Mark AWWA standard complied with	
		Show nominal pipe diameter	
		Show AWWA pressure class or DR	
		Manufacturer and manufacturing date code	
	Size	4"-12" diameter as shown. Match outside diameter of ductile-iron pipe unless otherwise shown.	
	Wall Thickness	**WORKING PRESSURE CLASS ON PLANS**	**MINIMUM DIMENSION RATIO (DR)** (to AWWA C900 Table 1 tolerances.)
		0-100 psi	DR 14 (Class 305)
		Pipe with PVC Joint Restraints	DR 14 (Class 305)
		Not shown	DR 14 (Class 305)
	Lengths	20' with option to supply up to 15% random (minimum length 10') sections.	
	Color	See below.	
Joints	Style	Push-on, integral bell and spigot per ASTM D3139	
	Gaskets	Elastomeric Membrane per AWWA C900 Section 4.2.4 (Gaskets and Lubricants) and ASTM F477	
	Lubricants	Per AWWA C900 Section 4.2.5	
	Working Pressure	As required by class of pipe shown on Plans	
Joint Gaskets	Material	Elastomeric Membrane per AWWA C900 Section 4.2.5 (Gaskets and Lubricants) and ASTM F477 Butadiene Styrene (SBR or BR)	
	Gasket Age	<180 days old or <2 years old but retested <60 days prior to installation	

C. Fittings shall be constructed of the following materials:

MATERIAL/ COMPONENT	TEST/PHYSICAL CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Fittings	Standards	ANSI A21.10, AWWA C110, or AWWA C153
	Material	Ductile iron
	Style	Push-on, integral bell and spigot with rubber ring retaining groove
	Markings	Letters "DI" or "DUCTILE" shall be cast on fittings
	Bell Size	Compatible with class of cast-iron equivalent PVC water transmission pipe

MATERIAL/ COMPONENT	TEST/PHYSICAL CHARACTERISTICS	SPECIFICATION/REQUIREMENT
	Lining	Cement mortar (double thickness)
	Coating	1-mil petroleum asphaltic coating
	Plastic Film Wrap for Corrosion Protection	AWWA C105
Joints	Style	Push-on, integral bell and spigot
	Working pressure	As required by class of pipe shown on Plans
PVC Pipe Joint Restraints	Material	Ductile Iron passing ASTM F1674
	Style	Gripping Wedge or Serrated Ring
	Working Pressure Rating	350 psi

D. Provide identification for buried AWWA C900 PVC water transmission pipe in the following manner:

PIPE CONTENTS	IDENTIFICATION/ WARNING/ LOCATING	TYPE	MATERIALS/METHOD
Sewage	Pipe Contents Identification	Pipe color	White
		AND	
		Stenciling	Green stenciling marked on pipe stating “SEWER”
			⅝”-high letters
			Repeated at 1’ intervals
		OR	
		Identification Tape	2”-high letters reading “CAUTION: SEWER”
			Color = green with white letters
			Attached to top of pipe with adhesive tape
			Specification – See Section 33 05 26
	Pipe Warning and Locating	Warning and Locating Tape	2”-high letters reading “CAUTION: SEWER BURIED BELOW”
			Color = green with white letters
			Place in pipe trench 18” above pipe
			Specification – See Section 33 05 26
			Metallic strip that can be registered by a magnetic field locating device
		Locating Wire	In lieu of installing metallic warning tape; non-metallic warning tape and 10-gauge copper wire attached to top of pipe may be used.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install PVC pressure pipe and fittings before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Prior to installing pipe, grade and prepare trench bottom to provide uniform bearing throughout entire length of each joint of pipe. Dig bell holes of ample dimension in trench bottom at locations of each joint to facilitate joining. Form flat or semi-circular trench bottom conforming to grade to which pipe is to be installed.

C. Dewater trench so trench bottom and bedding material are dry.

D. Minimum bedding depth and trench width at crown of pipe shall be as follows based on AWWA M23 Chapter 7 page 79:

NOMINAL PIPE OD	MINIMUM BEDDING DEPTH (in below bell)	MINIMUM TRENCH WIDTH B_d (in)	PARALLEL PIPE CLEARANCE (in)
8"	4"	21"	6"
10"	4"	23"	6"
12"	4"	25"	6"

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Refer to Section 31 23 00 for open trench requirements.

C. Furnish and install pipe and fittings at locations shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. Applicable building, fire and plumbing code requirements
4. AWWA C605 "Underground Installation of PVC Pipe"
5. AWWA Manual M23 PVC Pipe Design and Installation

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. Protect water systems by maintaining separations and using materials described in Section 31 05 50.

G. Excavation and backfill, including pipe bedding, shall conform to provisions of Section 31 23 00 and AWWA M23, Chapter 7.

H. Accurately place pipe to lines and grades shown. Support fittings independently of pipe.

I. Assemble joints as follows:

1. Spigot and bell shall slide together without displacement of rubber gasket. Joint shall be dirt free. Where possible install pipe with bell facing in direction of laying.
2. Confirm pipe spigot is clean. Wipe with clean dry cloth around entire pipe end circumference to 1" beyond reference mark.
3. Do not lubricate gasket or gasket groove in bell.

4. Lubricate full spigot end circumference including beveled end using lubricant supplied by pipe Manufacturer. If dirt or sand adhere to lubricant, wipe spigot clean and relubricate.

5. Insert rubber ring into groove making sure ring is completely seated and reference mark on spigot is flush with bell end.

6. Insert spigot into bell and force slowly into position using large bar lever and wood block across pipe end. For large pipe, a come-along (with padding that will not scratch pipe) may be used.

7. If undue resistance to spigot insertion is encountered or reference mark does not reach flush position, disassemble joint and check position of rubber gasket. If it is twisted or dislodged, clean gasket, bell, and spigot and repeat assembly steps. If gasket is not out of position, measure distance between reference mark and spigot end and check it against correct values provided by pipe Manufacturer.

8. Allowable joint deflections shall not exceed the following

PIPE NOMINAL DIAMETER (Inches)	ALLOWABLE JOINT DEFLECTION - α	ALLOWABLE JOINT DEFLECTION - α - WITH HIGH-DEFLECTION COUPLING	ALLOWABLE LONGITUDINAL BENDING FOR 20-FT LENGTH - β
8"	2.0°	4.0°	Longitudinal bending not permitted
10"	2.0°	4.0°	
12"	1.68°	4.0°	

9. Values shown above are based on 80% of that recommended by AWWA M23 Table 13 or coupling Manufacturer. In no case shall deflection exceed two degrees in any direction without use of high-deflection couplings.

10. Minimum radii shall not be less than the following unless pipe lengths shorter than 20' are used:

PIPE NOMINAL DIAMETER (Inches)	MINIMUM RADIUS $R>180/\pi(L/\alpha)$ (Feet)	MINIMUM RADIUS - $R>180/\pi(L/\alpha)$ (Feet) WITH HIGH-DEFLECTION COUPLING	MINIMUM RADIUS WITH LONGITUDINAL BENDING (Feet)
8"	573'	286'	Longitudinal bending not permitted
10"	573'	286'	
12"	682'	286'	

J. Join flanges on PVC pipe as follows:

1. Clean flange surfaces to mate with gasket, removing loose dirt, scale and detritus.

2. Inspect flange bolts and studs for proper size, threading and length.

3. With gasket in place, align mating flange bolt holes. Make sure mating flange faces are flush against gasket prior to bolt-up.

4. Insert bolts, nuts and washers. Tighten by hand until snug.

5. Before tightening bolts beyond hand-tight, operate adjacent valves through full range of motion to ensure clear unobstructed operation of discs and other internal parts.

6. Tighten bolts in sequence by 5-lb. increments following a 180° opposing sequence.

7. Flange bolt torques shall be as follows:

FLANGE SIZE (nominal inches)	RECOMMENDED TORQUE (Ft-lb)
8”	40 ft-lb
10”	64 ft-lb
12”	95 ft-lb

8. Clean and lubricate bolt threads using lubricant chemically compatible with all materials involved.

K. Provide PE wrap on ductile iron and cast iron fittings as follows:

9. Comply with AWWA C105.

10. Wrap film snugly around all exterior ferrous surfaces and 8” beyond bells, overlapping at least 2” at each seam.

11. Do not install plastic film wrap on sections of pipe to be concrete encased, installed within casings, or through concrete slope anchors.

12. Leave stainless steel nuts and bolts exposed.

13. Secure polyethylene wrap in place using 2” wide plastic tape.

14. At least 3 circumferential turns of plastic tape shall seal film wrap ends over pipe and above valve bonnets.

15. A 15-mil coat of Koppers Bituplastic No 33 may be applied instead of polyethylene wrapping.

L. Provide thrust restraint as follows:

1. Place concrete thrust blocks in accordance with Section 03 30 00 as shown using Portland cement concrete containing not less than 5 sacks of Portland cement per cubic yard.

2. Place concrete blocks between undisturbed ground and fittings to be anchored.

3. Quantity of concrete and bearing area of pipe undisturbed soil shall be as shown, unless otherwise determined by Owner's Representative.

4. Place concrete, unless specifically shown otherwise, so pipe joints and fittings remain accessible to repairs.

5. Use of mechanical thrust restraint devices in lieu of thrust blocks will be permitted only where sufficient right of way for thrust blocks is unavailable due to conflicts with existing buried or surface improvements, utilities or right of way limits. In such case, Contractor shall submit:

    a. Catalog cuts for restraint method proposed.

    b. Certification from pipe Manufacturer that thrust restraint system will not compromise pressure rating of pipe below that required for pressure testing.

c. Wall thickness of pipe used with mechanical thrust restraint devices shall be no less than DR14. For working pressures in excess of 150 psi, use ductile iron pipe on restrained joint sections to achieve necessary pressure class and wall thickness.

M. Install pipe identification, warning, and locating measures continuously along entire length of pipe. Fasten pipe identification tape to pipe at maximum 5' intervals using adhesive tape banded around pipe. Provide 5' minimum overlap of warning tape at each end of pipe for tape attached to pipe outside of trench.

3.3 Field Quality Control

A. Do not backfill any joint until Owner's Representative has observed it. Leave open sufficient trench space in vicinity of each joint to permit visual observation around entire joint periphery.

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
PVC Pressure Pipe and Fittings	Pipe Separations	Section 31 05 50.	All new pipe	Contractor	Contractor
	Hydrostatic Test	Section 33 08 11 and AWWA C605	All new PVC potable water pipe	Contractor	Contractor
	Leakage and Infiltration Testing	Section 33 08 31	All new PVC sewer pipe	Contractor	Contractor
	Anchorage and Support of Exposed Pipe	Visual inspection of finished installation. Support per UPC Table 3-1 and 3-2	1 inspection	Owner	Owner
	Installation	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

C. Remove damaged pipe or fittings upon discovery and without delay from Project Site.

3.4 Cleaning and Disinfection

A. Clean and disinfect pipe in accordance with Section 33 13 00.

3.5 Protection

A. Close open end of pipe with tight-fitting cap or plug to prevent entrance of foreign matter into pipe at all times when pipe installation is not in progress. These provisions shall apply during noon hour as well as overnight. Do not use pipeline as drain for removing water that has infiltrated into trench. Maintain inside of pipe free from foreign materials and in clean and sanitary condition until acceptance by Owner.

END OF SECTION

SECTION 33 11 33
PVC SCHEDULE 40 and 80 PLASTIC PIPE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of PVC plastic pipe.

B. Do not use PVC schedule 40 and 80 plastic pressure pipe under any of the following circumstances:

1. For pipelines where working pressure > 50 psi for Schedule 40 pipe.
2. For pipelines ≤ 1" where working pressure > 150 psi.
3. For pipelines ≤ 2½" where working pressure > 100 psi
4. For pipelines ≤ 4" where working pressure > 80 psi
5. For pipelines ≤ 6" where working pressure > 70 psi
6. For force mains, pump station discharges and pipe subject to repeated pressurization / depressurization cycles.
7. For pipelines having fluid velocities > 5 fps.
8. For pipelines where normal fluid temperature > 110°F.
9. For pipelines buried in soils containing organic solvents or petroleum products
10. For potable water piping on public side of meter.
11. For piping inside buildings or plenum areas, CPC Table 6-4 prohibits use of PVC
12. For exterior piping exposed to sunlight.
13. For pipeline exposed to changes in temperature where ⅜" per 100' per 10°F thermal expansion of PVC pipe cannot be accommodated.
14. For pipe > 6" diameter.

C. Outdoor piping exposed to sunlight shall be painted with a coat of water-based latex paint per Section 09 90 00. Use pastel shades or white to reduce thermal expansion.

D. For pipe larger than 6" diameter, see Section 33 11 31.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 01 73 33: Mechanical Identification
I. Section 09 90 00: Painting and Coating
J. Section 22 10 00: Plumbing Piping
K. Section 31 23 00: Excavation and Fill
L. Section 31 05 50: Protecting Existing Utilities
M. Section 33 05 31: Pipeline Joint Materials
N. Section 33 05 26: Utility Identification
O. Section 33 05 38: Hangers and Supports
P. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
Q. Section 33 08 31: Leakage and Infiltration Testing of Gravity Sewer Pipelines
R. Section 33 13 00: Disinfecting of Water Utility Distribution

S. Section 33 11 31: PVC Pressure Pipe C900
T. Section 33 30 31: PVC Gravity Sewer Pipe

1.3 System Description

A. Furnish and install complete operating piping system including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Pipe, tubing and fittings shall bear NSF seal except for drainage piping.

C. Pipe and fittings shall be produced by same Manufacturer

D. Mark pipe with nominal size, type, class, schedule or pressure rating, and Manufacturer.

E. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
PVC Piping, Schedule Type	ASTM Compliance	Mark pipe and fittings in accordance with ASTM D1785	At least one mark ea item	Contractor	Contractor

1.5 References

A. ASME/ANSI B1.20.1 (ANSI B2.1) Pipe Threads – NPT National Pipe Thread Taper
B. ASME/ANSI B16.5 Steel Pipe Flanges and Flanged Fittings (Including ratings for Class 150, 300, 400, 600, 900, 1500, and 2500)
C. ASTM D656 Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
D. ASTM D1599 Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings
E. ASTM D1784 Rigid Poly(Vinyl-Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl-Chloride) (PVC) Compounds
F. ASTM D1785 Poly(Vinyl-Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120
G. ASTM D2241 Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
H. ASTM D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
I. ASTM D2464 Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings
J. ASTM D2466 Poly(Vinyl-Chloride) (PVC) Plastic Pipe Fittings, Schedules 40, 80 and 120
K. ASTM D2467 Socket-Type Poly(Vinyl-Chloride) (PVC) Plastic Pipe Fittings Schedule 80
L. ASTM D2485 Recommended Practice for Making Solvent-Cemented Joints with Poly(Vinyl-
ASTM D2564 Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Pipe and Fittings
M. Chloride) (PVC) Plastic Pipe and Fittings
N. ASTM D2774 Underground Installation of Thermosetting Pressure Piping
O. ASTM D2855 Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
P. ASTM F402 Safe Handling of Solvent Cements, Primers and Cleaners Used for Joining Thermoplastic Pipe and Fittings

Q. ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
R. ASTM F645 Selection, Design and Installation of Thermoplastic Water Pressure Piping Systems
S. ASTM F656 Primers for Use in Solvent Cement Joints of Poly(Vinyl-Chloride) (PVC) Plastic Pipe and Fittings
T. ASTM F1498 Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings
U. California Green Building Standards Code (CALGreen Code)
V. Code of Federal Regulations Title 49
W. NSF/ANSI 14 Plastics Piping System Components and Related Materials
X. NSF/ANSI 61 Drinking Water System Components – Health Effects
Y. Plastic Pipe Institute PE 3408

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
Certificate of Compliance	Submit Manufacturer's certification of plastic pipe and tubing for each lot delivered per certificate of compliance requirements.
	Submit copies of solvent cement Manufacturer's report and certification in accordance with ASTM D2564 for PVC piping.
Test Record Transcripts	Submit test results for factory tests per foundry or test record transcript requirements.
Warranty	Furnish one -year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, certificates of compliance, and test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Protect piping materials from sunlight, scoring and distortion.

C. Do not allow surface temperatures on pipe and fittings to exceed 120°F.

D. Manufacturer's instruction and warranty requirements for delivery, storage and handling of PVC plastic pipe and fittings shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
PVC Plastic Pipe and Fittings ⅜"-24"	Certainteed Pipe	Valley Forge, PA
	Harrington Industrial Plastics, Inc.	Chino, CA
	Harvel Plastics, Inc.	Easton, PA
	J.M. Eagle Manufacturing Company	Los Angeles, CA
	Pacific Plastics	Brea, CA
	Spears Manufacturing Company	Sylmar, CA
	Accepted equal	
PVC Sensor Probe Fittings	Spears Manufacturing Company	Sylmar, CA
	Accepted equal	
PVC Saddles	Spears Manufacturing Company	Sylmar, CA
	Accepted equal	
PVC Flanges	Spears Manufacturing Company	Sylmar, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Potable Water	0.894cP	1.00	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<500 ppm
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Adhesives and solvent welding materials used on Work shall comply with VOC limits set forth in Section 5.504.4.1 of CALGreen Code.

D. PVC pipe may be used for temperatures to 110°F, and shall be constructed of the following materials:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Pipe	Standards	ASTM D1785
	NSF Certification	NSF 61-certified for potable water pipe
	Material	ASTM D1784 Cell Class 12454 Virgin rigid PVC Conform to NSF 14
	Size	As shown on plans.
	Wall Thickness	Schedule 80. See Plans
	Color	Gray / White / Standard Clear / Near Water Clear / Blue for potable water / Green for wastewater
Joints	Restrained Style	Solvent-welded socket joints except at valve connections Provide threaded or flanged adaptors as required for valve connections
Fittings	Standards	ASTM D2466
	Weight	Use same schedule as adjacent pipe

	Threads	Injection molded type where required Conform to ASTM F1498
	Threaded Nipples	ASTM D2464, Schedule 80 with molded threads
	Threaded Fittings (Use only where specifically allowed on plans)	ASTM D2464 with PTFE tape
	Tees and Ells	Side-gated
	Socket Fittings	ASTM D2467
	Tapping Saddles	For dimensions and test performance, see ASTM D2466 and D1599
	Transition Fittings	Required per CPC 606.2 for transitioning between metal and PVC pipe
	Material and Color	Same as pipe
Solvent Cement	Material	ASTM D656 primer
		ASTM D2564 solvent cement
Flanges	Pressures 0-150 psi	Plain-faced 125 or 150 psi flanges per ANSI B16.5
Flange Alignment	Horizontal Pipelines	Boltholes shall straddle horizontal centerlines of pipe run to which flanges are attached.
	Vertical Pipelines	Boltholes shall straddle plant North-South and plant East-West centerlines of pipe run to which flanges are attached.
Flange Bolts, Nuts and Washers and Gaskets		See Section See Section 33 05 31.
Painting/Coating	Exterior Where Exposed to Sunlight or Required in Vaults and Buildings for Color Coding	See Section 09 90 00.

E. Provide identification for buried PVC pipe in the following manner:

PIPE CONTENTS	IDENTIFICATION/ WARNING/ LOCATING	TYPE	MATERIALS/METHOD
Potable Water	Pipe Contents Identification	Pipe Color	Blue or white
		AND	
		Stenciling	Stenciling marked on pipe in contrasting color to background color of pipe stating “POTABLE WATER”
			⅝”-high letters
			Repeated at 1’ intervals
		OR	
		Identification Tape	2”-high letters reading “POTABLE WATER”
			Color = blue with white letters
			Attached to top of pipe with adhesive tape
			Specification – See Section 33 05 26
	Pipe Warning and Locating	Warning and Locating Tape	2”-high letters reading “CAUTION: WATERLINE BURIED BELOW”
			Color = blue with white letters
			Place in pipe trench 18” above pipe
			Specification – See Section 33 05 26
			Metallic strip that can be registered by magnetic field locating device
		Locating Wire	In lieu of installing metallic warning tape; non-metallic warning tape and 10-gauge copper wire attached to top of pipe may be used.
Sewage	Pipe Contents Identification	Pipe color	White
		AND	
		Stenciling	Green stenciling marked on pipe stating “SEWER”
			⅝”-high letters
			Repeated at 1’ intervals
		OR	
		Identification Tape	2”-high letters reading “CAUTION: SEWER”
			Color = green with white letters
			Attached to top of pipe with adhesive tape
			Specification – See Section 33 05 26
	Pipe Warning and Locating	Warning and Locating Tape	2”-high letters reading “CAUTION: SEWER BURIED BELOW”
			Color = green with white letters
			Place in pipe trench 18” above pipe
			Specification – See Section 33 05 26
			Metallic strip that can be registered by a magnetic field locating device
		Locating Wire	In lieu of installing metallic warning tape; non-metallic warning tape and 10-gauge copper wire attached to top of pipe may be used.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install PVC plastic pipe before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Clean dirt and moisture from pipe and fittings. Bevel pipe ends per Manufacturer's instructions with chamfering tool or file. Remove burrs.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Refer to Section 31 23 00 for open trench requirements.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. Applicable building, fire and plumbing code requirements
4. ASTM D2855 Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
5. ASTM F402 Safe Handling of Solvent Cements, Primers and Cleaners Used for Joining Thermoplastic Pipe and Fittings
6. ASTM F645 Selection, Design and Installation of Thermoplastic Water Pressure Piping Systems
7. ASTM D2774 Underground Installation of Thermosetting Pressure Piping
8. ASTM F1668 Construction Procedures for Buried Plastic Pipe

C. PVC plastic pipe shall be furnished and installed by Contractor at location shown on Plans and Submittals.

D. Install PVC plastic pipe to tolerances recommended by Manufacturer. Unless otherwise shown, install PVC plastic pipe true, plumb, and level using precision gauges and levels.

E. Install threaded pipe as follows:

1. Install threaded PVC pipe only where specifically called out on plans or for mating with unions.
2. Do not use threaded pipe joints for applications having pressures in excess of 100 psi.
3. Use Schedule 80 pipe or thicker for threaded applications. Do not thread Schedule 40 pipe.

4. Do not use Teflon tape as lubricant. Use paste recommended by Manufacturer such as Spears 75 thread paste.

5. Use a strap wrench that will not damage pipe for tightening joints.

6. Do not tighten threaded pipe more than 2 turns beyond finger tight.

F. Provide molded transition fittings for transitions from plastic to metal or IPS pipe. Do not thread plastic pipe.

G. Locate unions where shown and where needed for easy access and assembly of piping system.

H. Install solvent-welded PVC pipe as follows:

1. Do not solvent weld joints when ambient temperatures are below 40°F or above 90°F unless solvents specifically formulated for these conditions are used.

2. De-burr and bevel pipe surfaces to be solvent-welded.

3. Clean and dry pipe surfaces to be solvent-welded.

4. Use only solvent recommended by Manufacturers of pipe and fittings.

5. Apply solvent with a non-synthetic bristle brush no less than ½ nominal size of pipe diameter.

6. Follow proper primer and cement application sequence as described in ASTM D2855.

7. Apply even coat of solvent to inside of fitting and to outside of pipe on full area to be inserted into fitting socket.

8. Insert pipe into fitting to full depth immediately after coating, and then rotate pipe 90 degrees to distribute solvent and remove air bubbles.

9. Remove all excess solvent from outside of joint.

10. Each joint shall remain undisturbed for at least 30 minutes to develop handling strength.

11. Allow 24 hours drying time before pressure testing.

I. Install flanges on PVC pipe as follows:

1. Clean flange surfaces to mate with gasket, removing loose dirt, scale and detritus.

2. Inspect flange bolts and studs for proper size, threading and length.

3. Clean and lubricate bolt threads using lubricant chemically compatible with all materials involved.

4. With gasket in place, align mating flange bolt holes. Make sure mating flange faces are flush against gasket prior to bolt-up.

5. Insert bolts, nuts and washers. Tighten by hand until snug.

6. Before tightening bolts beyond hand-tight, operate adjacent valves through full range of motion to ensure clear unobstructed operation of discs and other internal parts.

7. Tighten bolts in sequence by 5-lb. increments following a 180° opposing sequence.

8. Flange bolt torques shall be as follows:

FLANGE SIZE	RECOMMENDED TORQUE
½"	12 ft-lb
¾"	12 ft-lb
1"	12 ft-lb
1¼"	12 ft-lb
1½"	12 ft-lb
2"	25 ft-lb
2½"	25 ft-lb
3"	25 ft-lb
3½"	25 ft-lb
4"	25 ft-lb
5"	30 ft-lb
6"	40 ft-lb

J. Provide serrated nipples where required for transition from plastic pipe to rubber hose.

K. Refer variances between Manufacturer's installation instructions and Contract Documents to Owner's Representative.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Completed Piping Systems Completed Piping Systems	Hydrostatic Test	Section 33 08 11.	All PVC pipe	Contractor	Contractor
	Disinfection	Section 33 13 00 and AWWA C651.	All PVC potable water pipe	Contractor	Contractor
	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
		Hydrostatic Test to 150 psi	1 each system as directed by Owner	Contractor	Contractor
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

3.4 Cleaning and Disinfection

A. Clean and disinfect pipe in accordance with Section 33 13 00.

3.5 Protection

A. At all times when pipe laying is not in progress, close open end of pipe with tight-fitting cap or plug to prevent entrance of foreign matter into pipe. These provisions shall apply during noon hour as well as overnight. In no event shall pipeline be used as to drain water which has infiltrated into trench. Maintain inside of pipe free from foreign materials and in clean and sanitary condition until acceptance by Owner's Representative.

END OF SECTION

SECTION 33 12 09
BACKFLOW PREVENTION DEVICES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of backflow prevention devices.

B. Use double check valve assemblies or reduced pressure assemblies to prevent backflow of pollutants that are objectionable but not toxic.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 01 73 33: Mechanical Identification
I. Section 09 90 00: Painting and Coating
J. Section 09 96 56: Epoxy Linings and Coatings
K. Section 33 05 31: Pipeline Joint Materials
L. Section 33 12 12: Resilient Wedge Gate Valves
M. Section 33 12 22: Bronze Valves 3” and Smaller

1.3 System Description

A. Furnish and install complete operating backflow prevention device including appurtenant structural, mechanical and/or electrical mountings, isolation valves, or connections required for compliance with Manufacturer’s installation requirements and compliance with applicable building and plumbing codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with the Federal Reduction of Lead in Drinking Water Act and California law AB1953, and shall be marked as complying.

C. Comply with California Code of Regulations Title 17 and Title 24 Part 5 (California Plumbing Code.)

D. Kitchen, lavatory and shower fittings with flexible hose shall have backflow protection complying with ASME/ANSI A112.18.3.

E. Products in contact with hot water shall be rated and designed to operate at temperatures in excess of 110°F

F. Products shall be IAPMO listed, FM approved, UL classified, and approved by Foundation for Cross Connection Control and Hydraulic Research at University of Southern California.

G. Factory testing for double check valve (DC) assemblies shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Double Check Valve Assemblies	Backflow Prevention	ASSE Standard 1015 AWWA C510 and USC Foundation for Cross Connection Control and Hydraulic Research	All devices shall meet or exceed requirements	Contractor	Contractor
Interior Lining	Holidays and Lining Thickness	See Section 09 96 56	1 each valve	Contractor	Contractor

1.5 References

A. ASME/ANSI A112.1.3 Air Gap Fittings for Use with Plumbing Fixtures, Appliances, and Appurtenances
B. ASME/ANSI A112.18.3 Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings
C. ASME/ANSI B1.20.1 (ANSI B2.1) Pipe Threads – NPT National Pipe Thread Taper
D. ASME/ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings – Class 25, 125, 150 and 800
E. ASME/ANSI B16.4 Cast Iron Threaded Fittings
F. ASME/ANSI B16.5 Steel Pipe Flanges and Flanged Fittings (Including ratings for Class 150, 300, 400, 600, 900, 1500, and 2500)
G. ASME/ANSI B16.15 Cast Bronze Threaded Fittings
H. ASME/ANSI B16.24 Cast Copper Alloy Pipe Flanges and Flanged Fittings
I. ASME/ANSI B16.42 Ductile Iron Flanged Fittings – Classes 150 and 300
J. ASSE 1001 Atmospheric Type Vacuum Breakers
K. ASSE 1011 Hose Connection Vacuum Breakers
L. ASSE 1012 Backflow Preventer with Intermediate Atmospheric Vent
M. ASSE 1013 Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers
N. ASSE 1014 Backflow Prevention Devices for Handheld Showers
O. ASSE 1015 Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies
P. ASSE 1019 Vacuum Breaker Wall Hydrant, Freeze-Resistant Automatic Draining Type
Q. ASSE 1020 Pressure Vacuum Breaker Assembly
R. ASSE 1024 Dual Check Valve Backflow Preventers
S. ASSE 1035 Laboratory Faucet Backflow Preventers
T. ASSE 1037 Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures
U. ASSE 1047 Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies
V. ASSE 1048 Double Check Detector Fire Protection Backflow Prevention Assemblies
W. ASSE 1052 Hose Connection Backflow Preventers
X. ASSE 1055 Chemical Dispensing Systems
Y. ASSE 1056 Spill-Resistant Vacuum Breakers
Z. ASTM A536 Ductile Iron Castings
AA. ASTM B584 Copper Alloy Sand Castings for General Applications
BB. AWWA C213 Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines
CC. AWWA C510 Double Check Valve Backflow Prevention Assembly
DD. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
EE. AWWA M14 Backflow Prevention and Cross Connection Control

FF. University of Southern California Foundation for Cross Connection Control and Hydraulic Research List of Approved Devices
GG. California Code of Regulations Title 17
HH. California Plumbing Code (CPC)
II. NSF/ANSI 61 Drinking Water System Components – Health Effects
JJ. NSF/ANSI 372 Drinking Water System Components – Lead Content (Formerly NSF/ANSI 61 Annex G)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
	Show lining and coating data and thicknesses on backflow preventers ≥ 4"
Installation Instructions	Required per installation or application instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements
Certificate of Compliance	Submit coating system and application certification per certificate of compliance requirements.
List of Approved Devices	Submit current copy of University of Southern California Foundation for Cross Connection Control List of Approved Backflow Prevention Devices with device furnished shown highlighted.
Test Record Transcripts	Submit certificate of adequacy and operational compliance following testing of installed device by independent laboratory as described below.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, O&M instructions, certificates of compliance, and test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of backflow prevention devices shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for backflow prevention assemblies other than double-check valve assemblies or reduced-pressure assemblies include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Air Gap Fixtures	Febco Div. CMB Industries 601 Series	Fresno, CA
	Jay. R. Smith Mfg. Co (Figure 3950)	Montgomery AL
	Wade (W-02490)	Tyler TX
	Watts Water Technologies "Series 909"	Lawrence, MA
	Wilkins Division Zurn Industries AG Series	Paso Robles, CA
	Accepted Equal	
Bronze Pressure Vacuum Breaker (PVB) Backflow Prevention Assemblies	Apollo Valve Div Conbraco Industries Series 4A	Matthews, NC
	Apollo Valve Div Conbraco Industries 38 Series	Matthews, NC
	Febco Div. CMB Industries 765 Series	Fresno, CA
	Zurn Industries, Wilkins Div. Model 420XL	Paso Robles, CA
	Accepted Equal	
Bronze Pressure Vacuum Breaker Spill-Resistant-Type (SVB) Backflow Preventers	Apollo Valve Div Conbraco Industries	Matthews, NC
	Wilkins Division Zurn Industries Model 12-460XL	Paso Robles, CA
	Accepted Equal	
Bronze Hose Connector Backflow Preventers	Apollo Valve Div Conbraco Industries HBV Series	Matthews, NC
	Febco Div. CMB Industries 731 Series	Fresno, CA
	Johnson Diversey Equipment	Santa Cruz, CA
	Watts Water Technologies "Series 8A"	North Andover, MA
	Wilkins Division Zurn Industries	Paso Robles, CA
	Accepted Equal	

B. Acceptable Manufacturers for double-check-valve (DC) backflow prevention assemblies for use on irrigation systems include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Double Check Valve (DC) Backflow Prevention Assembly 2½"-10"	Ames Company "3000 Series"	Woodland, CA
	Apollo Valve Div Conbraco Industries Series 4A-DCLF 100	Matthews, NC
	Cla Val Company "DC"	Newport Beach, CA
	Danfoss Flomatic Corp. "DCV Series"	Glens Falls, NY
	Febco Div. CMB Industries "805YD"	Fresno, CA
	Febco Div. CMB Industries "850"	Fresno, CA
	Watts Water Technologies "Series 709"	Lawrence, MA
	Wilkins Division Zurn Industries "Model 350"	Paso Robles, CA
	Accepted equal on California (USC) "List of Approved Devices"	
Double Check Valve (DC) Backflow Prevention Assembly 2½"-10" Compact "N-Style"	Apollo Valve Div Conbraco Industries Series 4A-DCLF 100	Matthews, NC
	Febco Div. CMB Industries "870V" with 611 series valve setter	Fresno, CA
	Wilkins Division Zurn Industries Model 450	Paso Robles, CA
	Accepted equal on California (USC) "List of Approved Devices"	

C. Acceptable Manufacturers shall be listed on most current list of approved backflow prevention devices published by University of Southern California Foundation for Cross Connection Control:

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Comply with requirements of Chapter 6 of California Plumbing Code, "Water Supply and Distribution."

C. Backflow prevention devices shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body	Ductile Iron (for pressures 0-300 psi or devices 2½" and larger)	ASTM A536 Grade 65-45-12
Test Cocks	Bronze	ASTM B584 Alloy C89836, ASTM B763, AWWA C800, and NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications
Internals and Springs	Stainless Steel	AISI Type 304 or 316
Seal Rings	EPDM	FDA-approved
O-Rings	Buna-N Nitrile	FDA-approved
Welded Ends	Butt Weld	ASME/ANSI B16.9 / ASME/ANSI B16.25
	Socket Weld	ASME/ANSI B16.11
Solder Ends		ASME/ANSI B16.18 or ASME/ANSI B16.22
Threaded Ends Sizes ⅜"-2" Working Pressures 0-400 psi	Bronze	Female-threaded ASME/ANSI B1.20.1 (ANSI B2.1) ASME/ANSI B16.15
	Ductile Iron	Female-threaded ASME/ANSI B1.20.1 (ANSI B2.1)
Flanges Sizes 2½"-10" Working Pressures 0-150 psi	Bronze	ASME/ANSI B16.24 Class 125 Raised or plain faced
	Ductile Iron	ASME/ANSI B16.42 Class 150 Raised or plain faced
Flange Alignment	Horizontal Pipelines	Boltholes shall straddle horizontal and vertical centerlines of pipe run to which flanges are attached.
	Vertical Pipelines	Boltholes shall straddle plant North-South and plant East-West centerlines of pipe run to which flanges are attached.
Flange Bolts, Nuts, and Washers	Various steels	See Section 33 05 31.
Flange Gaskets		See Section 33 05 31.
Gate Valves		See Section 33 12 12.
Epoxy Lining (Iron Surfaces of Devices < 4")	Epoxy	See Section 09 96 56. AWWA C213 and AWWA C550 8-mil minimum DFT NSF61 Listed for potable water Do not coat sealing areas and bronze or stainless steel parts.
Exterior Finish Coat	Epoxy Urethane	See Section 09 90 00.
Coating Color	Domestic Service	Blue
	Irrigation Service	Green

D. Air gap fixtures shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Air Gap Fixtures	Body	ASTM A126 Class B

E. The following product design criteria, options and accessories are required for double check valve (DC) backflow prevention devices:

ITEM	DESCRIPTION	
Design Criteria	Double-Check-Valve Backflow Prevention Device	Double Check Valve per AWWA C510 and ASSE 1015
	Gate Valves (2 required)	Resilient Wedge Non Rising Stem (NRS)
	Test Cocks (4 required)	Configure to allow each check valve to be tested
	Minimum Rated Working Pressure	125 psi for cold water service Class 150 (300 WOG psi at 150F)
	Fluid Conveyed	Cold potable water
	Maximum Water Temperature	110°F
	Ends	Female threaded ASME/ANSI B1.20.1

F. The following product design criteria, options and accessories are required for vacuum breakers:

ITEM	DESCRIPTION	
Design Criteria	Vacuum Breaker	Pressure Vacuum Breaker Backflow Prevention Assembly (PVB) per ASSE 1020 / Pressure Vacuum Breaker Spill-Resistant-Type Backflow Prevention Assembly (SVB) per ASSE 1056 / Hose Connection Vacuum Breaker per ASSE 1011 / Wall Hydrant Vacuum Breaker per ASSE 1019
	Functional Description	Required on plumbing fixtures and equipment furnished with hose connectors Shall allow air to enter water line in event vacuum occurs in line. Air inlet shall close without spillage on initial application of line pressure.
	Minimum Rated Working Pressure	125 psi for cold water service Class 150 (300 WOG psi at 150F)
	Fluid Conveyed	Cold potable water
	Maximum Water Temperature	110°F
	Ends	Female threaded ASME/ANSI B1.20.1

G. The following product design criteria, options and accessories are required for air gap fixtures:

ITEM	DESCRIPTION	
Air Gap Fixtures	Air Gap Fixture	Comply with ASME/ANSI A112.1.3
	Inlet	Threaded inlet or inlet with set screw
	Outlet	No hub outlet
	Air Gap	Minimum air gap of 2 diameters but ≥ 1”
	Ends	Female threaded ASME/ANSI B1.20.1

H. Backflow preventers with intermediate atmospheric vents shall comply with ASSE 1012.

I. Dual check valve backflow preventers shall comply with ASSE 1024.

J. Backflow preventers for laboratory faucets shall comply with ASSE 1035.

K. Backflow prevention for pressurized flushing devices (Flushometers) shall comply with ASSE 1037.

L. Hose connection backflow preventers shall comply with ASSE 1052.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install backflow prevention devices before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install backflow prevention devices at locations shown on Plans and Submittals. Locate device as close as possible to user's connection. Owner and Water Utility shall have final authority in determining required location of backflow prevention devices.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Plumbing Code Chapter 6 "Water Supply and Distribution" Section 603 "Cross-Connection Control," and Tables 6-2 "Backflow Prevention Devices, Assemblies and Methods" and 6-3 "Minimum Airgaps for Water Distribution."

4. Other applicable fire, plumbing, and electrical code requirements

5. Section 7603 of Title 17 of California Code of Regulations

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install backflow prevention devices to tolerances recommended by Manufacturer. Unless otherwise shown, install backflow prevention devices true and level using precision gauges and levels.

3.3 Field Quality Control

A. Test backflow prevention devices immediately following installation. Do not place into service until test results are submitted to and approved by Owner and servicing water utility.

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Backflow Prevention Device	Backflow	Test by County-approved independent laboratory per County Department of Health Services Standards	1 each unit immediately after installation	Contractor	Contractor
	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Backflow Prevention Device (cont.)	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 12 12
RESILIENT-WEDGE GATE VALVES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of resilient-wedge gate valves.

B. Do not use resilient-wedge gate valves under any of the following circumstances:

1. For throttling service.
2. For slurry handling service.
3. In shallow pipelines where insufficient clearance is available for stems.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 33: Mechanical Identification
H. Section 09 90 00: Painting and Coating
I. Section 09 96 56: Epoxy Linings and Coatings
J. Section 31 05 50: Protecting Existing Utilities
K. Section 33 05 31: Pipeline Joint Materials
L. Section 33 05 39: Manual Valve Operators
M. Section 33 08 11: Pressure Testing and Flushing of Water Utilities

1.3 System Description

A. Furnish and install complete operating valve including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and applicable building codes and standards.

B. Gate valves shall provide positive shutoff when valve is in closed position and shall provide unobstructed flow when valve is in open position.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with the Federal Reduction of Lead in Drinking Water Act and California law AB1953.

C. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Resilient Wedge Gate Valve	Proof of Design Test	AWWA C515 Section 5.1.1	1 each prototype	Contractor	Contractor
	Operation Test	AWWA C515 Section 5.1.2.1	1 each valve	Contractor	Contractor
	Shell Test	AWWA C515 Section 5.1.2.2 at 400 psi	1 each valve	Contractor	Contractor
	Seat Test	AWWA C515 Section 5.1.2.3 at 200 psi	1 each valve	Contractor	Contractor
	Metal to Rubber Bond	ASTM D429	1 each valve	Contractor	Contractor
Interior Lining	Holidays and Lining Thickness	See Section 09 96 56	1 each valve	Contractor	Contractor

1.5 References

A. API/ANSI 598 Valve Inspection and Testing
B. ASME/ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings – Class 25, 125, 150 and 800
C. ASME/ANSI B16.10 Face-to-Face and End-to-End Dimensions of Valves
D. ASME/ANSI B16.21 Non Metallic Flat Gaskets for Pipe Flanges
E. ASME/ANSI B16.42 Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300
F. ASTM A126 Gray Iron Castings for Valves, Flanges and Pipe Fittings
G. ASTM A217 Steel Castings, Martensitic Stainless and Alloy, for Pressure-Containing Parts, Suitable for High-Temperature Service
H. ASTM A276 Stainless Steel Bars and Shapes
I. ASTM A473 Stainless Steel Forgings
J. ASTM A536 Ductile Iron Castings
K. ASTM A582 Free Machining Stainless Steel Bars
L. ASTM A743 Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
M. ASTM B16 Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
N. ASTM B62 Composition Bronze or Ounce Metal Castings (do not use for potable water wetted surfaces)
O. ASTM B98 Copper Silicon Alloy Rod, Bar, and Shapes
P. ASTM B124 Copper and Copper Alloy Forging Rod, Bar, and Shapes
Q. ASTM B138 Manganese Bronze Rod, Bar, and Shapes
R. ASTM B148 Aluminum Bronze Sand Castings
S. ASTM B283 Copper and Copper Alloy Die Forgings (Hot Pressed)
T. ASTM B584 Copper Alloy Sand Castings for General Applications
U. ASTM B763 Copper Alloy Sand Castings for Valve Applications
V. ASTM D429 Rubber Property—Adhesion to Rigid Substrates
W. ASTM D2000 Classification System for Rubber Products in Automotive Applications
X. AWWA C105 Polyethylene Encasement for Ductile Iron Pipe Systems
Y. AWWA C213 Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines
Z. AWWA C509 Resilient Seated Gate Valves for Water Supply Service
AA. AWWA C515 Reduced Wall, Resilient Seated Gate Valves for Water Supply Service
BB. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
CC. AWWA C606 Grooved and Shouldered Joints
DD. MSS SP111 Gray-Iron and Ductile-Iron Tapping Sleeves
EE. NSF/ANSI 61 Drinking Water System Components – Health Effects

FF. NSF/ANSI 372 Drinking Water System Components – Lead Content (Formerly NSF/ANSI 61 Annex G)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for valves larger than 16" diameter per valve shop drawing requirements.
Catalog Data	Required per catalog data requirements.
	Show lining and coating data and thicknesses.
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements.
Certificate of Compliance	Submit certified test results for leakage and hydrostatic tests
	Submit certified report of testing of factory-applied linings
	Submit affidavit of compliance with AWWA C515
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of gate valves shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for valves include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Resilient Wedge Gate Valves (Potable Water C515) 2"-66"	American AVK Series 45	Fresno, CA
	ACIPCO American Flow Control Series 2500	Birmingham, AL
	Clow Valve Series 2600	Corona, CA
	Kennedy Valve Div., McWane, Inc. Kenseal II	Birmingham AL
	M&H Valve Div. McWane Inc Style 4067 or 7000	Anniston AL
	Mueller Co. Series 2360	Decatur IL
	Stockham	Birmingham, AL
	U S Pipe Series USP0	
	Accepted equal	Fresno, CA

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Resilient-wedge gate valves shall comply with AWWA C515.

C. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Potable Water	0.894cP	1.00	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<500 ppm
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

D. Resilient wedge gate valves for potable water service shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, Bonnet and Yoke if Applicable	Ductile Iron (for pressures 0-300 psi)	ASTM A536 Grade 65-45-12
	Cast Iron (for pressures 0-150 psi)	ASTM A126 Class B
Dimensions	Laying Length	ASME/ANSI B16.10 Table 1 (Class 125 or 150)
Gate (same material as valve body)	Ductile Iron	ASTM A536 Grade 65-45-12
	Cast Iron	ASTM A126 Class B
	Bronze	ASTM B16, B62, B98, B124, B138, B148, B283, B584, or B763 Use alloy listed in AWWA C515 Table 5 Comply with NSF/ANSI 372 lead threshold for potable water applications
Wedge Resilient Coating	Ethylene-Propylene Diene Monomer (EPDM)	ASTM D429 Peroxide cured
Stem and Stem Nut	Bronze	ASTM B16, B98, B138, B148, B283, B584, or B763 Use alloy listed in AWWA C515 Table 5 Comply with NSF/ANSI 372 lead threshold for potable water applications Maximum 7% zinc, 2% aluminum Minimum tensile strength = 70,000 psi Minimum yield strength = 40,000 psi Elongation >15% in 2” Visibly mark stem to show compliance with above.
Bonnet Bolts	Stainless Steel	SAE Type 316 with antiseize lubricant
O-Rings	Synthetic Rubber	ASTM D2000
Flanges Sizes 3”-48” Working Pressures 0-150 psi	Ductile Iron	ASME/ANSI B16.42 Class 150 Raised or plain faced
	Cast Iron	ASME/ANSI B16.1 Class 125 Raised or plain faced
Flange Alignment	Valves	Boltholes shall straddle horizontal and vertical centerlines of valve.
Flange Bolts, Nuts, and Washers	Various Steels	See Section 33 05 31.
Flange Gaskets		See Section 33 05 31.
Grooved Ends	Provide where shown	AWWA C606 Compatible with adjacent coupling
Lining	Fusion-Bonded Epoxy	See Section 09 96 56. AWWA C213 and AWWA C550 12-mil minimum DFT Meet NSF 61 for potable water applications Do not coat sealing areas or bronze or stainless steel parts.
Exterior Finish Coat	Epoxy-Urethane	See Section 09 90 00.
Polyethylene Encasement on Buried Valves	Polyethylene	AWWA C105 2 layers of 8-mil wrap

E. The following product design criteria, options and accessories are required for resilient-wedge gate valves:

ITEM	DESCRIPTION	
Design Criteria	Design Standard	AWWA C515
	Stem Seal	Double O-Ring Type
	Wedge	Sealing surface permanently bonded and fully encapsulated with resilient material
	Thrust Bearings	Low-friction torque-reduction type located both above and below stem collar.
	Valves Connecting to Mains	Provide flange on main side unless otherwise shown.
	Markings	Manufacturer's name or symbol, size of valve, year of manufacture, and working pressure shall be cast in valve bonnet or body. Body shall have arrow cast in metal to show direction of opening,
Rated Working Pressure	Suction Piping	150 psi
	Discharge Piping	150 psi
Valve Actuators – Above Ground	Operator	Handwheel
	Stem	Nonrising stem
	Position Indicator	Required
	Operation	Valve shall open with counterclockwise operator rotation
Valve Actuators - Buried	Operator	Enclosed gear or screwed rod type with 2" AWWA nut
	Stem	Nonrising stem
	Position Indicator	Not required
	Operation	Valve shall open with counterclockwise operator rotation
Valve Stem Input Torque	AWWA C515 Table 1	
Stem Nut Extension	Where Required	Required on valves buried 4' or deeper.
	Construction	Center extension in valve well using guide.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install gate valves before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Gate valves shall be furnished and installed by Contractor at location shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

D. Install gate valves or tapping valves to tolerances recommended by Manufacturer. Unless otherwise shown, install valves true, plumb, and level using precision gauges and levels.

E. Refer variances between Manufacturer's installation instructions and Contract Documents to Owner's Representative.

F. Buried gate valves shall be installed as follows:

1. Install and connect gate valve according to Manufacturer's installation and warranty requirements.

2. Wrap 2 layers of 8-mil AWWA C105 polyethylene encasement around valve and flanges and secure with plastic adhesive tape wrapped around valve stem below operating nut to prevent entrance of soil. Fold overlaps twice and tape. Backfill with care to protect polyethylene.

3. Place and compact backfill to height of valve stem.

4. Place block pads under extension pipe to maintain valve box in vertical position during backfilling and repaving and to prevent extension pipe from contacting valve bonnet.

5. Mount upper slip pipe of extension in mid-position and secure with backfill around extension pipe.

6. Pour concrete ring allowing a depression so valve box cap will be flush with finished surface.

G. Refer to Section 31 05 50 for additional requirements associated with tapping existing water lines.

3.3 Field Quality Control

A. Valves shall be tested at same time connecting pipelines are pressure tested and in accordance with Contract Document sections covering testing. During pressure testing, protect or isolate valves, operators, or control and instrumentation elements whose pressure rating is less than test pressure.

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Gate Valve	Installation & Leakage	Visual inspection for drip tight finished installation under pressure.	1 inspection	Owner	Owner
	Pressure Test	See Section 33 08 11.	1 test	Contractor	Contractor
	Actuator	Operate valve through 10 full opening and closing cycles without sticking, or binding and without required operating torque exceeding 150 ft-lbs at any point	1 test	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
	Actuator Torque	No valve or actuator component shall show any evidence of deformity after application of the following torques in presence of Owner's Representative. 4" – 240 ft-lbf 6" – 330 ft-lbf 8" – 400 ft-lbf 10" – 460 ft-lbf 12" – 550 ft-lbf	1 test	Contractor	Contractor
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 33 12 16
PLUG VALVES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of plug valves.

B. Do not use plug valves under any of the following circumstances:

1. For slurry handling service.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 09 96 56: Epoxy Linings and Coatings
I. Section 33 05 31: Pipeline Joint Materials
J. Section 33 05 39: Manual Valve Operators
K. Section 33 08 11: Pressure Testing and Flushing of Water Utilities

1.3 System Description

A. Furnish and install complete operating valves including appurtenant mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable standards.

B. Valves shall provide positive shutoff when valve or port is in closed position and shall permit unobstructed flow when valve or port is in open position.

C. Valves shall seat drip tight against seating pressure equal to rated design pressure of valve.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with the Federal Reduction of Lead in Drinking Water Act and California law AB1953.

C. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Resilient-Seated Cast Iron Eccentric Plug Valve	Shell Test	AWWA C517 Section 5.2.1.1	1 each valve	Contractor	Contractor
	Seat Test	AWWA C517 Section 5.2.1.2	1 each valve	Contractor	Contractor
	Proof of Design	AWWA C517 Section 5.2.2	1 each prototype	Contractor	Contractor
Interior Lining	Holidays and Lining Thickness	See Section 09 96 56	1 each valve	Contractor	Contractor

1.5 References

A. API/ANSI 598 Valve Inspection and Testing
B. API/ANSI 599 Metal Plug Valves – Flanged, Threaded and Welding Ends
C. ASME/ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings – Class 25, 125, 150 and 800
D. ASME/ANSI B16.5 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24
E. ASME/ANSI B16.10 Face-to-Face and End-to-End Dimensions of Valves
F. ASME/ANSI B16.42 Ductile Iron Flanged Fittings – Classes 150 and 300
G. ASTM A48 Gray Iron Castings
H. ASTM A126 Gray Iron Castings for Valves, Flanges and Pipe Fittings
I. ASTM A193 Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service
J. ASTM A194 Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
K. ASTM A536 Ductile Iron Castings
L. ASTM A743 Castings, Iron-Chromium, Iron Chromium Nickel, Corrosion Resistant for General Application
M. AWWA C213 Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines
N. AWWA C517 Resilient-Seated Cast-Iron Eccentric Plug Valves
O. AWWA C540 Power-Actuating Devices for Valves and Sluice Gates
P. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
Q. AWWA C606 Grooved and Shouldered Joints
R. MSS SP78 Cast Iron Plug Valves
S. NSF/ANSI 60 Drinking Water Treatment Chemicals – Health Effects
T. NSF/ANSI 61 Drinking Water System Components – Health Effects
U. NSF/ANSI 372 Drinking Water System Components – Lead Content (Formerly NSF/ANSI 61 Annex G)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per valve shop drawing requirements.
Catalog Data	Required per catalog data requirements.
	Show lining and coating data and thicknesses.
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance Instruction requirements.
Certificate of Compliance	Submit certified test results for proof of design, hydrostatic and leakage tests.
	Submit certified report of testing of factory-applied linings
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of valves shall be strictly followed.

C. Actuator and valve shall be shipped and delivered to jobsite as unit.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Eccentric Plug Valves and Actuators – Full Rectangular Port (½"-72")	DeZurik PEF	Sartell MN
	Accepted equal	
Eccentric Plug Valves and Actuators – Round Port	Henry Pratt Company "Ballcentric / Milliken Valve	Aurora, IL
	GA Industries, Inc. Series 517	Cranberry Twp, PA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Eccentric plug valves for waterworks service shall conform to AWWA C517.

C. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

D. Eccentric plug valves shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body	Ductile Iron (for pressures 0-300 psi)	ASTM A536 Grade 65-45-12
Body Seat (3" and larger valves)	Nickel	⅛" welded overlay seat of >90% nickel.
Dimensions	Laying Length	AWWA C517 Table 1 ASME/ANSI B16.10 Table 1 (Class 125 or 150) Short-Body
Plug	Ductile Iron	ASTM A536 Grade 65-45-12
Plug Elastomer	EPDM Synthetic Rubber (Ethylene-Propylene	ASTM D1418 ASTM D429

ITEM	MATERIAL	SPECIFICATION
Plug Elastomer (cont.)	Diene Monomer)	Peroxide cured Do not expose to petroleum oils or aromatic hydrocarbon fuels
Trim	Stainless Steel	SAE Type 316
Bearings – Valves ½"-36"	Stainless Steel Sleeve Type	SAE Type 316 ASTM A743 Grade CF-8M or SAE Type 317L Sintered, oil impregnated permanently lubricated
Cover Bolts	Stainless Steel	ASTM A193 Grade B8M SAE Type 316
Cover Nuts	Stainless Steel	ASTM A194 Grade 8M SAE Type 316
Centered Oil Bearings	Stainless Steel	ASTM A743 Grade CFBM SAE Type 316
Stem Packing Seals	NBR Synthetic Rubber (Nitrile Butadiene Rubber) (Buna N)	ASTM D1418 Do not expose to acetone, esters, ketones, chlorinated hydrocarbons, nitro hydrocarbons, ozone or direct sunlight
Grit Seals (Top and Bottom)	PTFE Fluoropolymer (Polytetrafluoroethylene) (Teflon)	ASTM D1418
Flanges Sizes 3"-72" Working Pressures 0-150 psi	Ductile Iron	ASME/ANSI B16.42 Class 150 Raised or plain faced
Flange Alignment	Valves	Boltholes shall straddle horizontal and vertical centerlines of valve.
Flange Bolts, Nuts, and Washers	Various Steels	See Section 33 05 31.
Flange Gaskets		See Section 33 05 31.
Grooved Ends	Provide where shown	AWWA C606 Compatible with adjacent coupling
Epoxy Lining (Iron Surfaces of Valves ≥ 4")	Liquid Epoxy	See Section 09 96 56. AWWA C213 and AWWA C550 16-mil minimum DFT Do not coat sealing areas and bronze or stainless steel parts.
Exterior Finish Coat	Epoxy	See Section 09 90 00.

E. The following product design criteria, options and accessories are required on nonlubricated eccentric plug valves:

ITEM	DESCRIPTION	
Port Size	Valves ≤ 36"	100% (3"-36")
Seat	Seat Area	Raised, with raised surface completely covered with weld to ensure plug face contacts only nickel
	Seating	Bidirectional
	Design	Do not use screwed-in seats
Eccentric Plug	Facing	Resilient faced with neoprene or hycar, suitable for use with sewage.
	Seating Surface	Cylindrical seating surface eccentrically offset from plug shaft center.
Shaft Seals	Design	Multiple V-ring type, externally adjustable and repackable without removing bonnet or actuator from valve under pressure. Do not use O-ring seals or non-adjustable packing.
Actuators	Manual Valve Actuators	Gear actuators and tee wrenches, extension stems, floorstands, etc., as shown on Plans
	Gear Actuators (Required on valves ≥ 6")	Enclose all gearing in semi-steel housing Gearing shall be suitable for running in lubricant. Provide seals on all shafts to prevent entry of dirt and water into actuator. Actuator shaft and quadrant shall be supported on permanently lubricated bronze bearings.
	Position Indicator	Required

ITEM	DESCRIPTION	
Actuators (cont.)	Adjustable Stop	Shall allow manual set of closing torque and provide seat adjustment to compensate for change in pressure differential or flow direction change.
	Submerged or Buried Actuators	Design to operate beneath 15' head of water without damage to valve, gland or gland adjusting mechanism Actuators shall have seals on all shafts and gaskets on valve and actuator covers to prevent water entry. Actuator mounting brackets shall be totally enclosed and have gasket seals.

PART 3 - EXECUTION

3.1 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install plug valves at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable fire, plumbing and mechanical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install plug valves to tolerances recommended by manufacturer. Unless otherwise shown, install plug valves true, plumb, and level using precision gauges and levels.

F. Install valve so seat is opposite the high-pressure side.

G. For suspended solids applications, install plug horizontal and rotating to top of valve when open. For buried or submerged service, this requires actuator to be mounted 180° from standard mounting position.

3.2 Field Quality Control

A. Test valves at same time connecting pipelines are pressure tested. Valves, operators, or control and instrumentation elements whose pressure rating is less than test pressure shall be protected or isolated during pressure testing.

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Plug Valve	Installation & Leakage	Visual inspection for drip tight finished installation under pressure.	1 inspection	Owner	Owner
	Pressure Test	See Section 33 08 11.	1 test	Contractor	Contractor
	Actuator	Operate valve through 10 full cycles of opening and closing. Valve shall operate from full open to full close without sticking, or binding and without required operating torque exceeding 150 ft-lbs at any point	1 test	Contractor	Contractor
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 12 18
CHECK VALVES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of check valves.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 09 96 56: Epoxy Linings and Coatings
I. Section 33 05 31: Pipeline Joint Materials
J. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
K. Section 33 12 22: Bronze Valves 3" and Smaller

1.3 System Description

A. Furnish and install complete operating check valve including appurtenant mountings or connections required for compliance with Manufacturer's installation requirements and applicable standards.

B. Check valves shall prevent backflow of fluid when downstream pressure exceeds upstream pressure. Valves shall seat drip tight against a downstream seating pressure equal to rated design pressure of valve.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with the Federal Reduction of Lead in Drinking Water Act and California law AB1953.

C. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Swing Check Valve	Hydrostatic Shell Test	AWWA C508 Section 5.2.1	1 each valve	Contractor	Contractor
	Hydrostatic Seat LeakageTest	AWWA C508 Section 5.2.2	1 each valve	Contractor	Contractor
Interior Lining	Holidays and Lining Thickness	See Section 09 96 56	1 each valve	Contractor	Contractor

1.5 References

A. ASME/ANSI B1.20.1 (ANSI B2.1) Pipe Threads – NPT National Pipe Thread Taper
B. ASME/ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings – Class 25, 125, 150 and 800
C. ASME/ANSI B16.3 Malleable Iron Threaded Fittings
D. ASME/ANSI B16.4 Cast Iron Threaded Fittings
E. ASME/ANSI B16.10 Face-to-Face and End-to-End Dimensions of Valves
F. ASME/ANSI B16.42 Ductile Iron Flanged Fittings – Classes 150 and 300
G. API/ANSI 594 Check Valves: Flanged, Lug, Wafer and Butt-welding
H. ASTM A48 Gray Iron Castings
I. ASTM A126 Gray Iron Castings for Valves, Flanges and Pipe Fittings
J. ASTM A193 Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service
K. ASTM A194 Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
L. ASTM A269 Seamless and Welded Austenitic Stainless Steel Tubing for General Service
M. ASTM A216 Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service
N. ASTM A217 Steel Castings, Martensitic Stainless and Alloy, for Pressure- Containing Parts, Suitable for High-Temperature Service
O. ASTM A276 Stainless and Heat Resisting Steel Bars and Shapes
P. ASTM A313 Stainless Steel Spring Wire
Q. ASTM A351 Castings, Austenitic, for Pressure-Containing Parts
R. ASTM A536 Ductile Iron Castings
S. ASTM A582 Free-Machining Stainless and Heat Resisting Steel Bars
T. ASTM B584 Copper Alloy Sand Castings for General Applications
U. ASTM B16 Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
V. ASTM B62 Composition Bronze or Ounce Metal Castings (do not use for potable water wetted surfaces)
W. ASTM B148 Aluminum-Bronze Sand Castings
X. ASTM B271 Copper-Base Alloy Centrifugal Castings
Y. ASTM B584 Copper Alloy Sand Castings for General Applications
Z. ASTM D2000 Rubber Products in Automotive Applications
AA. AWWA C213 Fusion-Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines
BB. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
CC. MSS SP71 Gray Iron Swing Check Valves, Flanged and Threaded
DD. MSS SP125 Gray Iron and Ductile Iron In-Line Spring-Loaded Center-Guided Check Valves
EE. MSS SP136 Ductile Iron Swing Check Valves

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per valve shop drawing requirements. Include detail of any penetration of valve body by hinge pin showing packing gland, hinge pin gland, cap and other pieces used.
Catalog Data	Required per catalog data requirements.
	Show lining and coating data and thicknesses.
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements.
Certificate of Compliance	Submit certified report of testing of factory-applied linings
	Submit affidavit of compliance with AWWA C508 for swing check valves
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of check valves shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Swing Check Valves 2"-66"	DeZurik / APCO Series 250 or 6000	Sartell, MN
	Henry Pratt Company / Milliken "CC&E"	Aurora, IL
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Stormwater	0.894cP	1.00	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Swing check valves 2"-66" shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body and Cap (Bonnet)	Ductile Iron (for pressures 0-300 psi)	ASTM A536 Grade 65-45-12
Dimensions	Laying Length	ASME/ANSI B16.10 Table 7(Class 125 or 150)
Disc	Ductile Iron	ASTM A536, Grade 65-45-12
Seat	Aluminum Bronze	ASTM B148
Hinge Pin	Stainless Steel	ASTM A582 Type 303, 304 or 410
Cover Bolts	Stainless Steel	ASTM A193 Grade B8M
Cover Nuts	Stainless Steel	ASTM A194 Grade 8M
Outside Lever and Weight		Required
Mechanical Disc Position Indicator		Required
Flanges Sizes 2"-66" Working Pressures 0-150 psi	Ductile Iron	ASME/ANSI B16.42 Class 150 Raised or plain faced
Flange Alignment	Valves	Boltholes shall straddle horizontal and vertical centerlines of valve.

ITEM	MATERIAL	SPECIFICATION
Flange Bolts, Nuts, and Washers	Various Steels	See Section 33 05 31.
Flange Gaskets		See Section 33 05 31.
Epoxy Lining (Iron Surfaces of Valves ≥ 4")	Fusion-Bonded Epoxy	See Section 09 96 56. AWWA C213 and AWWA C550 12-mil minimum DFT Do not coat sealing areas and bronze or stainless steel parts.
Exterior Finish Coat	Epoxy	See Section 09 90 00.
Limit Switch	Design	Provide limit switch on valve with necessary signals transmitted to PLC

PART 3 - EXECUTION

3.1 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install check valves at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable fire, plumbing, mechanical and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

3.2 Field Quality Control

A. Valves shall be tested at same time connecting pipelines are pressure tested and in accordance with sections of Contract Documents covering testing. Valves, operators, or control and instrumentation elements whose pressure rating is less than test pressure shall be protected or isolated during pressure testing.

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Check Valve	Installation & Leakage	Visual inspection for drip tight finished installation under pressure.	1 inspection	Owner	Owner
	Pressure Test	See Sections 33 08 11.	1 test	Contractor	Contractor
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

SECTION 33 12 22
BRONZE VALVES 3" AND SMALLER

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of valves ≤ 3" on customer side of meters and laterals including

1. Potable water and irrigation systems.

2. Drain, waste and vent systems.

B. Utility work on Utility side of meters and laterals is typically covered by other sections which reflect standards for Servicing Utility.

C. Backflow prevention devices are covered in Section 33 12 09.

D. Trap Primer Valves are covered in Section 22 40 00.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 33: Mechanical Identification
H. Section 22 10 00: Plumbing Piping
I. Section 22 40 00: Plumbing Fixtures
J. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
K. Section 33 11 21: Brass and Copper Pipe
L. Section 33 11 33: PVC Schedule 40 and 80 Plastic Pipe
M. Section 33 12 09: Backflow Prevention Devices
N. Section 33 12 31: Water Service and Flowmeter Assemblies
O. Section 33 13 00: Disinfecting of Water Utility Distribution

1.3 System Description

A. Furnish and install complete operating valves as shown including appurtenant structural, mechanical and/or electrical mountings, connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

1.4 Quality Assurance

A. Use skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Valves shall be UL listed.

C. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with the Federal Reduction of Lead in Drinking Water Act and California law AB1953.

D. Stainless steel products may be substituted for bronze products provided dielectric protection is provided between stainless steel and bronze or copper alloys.

E. National Sanitation Foundation marking shall appear on all potable water valves.

F. National Sanitation Foundation marking is not required for piping in nonpotable water or drainage service.

G. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Butterfly Valve	Seat Bond	ASTM D429 Method B withstand 75 lb pull	1 each valve	Contractor	Contractor
	Proof of Design	ASTM C504 Section 5	Cycle testing per C504	Contractor	Contractor
	Leakage Test	AWWA C504 Section 5 and ASTM D1599	1 each valve	Contractor	Contractor
	Hydrostatic Test	AWWA C504 Section 5	1 each valve	Contractor	Contractor
Interior Lining	Holidays and Lining Thickness	See Section 09 96 56.	1 each valve	Contractor	Contractor

1.5 References

A. ASME/ANSI A112.4.14 Manually Operated Quarter-Turn Shutoff Valves for Use in Plumbing Systems Valves
B. ASME/ANSI B1.20.1 (ANSI B2.1) Pipe Threads – NPT National Pipe Thread Taper
C. ASME/ANSI B2.4 Hose Coupling Screw Threads For All Connections Having Nominal Hose (inside) Diameters Of ½, ⅝, ¾, 1, 1¼, 1½, 2, 2½, 3, 3½ and 4”
D. ASME/ANSI B16.10 Face-to-Face and End-to-End Dimensions of Valves
E. ASME/ANSI B16.23 Cast Copper Alloy Solder Joint Drainage Fittings (DWV)
F. ASME/ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings
G. ASME/ANSI B16.34 Valves – Flanged, Threaded and Welding End
H. ASSE 1003 Water Pressure Reducing Valves
I. ASTM A217 Steel Castings, Martensitic Stainless and Alloy, for Pressure- Containing Parts, Suitable for High-Temperature Service
J. ASTM B32 Solder Metal
K. ASTM B61 Steam or Valve Bronze Castings
L. ASTM B62 Composition Bronze or Ounce Metal Castings (Do not use for potable water wetted surfaces)
M. ASTM B98 Copper-Silicon Alloy Rod, Bar and Shapes
N. ASTM B99 Copper-Silicon Alloy Wire for General Applications
O. ASTM B124 Copper and Copper Alloy Forging Rod, Bar, and Shapes
P. ASTM B371 Copper-Zinc-Silicon Alloy Rod
Q. ASTM B584 Copper Alloy Sand Castings for General Applications
R. ASTM B763 Copper Alloy Sand Castings for Valve Applications
S. AWWA C504 Rubber-Seated Butterfly Valves 3”-72”
T. AWWA C800 Underground Service Line Valves and Fittings
U. California Plumbing Code (CPC)
V. MSS SP67 Butterfly Valves

W. MSS SP80 Bronze Gate, Globe, Angle and Check Valves
X. MSS SP 110 Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
Y. MSS SP139 Copper Alloy Bronze Gate, Globe, and Check Valves for Low-Pressure/Low-Temperature Plumbing Applications
Z. NEMA/ANSI 250 Enclosures for Electrical Equipment
AA. NFPA 70 National Electric Code
BB. NSF/ANSI 61 Drinking Water System Components – Health Effects
CC. NSF/ANSI 372 Drinking Water System Components – Lead Content (Formerly NSF/ANSI 61 Annex G)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for each type of valve per shop drawing requirements.
Catalog Data	Required for each type of valve per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance Instruction requirements.
Certificate of Compliance	Submit certified report of testing of factory-applied linings
Warranty	Furnish one-year warranty from date of final acceptance.

B. Refer to Section 01 33 00 for definition of requirements for shop drawing, catalog data, installation instructions, O&M instructions and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of plumbing, fixtures, and appurtenant equipment shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for bronze valves include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
GENERAL PURPOSE VALVES		
Bronze Gate Valves ≤ 3" Class 150 for Potable Water Service	Apollo Valve Div Conbraco Industries Series 30-LF	Matthews, NC
	Nibco Inc. Fig T-113-LF or S-113-LF	Elkhart, IN
	Accepted equal	
Bronze Gate Valves ≤ 3" Class 150	A. Y. McDonald Co. Series 2038	Dubuque, IA
	Apollo Valve Div Conbraco Industries Series 30	Matthews, NC
	Conbraco Industries Fig F-56	Matthews, NC
	Crane Valves Fig 431-UB	Bolingbrook, IL
	Fairbanks Valves Fig U-0226	Bakersfield, CA
	Hammond Valve Fig IB629	Prairie du Sac WI
	Jenkins Valves Inc. Fig 47U	Bolingbrook, IL
	Lunkenheimer Co. Fig 3151	Cincinnati, OH

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Bronze Gate Valves ≤ 3" Class 150 (cont.)	Nibco Inc. Fig T-134	Elkhart, IN
	Red-White Valve Co.	Lake Forest, CA
	Stockham Valves & Fittings Fig B120	Birmingham, AL
	Walworth Co. Fig 11	Houston, TX
	William Powell Co. Fig 2714	Cincinnati, OH
	Accepted equal	
Bronze Globe Valves ≤ 2" Class 150 for Potable Water Service	Apollo Valve Div Conbraco Industries Series 33-LF	Matthews, NC
	Accepted equal	
Bronze Globe Valves ≤ 2 Class 150	Apollo Valve Div Conbraco Industries Series 33	Matthews, NC
	Conbraco Industries Fig F-80	Matthews, NC
	Crane Valves Fig 7TF	Bolingbrook, IL
	Fairbanks Valves Fig U01	Bakersfield, CA
	Hammond Valve Fig IB413T	Prairie du Sac WI
	Jenkins Valves Inc. Fig 106A	Bolingbrook, IL
	Lunkenheimer Co. Fig 123	Cincinnati, OH
	Nibco Inc. Fig T235YW	Elkhart, IN
	Red-White Valve Co.	Lake Forest, CA
	Stockham Valves & Fittings Fig B22	Birmingham, AL
	Walworth Co. Fig 95	Houston, TX
	William Powell Co. Fig 150A	Cincinnati, OH
	Accepted Equal	
Bronze Angle Valves ≤ 3" Class 150	A. Y. McDonald Co.	Dubuque, IA
	Crane Valves Fig 17	Bolingbrook, IL
	Fairbanks Valves Fig U-03	Bakersfield, CA
	Hammond Valve Fig IB454-T	Prairie du Sac WI
	Jenkins Valves Inc. Fig 108A	Bolingbrook, IL
	Lunkenheimer Co. Fig 214	Cincinnati, OH
	Stockham Valves & Fittings Fig B222	Birmingham, AL
	Walworth Co. Fig 96	Houston, TX
	William Powell Co. Fig 151	Cincinnati, OH
	Accepted equal	
Bronze Hose Bibbs	A. Y. McDonald Co	Dubuque, IA
	Conbraco Industries 35 Series	Matthews, NC
	Jenkins Valves Inc. Fig 112, 113, or 372	Bolingbrook, IL
	Nibco Inc. Fig T113HC	Elkhart, IN
	Wilkins Div Zurn Valve Co. 195 Series	Gardena, CA
	William Powell Co. Fig 503H	Cincinnati, OH
	Accepted equal	
Bronze Ball Valves ≤ 3" for Potable Water Service	Apollo Valve Div Conbraco Industries Series 70-LF Series	Matthews, NC
	Accepted equal	
Bronze Ball Valves ≤ 3" – 2-Port	Apollo Valve Div Conbraco Industries Series 70	Matthews, NC
	A. Y. McDonald Co.	Dubuque, IA
	Crane Valves Fig 930-TF	Bolingbrook, IL
	ITT-Grinnell Fig 1650	Cranston, RI
	Jamesbury Div. Metso Automation Fig 2111,A-11-TT	Portland, OR
	Jenkins Valves Inc. Fig 32-A	Bolingbrook, IL
	Lunkenheimer Co. Fig 707	Cincinnati, OH
	Nibco Inc. Fig T-590	Elkhart, IN
	Red-White Valve Co.	Lake Forest, CA
	Stockham Valves & Fittings Fig S217	Birmingham, AL
	Swagelok Company	Solon, OH
	Accepted equal	
Bronze Needle Valves	Swagelok Company	Solon, OH
	Accepted equal	
CHECK VALVES		

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Bronze Swing Check Valves ≤ 3" Class 200 for Potable Water Service	Apollo Valve Div Conbraco Industries Series 61YLF	Matthews, NC
	Accepted equal	
Bronze Swing Check Valves ≤ 3" Class 200	A. Y. McDonald Co. Series 2050S	Dubuque, IA
	Crane Valves Fig 36	Bolingbrook, IL
	Fairbanks Valves Fig 0605	Bakersfield, CA
	Hammond Valve Fig IB949	Prairie du Sac WI
	Lunkenheimer Co. Fig 554-Y	Cincinnati, OH
	Nibco, Inc.	Elkhart, IN
	Stockham Valves & Fittings Fig B345	Birmingham, AL
	Walworth Co. Fig 420	Houston, TX
	William Powell Co. Fig 560Y	Cincinnati, OH
	Accepted equal	
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Comply with requirements of Chapter 6 of California Plumbing Code, "Water Supply and Distribution."

C. Valve materials shall be chemically compatible with chemicals and solutions handled. If any portion of specified valve is chemically incompatible with chemicals or solutions handled, substitute appropriate valve during submittals, stating reason for exception.

D. Valves shall have name of Manufacturer and size of valve cast or molded onto valve body or bonnet or shown on a permanently attached plate.

E. Bronze gate valves ≤ 3" for potable water service shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, Bonnet, Stuffing Box	Lead-Free Brass	ASTM B584 Alloy C89836, AWWA C800, and NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications
Dimensions	Laying Length	ASME/ANSI B16.10 Table 1 (Class 125)
Disc	Lead-Free Brass	ASTM B584 Alloy C89836, AWWA C800, and NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications
Stem	Bronze	ASTM B371 Alloy C69400 or AWWA C800, NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications
Handwheel	Lead-Free Brass	ASTM B584, AWWA C800
	Malleable Iron	
Handwheel Nut	Stainless Steel	SAE 300 Series
Packing	Grafoil Flexible Graphite	
	Kevlar Aramid Fiber	
	PTFE (Teflon)	
Nameplate	Aluminum	

F. Bronze gate valves ≤ 3" for non-potable water service shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, Bonnet, Stuffing Box	Bronze	ASTM B584 Alloy C89836, AWWA C800 ASTM B62 bronze may be used for recycled water applications
Dimensions	Laying Length	ASME/ANSI B16.10 Table 1 (Class 125)
Disc	Bronze	ASTM B584 Alloy C89836, AWWA C800 ASTM B62 bronze may be used for recycled water applications
Stem	Bronze	ASTM B371 Alloy C69400 AWWA C800
	Copper Silicon	ASTM B99 Alloy C65100 AWWA C800
Handwheel	Lead-Free Brass	ASTM B584, AWWA C800
	Malleable Iron	
Handwheel Nut	Stainless Steel	SAE 300 Series
Packing	Grafoil Flexible Graphite	
	Kevlar Aramid Fiber	
	PTFE (Teflon)	
Nameplate	Aluminum	

G. Bronze globe valves ≤ 2" for potable water service shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, Bonnet	Lead-Free Brass	ASTM B584 Alloy C89836, NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications
Dimensions	Laying Length	ASME/ANSI B16.10 Table 1 (Class 125)
Disc	PTFE (Teflon)	Renewable composition disc
Stem	Lead-Free Brass	ASTM B371 Alloy C69400 or AWWA C800, NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications
Handwheels	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
	Malleable Iron	
Packing	PTFE (Teflon) or Kevlar Aramid Fiber	

H. Bronze globe valves ≤ 2" shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, Bonnet	Bronze	ASTM B61 or B62
Dimensions	Laying Length	ASME/ANSI B16.10 Table 1 (Class 125)
Disc	PTFE (Teflon)	Renewable composition disc
Stem	Bronze	ASTM B584 (Alloy C87600)
	Copper Silicon	ASTM B98 (Alloy C65100), or ASTM B371 (Alloy C69400)
Handwheels	Bronze	ASTM B61 or B62
	Malleable Iron	
Packing	PTFE (Teflon) or Kevlar Aramid Fiber	

I. Bronze ball valves ≤ 2" for potable water service shall comply with ASME/ANSI A112.4.14 and shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, and Plug Ball Retainer	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
Ball	Lead-Free Brass with Chrome Plating	ASTM B584, AWWA C800, NSF 61, and NSF 372
Stem	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
Seats	Reinforced PTFE (Teflon)	
Lever Operators	Bronze with Plastic Coating	

J. Bronze ball valves ≤ 2" shall comply with ASME/ANSI A112.4.14 and shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, and Plug Ball Retainer	Bronze	ASTM B61 or B62
Ball	Bronze with Chrome Plating	ASTM B61 or B62
Stem	Bronze	ASTM B61 or B62
Seats	Reinforced PTFE (Teflon)	
Lever Operators	Bronze with Plastic Coating	

K. Bronze check valves ≤ 2" for potable water service shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, and Cap	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
Disc	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372

L. Bronze check valves ≤ 2" shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, and Cap	Bronze	ASTM B61 or B62
Disc	Bronze	ASTM B61 or B62

M. Bronze angle valves ≤ 2" for potable water service shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, Bonnet	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
Disc	PTFE (Teflon)	Renewable composition disc
Stem	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
	Copper Silicon	ASTM B99 Alloy C65100, or ASTM B371 (Alloy C69400), AWWA C800, NSF 61, and NSF 372
Handwheels	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
	Malleable Iron	

N. Bronze angle valves ≤ 2" shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, Bonnet	Bronze	ASTM B61 or B62
Disc	PTFE (Teflon)	Renewable composition disc
Stem	Bronze	ASTM B584 (Alloy C87600)
	Copper Silicon	ASTM B98 (Alloy C65100), or ASTM B371 (Alloy C69400)
Handwheels	Bronze	ASTM B61 or B62
	Malleable Iron	
Packing	Teflon or Kevlar Aramid Fiber	

O. Bronze hose bibbs shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body, Bonnet	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
Disc	PTFE (Teflon)	Renewable composition disc
Stem	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
	Copper Silicon	ASTM B99 Alloy C65100, or ASTM B371 (Alloy C69400), AWWA C800, NSF 61, and NSF 372
Handwheels	Lead-Free Brass	ASTM B584, AWWA C800, NSF 61, and NSF 372
	Malleable Iron	
Packing	PTFE (Teflon) or Graphite	

P. The following product design criteria, options and accessories are required on bronze valves:

ITEM	DESCRIPTION	
Bronze Angle Valves ≤ 2”	Standard	MSS SP80
	Actuator	Quarter-turn handle operator
	Stem	Rising
	Bonnet	Screwed Union
	Back Seating Capacity	Required
	Function	Shutoff
	Fluid Conveyed	Potable water
	Minimum Rated Working Pressure	Class 150 (300 WOG psi at 150°F)
	Fluid Temperature	33°F-120°F
Bronze Ball Valves ≤ 2”	Actuator	Quarter-turn handle operator
	Fluid Conveyed	Potable water
	Function	Shutoff
	Flow Pattern	2-way
	Position Indicator	Not required
	Nonblowout stem	
	Minimum Rated Working Pressure	Class 150 (300 WOG psi at 150°F)
	Fluid Temperature	33°F-120°F
	Ends	Female-threaded ASME/ANSI B1.20.1
Bronze Swing Check Valves ≤ 3”	Standard	MSS SP80
	Pattern	Wye
	Disc	Swing Type
	Fluid Conveyed	Potable water
	Minimum Rated Working Pressure	Class 150 (300 WOG psi at 150°F)
	Fluid Temperature	33°F-120°F
	Ends	Female-threaded ASME/ANSI B1.20.1
Bronze Gate Valves ≤ 3”	Standard	MSS SP80
	Actuator	Handwheel
	Stem	Rising
	Bonnet	Screwed Union
	Disc	Solid wedge type
	Fluid Conveyed	Potable water
	Minimum Rated Working Pressure	Class 150 (300 WOG psi at 150°F)
	Fluid Temperature	33°F-120°F
	Ends	Female-threaded ASME/ANSI B1.20.1
Bronze Globe Valves ≤ 2”	Standard	MSS SP80
	Actuator	Handwheel
	Stem	Rising
	Bonnet	Screwed Union

ITEM	DESCRIPTION	
	Back Seating Capacity	Required
	Function	Shutoff
	Fluid Conveyed	Potable water
	Minimum Rated Working Pressure	Class 150 (300 WOG psi at 150°F)
	Fluid Temperature	33°F-120°F
	Ends	Female-threaded ASME/ANSI B1.20.1
Bronze Hose Bibbs	Actuator	Handwheel
	Stem	Nonrising
	Vacuum Breaker	Provide vacuum breaker per Section 33 12 09 and approved by local Health Department
	Fluid Conveyed	Potable Water
	Minimum Rated Working Pressure	125 psi for cold water service
	Fluid Temperature	33°F-120°F
	Inlet End	Female-threaded ASME/ANSI B1.20.1
	Outlet End	Male-threaded ASME/ANSI B2.4 to fit standard garden hose

Q. The following electrical design criteria are required for equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Nonhazardous Class I Division 1 (wet well)
Enclosures – Indoor Dry Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 1 – General Purpose
Enclosures – Outdoor or Wet Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 4X – Watertight, Corrosion-Resistant, Stainless steel
Enclosures – Class 1 Division 1 Wet Well Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 7 – Explosion Proof, Rated for Class I Locations
Other Enclosures	NEMA 250 Enclosure Rating	As shown on plans NEMA 12 – Industrial Use
All Enclosures	Construction	Lockable With powdercoat epoxy finish on steel surfaces
	Submergence Rating	IP 65 water jet
Power Supply	Control Panel	As shown on plans None – Provide battery as recommended by Manufacturer 120VAC – 1 phase – 60Hz
	Solenoid	As shown on plans 24 VDC at control panel 120VAC – 1 phase – 60Hz

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install valves before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Remove scale and dirt on inside and outside of valves before assembly.

3.2 Installation

A. Refer to Section 01 73 00 / 02 05 00 for execution and installation requirements.

B. Furnish and install valves at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Plumbing Code Chapter 6 "Water Supply and Distribution" Section 605 "Valves."

4. California Plumbing Code Chapter 6 "Water Supply and Distribution" Section 608 "Water Pressure, Pressure Regulators, Pressure Relief Valves and Vacuum Relief Valves."

5. Other applicable fire, plumbing, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Use valve hangers and supports as detailed on Plans, as specified, and as required by applicable plumbing codes.

F. Obtain and review dimensioned shop drawings from valve suppliers before roughing in for any equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Install vacuum breakers to entirely eliminate any danger of siphoning waste materials into water supply system.

I. Painting and Coating shall comply with Division 9.

3.3 Field Quality Control

A. Use adequate numbers of skilled plumbers trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods needed for proper performance of Work of this section.

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
All Valves	Installation & Leakage	Visual inspection for drip tight finished installation under pressure.	1 inspection	Owner	Owner
	Pressure Test	See sections of Contract Documents covering pressure tests	1 test	Contractor	Contractor
	Actuator	Operate valve through 10 full cycles of opening and closing. Valve shall operate from full open to full close without sticking, or binding and without required operating torque exceeding 150 ft-lbs at any point	1 test	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
	Field Performance	Demonstrate compliance of fixtures and equipment to Contract Documents and Manufacturer's printed Literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance of all work to Contract Documents and Manufacturer's printed literature	1 inspection	Owner	Contractor

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SECTION 33 12 25
AIR AND VACUUM VALVES FOR WASTEWATER SERVICE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of air and vacuum valves for wastewater service, including air release valves, air/vacuum valves, and combination air and vacuum valves.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 01 73 33: Mechanical Identification
I. Section 09 90 00: Painting and Coating
J. Section 09 96 56: Epoxy Linings and Coatings
K. Section 33 05 31: Pipeline Joint Materials

1.3 System Description

A. Furnish and install complete operating air and vacuum valve including appurtenant structural and/or mechanical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

B. Combination air and vacuum valves shall automatically release small pockets of air that accumulate at high points in system and shall allow air to enter or exit pipe to alleviate excess air or vacuum conditions in pipe.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods or proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Air and Vacuum Valves	Hydrostatic Test	AWWA C512 Section 5 "Verification"	1 each valve	Contractor	Contractor
	Seat Leakage Test	AWWA C512 Section 5 "Verification"	1 each valve	Contractor	Contractor
	Holidays and Lining Thickness	See Section 09 96 56.	1 each valve	Contractor	Contractor

1.5 References

A. ASCE 7 Minimum Design Loads for Buildings and Other Structures Chapter 13 and Chapter 15
B. ASME/ANSI B1.20.1 (ANSI B2.1) Pipe Threads – NPT National Pipe Thread Taper
C. ASME/ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings – Class 25, 125, 150 and 800
D. ASME/ANSI B16.4 Cast Iron Threaded Fittings
E. ASME/ANSI B16.5 Pipe Flanges and Flanged Fittings: ½"-24"
F. ASME/ANSI B16.5 Steel Pipe Flanges and Flanged Fittings (Including ratings for Class 150, 300, 400, 600, 900, 1500, and 2500)
G. ASME/ANSI B16.42 Ductile Iron Flanged Fittings – Classes 150 and 300
H. ASTM A240 Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels
I. AWWA C512 Air Release, Air/Vacuum and Combination Air Valves for Water Service
J. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required on valves ≥ 6" per valve shop drawing requirements. Required for lateral supports for valves weighing more than 30 lbs.
Catalog Data	Required per catalog data requirements.
	Show lining and coating data and thicknesses.
Installation Instructions	Required per installation or application instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements
Certificate of Compliance	Submit certified test results for leakage and hydrostatic tests
	Submit certified report of testing of factory-applied linings
	Submit affidavit of compliance with AWWA C512
Engineering Calculations (California only)	For valves weighing more than 30 lbs, submit engineering calculations supporting lateral support design showing valve support can resist moment from minimum of either: a. Lateral force of 1.0 times weight of valve applied at valve center of mass. or b. Site-specific lateral forces computed per Section 01 73 24 & ASCE 7.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, engineering calculations and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of air and vacuum valves shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for air and vacuum valves for wastewater applications include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Combination Air and Vacuum Valves for Wastewater	ARI Flow Control Accessories D-020 or D-025	San Diego, CA
	Cla-Val Company Series 36WW	Newport Beach, CA
	Crispin Multiplex Manufacturing Co.	Berwick, PA
	DeZurik / APCO / Hilton Series 440 or 440C	Sartell, MN
	GA Industries, Inc. Figure 942	Cranberry Twp, PA
	Henry Pratt "Air-Pro" Series WWCV	Aurora, IL
	Val-Matic Valve and Manufacturing Corp. Series 800	Elmhurst, IL
	Vent-O-Mat	Benoni, SA
	Accepted Equal	

B. Air release and air and vacuum valves shall be same model as combination air and vacuum valves of same size to allow valves to be interchangeable in field.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Combination air and vacuum valves for wastewater service shall comply in function with AWWA C512

C. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

D. Combination air and vacuum valves shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body and Cover	Stainless Steel	ASTM A743-CF-8M SAE Type 316
Float	Polycarbonate	
	Stainless Steel	ASTM A240 SAE Type 316
	Polyethylene	
Needle and Seat	Buna N	
Plug	Stainless Steel	ASTM A240 SAE Type 316
Leverage Frame	Delrin	
	Stainless Steel	ASTM A240 SAE Type 316
Body Bolts	Stainless Steel	SAE Type 316
Threaded Ends Sizes ⅜"-4" Working Pressures 0-400 psi	Stainless Steel	Female-threaded ASME/ANSI B1.20.1 (ANSI B2.1)
Epoxy Lining (Iron Surfaces of Valves < 4")	Epoxy	See Section 09 96 56. AWWA C213 and AWWA C550 8-mil minimum DFT Do not coat sealing areas and bronze or stainless steel parts.
Exterior Finish Coat	Epoxy Urethane	See Section 09 90 00.

E. The following product design criteria, options and accessories are required for combination air and vacuum valves:

ITEM	DESCRIPTION	
Design	Use manufacturer's standard design for wastewater applications	
	Design Pressure	150 psi
	Location	Field tap for valve in level pipe section no closer than 18" to bell, coupling, joint, or fitting. Only factory outlets will be permitted within 18" of joint or flange.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install air and vacuum valves before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Field tap for valve shall be made in a level section of pipe no closer than 18" to bell, coupling, joint, or fitting. Only factory outlets will be permitted within 18" of joint or flange.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install air and vacuum valves at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable fire, plumbing, and mechanical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install air and vacuum valves to tolerances recommended by Manufacturer. Unless otherwise shown, install air and vacuum valves true, plumb, and level using precision gauges and levels.

F. Do not pressure test against air valves. Close isolation valve beneath air and vacuum valves during hydrostatic testing

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Air and Vacuum Valves	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

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SECTION 33 12 31
WATER SERVICES AND FLOW METER ASSEMBLIES

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of water service laterals, service valves, meter boxes, and flowmeter assemblies.

B. Materials shall comply with Golden State Water Company Standard Plan1.04.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 33: Mechanical Identification
H. Section 09 90 00: Painting and Coating
I. Section 26 05 00: Common Work Results for Electrical
J. Section 26 05 53: Identification for Electrical Systems
K. Section 31 23 00: Excavation and Fill
L. Section 33 05 31: Pipeline Joint Materials
M. Section 33 11 21: Brass and Copper Pipe
N. Section 33 71 73: Electrical Utility Services
O. Section 40 90 10: Common Work Results for Instrumentation and Control

1.3 System Description

A. Furnish and install complete operating flow meter assembly including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

B. Flow meter instrument output variables shall include:

ITEM	VARIABLE	DESCRIPTION
Output signals (Analog)	Water Meter Reading	Compatible with Owner's meter reading system

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. National Sanitation Foundation marking shall appear on all potable water valves.

C. National Sanitation Foundation Marking is not required for piping in nonpotable water drainage service.

D. Products coming into contact with potable water shall contain no more than 0.25% lead by average weight in compliance with the Federal Reduction of Lead in Drinking Water Act and California law AB1953, and shall be marked as complying.

E. Stainless steel products may be substituted for bronze products provided dielectric protection is provided between stainless steel and bronze or copper alloys.

F. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Cold Water Meter Displacement Type	Accuracy	Furnish affidavit of compliance with AWWA C700	1 affidavit each batch	Contractor	Contractor

1.5 References

A. ASME/ANSI B1.20.1 (ANSI B2.1) Pipe Threads – NPT National Pipe Thread Taper
B. ASME/ANSI B16.15 Cast Bronze Threaded Fittings
C. ASME/ANSI B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
D. AWWA C700 Cold-Water Meters – Displacement Type Bronze Main Case
E. AWWA C706 Direct-Reading, Remote-Registration Systems for Cold-Water Meters
F. AWWA C707 Encoder-Type Remote Registration Systems for Cold-Water Meters
G. AWWA C712 Cold-Water Meters – Single Jet Type
H. AWWA C713 Cold-Water Meters – Fluidic-Oscillator Type
I. AWWA C800 Underground Service Line Valves and Fittings
J. AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing ½"-3" for Water Service
K. AWWA C903 Polyethylene-Aluminum-Polyethylene & Cross-Linked-Polyethylene-Aluminum-Cross-Linked-Polyethylene Composite Pressure Pipes ½"-2" for Water Service
L. AWWA C904 Cross-Linked Polyethylene (PEX) Pressure Pipe ½"-3" for Water Service
M. AWWA M6 Water Meters – Selection, Installation, Testing and Maintenance
N. California Health and Safety Code Section 116875
O. NSF/ANSI 61 Drinking Water Standards Health Effects
P. NSF/ANSI 372 Drinking Water System Components – Lead Content (Formerly NSF/ANSI 61 Annex G)

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements
Certificate of Compliance	Submit coating system and application certification per certificate of compliance requirements.
Test Record Transcripts	Submit for factory tests per test record transcript requirements.
Warranty	Furnish 3-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, certificates of compliance, and test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage, and handling of flowmeter assemblies shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable meter Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Positive Displacement Meters (Nutating Disc Type)	Badger Meter, Inc.	Milwaukee, WI
	Hersey Meter	Cleveland, NC
	Neptune Technology Group Schlumberger T-10	Tallassee, AL
	Sensus Metering Systems SR-2	Raleigh NC
	Accepted equal	

B. Flow indicators, totalizers and transmitters where shown shall be manufactured by same manufacturer as flow sensing equipment and shall be fully compatible with equipment furnished.

C. Acceptable Manufacturers of iron service saddles with AWWA "CC" threaded female outlets include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Epoxy-Coated Ductile Iron Single-Bale Service Saddles with AWWA "CC" threaded female outlets	A. Y. McDonald Co. 4815A AWWA Series	Dubuque, IA
	Ford Meter Box Co. F101-CC Series Epoxy-Coated	Wabash, IN
	Romac Industries 101U-CC Series Epoxy Coated	Bothell, WA
	Smith Blair Inc. 311-CC Series	Texarkana, TX
	Accepted equal	
Nylon-Coated Ductile Iron Single- Bale Service Saddles with AWWA "CC" threaded female outlets	Mueller Company DR1A-CCSeries	Decatur IL
	Romac Industries 101NU-CC Series	Bothell, WA
	Accepted equal	
Epoxy-Coated Ductile Iron Double- Bale Service Saddles with AWWA "CC" threaded female outlets	A. Y. McDonald Co. 4826A AWWA Series	Dubuque, IA
	Ford Meter Box Co. F202-CC Series Epoxy-Coated	Wabash, IN
	Romac Industries 202U-CC Series Epoxy Coated	Bothell, WA
	Smith Blair, Inc. 313-CC Series	Texarkana, TX
	Accepted equal	
Nylon-Coated Ductile Iron Double- Bale Service Saddles with AWWA "CC" threaded female outlets	Mueller Company DR2A-CCSeries	Decatur IL
	Romac Industries 202NU-CC Series	Bothell, WA
	Accepted equal	
Epoxy-Coated Ductile Iron Single-Strap Service Saddles with SS Band and AWWA "CC" threaded female outlets	A. Y. McDonald Co. 4835A AWWA Series	Dubuque, IA
	Ford Meter Box Co. FC101-CC Series	Wabash, IN
	Romac Industries 101S-CC Series Epoxy-Coated	Bothell, WA
	Smith Blair, Inc. 315-CC Series	Texarkana, TX
	Accepted equal	
Nylon-Coated Ductile Iron Single-Strap	JCM Industries, Inc. 405CC Series	Nash, TX
	Mueller Company DR1S-CC Series	Decatur IL

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Service Saddles with SS Band and AWWA "CC" threaded female outlets	Romac Industries 101NS-CC Series	Bothell, WA
	Accepted equal	
Epoxy-Coated Ductile Iron Single-Strap Service Saddles with Two-Bolt Wide SS Band and AWWA "CC" threaded female outlets	A. Y. McDonald Co. 4845A AWWA Series	Dubuque, IA
	Ford Meter Box Co. FC202-CC Series"	Wabash, IN
	Smith Blair, Inc. 397-CC Series	Texarkana, TX
	Accepted equal	
Epoxy-Coated Ductile Iron Service Saddles with Double SS Bands and AWWA "CC" threaded female outlets	A. Y. McDonald Co. 4855A AWWA Series	Dubuque, IA
	Ford Meter Box Co. FCD202-CC Series	Wabash, IN
	Romac Industries 202S-CC Series Epoxy-Coated	Bothell, WA
	Smith Blair, Inc. 317-CC Series	Texarkana, TX
	Accepted equal	
Nylon-Coated Ductile Iron Service Saddles with Double SS Bands and AWWA "CC" threaded female outlets	JCM Industries, Inc. 406CC Series	Nash, TX
	Mueller Company DR2S-CC Series	Decatur IL
	Romac Industries 202NS-CC Series	Bothell, WA
	Accepted equal	

D. Acceptable Manufacturers of ball corporation stops with AWWA "CC" male inlets and compression outlets include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Ball Valve Corporation Stops AWWA "CC"x CTS Compression End	A. Y. McDonald Co. Series 74701B – No Lead	Dubuque, IA
	A. Y. McDonald Co. Series 74101BCAP – No Lead	Dubuque, IA
	Ford Meter Box Company FB 1000-NL	Wabash, IN
	Mueller Company 300 Series B-25008N	Decatur IL
	Mueller Company 300 Series B-25006N (CTS PE)	Decatur IL
	Accepted equal	
Ball Valve Corporation Stops AWWA "CC"x CTS Pack Joint End	Ford Meter Box Company FB 1000-NL	Wabash, IN
	James Jones J-1937 - No Lead	El Monte, CA
	Mueller Company 300 Series P-25008N	Decatur IL
	Accepted equal	
Ball Valve Corporation Stops Dielectric Bushing and AWWA "CC"x Compression End	A. Y. McDonald Co. Series 74701BDB – No Lead	Dubuque, IA
	Accepted equal	
Ball Valve Corporation Stops AWWA "CC"x C903 Compression End	A. Y. McDonald Co. Series 74701BK – No Lead	
	Accepted equal	
Ball Valve Corporation Stops AWWA "CC"x IPS PE Compression End	A. Y. McDonald Co. Series 74701B-33 – No Lead	Dubuque, IA
	Ford Meter Box Company FB 1001-NL	Wabash, IN
	James Jones J-1938SGP – No Lead	El Monte, CA
	Mueller Company 300 Series B-25009N	Decatur IL
	Mueller Company 300 Series B-25005N	Decatur IL
	Accepted equal	
Ball Valve Corporation Stops AWWA "CC"x IPS PE Pack Joint End	Ford Meter Box Company FB 1001-NL	Wabash, IN
	Mueller Company 300 Series E-25009N	Decatur IL
	Accepted equal	
Ball Valve Corporation Stops AWWA "CC"x IPS PE Compression End	James Jones J-1938 – No Lead	El Monte, CA
	Accepted equal	

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Ball Valve Corporation Stops AWWA "CC"x IPS PVC Compression End	A. Y. McDonald Co. Series 74701B-44 – No Lead	Dubuque, IA
	Ford Meter Box Company FB 1002-NL	Wabash, IN
	Accepted equal	
Ball Valve Corporation Stops AWWA "CC"x IPS PVC Pack Joint End	Ford Meter Box Company FB 1002-NL	Wabash, IN
	James Jones J-1985 – No Lead	El Monte, CA
	Mueller Company 300 Series V-25056N	Decatur IL
	Accepted equal	

E. Acceptable meter ball valve Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Angle Compression x Meter Swivel Nut Ball Meter Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series B-24258N	Decatur IL
	Mueller Company 300 Series B-24267N	Decatur IL
	Accepted equal	
Angle Compression x Meter Flange Ball Meter Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series B-24276N	Decatur IL
	Accepted equal	
Angle Pack Joint x Meter Swivel Nut Ball Meter Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series P-24258N	Decatur IL
	Accepted equal	
Angle Compression x Meter Flange Ball Meter Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series P-24276N	Decatur IL
	Accepted equal	
Angle Compression x Meter Swivel Nut Ball Meter Valves IPS PE	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series B-24259N	Decatur IL
	Mueller Company 300 Series B-24266N	Decatur IL
	Accepted equal	
Angle Compression x Meter Flange Ball Meter Valves IPS PE	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series B-24276N	Decatur IL
	Accepted equal	
Angle Pack Joint x Meter Swivel Nut Ball Meter Valves IPS PE	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series E-24259N	Decatur IL
	Accepted equal	

F. Acceptable customer service valve Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Angle FNTP x MNTP Ball Service Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series B-24287N	Decatur IL
	Accepted equal	
Angle FNTP x FNTP Ball Service Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series B-24285N	Decatur IL
	Accepted equal	
Angle Flare x FNTP Ball Service Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series B-24275N	Decatur IL
	Accepted equal	
Angle Compression x FNTP Ball Service Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company 300 Series B-24274N	Decatur IL
	Accepted equal	

G. Acceptable curb stop Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Straight Ball Meter Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company	Decatur IL
	Accepted equal	
Straight Compression Meter Valves	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company	Decatur IL
	Accepted equal	

H. Acceptable meter yoke Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Meter Yokes	A. Y. McDonald Co.	Dubuque, IA
	Cambridge Brass	Cambridge, ON
	Ford Meter Box Co.	Wabash, IN
	James Jones	El Monte, CA
	Mueller Company. EZ Setter	Decatur IL
	Accepted equal	

I. Acceptable meter bolt Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Meter Bolts – Silicon Bronze	Tripac Fasteners	Corona, CA
	Accepted equal	

J. Acceptable concrete meter box Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Meter Box 2" Meter	Applied Engineering Products	
	Brooks Products Model 66S (non-traffic-rated)	Ontario, CA
	Brooks Products Model 66TR (traffic-rated)	Ontario, CA
	Eisel Enterprises Inc. No 437 or No 666	Placentia, CA
	Ford Meter Box Co.	Wabash, IN
	J &.R Concrete Products W5	Perris, CA
	Utility Vault Division Oldcastle Precast	Fontana, CA
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Service saddles shall be constructed of the following materials:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Service Saddles for CIP	Standards	AWWA C800, and NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications.
	Threads	AWWA C800 Table 7 "CC" Taper-Thread
	Saddle Material	ASTM A395 Ductile Iron with 10-mil Nylon Coating
	O-Ring or Gasket	NBR Synthetic Rubber (Nitrile Butadiene Rubber) (Buna N)
	Strap Material	SAE Type 304 or SAE Type 316 Stainless Steel
	Size	As shown on plans.
	2" Service Saddles	Double-Strap Type with flat straps or bails
	Bolts and Nuts	SAE Type 304 or SAE Type 316 stainless steel
	Published Working Pressure	As required by class of pipe shown on Plans

C. Corporation stops shall be constructed of the following materials:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Corporation Stops	Standards	ASTM B584 AWWA C800, and NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications.
	Type	Ball Valve
	Material	Lead-Free Waterworks Brass
	Ball Coating	PTFE (Teflon)
	Inlet Connection	Male AWWA C800 Table 7 "CC" Taper-Thread
	Outlet Connection	Compression Type for Copper or Plastic Tubing (CTS)
	Insert Stiffeners	Required for connections to PE pipe or tubing.

D. Bronze service materials shall be constructed of the following materials:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Couplings in 2" Service Laterals		Make joint with copper tube fittings per ASME/ANSI B16.22 Clearance between tube and fitting shall be 0,004"-0,010". Solder with 95/5 (tin-antimony) solder containing less than 0.2% lead.
Angle Meter Valves	Standards	ASTM B584, AWWA C800, and NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications.
	Material	Lead-Free Waterworks Brass
	Inlet Connection	Compression type or iron-pipe thread
	Outlet Connection	Meter flange or meter coupling. Inlet and outlet shall form angle of 90 degrees on vertical plane through centerline of meter stop.
	Shutoff Mechanism	Rectangular lug and lock wing on top of fitting
	Valve Description	Full-port "ball" type with locking wing on key operator and full 360° rotation of tee head. 2" angle meter stops shall be with "slotted" holes for 1½" or 2" meters.
Customer Service Valves	Standards	ASTM B584 AWWA C800, and NSF 61 Comply with NSF/ANSI 372 lead threshold for potable water applications.
	Material	Lead-Free Waterworks Brass
	Inlet Connection	Meter flange or meter coupling.
	Outlet Connection	Female pipe thread
	Shutoff Mechanism	Lever-type turn handle
Tapping Saddle and/or Meter Bolts, Nuts and Washers	Standards	See Section 33 05 31.
	Material	Silicon Bronze

E. Meter boxes shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Meter Box	Precast Concrete	Compressive strength of 4,000 psi
	Polymer Concrete	Compressive strength of 4,000 psi
Meter Box Cover	Precast Concrete	Compressive strength of 4,000 psi
	Polymer Concrete	Compressive strength of 4,000 psi

F. Flowmeter assemblies shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Positive Displacement Meter	Lead-Free Brass	AWWA C700, ASTM B584, NSF 61, NSF 372
Threaded Ends Sizes ⅜"-2" Working Pressures 0-400 psi	Lead-Free Brass	Female-threaded ASME/ANSI B1.20.1 (ANSI B2.1) ASME/ANSI B16.15

G. The following product design criteria, options and accessories are required for displacement-type flow meters:

ITEM	DESCRIPTION	
Displacement-Type Flow Meter	Flow Sensor	AWWA C700 Displacement-Type Meter Bronze Case
	Style	Nutating Disc
	Fluid Metered	Potable Water
	Diameter	See plans

ITEM	DESCRIPTION	
Displacement-Type Flow Meter (cont.)	Flow Range at Rated Accuracy	1-15 gpm (½" meter) 1-15 gpm (½"x ¾" meter) 1-20 gpm (⅝" meter) 1-20 gpm (⅝"x ¾" meter) 2-30 gpm (¾" meter) 3-50 gpm (1" meter) 5-100 gpm (1½" meter) 8-160 gpm (2" meter)
	Accuracy within Flow Range	±1.5%
	Repeatability within Flow Range	±0.25%
	Fluid Temperature Range	32-90°F
	Maximum Operating Pressure	150 psi
	Maximum Pressure Drop	15 psi at maximum flow
Indicator Totalizer	Indicator Units	0-3500 gpm
	Indicator Direction	Forward-only
	Empty Pipe Sensing	zero return with electrodes dry
	Totalizer Units	1000 cubic feet
	Totalizer Direction	Forward-only
	Output Signal	4-20mA
Register	Type	Compatible with Owner's meter reading system
	Seal	Hermetically sealed register with register test hand
	Coupling	Provide magnetic coupling between meter and register

H. The following product design criteria, options and accessories are required for single-jet-type flow meters:

ITEM	DESCRIPTION	
Single-Jet-Type Flow Meter	Flow Sensor	AWWA C712 Single-Jet-Type Meter
	Fluid Metered	Potable Water
	Diameter	See plans
	Flow Range at Rated Accuracy	1-20 gpm (⅝" meter) 1-20 gpm (⅝"x ¾" meter) 2-30 gpm (¾" meter) 3-50 gpm (1" meter) 1.5-100 gpm (1½" meter) 2-160 gpm (2" meter) 2.5-320 gpm (3" meter) 3-500 gpm (4" meter) 4-1000 gpm (6" meter)
	Accuracy within Flow Range	±1.5%
	Repeatability within Flow Range	±0.25%
	Fluid Temperature Range	32-90°F
	Maximum Operating Pressure	150 psi
	Maximum Pressure Drop	15 psi at maximum flow
Indicator Totalizer	Indicator Units	0-3500 gpm
	Indicator Direction	Forward-only
	Empty Pipe Sensing	zero return with electrodes dry
	Totalizer Units	1000 cubic feet
	Totalizer Direction	Forward-only
	Output Signal	4-20mA
Register	Type	Compatible with Owner's meter reading system
	Seal	Hermetically sealed register with register test hand
	Coupling	Provide magnetic coupling between meter and register

I. The following product design criteria, options and accessories are required for fluidic-oscillator-type flow meters:

ITEM	DESCRIPTION	
Fluidic-Oscillator-Type Flow Meter	Flow Sensor	AWWA C713 Fluidic-Oscillator-Type Meter
	Fluid Metered	Potable Water
	Diameter	See plans
	Flow Range at Rated Accuracy	1-15 gpm (½" meter) 1-15 gpm (½"x ¾" meter) 1-20 gpm (⅝" meter) 1-20 gpm (⅝"x ¾" meter) 2-30 gpm (¾" meter) 3-50 gpm (1" meter) 5-100 gpm (1½" meter) 8-160 gpm (2" meter)
	Accuracy within Flow Range	±1.5%
	Repeatability within Flow Range	±0.25%
	Fluid Temperature Range	32-90°F
	Maximum Operating Pressure	150 psi
	Maximum Pressure Drop	15 psi at maximum flow
Indicator Totalizer	Indicator Units	0-3500 gpm
	Indicator Direction	Forward-only
	Empty Pipe Sensing	zero return with electrodes dry
	Totalizer Units	1000 cubic feet
	Totalizer Direction	Forward-only
	Output Signal	4-20mA
Register	Type	Compatible with Owner's meter reading system
	Seal	Hermetically sealed register with register test hand
	Coupling	Provide magnetic coupling between meter and register

J. The following product design criteria, options and accessories are required for meter boxes:

ITEM	DESCRIPTION	
Meter Box	Covers	Traffic rated
	Reading Lid	Hinged Lid Required

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install service saddles, taps, service fittings, and flowmeter assemblies before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Refer to Section 31 23 00 for open trench requirements.

C. Furnish and install flowmeters and services at locations shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing and electrical code requirements

4. Servicing water utility requirements

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. For dry-tapping ¾", 1" and 2" services on PVC pipe, bore hole into pipe with hole saw that retains coupon and allows shavings to fall clear of hole. Center service saddle over hole, seat, tighten, and install corporation stop using pipe thread sealant.

G. Install service saddles as follows:

1. File pipe surface to remove all loose material and to provide hard, clean surface before placing service saddle.

2. Tighten service saddle to ensure tight seal, taking care to prevent damage or distortion of either corporation stop or service saddle by over-tightening.

3. Tap pipe in accordance with pipe Manufacturer's recommendation.

H. Make connections using compression couplings, angle valves, etc. In accordance with Manufacturer's recommendations and accepted trade practices.

I. All domestic service laterals shall be 1" minimum size copper tubing. End connections shall be compression type.

J. Install all 2" size services with straight lengths of soft copper water tube Type K. Solder or compression fittings are acceptable on only corporation stop and angle meter stop. All couplings and adapters shall be silver-soldered.

K. Install flowmeter assemblies to tolerances recommended by Manufacturer. Unless otherwise shown, install flowmeter assemblies true and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Water Service Laterals	Hydrostatic Pressure Test	See Section 33 08 11.	1 each meter tube	Owner	Contractor
	Accuracy	Owner reserves right to either test meter in shop before placing meter in service or test in field using test tap to be furnished by Contractor.	As directed	Owner	Contractor
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 12 34
MAGNETIC FLOW METERS

PART 1 - GENERAL

1.1 Work Included

A. This section covers work necessary for magnetic flow meters.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 09 90 00: Painting and Coating
H. Section 09 96 56: Epoxy Linings and Coatings
I. Section 26 05 10: Common Work Results for Electrical
J. Section 33 05 16: Precast Concrete Utility Structures
K. Section 33 05 31: Pipeline Joint Materials
L. Section 33 08 11: Pressure Testing and Flushing of Water Utilities
M. Section 40 90 10: Common Work Results for Instrumentation and Control
N. Section 40 90 20: Control System Descriptions

1.3 System Description

A. Furnish and install complete operating flow meter including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building, plumbing, and electrical codes and standards.

B. Flow meter instrument output variables shall include:

ITEM	VARIABLE	DESCRIPTION
Output signals (Analog)	Rate of flow	4-20mA signal

Comment [MP1]: We to check w/ the electrical engineer to see if we can obtain accumulative flow for the month . I think if they use the pulse they may be able to get the pulse into accumulative monthly rate. This for the city billing w/ the city LA .

1.4 Quality Assurance

A. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Flow Meter	Wet Calibration	Hydraulic Institute Standards	1 each meter	Contractor	Contractor
Interior Lining	Holidays and Lining Thickness	See Section 09 96 56.	1 each meter	Contractor	Contractor
Meter	Accuracy of Flow Measurement	AWWA M6	as directed	Contractor	Contractor

1.5 References

A. ASME/ANSI B16.5 Steel Pipe Flanges and Flanged Fittings (Including ratings for Class 150, 300, 400, 600, 900, 1500, and 2500)

B. AWWA C207 Steel Pipe Flanges for Waterworks Service
C. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
D. AWWA M6 Water Meters – Selection, Installation, Testing and Maintenance
E. NEMA/ANSI 250 Enclosures for Electrical Equipment
F. NFPA 70 National Electric Code

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per pipeline equipment shop drawing requirements
	Required for transducers under electrically controlled equipment shop drawing requirements
Catalog Data	Required per catalog data requirements
	Show lining and coating data and thicknesses.
Installation Instructions	Required per installation instruction requirements
O & M Instructions	Required per operation and maintenance Instruction requirements
Certificate of Compliance	Submit certificate of factory testing for meter accuracy and capacity.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, and certificates of compliances.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instructions and warranty requirements for delivery, storage and handling of magnetic flow meters shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Magnetic Flow Meters	Rosemount "Model 8705"	Chanhassen, MN
	No exceptions	

B. Flow indicators, totalizers, transmitters, where shown shall be manufactured by same Manufacturer as flow sensing equipment and shall be fully compatible with equipment furnished.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. Magnetic flow meters shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Metering Tube	Cast Carbon Steel (for pressures 0-400 psi)	ASTM A216 Grade WCB
Dimensions	Laying Length	Verify fit in available area
Electrodes	Stainless Steel	SAE Type 316
Grounding Ring	Stainless Steel	SAE Type 316
Flanges Sizes 2½"-54" Working Pressures 0-150 psi	Carbon Steel	AWWA C207 Class D, or ANSI /ASME 16.5 Class 150 Raised or plain faced ASTM/ANSI B16.47 Class 150 Raised or plain faced for flanges ≥ 26"
Flange Alignment	Meters	Boltholes shall straddle horizontal and vertical centerlines of meter.
Flange Bolts, Nuts, and Washers	Various Steels	See Section 33 05 31.
Flange Gaskets		See Section 33 05 31.
Lining	Fusion-Bonded Epoxy	See Section 09 96 56. AWWA C213 and C550 12- mil minimum DFT Do not coat bronze or stainless steel parts.
Exterior Finish Coat	Epoxy Urethane	See Section 09 90 00.

C. The following product options and accessories are required:

ITEM	DESCRIPTION	
Meter	Fluid Metered	Sewage
	Diameter	See plans
	Flow Range at Rated Accuracy	85-2800 gpm 6" meter) 145-4800 gpm (8" meter) 240-7800 gpm (10" meter) 335-11,000 gpm (12" meter) 20:1 Turndown Ratio
	Accuracy within Flow Range	±0.5%
	Fluid Temperature Range	32-90°F
	Maximum Operating Pressure	150 psi
	Maximum Pressure Drop	1 psi at 17 fps
Electrodes		Removable for inspection and cleaning without removing flowmeter from line
Indicator/Totalizer	Indicator Units	0-3500 gpm
	Indicator Direction	Forward-only
	Empty Pipe Sensing	zero return with electrodes dry
	Totalizer Units	1000 gal
	Totalizer Direction	Forward-only
	Output Signal	4-20 mA output
Register	Hermetically sealed register with register test hand	

D. The following electrical design criteria are required for equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Nonhazardous Class I Division 1 (wet well)
Enclosures – Indoor Dry Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 12 – Industrial Use
Enclosures – Outdoor or Wet Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 4X – Watertight, Corrosion-Resistant, Stainless steel
Enclosures – Class 1 Division 1 Wet Well Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 7 – Explosion Proof, Rated for Class I Locations
Other Enclosures	NEMA 250 Enclosure Rating	As shown on plans
All Enclosures	Construction	Lockable

ITEM	DESCRIPTION	
		With powdercoat epoxy finish on steel surfaces
	IEC 60529 Enclosure Rating for Underground Equipment	IP 65 water jet
Indicator/Totalizer Mounting	Remote Mount	Telemetry cabinet See plans
Power Supply	Flow Meter	120VAC – 1 phase – 60Hz

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install magnetic flow meters before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install flowmeters at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install magnetic meter with electrodes located at ends of a horizontal diameter (9 o'clock and 3 o'clock positions) to ensure continued electrode immersion when air bubbles are present in metered fluid.

F. On meters 3" and larger, provide 2" outlet or service saddle and corporation stop on spool at least two pipe diameters downstream from meter. Coordinate location of tap with Owner's Representative.

G. Provide grounding rod and ground meter as required by Manufacturer's Installation Instructions.

H. Finished installation shall be compatible with Owner's existing flow measurement and telemetry facilities.

3.3 Field Quality Control

A. Field testing will include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Magnetic Meter	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Hydrostatic Pressure Test	See Section 33 08 11.	1 each meter tube	Owner	Contractor
	Accuracy	Owner reserves right to either test meter in shop before placing meter in service or test in field using test tap to be furnished by Contractor.	As directed	Owner	Contractor
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	Integration with Owner's Telemetry	Verify successful operation with telemetry.	As directed	Contractor	Contractor
	11-month Warranty Inspection	Accuracy of registration and compatibility with existing telemetry. Demonstrate compliance to Contract Documents and Manufacturer's printed literature	As directed	Owner	Contractor

3.4 Adjusting and Cleaning

A. Provide services of Manufacturer's representative as needed for startup, inspection and necessary adjustments as needed to integrate new flowmeter into existing telemetry network.

END OF SECTION

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SECTION 33 13 00
DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 - GENERAL

1.1 Work Included

A. Disinfection, flushing and dechlorinating of all potable water mains.

B. Plan construction activities to allow and facilitate flushing, disinfection, testing, and dechlorinating of all sections of new water facilities, and existing water facilities removed from service during construction and restored to service prior to final acceptance.

C. Obtain all permits required to complete Work specified herein.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 33 08 11: Pressure Testing and Flushing of Water Utilities

1.3 System Description

A. Disinfect pipe to meet all AWWA and public health standards.

B. Disinfect other water facilities to meet all AWWA and public health standards.

C. Dechlorinate to meet all AWWA and public health standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. AWWA C651 Disinfecting Water Mains
B. AWWA C655 Field Dechlorination
C. National Pollutant Discharge Elimination System Permit (NPDES) – Los Angeles Regional Water Quality Control Board (LARWQCB) – General National Pollutant Discharge Elimination System Permit and Waste Discharge Requirements for Discharges of Hydrostatic Test Water to Surface Waters in Coastal Watersheds of Los Angeles and Ventura Counties, Los Angeles Region Order No. 97-047, NPDES Permit No. CAG674001 or most recent order or amendment.
D. Standard Methods for Examination of Water and Wastewater

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Disinfection, Flushing and Dechlorinating Plan	On Owner's request, submit detailed plan showing how Contractor intends to test, disinfect and flush pipeline and dechlorinate discharge from flushing operation.
Written Permission to Discharge into Sewer	Required from owner of any sanitary sewer prior to discharge of flushing water into sewer. Submittal shall include any special requirements for treatment of flushing water prior to sewer discharge, estimate of expected maximum discharge rate of flushing flow and analysis of sewer's capacity.
Written Permission to Discharge into Storm Drain	Required from owner of any storm drain prior to discharge of flushing water into storm drain. Submittal shall include any special requirements for treatment of flushing water prior to storm drain discharge, estimate of expected maximum discharge rate of flushing flow and analysis of storm drain's capacity.
Laboratory Report for Disinfection Testing	Submit report from Owner-accepted testing laboratory

B. Refer to Section 01 33 00 for definition of requirements for reports and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of chemicals and equipment shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for items to which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Furnish all labor, water, chemicals, and equipment necessary to complete disinfection process and obtain, transport, and test samples.

B. Contractor shall be solely responsible for safe and proper transportation, storage and handling of chlorine compounds or other hazardous chemicals used for disinfection.

C. Only chlorine from hypochlorite solution will be allowed. Tablets may be allowed upon written permission from Owner. Do not directly inject chlorine gas.

D. Hypochlorite solutions shall be pre-mixed and fed to tanks or piping and not placed dry.

E. Containers and equipment used in sampling shall be clean and free of contamination. Obtain sampling bottles from testing lab along with instructions for handling.

F. Contractor shall be fully responsible for safe and proper transportation, storage and handling of sodium thyosulfate compounds or other hazardous chemicals used for dechlorination.

G. Other appropriate means and methods of dechlorinating water flushed from pipe may be used with acceptance by Owner's Representative.

PART 3 - EXECUTION

3.1 Preparation

A. Flush all mains and services with potable water (or water as otherwise approved by Owner and regulatory agencies) after completion of pressure test. Provide sufficient number of suitable outlets at end(s) of line(s) being flushed in addition to those shown on Plans to permit flushing of main with water at velocity of at least 2.5 fps over its entire length. Outlets provided shall meet requirements for fittings specified for type of main constructed. Velocity through outlets and fittings shall not exceed 25 fps during flushing. Construct drainage facilities such that water lines cannot be contaminated through flushing outlets.

B. Provide sufficient hoses, fittings and equipment to direct flushing water to established point of discharge such as gutter and storm drain inlet or natural drainage channel to prevent damage to public or private property and to prevent creating a public hazard. If flushing water must be discharged into traffic lanes, set up traffic control in accordance with requirements of agency having jurisdiction over public right-of-way. Schedule flushing in or adjacent to public streets during periods of reduced traffic volume.

C. Contractor shall be solely responsible for providing source of water for flushing and for methods for discharge of water, including all associated costs and permits.

3.2 Field Quality Control

A. Sequence of testing shall ensure discharge of contaminated water does not occur into facilities previously decontaminated, tested and verified as decontaminated. The following test sequence is recommended:

1. Satisfactorily pass all hydrostatic pressure testing on new piping.

2. Satisfactorily pass bacteriological test on wells upon re-commissioning

B. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pipe	4-hour Hydrostatic Pressure Test	See Section 33 08 11	All pipe sections	Contractor (Owner's Representative will observe and record results)	Contractor (Owner's Representative will observe and record results)
Pipe Disinfection	Bacteriological Contamination	AWWA C651 Section 5 "Verification" and Standard Methods of Examination of Water and Wastewater as amplified below	All pipe sections at minimum spacing of 2,500'	Contractor	Contractor
Dechlorination	Residual Chlorine Level	AWWA C655 Section 5 "Verification"	As required to meet local health agency requirements, but at least one measurement per discharge incident	Contractor	Contractor

C. Following pressure testing and flushing described in Section 33 08 11, pipeline disinfection shall proceed as follows:

1. All pipelines, valves, hydrants, service laterals, fittings, tanks and other surfaces exposed to water shall be disinfected in accordance with AWWA C651, except as modified herein.

2. After flushing, disinfect all mains and services with or chlorine compound solution made with liquid chlorine, calcium hypochlorite in solution, or sodium hypochlorite solution, which shall be water mixed and introduced into mains to produce dosage of 50 to 100 mg/l in all sections of pipeline and appurtenances.

3. Treated water shall be retained within system for at least 24-hours and shall produce at end of retention period chlorine residual ≥25 mg/l in all sections disinfected.

4. If tests are not satisfactory, provide additional disinfection as required until all tests are passed to Owner's satisfaction.

5. During disinfection process, operate all valves, hydrants, and other accessories.

6. Do not allow chlorinated water to remain in contact with internal waterway ports of pumps, valves, and sensor line assemblies for longer than necessary.

7. After chlorination, flush water from line at its extremities until replacement water tests are equal chemically and bacteriologically to those of permanent source of supply.

8. Placing of HTH capsules or powder in pipe sections during laying process will not be considered adequate disinfection.

9. Keep adequate chlorine residual testing and indicating apparatus available on site during entire disinfection period. After final flushing, plug flushing fittings with devices intended for this purpose at pressure class of pipe.

10. Where water main is coated, plugs and outlets shall be similarly coated.

D. Dechlorinate and remove pollutants from water flushed from water mains in accordance with AWWA C655 and NPDES Permit applicable for Water Quality Region in which discharge occurs.

E. Flushing water may be discharged to sanitary sewer system as alternative to discharging to storm drain, provided Contractor obtains and submits to Owner a copy of written permission to discharge from sanitary sewer owner including supplementary information described above under Submittals. Schedule discharges to sewers during off-peak periods as recommended by sewer owner.

F. Bacteriologic Samples: On 2 consecutive days, take bacteriological samples and submit them to Owner's designated laboratory. Passing bacteriological tests on 2 consecutive days must be achieved prior to placing pipeline in service. If initial chlorination fails to produce 2 consecutive days of passing bacteriological tests, repeat chlorination until 2 consecutive days of passing bacteriological tests are achieved.

G. Samples of water for specified bacteriologic test shall be taken from each end of disinfected main (located downstream of point of introduction of chlorine disinfectant). For mains over 2,400' in length, AWWA C651 Section 5.1.1 requires additional samples be taken at intermediate points so at least one sample is taken for each 2,400' of main.

H. If trench water has entered new pipeline during construction, or if, in opinion of Owner's Representative, excessive dirt or debris have entered new pipeline, AWWA C651 Section 5.1.2 requires taking bacteriological samples at intervals of approximately 200' to extent such sampling is possible.

I. Satisfactory bacteriological results shall be as follows:

1. No total or fecal coliform.

2. Heterotrophic plate count less than 500CFU (colony forming units) per ml per AWWA C651 Section 5.1.4.

3. Presence of chlorine residual.

J. For non-pipeline facilities, samples shall be taken and tests conducted as stipulated in applicable AWWA standard for that facility type.

END OF SECTION

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SECTION 33 30 11
FERROUS DRAINAGE AND SOIL PIPE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of ductile iron drainage pipe for drainage.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 33: Mechanical Identification
H. Section 22 10 00: Plumbing Piping
I. Section 33 05 26: Utility Identification
J. Section 31 05 50: Protecting Existing Utilities
K. Section 31 23 00: Excavation and Fill
L. Section 33 05 38: Hangers and Supports
M. Section 33 30 31: Polyvinyl-Chloride Gravity Sewer Pipe

1.3 System Description

A. Furnish and install complete operating ferrous piping system including appurtenant structural, mechanical and/or electrical mountings, vents or connections required for compliance with Manufacturer's installation requirements and compliance with applicable plumbing codes and standards.

1.4 Quality Assurance

A. National Sanitation Foundation (NSF) seal shall appear on all or cast iron soil pipe and fittings, ductile iron drainage pipe and fittings, or steel drain pipe and fittings.

B. Cast Iron Soil Pipe Institute (CISPI) trademark shall appear on all cast iron soil pipe and fittings.

C. Pipe and fittings shall be produced by same Manufacturer

1.5 References

A. ASME/ANSI B1.20.1 NPT National Pipe Thread Taper
B. ASME/ANSI B16.12 Cast Iron Threaded Drainage Fittings
C. ASTM A746 Ductile Iron Gravity Sewer Pipe
D. ASTM C564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
E. AWWA C105 Polyethylene Encasement of Ductile Iron Pipe Systems
F. AWWA C111/ANSI A21.10 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
G. AWWA C151/ANSI A21.53 Ductile Iron Pipe
H. California Plumbing Code

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Catalog Data	Required for each type of drainage piping or fitting per catalog data requirements
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance Instruction requirements.
Certificate of Compliance	Submit certified report of testing of factory-applied linings
Warranty	Furnish one-year warranty from date of final acceptance for plumbing fixtures.

B. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and O&M instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of plumbing, fixtures, and appurtenant equipment shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Ductile Iron Drainage Pipe	American Ductile Iron Pipe	Birmingham, AL
	Atlantic States Cast Iron Pipe Company	Phillipsburg, NJ
	Clow Water Systems Company	Coshocton, OH
	Griffin Pipe	Council Bluffs, IA
	Pacific States Cast Iron Pipe Co Div. McWane, Inc.	Provo, UT
	U.S. Pipe and Foundry	Birmingham, AL
	Accepted Equal	
Polyethylene Encasement	Dupont Alathon	Wilmington, DE
	Northtown Co,	Huntington Beach, CA
	Trumbull Industries, Inc.	Youngstown, OH
	Accepted Equal	
Polyethylene Pipe Wrap Joint Tape	Berry Plastics "Polyken No 900"	Franklin, MA
	J-M Manufacturing Co., No V-10	Livingston, NJ
	Plicoflex No 340	
	Protecto Wrap No 200	Denver, CO
	Scotchwrap (3M), No 50	St Paul, MN
	Tapecoat Co., CT	Evanston, IL
	Accepted equal	
Tape Wrap – Cold Applied	Protecto-Wrap Co (200)	Denver CO
	Tapecoat Company (CT)	Evanston, IL
	Accepted Equal	
Tape Wrap – Hot-Applied	Protecto-Wrap Co (110)	Denver CO
	Tapecoat Company (20)	Evanston, IL
	Accepted Equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Ductile iron DWV pipe shall meet or exceed the following materials and manufacturing requirements:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT	
Pipe	Standards	ASTM A746	
	Material	Ductile-iron	
	Marking	Per ASTM A746 Section 19	
	Size	As shown on plans and submittals	
	Wall Thickness	Under 14" diameter = pressure class 350	
	Lengths	18 or 20-foot lengths per AWWA C151/ANSI A21.51, except where shorter lengths are required to fit horizontal or vertical alignment.	
	Coatings	Buried	Shop coat with one prime coat of asphaltic coating approximately 1-mil thick per AWWA C151
		Above ground and in vaults	See Section 09 90 00.
	Standard Lining	Double thickness cement-mortar lined per AWWA C104 using Type II cement, unless otherwise specified.	
Joints	Standard Push-on Style	AWWA C111	
Fittings	Material	Ductile-iron	
	Standards	AWWA C110/ANSI A21.10 or AWWA C153/ANSI A21.53	
	Style	Push-on (standard) Mechanical joint fittings not allowed unless otherwise shown on Plans.	
	Marking	Cast letters "DI" or "DUCTILE" into fittings, unless otherwise specified.	
	Coatings	Same coating as adjacent pipe, as described above for Pipe Coatings.	
	Linings	Same lining as adjacent pipe, as described above for Pipe Linings.	
Shop Coat	Prime Coat	12 mils MDFT Koppers 11-S primer	
Alternate to Plastic Film Wrap for Corrosion Protection	Finish Coat	15 mils MDFT Koppers Bituplastic No 33	
Plastic Film Wrap for Corrosion Protection	Standards	AWWA C105/ANSI A21.50	
	Material	Polyethylene plastic tube	
	Thickness	8-mil, single layer on pipe and double layer on fittings and appurtenances	
Plastic Film Wrap for Corrosion Protection (cont.)	Adhesive tape to connect plastic film tubes and plastic film wrap at fittings and appurtenances	2" wide polyethylene adhesive tape	

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Backfill	Native earth	

D. Provide identification for buried ferrous drainage and soil pipe in the following manner:

PIPE CONTENTS	IDENTIFICATION/ WARNING/ LOCATING	TYPE	MATERIALS/METHOD
Sewage	Pipe Contents Identification	Identification Tape	2" high letters reading "CAUTION: SEWER"
			Color = green with white letters
			Attached to top of pipe with adhesive tape
			Specification – See Section 33 05 26
	Pipe Warning Tape	Warning Tape	2" high letters reading "CAUTION: SEWER BURIED BELOW"
			Color = green with white letters
			Installed in pipe trench 18" above pipe
			Specification – See Section 33 05 26

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install ferrous piping before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Ream pipe and tube ends. Remove scale and dirt on inside and outside piping before assembly. Prepare piping connections to equipment with flanges or unions.

C. Inspect pipe before installation. Repair or patch damaged areas on interior or exterior coatings with material matching original lining and coating.

D. Pipe requiring taping shall have tape applied in 2", 3", or 4" tape wrap applied spirally with a minimum overlap of 50% of tape width.

3.2 Installation

A. Refer to Section 01 73 00 and 01 73 33 for execution and installation requirements.

B. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, and plumbing code requirements

C. Use pipe hangers and supports as detailed on Plans, as specified, and as required by applicable plumbing codes.

D. Stub rough-in piping 3" from finish building surfaces. Temporarily plug and cap piping until fixtures and equipment are ready to be installed.

E. Bends in steel tubing shall be made with suitable bending tool. Replace pipe flattened during bending process with new pipe.

F. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

G. Provide clearance for installation of insulation and access to fittings.

H. Refer variances between manufacturer's installation instructions and Contract Documents to Owner's Representative.

I. Drainage piping shall be installed as follows:

1. Make changes in direction using 45° wyes, long or short sweep ¼ bends, 1/6 bends, ⅛ bends, 1/16 bends or by combination of these or equivalent fittings. Use single or double sanitary tees and ¼ bends only where direction of flow is from horizontal to vertical. Do not use straight tee branches as drainage fittings.

2. Maintain separation ≥ 3' between drains and parallel bearing walls.

3. Slope horizontal piping and arrange to drain at low points. If no slope is shown, slope at a rate of ¼" per foot.

4. Install drainage and sewer cleanouts where shown, at bends, angles, upper terminals, and not more than 50' apart in any linear run of piping. Bring floor cleanouts to grade.

5. Close openings for connections with screw plugs until used. Close handholes at once. Remove any earth or foreign matter that may get into sewer.

J. Cast iron soil pipe shall be installed as follows:

1. Install CISP in accordance with requirements of CISPI 310.

2. Support horizontal pipe at each joint. For pipe inside buildings, provide supports within 12" of pipe ends.

3. Where piping is suspended > 18" from ceiling using hanger rods, provide horizontal pipe bracing for lateral support.

4. Brace piping at each elbow or change of direction. Provide hangers or supports at each horizontal branch connection. Place hangers adjacent to couplings.

5. Cut pipe ends smooth and square before inserting pipe end into coupling gasket. Seat pipe end firmly against center rib or shoulder of gasket before tightening clamping bands.

6. Install couplings between pipes by placing gasket on end of one pipe and clamp assembly on end of other pipe. Firmly set pipe ends against shoulder inside gasket. Slide clamp assembly into position over gasket and tighten bands.

7. Use calibrated torque wrench to tighten bands to 60 in-lbs of torque. Tighten bands alternately during fastening.

K. Painting and Coating shall comply with Division 9 and the following requirements.

1. Coat exposed ferrous piping materials taking special care including taping to avoid accidentally coating CISP rubber sleeve or gasket joints.

3.3 Field Quality Control

A. Use adequate numbers of skilled plumbers trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Trench Backfill	Backfill Compaction	ASTM D1557	As directed	Owner	Contractor
Drainage Piping Inside Buildings	Leakage	Add water and maintain at 5 psi for at least one hour. Joints shall show no visible leaks	All interior drainage pipe	Contractor	Contractor
Drainage Piping Outside Buildings	Leakage	Add water and maintain at 5 psi for at least one hour. Leakage shall not exceed allowable leakage defined above.	All buried drainage pipe	Contractor	Contractor
Drainage Piping	11-month Warranty Inspection	Demonstrate compliance of all work to Contract Documents and Manufacturer's printed literature	1 inspection	Owner	Contractor

END OF SECTION

SECTION 33 30 21
VITRIFIED CLAY PIPE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of vitrified clay pipe (VCP) for gravity sewers.

B. Do not use VCP gravity sewer pipe under any of the following circumstances:

1. For pipe smaller than 6” diameter.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 02 41 14: Paving Removal and Resurfacing
H. Section 03 30 00: Cast-in-Place Concrete
I. Section 22 10 00: Plumbing Piping
J. Section 31 05 50: Protecting Existing Utilities
K. Section 31 23 00: Excavation and Fill
L. Section 33 05 26: Utility Identification
M. Section 33 08 31: Leakage and Infiltration Testing of Gravity Sewer Pipelines
N. Section 33 39 13: Pre-Cast Concrete Manholes

1.3 System Description

A. Furnish and install complete sewer pipe to limits shown on Plans including appurtenant connections in conformance with Manufacturer’s installation requirements and compliance with applicable construction safety codes and standards.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Joints	Leakage	ASTM C425	2% of lot for each size pipe but not less than 5 pieces	Contractor	Contractor
Pipe	Absorption	ASTM C700	2% of lot for each size pipe but not less than 5 pieces	Contractor	Contractor
	Acid Resistance	ASTM C301		Contractor	Contractor
	Hydrostatic Pressure	ASTM C301 hydrostatic pressure test shall precede 3-edge bearing test by 1 to 3 hours		Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
	3-Edge Bearing	ASTM C301 and ASTM C700 tabulated loads		Contractor	Contractor

C. If more than 10% of pipe specimens tested fail first test, retest 5 additional specimens for each specimen failing test. Pipe will not be accepted unless 90% percent of all specimens tested (including those that failed first round) are found to be satisfactory.

D. Any pipe or fitting containing imperfections or blisters, fractures and cracks in excess of those allowed by ASTM C700 will be rejected irrespective of factory test results.

E. Owner or other designated representative shall be entitled to inspect pipes and witness manufacturing process.

1.5 References

A. ASTM C12 Installing Vitrified Clay Pipe Lines
B. ASTM C301 Test Methods for Vitrified Clay Pipe
C. ASTM C425 Compression Joints for Vitrified Clay Pipe and Fittings
D. ASTM C700 Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
E. ASTM C1208 Vitrified Clay Pipe and Joints for Use in Microtunneling, Sliplining, Pipe Bursting, and Tunnels
F. ASTM C1460 Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground
G. Standard Specifications for Public Works Construction (Greenbook) Section 306.1.2 “Pipe Laying”

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Submit cut sheets showing invert elevations, ground elevations and pay cuts every 25’. Show lateral locations.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements. Submit copy of ASTM C12 on Owner’s request.
Certificate of Compliance	Deliver with pipe an affidavit from pipe Manufacturer stating compliance with requirements of ASTM C700.
Foundry or Test Record Transcripts	Submit report on factory leakage test of joints per ASTM C425. Submit report on crushing strength, adsorption, hydrostatic pressure and acid resistance test per ASTM C700 Perform calculations and prepare test reports per ASTM C301 paragraphs 5.5, 6.4 and 8.6.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, certificates of compliance, and foundry or test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of vitrified clay pipe shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Vitrified Clay Pipe 4"-42"	Gladding McBean, Inc.	South Gate, CA
	Mission Clay Products	Corona, CA
	Pacific Clay Pipe	Corona, CA
	Approved equal	
Joints	Gladding McBean, Inc. – Speed Seal	South Gate, CA
	Mission Clay Products - JCP	Corona, CA
	Pacific Clay Pipe - Wedgelock	Corona, CA
	Approved equal	
Neoprene Stoppers	Gladding McBean, Inc.	South Gate, CA
	Mission Rubber Company "T-Cone"	Corona, CA
	Pacific Clay Pipe	Corona, CA
	Accepted equal	
Transition Couplings for Sewers 4"-27"	Mission Rubber Company "MR02"	Corona, CA
	Mission Rubber Company "MR02"	Corona, CA
	Accepted equal	
Sewer Saddles	Gladding McBean, Inc.	South Gate, CA
	Mission Rubber Company "Twis-Tee"	Corona, CA
	Accepted equal	
Buried Pipe Identification Tape	Calpico, Inc.	South San Francisco, CA
	Terra Tape Division Reef Industries	Houston, TX
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Vitrified clay pipe shall be constructed of the following materials:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Pipe	Standards	ASTM C700
	Material	Vitrified Clay Pipe
	Size	As shown on plans.
	Wall Thickness	Extra Strength

Joints	Type	Bell and Spigot compression type per ASTM C425 SSPWC(Greenbook) Type G polyurethane per Section 208-2.3
Fittings and Couplings	Standards	ASTM C700
Joint Gaskets	Standards	ASTM C700
	Material	Neoprene
Stoppers	Material	Neoprene or Vitrified clay ¾" thick with factory-made plasticized PVC compound-joint material bonded to pipe
	Compression Joint	Watertight compression coupling adequate to withstand leakage test pressures without damaging pipe socket.

C. Provide identification for buried VCP in the following manner:

PIPE CONTENTS	IDENTIFICATION/ WARNING/ LOCATING	TYPE	MATERIALS/METHOD
Sewage	Pipe Contents Identification	Identification Tape	2"-high letters reading "CAUTION: SEWER"
			Color = green with white letters
			Attached to top of pipe with adhesive tape
			Specification – See Section 33 05 26
	Pipe Warning and Locating	Warning and Locating Tape	2"-high letters reading "CAUTION: SEWER BURIED BELOW"
			Color = green with white letters
			Place in pipe trench 18" above pipe
			Specification – See Section 33 05 26
			Metallic strip that can be registered by a magnetic field locating device
		Locating Wire	In lieu of installing metallic warning tape; non-metallic warning tape and 10-gauge copper wire attached to top of pipe may be used.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install vitrified clay pipe before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Grade trench bottom to line and grade to which pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent uniform bedding thickness. Before laying each pipe section, check grade with straight-edge and correct any irregularities found. Trench bottom shall form continuous and uniform bearing and support for pipe at every point between bell or coupling holes, except grade may be disturbed for removal of lifting tackle.

C. At each joint location dig bell (joint) holes in trench bottom and at sides to permit visual inspection of entire joint.

D. Provide and maintain means and devices at all times to remove and dispose of all water entering trench during pipe-laying operations. Keep trench dry until pipe-laying and jointing are completed.

3.2 Installation

B. Refer to Sections 01 73 00, and 01 73 33 for basic execution and installation requirements.

C. Furnish and install pipe at locations shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, mechanical and electrical code requirements

4. ASTM C12 Installing Vitrified Clay Pipe Lines

E. Refer variances between Manufacturer's installation instructions and Contract Documents to Owner's Representative.

F. Protect water and recycled water systems by constructing sewers with separations and materials described in Section 31 05 50.

G. Install VCP Pipe as follows

1. Use proper care to prevent damage in handling, moving, and placing pipe. Hoist pipe with forklift, crane, backhoe or other handling equipment to prevent damage or reduction of pipe service life. Use cloth belt sling or continuous fiber rope to prevent scratching pipe. Lower (do not drop) pipe from truck. Dropped pipe will be rejected.

2. Install VCP gravity sewer pipe and fittings to tolerances recommended by Manufacturer. Unless otherwise shown, install VCP gravity sewer pipe and fittings at locations and grades shown on Plans using precision gauges and levels.

3. Install pipe without break, upgrade from structure to structure, with bell ends of pipe upgrade. Install pipe to line and grade given so as to form close concentric joint with adjoining pipe and prevent sudden offsets of flow line.

4. Inspect each pipe and fitting before lowering pipe or fitting into trench.

5. Clean interior of pipe and fittings of all dirt and superfluous materials of all description immediately prior to installing pipe. Wipe joints clean of all dirt and foreign matter.

6. Apply joint Manufacturer's recommended lubricant to joint surface to assemble joint. Joints shall be watertight and root-tight.

7. Pipe may be deflected at joint for curved alignment by closing joint on one side. Minimum radii for pipes of length L in feet are as follows:

PIPE DIAMETER	MAXIMUM ALLOWABLE DEFLECTION	MINIMUM ALLOWABLE RADIUS
12"	1.9°	R=30xL
15"	1.4°	R=40xL

8. Values shown above are based on 80% of the jo0int deflection recommended by ASTM C12 Table 1 or Manufacturer.

9. Use shorter pipe lengths where needed to accommodate tight radii.

10. Close open end of pipe with tight-fitting cap or plug to prevent entrance of foreign matter into pipe at all times when pipe installation is not in progress. These provisions shall apply during noon hour as well as overnight.

11. Do not use pipeline to drain water that has infiltrated into trench. Maintain inside of pipe free from foreign materials and in clean and sanitary condition until its acceptance by Owner.

12. Connect VCP sewer pipe to manholes using gasketed plastic manhole coupling to provide watertight connection.

13. After joint assembly. Bring bedding material up to pipe spring line. Place bedding material on each side of pipe. Do not drop rock or crushed gravel directly onto pipe. Walk and tamp bedding material into final position at pipe spring line and continue to top of pipe.

14. Then place bedding material to top of pipe zone and compact to specified pipe zone compaction.

H. Install VCP wyes and saddles as follows:

1. Unless otherwise specified, incline branch of wye fittings upward at angle ≤ 45° from horizontal. Place no wye closer than 5’ in downstream side to centerline of any structure. Do not install wyes or tees back to back. There shall be ≥ 4’ between each branch fitting. Place support of crushed rock or gravel under every wye branch when installed.

2. All wyes shall be ≥ 6” diameter. If existing laterals ≤ 4” are encountered, or if existing VCP other non-PVC laterals are encountered, install appropriate reducers or transition hardware to connect to new 6” PVC wye.

I. Install pipe at manholes and structures follows:

1. Place 2’ VCP joint of same inside diameter as adjoining pipe at inlet and outlet to each manhole or structure.

2. Do not cast pipe bells into manholes or structures. Cut off bell so no recess or offset appears on exposed face from inside wall of pipe to outside wall of pipe. Pipe shall have plain end, flush with inside manhole or structure wall.

J. Install service laterals as follows:

1. Join laterals to wye using ⅛ bends.

2. Plug laterals with stopper in socket of last joint of lateral. Seal stopper securely in place to withstand internal pressure from leakage tests but also in such manner to allow removal without damaging socket.

3. Resurface over laterals in accordance with Section 02 41 14.

4. Mark location of lateral at upper end as directed by Owner’s Representative. Unless otherwise directed, chisel letter “S” 1½” high on top of curb. If curb improvements do not exist, furnish and install 2”x2”x36” wood stake at end of service lateral. Paint top of stake white.

5. Restore curbs, gutters, paving, driveways, lawns, shrubs, fences, retaining walls, sprinklers landscaping and other improvements damaged by Contractor's operations in accordance to preconstruction conditions.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pipe	Horizontal Alignment	1" maximum horizontal deviation from plan alignment	Mirror each straight section of pipe	Contractor	Contractor
	Vertical Alignment	¼" maximum horizontal deviation from plan grades	Mirror each straight section of pipe	Contractor	Contractor
	Pipe Separations	Section 31 05 50.	All new pipe	Contractor	Contractor
	Pressure Test for Leakage and Infiltration	Section 33 08 31.	1 test per run of pipe	Contractor	Contractor
	Mandrel Test for Obstructions and Pipe Deflections	SSPWC Section 306-1.2.12 (See Below)	1 test per run of pipe	Contractor	Contractor
	Video Inspection	Video entire new alignment. Submit copy of video to Owner	All new pipe	Contractor	Contractor
Laterals	Horizontal Alignment	1" maximum horizontal deviation from plan alignment	Survey location of each lateral	Contractor	Contractor
	Vertical Alignment	¼" maximum horizontal deviation from plan grades	Survey location of each lateral	Contractor	Contractor
Sewer System	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Perform mandrel test after placement and compaction of backfill, installation of utilities, pipe testing, and prior to placing of permanent paving. Correct all obstructions encountered during mandrel test at no additional cost to Owner

3.4 Cleaning

A. Prior to testing, thoroughly clean sewers from structure to structure with hydro-flush equipment or sewer scrubbing ball. Remove all debris and trash from each structure. Disinfection of sewer is not required.

END OF SECTION

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SECTION 33 30 31
POLYVINYL-CHLORIDE GRAVITY SEWER PIPE

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of polyvinyl chloride (PVC) gravity sewer pipe and fittings.

B. Do not use PVC gravity sewer pipe under any of the following circumstances:

1. For force mains or pipelines where working pressure exceeds 10 psi.
2. For pipelines buried in soils containing organic solvents or petroleum products
3. For exterior piping exposed to sunlight unless expressly designed for such exposure and advertised as such in Manufacturer's product literature.
4. For pipe smaller than 4" diameter.
5. For exterior piping exposed to sunlight.
6. For pipeline exposed to changes in temperature where ⅜" per 100-ft per 10°F thermal expansion of PVC pipe cannot be accommodated.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 02 41 14: Paving Removal and Resurfacing
H. Section 03 30 00: Cast-in-Place Concrete
I. Section 22 10 00: Plumbing Piping
J. Section 31 05 50: Protecting Existing Utilities
K. Section 31 23 00: Excavation and Fill
L. Section 33 05 26: Utility Identification
M. Section 33 08 31: Leakage and Infiltration Testing of Gravity Sewer Pipelines
N. Section 33 39 13: Pre-Cast Concrete Manholes

1.3 System Description

A. Furnish and install complete sewer pipe to limits shown on Plans including appurtenant connections in conformance with Manufacturer's installation requirements and compliance with applicable construction safety codes and standards.

1.4 Quality Assurance

A. Contractor or subcontractor performing Work of this Section requiring fusion of fusion-bonded PVC pipe shall be licensed by Manufacturer or be Manufacturer of PVC pipe furnished.

B. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

C. Pipe and fittings shall be produced by same Manufacturer

D. Manufacturer of pipe and fittings shall employ manufacturing methods and material formulations in use for at least 5 years.

E. Owner or Owner's Representative shall be entitled to inspect pipes and witness manufacturing process.

1.5 References

A. ASTM C1460 Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground
B. ASTM D1599 Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings
C. ASTM D1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
D. ASTM D1785 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
E. ASTM D2241 2241 Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe SDR Series
F. ASTM D2321 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
G. ASTM D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
H. ASTM D2564 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
I. ASTM D2665 Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
J. ASTM D2729 Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
K. ASTM D3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings (4"-15")
L. ASTM D3212 Joints for Drain and Sewer Plastic Pipe Using Elastomeric Seals
M. ASTM D4396 Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications
N. ASTM F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
O. ASTM F656 Primers for Buried PVC Pipe and Fittings
P. ASTM F1417 Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
Q. ASTM F1866 Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings
R. California Green Building Standards Code (CALGreen Code)
S. NSF/ANSI 14 Plastic Piping Components and Related Materials
T. SSPWC Standard Specifications for Public Works Construction (Greenbook)
U. UNI-B-5 Uni-Bell Recommended Practice for the Installation of PVC Sewer Pipe

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Qualifications of Fusion-Bonding Subcontractor	Submit evidence of factory authorization or licensing by Manufacturer of lining system to install product
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.
Certificate of Compliance (Schedule 80 DWV Pipe)	Deliver with pipe affidavit from pipe Manufacturer certifying compliance with requirements of ASTM D1785 and Contract Documents and copy of test data results.
Certificate of Compliance Type PSM Pipe	Deliver with pipe affidavit from pipe Manufacturer certifying compliance with requirements of ASTM D3034 or ASTM F679 and Contract Documents and copy of test data results.
Warranty	Furnish one-year warranty from date of final acceptance

B. For fusion-bonded PVC pipe, furnish the following additional submittals.

SUBMITTAL	DESCRIPTION
Qualifications of Fusion-Bonding Subcontractor	Submit evidence of factory authorization or licensing by Manufacturer of lining system to install product
Installation Instructions	Submit Manufacturer's published instructions for installation of fusion-bonded PVC pipe including recommended minimum bending radius, recommended maximum safe pull force and instructions for proper handling, storage, installation, tapping and testing of fusion-bonded PVC pipe.
Warranty	Furnish one-year warranty from date of final acceptance

C. Refer to Section 01 33 00 for definition of requirements for catalog data, installation instructions, and certificates of compliance.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of PVC gravity sewer pipe and fittings shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
PVC Schedule 80 Drainage Waste and Vent (DWV) Pipe	Carlon Div Lamson & Session Co	Beachwood, OH
	Charlotte Pipe and Foundry Company "DWV"	Charlotte, NC
	Diamond Plastics Corporation	Grand Island NB
	North American Specialty Products, LLC	Lodi, CA
	Pacific Plastics	Brea, CA
	Vinyltech Corp.	Phoenix, AZ
	Accepted equal	
PVC Sewer Pipe, Fittings, Couplings, and Gaskets 4"-15" (ASTM D3034)	Carlon Div Lamson & Session Co	Beachwood, OH
	Charlotte Pipe and Foundry Company "DWV"	Charlotte, NC
	Diamond Plastics Corporation	Grand Island NB
	North American Specialty Products, LLC	Lodi, CA
	Pacific Plastics	Brea, CA
	Vinyltech Corp.	Phoenix, AZ
	Accepted equal	
Neoprene Stoppers	Gladding McBean, Inc.	South Gate, CA
	Mission Rubber Company "T-Cone"	Corona, CA
	Pacific Clay Pipe	Corona, CA
	Accepted equal	
Transition Couplings for Laterals 4"-8"	Gladding McBean, Inc.	South Gate, CA
	Mission Rubber Company "Band-Seal"	Corona, CA
	Accepted equal	
Transition Couplings for Sewers 4"-27"	Mission Rubber Company "MR02"	Corona, CA
	Accepted equal	
Sewer Saddles	Mission Rubber Company "T-Flex"	Corona, CA
	Accepted equal	
Epoxy Resin for	Furane Plastics, Incorporated "Epibond 157"	Glendale, CA

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Saddle Connections or Repair Work	Shell Chemical Corporation "Epon 828"	Norco, CA
	Wyndham Chemicals Incorporated "WR633 A&B"	Parsippany, NJ
	Accepted equal	
Buried Pipe Identification Tape	Calpico, Inc.	South San Francisco, CA
	Terra Tape Division Reef Industries	Houston, TX
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Adhesives and solvent welding materials used on Work shall comply with VOC limits set forth in Section 5.504.4.1 of CALGreen Code.

D. PVC Schedule 80 drainage waste and vent (DWV) pipe may be used to temperatures of 140°F and shall be constructed of the following materials:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Pipe	Standards	ASTM D1785
	Material	ASTM D1784 Cell Class 12454 Virgin rigid PVC Conform to NSF 14
	Marking	Mark pipe at 5' maximum intervals.
		Show ASTM standard complied with
		Show nominal pipe diameter.
		Show SDR
		Show material, and PVC cell classification
		Show coded number identifying Manufacturer, plant, machine, date and shift on which pipe was extruded.
		Mark pipe with home mark on spigot to indicate proper penetration when joint is made
	Size	As shown on plans.
	Wall Thickness	Schedule 80
Joints	Restrained Style	Solvent-welded socket joints
Solvent Cement	Material	ASTM F656 Primer
		ASTM D2564 Solvent Cement
Fittings	Standards	ASTM D2665
	Material	ASTM D1784 Virgin rigid PVC Cell Class 12454 Conform to NSF 14
	Color	Same as pipe

E. PVC solid-wall gravity sewer pipe, fittings, couplings, and gaskets may be used to temperatures of 140°F and shall be constructed of the following materials:

MATERIAL/ COMPONENT	STANDARDS/ CHARACTERISTICS	SPECIFICATION/REQUIREMENT
Pipe	Standards	Pipe sizes 4”-15” ASTM D3034
	Material	ASTM D1784 Cell Class 12454B, 12454C, 13364-A, or 13364-B Virgin rigid PVC Conform to NSF 14
	Marking	Mark pipe at 5’ maximum intervals.
		Mark ASTM standard complied with
		Show nominal pipe diameter.
		Show SDR
		Show material, and PVC cell classification
		Show coded number identifying Manufacturer, plant, machine, date and shift on which pipe was extruded.
		Mark pipe with home mark on spigot to indicate proper penetration when joint is made
	Size	As shown on plans.
	Wall Thickness	Pipe sizes 4”-15” = SDR 26, unless otherwise specified.
	Standard Lengths	12.5’ and 20’ with option to supply up to 15% of pipe delivery in random lengths
	Pipe Stiffness	46 psi per ASTM D2412
	Type of construction	Solid wall with smooth interior and exterior surfaces
Joints	Type	Integral bell gasketed joint meeting ASTM D3212
	Joint Gasket	Synthetic elastomer per ASTM F477
		Factory installed in belled end of pipe and fittings
Fittings and Couplings	Standards	Pipe sizes 4”-15” ASTM D3034
	Material	ASTM D1784 Cell Class 12454-B, 12454-C, or 13343-C Virgin rigid PVC Conform to NSF 14
	Markings	Show nominal pipe diameter
		Show material, and PVC cell classification
		Show coded number identifying Manufacturer, plant, machine, date and shift on which pipe was extruded.
		Show service designation or legend

F. Provide identification for buried PVC gravity pipe in the following manner:

PIPE CONTENTS	IDENTIFICATION/ WARNING/ LOCATING	TYPE	MATERIALS/METHOD
Sewage	Pipe Contents Identification	Pipe color	White
		AND	
		Stenciling	Green stenciling marked on pipe stating "SEWER"
			⅝"-high letters
			Repeated at 1' intervals
		OR	
		Identification Tape	2"-high letters reading "CAUTION: SEWER"
			Color = green with white letters
			Attached to top of pipe with adhesive tape
			Specification – See Section 33 05 26
	Pipe Warning and Locating	Warning and Locating Tape	2"-high letters reading "CAUTION: SEWER BURIED BELOW"
			Color = green with white letters
			Place in pipe trench 18" above pipe
			Specification – See Section 33 05 26
			Metallic strip that can be registered by a magnetic field locating device
		Locating Wire	In lieu of installing metallic warning tape; non-metallic warning tape and 10-gauge copper wire attached to top of pipe may be used.

G. Socket and spigot configurations for fittings and couplings shall be compatible to those used for pipe.

H. Pipe not installed within 120 calendar days of latest certification test shall not be used without prior approval from Owner's Representative.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install PVC gravity sewer pipe before submitting shop drawings or ordering materials. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

B. Grade trench bottom to line and grade to which pipe is to be laid, with allowance for pipe thickness. Dig bell holes or coupling holes of ample dimension in trench bottom at locations of each joint to facilitate joining. Remove hard spots that would prevent uniform bedding thickness. Before laying each pipe section, check grade with straight-edge and correct any irregularities found. Trench bottom shall form continuous and uniform bearing and support for pipe at every point between bell or coupling holes, except grade may be disturbed for removal of lifting tackle.

C. At each joint location dig bell (joint) holes in trench bottom and at sides to permit visual inspection of entire joint.

D. Provide and maintain means and devices at all times to remove and dispose of all water entering trench during pipe-laying operations. Keep trench dry until pipe-laying and jointing are completed.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements
2. Applicable OSHA and Cal OSHA regulations
3. Applicable building, fire and plumbing code requirements
4. ASTM D2321 Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
5. ASTM F1668 Construction Procedures for Buried Plastic Pipe
6. UNI-B-5 Uni-Bell Recommended Practice for the Installation of PVC Sewer Pipe

C. Refer variances between Manufacturer's installation instructions, published installation standards and Contract Documents to Owner's Representative.

D. Protect water and recycled water systems by constructing sewers with separations and materials described in Section 31 05 50.

E. Install PVC gravity sewer pipe as follows:

1. Install PVC gravity sewer pipe and fittings per ASTM D2321 and Uni-Bell Recommended Practice for the Installation of PVC Sewer Pipe and as herein specified.
2. Inspect each pipe and fitting before lowering pipe or fitting into trench.
3. Use proper care to prevent damage in handling, moving, and placing pipe. Hoist pipe with forklift, crane, backhoe or other handling equipment to prevent damage or reduction of pipe service life. Use cloth belt sling or continuous fiber rope to prevent scratching pipe. Lower (do not drop) pipe from truck. Dropped pipe will be rejected.
4. Install PVC gravity sewer pipe and fittings to tolerances recommended by Manufacturer. Unless otherwise shown, install PVC gravity sewer pipe and fittings at locations and grades shown on Plans using precision gauges and levels.
5. No longitudinal bending shall be allowed in installation of PVC gravity sewer pipe. Install all deflections at sewer manholes or by using joints and fittings specifically designed for use with PVC pipe of specified SDR.
6. Install pipe without break, upgrade from structure to structure, with bell ends of pipe upgrade. Install pipe to line and grade given so as to form close concentric joint with adjoining pipe and prevent sudden offsets of flow line.

7. Clean interior of pipe and fittings of all dirt and superfluous materials of all description immediately prior to installing pipe. Wipe joints clean of all dirt and foreign matter and apply accepted lubricant to mating surfaces of pipe to be joined.

8. Insert spigot end to proper depth of socket as indicated by home mark on pipe. Spigot end shall slide into bell end without displacement of rubber gasket.

9. Close open end of pipe with tight-fitting cap or plug to prevent entrance of foreign matter into pipe at all times when pipe installation is not in progress. These provisions shall apply during noon hour as well as overnight.

10. Do not use pipeline to drain water that has infiltrated into trench. Maintain inside of pipe free from foreign materials and in clean and sanitary condition until its acceptance by Owner.

11. After joint assembly. Bring bedding material up to pipe spring line. Place bedding material on each side of pipe. Do not drop rock or crushed gravel directly onto pipe. Walk and tamp bedding material into final position at pipe spring line and continue to top of pipe.

12. Then place bedding material to top of pipe zone and compact to specified pipe zone compaction.

F. Install wyes and saddles as follows:

1. Unless otherwise specified, incline branch of wye fittings upward at angle ≤ 45° from horizontal. Place no wye closer than 5’ in downstream side to centerline of any structure. Do not install wyes or tees back to back. There shall be ≥ 4’ between each branch fitting. Place support of crushed rock or gravel under every wye branch when installed.

2. All wyes shall be ≥ 6” diameter. If existing laterals ≤ 4” are encountered, or if existing VCP other non-PVC laterals are encountered, install appropriate reducers or transition hardware to connect to new 6” PVC wye.

3. Install all saddle connections into existing sewer lines with a wye saddle. Sewer to be saddled shall be scored to approximate shape of wye or tee and cut by mechanical hole cutters, or by keyhole or sabre saw. Cleanly machine tap holes and complete work by hand to provide true and neat opening for wye or tee saddle. Replace or repair any pipe damaged during operation.

4. Mount saddles on pipe using solvent cement in conformance with requirements of ASTM D2564 or by gaskets with all stainless steel straps. If solvent-welded saddle is used, secure saddle to main with stainless steel straps or with saddle clamps. After connection has set long enough for solvent cement to cure, encase fitting with Class B portland cement concrete.

5. Keep all chips, dirt, solvent cement, mortar and concrete out of sewer being saddled. Flush, clean, and ball reach of sewer main saddle if so directed by Owner's Representative.

6. In lieu of saddle connection, wye connection may be made in existing sewer by cutting sewer and installing wye and 2 sewer clamps with stainless steel bands.

G. Connect PVC sewer pipe to manholes using gasketed plastic manhole coupling to provide watertight connection.

H. Install service laterals as follows:

1. Join laterals to wye using ⅛ bends.

2. Plug laterals with stopper in socket of last joint of lateral. Seal stopper securely in place to withstand internal pressure from leakage tests but also in such manner to allow removal without damaging socket.

3. Resurface over laterals in accordance with Section 02 41 14.

4. Mark location of lateral at upper end as directed by Owner's Representative. Unless otherwise directed, chisel letter "S" 1½" high on top of curb. If curb improvements do not exist, furnish and install 2"x2"x36" wood stake at end of service lateral. Paint top of stake white.

5. Restore curbs, gutters, paving, driveways, lawns, shrubs, fences, retaining walls, sprinklers landscaping and other improvements damaged by Contractor's operations in accordance to preconstruction conditions.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pipe	Horizontal Alignment	1" maximum horizontal deviation from plan alignment	Mirror each straight section of pipe	Contractor	Contractor
	Vertical Alignment	¼" maximum horizontal deviation from plan grades	Mirror each straight section of pipe	Contractor	Contractor
	Pipe Separations	Section 31 05 50.	All new pipe	Contractor	Contractor
	Pressure Test for Leakage and Infiltration	Section 33 08 31	1 test per run of pipe	Contractor	Contractor
	Mandrel Test for Obstructions and Pipe Deflections	SSPWC Section 306-1.2.12 (See Below)	1 test per run of pipe	Contractor	Contractor
	Video Inspection	Video entire new alignment. Submit copy of video to Owner	All new pipe	Contractor	Contractor
Laterals	Horizontal Alignment	1" maximum horizontal deviation from plan alignment	Survey location of each lateral	Contractor	Contractor
	Vertical Alignment	¼" maximum horizontal deviation from plan grades	Survey location of each lateral	Contractor	Contractor
Sewer System	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed Literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Perform mandrel test after placement and compaction of backfill, installation of utilities, pipe testing, and prior to placing of permanent paving. Correct all obstructions encountered during mandrel test at no additional cost to Owner

3.4 Cleaning

A. Prior to testing, thoroughly clean sewers from structure to structure with hydro-flush equipment or sewer scrubbing ball. Remove all debris and trash from each structure. Disinfection of sewer is not required.

END OF SECTION

SECTION 33 32 22
SUBMERSIBLE CENTRIFUGAL WASTEWATER PUMPS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of end suction submersible centrifugal wastewater pumps.

1.2 Related Work

A. Section 01 22 00: Unit Prices
B. Section 01 33 00: Submittal Procedures
C. Section 01 40 00: Quality Requirements
D. Section 01 61 00: Common Product Requirements
E. Section 01 63 00: Product Substitution Procedures
F. Section 01 65 00: Product Delivery Requirements
G. Section 01 66 00: Product Storage and Handling Requirements
H. Section 01 73 00: Execution
I. Section 01 79 00: Demonstration and Training
J. Section 09 90 00: Painting and Coating
K. Section 09 96 56: Epoxy Linings and Coatings
L. Section 26 05 00: Common Work Results for Electrical
M. Section 26 05 53: Identification for Electrical Systems
N. Section 33 71 73: Electrical Utility Services

1.3 System Description

A. Furnish and install complete operating pumping system including pumps, motors and necessary appurtenances required by Contract Documents.

B. Furnish and install anchor bolts and all appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

C. Pump station control system input control variables shall include:

ITEM	VARIABLE	DESCRIPTION	
Input Signals (Analog)	Discharge	4-20 ma flowmeter signal to cut out power on no flow condition in automatic mode.	
Input Signals (Discrete)	Level Switches	Per plans as noted.	
	Temperature Switches	Motor overtemperature sensor on windings of each motor	
		Motor overtemperature sensor on bearings of each motor	
	Seal Failure	Motor seal failure sensor and relay for each motor	
Input (Manual)	Operation Mode (Selectors)	Hand-off-auto switch on each pump	Lead lag rotation switch
		Alarm reset	
	Settings	Time delay 0-3 minutes on start of each pump	Time delay 0-3 minutes on stop of each pump

D. Pump control system output variables shall include:

ITEM	VARIABLE	DESCRIPTION
Output Signals (Analog)	Discharge	4-20ma flowmeter signal
Output Signals (Discrete)	Run Condition (Lamp or LED)	Discrete signals "condition to run" "motor running" and "motor fail"
	Run Time Meter	6 digit non-resettable run time meter required on each motor
	Alarms – 1 alarm per Motor (Red lamp or LED)	1 alarm for each safety interlock

E. Pump normal startup sequence in automatic mode shall be as follows:

ITEM	VARIABLE	DESCRIPTION
Normal Start Sequence	Normal start signal	High wet well level signal
	Timed start	0-3 minutes

F. Pump normal shutdown sequence in automatic mode shall be as follows:

ITEM	VARIABLE	DESCRIPTION	
Normal Stop Sequence	Normal stop signal	Low wet well level signal	
	Timed stop	0-3 minutes	
	Safety Interlocks	No flow	Loss of control signal
		Motor bearing overtemperature	Motor winding overtemperature

G. On pumps with adjustable frequency drives, modify pump controls to incorporate additional safety cutouts on adjustable frequency drive equipment and to match pump rates with desired wet well levels.

1.4 Quality Assurance

A. All pumps furnished shall originate from ISO 9001-certified facility.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pump and Motor Assembly	Compliance with Purchase Order	Verify impeller, motor rating & electrical connections comply with Contract Documents	1 each pump assembly	Contractor	Contractor
	Holidays and Lining Thickness	See Section 09 96 56	1 each pump	Contractor	Contractor
	Dynamic Balance	NEMA Method MGI 12.06	1 each pump assembly	Contractor	Contractor
	Factory Test and Factory-Certified Pump Curve	Running test per ANSI/HI 11.6	1 each pump assembly 50 hp or larger 30-minute test to prepare 6-point curves for each pump assembly. On variable speed pumps, test each pump & prepare 6-point curves at four 100 rpm increments.	Contractor	Contractor
	Vibration	As needed to satisfy pump Manufacturer pumps will pass field tests described in Part 3 below.			

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pump and Motor Assembly (cont.)	Ragging	Pumps shall successfully pass 2 Clorox brand "Heavy Duty Reusable" Handi-Wipes, one Swiffer Sweeper X-Large cloth mop heads, and one standard rag mop head dropped into wet well without ragging	1 test on prototype (Furnished pumps will be tested in field)	Contractor	Contractor
3-Phase Motors	Short Commercial Test Data including no load current, full load current, winding resistance and high potential	NEMA MG1-12.51 and NEMA MG1-23.46	1 each motor	Contractor	Contractor
	Motor Efficiency	Provide guaranteed full-load efficiencies per NEMA MG 1-12.60 Determine efficiency using IEEE Method B using sine wave power for motors up to 300 hp and Method F for larger motors. List efficiency on nameplate per NEMA MG1-12.58.2	1 each motor	Contractor	Contractor
	Moisture Intrusion (Submersible and immersible pumps)	Verify no moisture intrusion in motor	1 each motor assembly	Contractor	Contractor
	Motor Noise	IEEE 85 with motor operating during test on rubber at no load with rated voltage and frequency	1 each motor	Contractor	Contractor
	Motor Vibration	NEMA MG1-12.06 and NEMA MG1-20.53	1 each motor	Contractor	Contractor
	Dynamic Balance	Balance and measure per NEMA MG1-12,06	1 each motor	Contractor	Contractor
	Motor Thermal Protectors	NEMA MG1 Winding Temperature and Trip Current Tests	1 each thermally-protected motor	Contractor	Contractor

C. Where pump and motor assemblies are manufactured as a unit such that motor cannot be separately tested from pump, tests on a prototype motor will be accepted.

D. Where motor controller other than standard across-the-line type is specified, furnish reviewed shop drawings to controller Manufacturer for coordination and sizing of controller.

E. Where adjustable frequency drives are used, project VFD shall be tested with assembled project pump and motor to guarantee compatibility.

F. In-lieu of a factory witness testing, the supplier shall submit the certified factory test records prior to shipment of pumps.

G. Testing shall be performed after final connection of pump and motor and after completion of static and dynamic balancing.

H. If vibration levels fall outside of acceptable limits established by Hydraulic Institute or above, shut down pump and correct for vibration before further testing.

1.5 References

A. ANSI/AFBMA 9 Load Ratings and Fatigue Life for Ball Bearings
B. ANSI/AFBMA 11 Load Rating and Fatigue Life for Roller Bearings
C. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings
D. ANSI C50.41 Polyphase Induction Motors for Power Generating Stations
E. ANSI HI11.6 Rotodynamic Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests
F. ASTM A36 Carbon Structural Steel
G. ASTM A48 Gray Iron Castings
H. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
I. California Building Code (CBC)
J. ISO 9001 Quality Management Standard
K. NEMA MG1 Motors and Generators.
L. NEMA MG13 Frame Assignments for Alternating Current Integral Horsepower Induction Motors
M. NEMA Standards
N. NEMA/ANSI 250 Enclosures for Electrical Equipment
O. NFPA 70 National Electric Code
P. UL547 Thermal Protectors for Electric Motors

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for pumps. Show volutes, impellers, drive assemblies, shafts, bearings, seals, and shaft guards per equipment shop drawing requirements. Show fabrication, assembly, foundation and installation requirements.
	Required for motor and motor controls under electrically controlled equipment shop drawing requirements.
	Show lining and coating data and thicknesses.
	Required for anchor bolts for slide rail system. Show placement, embedment, and edge distances as required by CBC Chapter 19. Show embedment distances and projections from concrete face.
Catalog Data	Required per catalog data requirements.
	Submit pretest pump curves with specified operating points marked. Curve shall also show moment of inertia of complete pumping unit, required submergence and NPSHR
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements.
Certificate of Compliance	Submit pump system certification per certificate of compliance requirements.
	Submit evidence of ISO 9001 factory certification

SUBMITTAL	DESCRIPTION
Certificate of Compliance (cont.)	Submit coating system and application certification per certificate of compliance requirements.
	In lieu of factory ragging test, Contractor may submit letter from Manufacturer certifying pumps being furnished have been designed and verified to pass solids and rags, including spheres up to specified diameter, Clorox brand "Heavy Duty Reusable Handi-Wipes", Swiffer Sweeper extra-large cloth mop heads, and other commercial household products of similar construction, size, and durability without ragging the impeller or clogging the pump. Include statement that Manufacturer understands pumps are being purchased in reliance on this promise and that Manufacturer's warranty covers pumping of these materials.
Manufacturer's Statement of Responsibility	Required per Manufacturer's Statement of Responsibility requirements. Include statement pumps installed comply with Contract Documents.
Test Record Transcripts	Before shipping pumps, submit certified pump curves for factory tests per Test Record Transcript requirements. Where variable speed drives are provided, submit certified pump curves in 100-rpm increments throughout pump operating range. Include written report stating date and location pumps were tested and certifying pump curves are accurate and meet specifications.
	Before shipping pumps, submit certified vibration test report including test results and modal shape signature results stating pump and motor assembly has been tested and vibration falls within limits allowed by HI 11.6 and above. Note: Vibration limits for Hidrostal are slightly higher for single vane pumps.
Motor Data	Required per motor data requirements of Section 26 05 00.
Testing Procedures	Submit written test procedures in advance of all field pump tests.
Warranty	Furnish 3-year warranty from date of final acceptance for all units. Warranty shall bear appropriate serial numbers.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, certificates of compliance, Manufacturer's statements of responsibility, and test record transcripts.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of pumps shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Centrifugal Sewage Pumps –Screw Type	Hidrostal Pump Company	
	NO OR EQUAL	
Motors	By pump Manufacturer	
Flexible Motor Coupling	Rexnard	
	Accepted equal	
Slide Rail System	By pump Manufacturer	

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Control Panel	By pump Manufacturer	
Vibration Testing	Accepted equal Class II vibration analyst certified by Vibration Institute of America	

B. Pumps furnished shall operate throughout their full submitted pump curve driven by motors of horsepowers specified below or shown on Plans. Pumps requiring larger motor than specified or shown are unacceptable absent written statement from Owner electrical infrastructure, drives and switchgear can support larger motor.

C. Pumps requiring larger motor than specified or shown are unacceptable in absence of written statement from Owner electrical infrastructure, drives and switchgear can support larger motor.

D. The specified pump and pump curve have been selected based on the reference pump noted in Section 2.2 to provide Owner with optimum performance at multiple operating points, and not solely at the best efficiency point. Contractor may substitute other pumps including pumps from other accepted equal manufacturers, provided the following conditions are met:

1. Provisions of HI11.6 limiting pump performance testing to one “guarantee point” shall not apply to pumps furnished on this project.

2. Testing shall demonstrate performance at “Point B Best Efficiency Point (BEP) conforms to Acceptance Level 1E as defined in HI11.6. Efficiencies at BEP shall meet or exceed specified efficiencies.

3. Testing shall demonstrate performance at Points A and C to conform to Acceptance Level 1B as defined in HI11.6. Efficiencies at Points A and C shall be within 3 percent of efficiencies specified for these points.

4. Testing shall demonstrate shutoff head falls within ±10% of specified shutoff head unless Owner elects to waive this requirement.

5. Pump manufacturer, if not listed above, shall in Owner’s opinion meet the criteria for product substitution procedures specified in Section 01 63 00.

6. At Owner’s option, penalties described under Section 01 22 00 may be assessed for failing pumps in lieu of rejecting installed pumps.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being pumped:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	23.76 mm Hg	6.5-8.5	<1.0%

C. Construct pumps and attached motors of materials conforming to industry standards for strength and durability.

D. Pumps and attached motors shall be rated for continuous duty and shall operate smoothly throughout specified pumping range without surging, cavitation or vibration.

E. Castings shall be free from blow holes, sand holes, and all other flaws and shall be accurately machined and fitted to close dimensions.

F. Pumps and motors shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Pump Casing and Bearing Frame	Cast Iron (for pressures 0-150 psi)	ASTM A 48 CL-30
Suction Elbow and Handhole Cleanout if Applicable	Same Material as Casing	
Suction and Discharge Flanges	Cast Iron	ANSI B16.1 Class 125
Suction and Discharge Flanges Working Pressures 0-150 psi	Cast Iron	ASME/ANSI B16.1 Class 125 Raised or plain faced
Flange Alignment	Pumps	Boltholes shall straddle horizontal and vertical centerlines of pump.
Flange Bolts, Nuts, and Washers	Various Steels	See Section 33 05 31.
Flange Gaskets		See Section 33 05 31.
Volute Wear Ring	Ni-Hard 550	If applicable
Pump Casing Wear Liner	Hi-Chrome	ASTM A532 CL.III
Impeller	Cast Iron	ASTM A48 Class 30 or better Bore and key impeller without use of steel inserts or lead babbitts
Impeller Bearings	Bronze	
Pump Shaft	Stainless Steel	ASTM A479
Exposed Nuts and Bolts	Stainless Steel	SAE Type 316
Motor Shaft	Stainless Steel	SAE Type 416
Motor Frames	Cast Iron	NEMA MG-1
Motor Enclosure	Cast Iron	ASTM A48 Class 30 or better
Motor Seals	Upper seal	Tungsten carbide with Buna N elastomers
	Lower seal	Tungsten carbide with Viton elastomers
	Metal parts	SAE Type 316 Stainless Steel
Steel Fabrications	Steel	ASTM A36
Epoxy Lining	Epoxy	See Section 09 96 56. AWWA C550 12 mil minimum DFT Do not coat bronze or stainless steel parts. Pump Manufacturer to notify Owner if epoxy lining interferes with impeller clearances
Pump Exterior Finish Coat	Fusion-Bonded Epoxy or Epoxy Urethane	See Section 09 90 00 or 09 96 56. 12 mil minimum thickness
Fasteners, Bolts, Cap screws, Anchor Bolts, Nuts, Washers and all External Hardware	Stainless Steel	SAE Type 304 or Type 316
Lifting Cable	Stainless Steel	SAE Type 316
Guides and Bar Brackets	Stainless Steel	SAE Type 316
Nameplates	Stainless Steel	SAE Type 316 permanently attached to pump frame and motor frame with information impressed, engraved or embossed into plate
		Show Manufacturer's name, model and serial number, year of manufacture, rpm, horsepower, impeller diameter, capacity, head rating and NPSHR

G. Lift system shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Lifting Cable	Stainless Steel	SAE Type 316

H. Motors shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Motor Design	Cast Iron	NEMA MG-1
Motor Frames		Frame assignments per MG13
Motor Terminal Boxes	Cast Iron	ASTM A48
Stator Windings	Copper	
Fasteners, Bolts, Cap screws, Anchor Bolts, Nuts, Washers and all External Hardware	Stainless Steel	SAE Type 316
Nameplates	Stainless Steel	SAE Type 316
		Permanently attached to motor frame with information impressed, engraved or embossed into plate
		Show information required by NEMA MG1-10.39 through 39, Manufacturer's name, model and serial number, year of manufacture, rpm, horsepower, voltage, phase, full load current, locked-rotor kVA code, motor type, frame, insulation class, centigrade degree rise and motor connection diagram. Also show bearing numbers for both bearings, efficiency, power factor at full load, and maximum recommended kVAR of power capacitors to result in a 90% power factor.

I. The following product design criteria, options and accessories are required for pumps:

ITEM	DESCRIPTION				
Pump Design Criteria		Q (gpm)	TDH (ft)	PUMP EFFICIENCY η	HP drawn at operating point
	Shutoff	0	125	n/a	n/a
	A (BEP)	1174	78.1	74	31.5
	B	900	86	69	29
	C	700	97	62	27
	D	600	101	60	20
	Notes:		See Hidrostal Model H5K-MH, 17.375" impeller		
	Net Positive Suction Head Available NPSHA		30 ft		
	Specific Speed		1200		
	Pump Speed		1177 with VFD drive 1077 RPM		
	Maximum Solid Size		3" passing sphere 3.75"		
	Application		Submersible		
	Maximum Sound Power Level, Lw		100 dBA		
	Maximum Sound Pressure Level at 3'		90 dBA		
Pump Casing	Clockwise centerline design Provide adaptor plate or indexed register to provide accurate fit between motor flange and volute				
	Handhole Cleanout		Required		
Impeller	Design		one vane screw impeller		
	Mount so as to minimize contact between solids and impeller. Impeller shall maintain full diameter back shroud regardless of impeller trim. Attach impeller to shaft using stainless steel bolt, stainless steel washer and stainless steel key. Do not use lock collets or slip type shaft over motor shaft to connect impeller to motor shaft.				

ITEM	DESCRIPTION	
Pump Bearings	Prelubricated at factory Bearings shall be locked to prevent shaft movement and to withstand high thrust loads.	
	Bearing Life	ANSI/ABMA 9 L_{10} of 50,000 hours
Pump Seals	Type	Mechanical Seals
Static and Dynamic Balance	Required for all rotating elements after motor has been mounted on pump for shipping. Mass and rotating moment of inertia shall be such that resonant harmonics do not occur within normal operating speed range.	
	Ratio of Relative Speed to Critical Speed	Less than 0.8 or more than 1.3 for pumping unit and all components
Mix Flush Valve	Description	Provide valve on one pump volute to provide scouring motion to clean wet well perimeter.
Guards	Guard Plates	Provide hinged or bolted plates over exposed couplings, drives and shafts in compliance with requirements of California Department of Industrial Relations, Division of Safety
Pre-rotation Basin	Factory manufactured pre-rotation Basin shall be furnish the lower installed pump per plans	Per manufacturer requirements

J. The following electrical design criteria are required for electrical equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Class I Division 1 (wet well)
Enclosures – Indoor Dry Locations	NEMA 250 Enclosure Rating	As shown on plans
Enclosures – Outdoor or Wet Locations	NEMA 250 Enclosure Rating	As shown on plans
Enclosures – Class 1 Division 1 Wet Well Locations	NEMA 250 Enclosure Rating	As shown on plans
Enclosures – Class 1 Division 2 Dry Well Locations	NEMA 250 Enclosure Rating	As shown on plans
Other Enclosures	NEMA 250 Enclosure Rating	As shown on plans
All Enclosures	Construction	Lockable With powder coat epoxy finish on steel surfaces
	IEC 60529 Enclosure Rating for Underground Equipment	IP 65 water jet / IP 67 immersion to 1 m / IP68 Submergence rated for 72-hours at 20' of head
Control Panel Mounting	Local Mount	See plans
	Remote Mount	MCC See plans
Power Supply	Motor Circuit	460VAC – 3-phase – 60Hz
	Heating Circuit	120VAC – 1 phase – 60Hz
	Control Panel	120VAC – 1 phase – 60Hz 230VAC – 1 phase – 60Hz

K. The following product design criteria, options and accessories are required for submersible pump motors:

ITEM	DESCRIPTION	
Motors	Motor Type	Squirrel cage induction/ Model: HE5B6
	Operating Frequency	60Hz maximum with VFD drive
	Synchronous Speed	1150 rpm (6-pole)
	Speed Control Range	1 rpm throughout range Paced by 4-20mA input

ITEM	DESCRIPTION	
Motors (cont.)	Motor Horsepower	50 Hp
	Efficiency	Premium Efficient Inverter Rated (RUSI)
	Starting Code	Code G for motors 15-hp and larger / Manufacturer's standard for motors smaller than 15 hp
	Duty	S1 Continuous Duty / S8 Continuous Operation with Periodic Changes in Load and Speed
	Shaft	Extend through both bearings with proper length to connect directly to pump impeller
	Temperature Rise	NEMA Design B Rated for Operation at 40°C (104°F)
	Operating Elevation	24.5
	Service Factor	1.15
	Starts per Hour	Motor shall be capable of 6 evenly-spaced starts per hour.
	Insulation	Class F (155°C) / Motor insulation on VFD-driven motors shall meet inverter-duty rating requirements of NEMA MG1, Part 31.
	Fill	Air filled. Do not use oil filled motors
	Overtemperature Protection Motor Windings (motors <200hp)	Provide automatic reset normally closed thermal overloads in each phase of motor windings per NEMA MG-1
	Overtemperature Protection Motor Windings (motors 200-hp and larger)	Provide 6 platinum 100Ω RTD's (two embedded in each phase of motor windings) windings per NEMA MG-1
	Overtemperature Protection Motor Bearings(motors 200-hp and larger)	Provide 2 platinum 100Ω RTD's (one on each motor bearing.) windings per NEMA MG-1
	Moisture Detector	Float type or capacitance type
	Vibration Detector (motors 200-hp and larger)	Required
	Control Leads on Protection Devices	Color code control leads, and terminate in separate conduit box.
	Motor Design	Submersible but rated for continuous operation in air
	Other Requirements	Insulate and brace windings for full voltage operation.
		Motor nameplate horsepower shall not be exceeded anywhere on pump curve.
	Space Heaters (Outdoor Applications)	120V - 1 phase cartridge or flexible wrap-around type condensation heaters
	Junction Box	Motor shall have oversized power junction box and auxiliary junction box for overtemperature switch and space heater circuit.
Motor Bearings	Bearing Life	ANSI/ABMA 9 L_{10} of 50,000hours
	Lubrication	Grease lubricated, prelubricated at factory
	Bracing	Brace and lock bearings to prevent shaft movement and to withstand high thrust loads in all directions.
Motor Enclosure	Enclosure	Watertight
	Lifting Eye	Include lifting lug or eye of adequate strength to lift entire pump and motor assembly
	Seal	Buna N O-ring seal
	Rabbet Joints	Provide rabbet joints with large overlap or adaptor plate to accomplish accurate fit equal to indexed register fit
Motor Connection Box	Design	Bolted, designed for NEC Article 505 Classification specified with adequate space for connections
	Gaskets	Provide watertight gaskets between box and housing and between box and cover
	Grounding Terminal	Provide in connection box
	Markings	Permanently mark motor leads in agreement with connection diagram

ITEM	DESCRIPTION	
Coatings	Epoxy	See Section 09 90 00. Coat fabricated steel enclosures on all inside and outside surfaces except shafts, register fits and nameplates.
Electrical Cable Leads	Cable Length	75'
	Seal	As required by UL for specified hazardous location.
	Connection to Motor Enclosure	Join to motor enclosure with epoxy mold and blind splice in motor end bracket or use motors with terminal board and junction box sealed from motor chamber.
Motor Seals	Moisture Intrusion Probes	Construct motors with oil chamber with two moisture sensing probes to detect moisture intrusion past lower seal and warn of impending inner seal failure.
Motor Blower	Contract Documents are based on pump Manufacturer not requiring blower to increase heat exchange efficiency. If motor Manufacturer recommends blower be provided for each pump motor, submit proposed revisions to drawings to accommodate blowers in accordance with shop drawing requirements described above. Where blower and appurtenant work is required by motor Manufacturer, provide at no additional cost to Owner.	

L. Motor torque and slip characteristics shall be as recommended by pump Manufacturer and as specified.

M. Motors shall start and accelerate driven equipment to design conditions without exceeding any specified design requirements. Where motor horsepower specified above or shown on Plans appears undersized for pump specified, refer conflict to Owner's Representative during submittal process for resolution.

N. Motors on VFD-driven pumps shall be compatible with VFD drives throughout expected range of operating speeds. Insulation voltage impulse levels shall meet NEMA 1, Part 31.

O. The following product design criteria, options and accessories are required for guide-rail systems

ITEM	DESCRIPTION	
Guide Rail System	Description	Dual-rail guide bar system extending from top of station to discharge connection allowing pumps to automatically connect to discharge connection without personnel having to enter wet well.
	Sealing System	Accomplish watertight seal with machined metal-to-metal contact. Use of elastomeric O-rings shall only be permitted if seal can be accomplished from surface without applying torsion to compress O-rings to make up seal.
	Mounting	Suspend pump from rail system such that no portion of pump bears directly on sump floor.
	Lifting Cable and System	Provide 10' of cable per for each pump Design lifting system for 2 x pump weight

P. The following product design criteria, options and accessories are required for control panels:

ITEM	DESCRIPTION	
Control Panels	Panel Full Load Amps	21 amps
	Motor Full Load Amp Range	6-10 amps
	Inner Door	Required
	Run Time Meter	Required
	Audible Alarm	Required

ITEM	DESCRIPTION	
Control Panels (cont.)	Alternator	Duplex Alternator with Lead Lag Selector switch
	Cleaning Cycle Controls	Provide programmable controls for alternating start point to prevent buildup of grease along wet well interior
	Alarm Contacts	High Level, Motor Overtemperature, Moisture Intrusion, Pump Vibration, Pump Fail

Q. Control Panel shall be fully compatible with pumps furnished.

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install pumps before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install pumps at location shown on Plans and Submittals.

C. The following installation standards shall be followed:

7. Manufacturer's installation and warranty requirements

8. Applicable OSHA and Cal OSHA regulations

9. Applicable building, fire, plumbing, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install pumps to tolerances recommended by Manufacturer. Unless otherwise shown, install pumps true, plumb, and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pumps Pumps (cont.)	6-hour field performance test to demonstrate compliance to Contract Documents and Manufacturer's printed literature	Conform to HI 14.6 to extent possible in field. Tests shall be witnessed by pump supplier's factory authorized representative who shall certify that installed pumping system complies with Contract Documents and Manufacturer's warranty requirements and that no drive equipment is overloaded.	1 six-hour test each pump	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
	Ragging	Field-installed pumps shall successfully pass 2 Clorox brand "Heavy Duty Reusable" Handi-Wipes, 2 Swiffer Sweeper X-Large cloth mop heads, and one standard mop head dropped into wet well without ragging impeller. Retrieve Handi-Wipes and other test items at manhole downstream and dispose of into dumpster.	3 tests each pump	Contractor	Contractor
	Passing Sphere	Field-installed pumps shall successfully pass tennis ball or similar spherical object of size specified.	2 tests each pump	Contractor	Contractor
	Motor Current	Record current in each phase of each motor and include in O&M manual. Repair or replace motor or motor-driven equipment if current exceeds motor nameplate FLC value.	Each phase of each motor	Contractor	Contractor
	Vibration	Running test with vibration analyzer per ANSI/HI 11.6 Do not exceed published HI standards or 0.20 in/sec RMS in absence of HI standards. *Note: Vibration limits for single vane impeller slightly higher than HI Standards.	1 test each pump during six-hour field performance test On VFD-driven pumps, test each pump at four 100 rpm increments.	Contractor	Contractor
	Installation, Noise, Odors, Heat and Leakage	Visual inspection of finished installation	1 inspection	Owner	Contractor
	Guide Rail System	Verify pumps can be easily removed and reinstalled through hatch by Owner's personnel without special equipment or undue difficulty	1 test	Owner	Owner
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor
	35-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Provide services of factory-authorized representative on-site to witness and inspect startup of pump operation. Before startup, check all equipment for proper lubrication, alignment, rotation, freedom from excessive vibration. Factory-authorized representative shall notify Contractor and Owner of any irregularities of installation which might render Manufacturer's warrantee null and void.

C. Conduct field performance test in presence of Owner's Representative and Owner's personnel after at least 24 hours of field operation have occurred to burn in system.

D. In event field performance tests show excessive vibration or fail to demonstrate compliance with requirements of Contract Documents or certified curves furnished, Owner shall have right to either:

1. Decline acceptance of failing pumps and require Contractor to replace them or

2. Deduct agreed upon allowance for Owner's incremental cost of additional power from payment due Contractor.

3.4 Field Training of Owner's Personnel

A. In addition to the above, provide services of pump Manufacturer's factory-authorized representative on-site for at least 8 man-hours (travel time excluded) to provide classroom instruction of Owner's personnel in proper recommended lubrication, operation and maintenance procedures as well as procedures for proper lockout out of each energy source.

B. The following handouts shall be provided by Manufacturer's factory-authorized representative to all attendees during classroom instruction:

1. Listing of any actions (or inactions) by Owner which would render Manufacturer's warranty null and void.

2. Written description of proper lubrication procedures.

3. Written list of all required scheduled maintenance including recommended service intervals to ensure warrantee remains valid and to ensure equipment remains functional.

4. Written description of procedures for lockout of each energy source.

3.5 Spare Parts

A. Furnish the following spare parts for each pump:

QUANTITY	PART
1	Mechanical seal
1	Pump impeller
2	Sets of all gaskets and o-rings
1	Duplicate nameplate for each pump and motor provided
1	Spare Pump shipped in crate

END OF SECTION

SECTION 33 32 23
SOUND ATTENUATED SKID MOUNTED BACK-UP PUMP WITH A UL LISTED BASE TANK

PART 1 - GENERAL

1.1. Work Included

A. Materials, testing, and installation of a permanently installed automatically starting pump station back-up pumpset.

1.2. Related Work

A. Section 01 22 00: Unit Costs
B. Section 01 33 00: Submittal Procedures
C. Section 01 40 00: Quality Requirements
D. Section 01 61 00: Common Product Requirements
E. Section 01 63 00: Product Substitution Procedures
F. Section 01 65 00: Product Delivery Requirements
G. Section 01 66 00: Product Storage and Handling Requirements
H. Section 01 73 00: Execution
I. Section 09 90 00: Painting and Coating
J. Section 09 96 56: Epoxy Linings and Coatings
K. Section 26 05 10: Common Work Results for Electrical
L. Specification Appendix C: General Operations Summary

1.3. System Description

A. Furnish and install complete operating pumping system including pumps, motors and necessary appurtenances required by Contract Documents.

B. Furnish and install anchor bolts and all appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

C. The pump shall be fitted with a fully-automatic priming system incorporating an air compressor, air ejector assembly, and an air/water separation tank. The priming system shall be capable of priming the pump from a completely dry pump casing. The air ejector shall operate on the discharge side of the compressor, eliminating the possibility of water being drawn into the air source. The pump must be capable of running totally dry for periods up to twenty-four hours, then automatically re-priming and returning to normal pumping volumes without need for any adjustment.

D. The priming system shall not use a vacuum or diaphragm pump, nor require the use of a "Foot"-type valve. It shall contain no moving parts or protective float gear. Priming systems that require manual water additions to facilitate pump priming are not acceptable. A demonstration of the pump's ability to repeatedly cycle from dry suction / pump / snore / repriming / pump shall be required. This will necessitate the draining of all residual water from the pump case to initiate a dry suction starting condition.

E. The pump offered shall be the manufacturer's standard production model. It shall have been in continuous use by municipal and industrial owners for a minimum of five years. A list of five user contacts including contact names and telephone numbers shall be

provided with the bid submittal. Failure to supply a verifiable users list will be cause for rejection of the bid.

F. Pump station control system input control variables shall include:

ITEM	VARIABLE	DESCRIPTION	
Input Signals (Discrete)	Level Switches	Per plans as noted.	
Input (Manual)	Operation Mode (Selectors)	Man-Off-Auto switch	
		Alarm reset	
	Settings	Time delay 0-3 minutes on start of pump	Time delay 0-3 minutes on stop of pump

G. Pump control system output variables shall include:

ITEM	VARIABLE	DESCRIPTION
Output Signals (Discrete)	Run Condition (Lamp or LED)	Discrete signals "condition to run" "engine running" and "engine fail"
	Run Time Meter	6 digit non-resettable run time meter required on each motor

H. Pump normal startup sequence in automatic mode shall be as follows:

ITEM	VARIABLE	DESCRIPTION
Normal Start Sequence	Normal start signal	Diesel Engine Pump ON signal
	Timed start	0-3 minutes

I. Pump normal shutdown sequence in automatic mode shall be as follows:

ITEM	VARIABLE	DESCRIPTION	
Normal Stop Sequence	Normal stop signal	Diesel Engine Pump OFF signal	
	Timed stop	0-3 minutes	
	Safety Interlocks	No flow	Loss of control signal

1.4. Quality Assurance

A. All pumps furnished shall originate from ISO 9001-certified facility.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pump and Engine Assembly	Compliance with Purchase Order	Verify impeller, engine rating & electrical connections comply with Contract Documents	1 each pump assembly	Contractor	Contractor
	Holidays and Lining Thickness	See Section 09 96 56 and Manufacturer Standards	1 each pump	Contractor	Contractor
	Dynamic Balance	NEMA Method MGI 12.06	1 each pump assembly	Contractor	Contractor
Pump and Engine	Factory Test and Factory-Certified	Running test per ANSI/HI 11.6	1 each pump assembly 50 hp or	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Assembly (cont.)	Pump Curve		larger 30-minute test to prepare 6-point curves for each pump assembly. On variable speed pumps, test each pump & prepare 6-point curves at four 100 rpm increments.		
	Vibration	As needed to satisfy pump Manufacturer pumps will pass field tests described in Part 3 below.			
	Ragging	Pumps shall successfully pass 2 Clorox brand "Heavy Duty Reusable" Handi-Wipes, one Swiffer Sweeper X-Large cloth mop heads, and one standard rag mop head dropped into wet well without ragging	1 test on prototype (Furnished pumps will be tested in field)	Contractor	Contractor

C. Where pump and engine assemblies are manufactured as a unit such that engine cannot be separately tested from pump, tests on a prototype engine will be accepted.

D. In-lieu of a factory witness testing, the supplier shall submit the certified factory test records prior to shipment of pumps.

E. Testing shall be performed after final connection of pump and engine and after completion of static and dynamic balancing.

F. Units described shall be new, unused, and of the current year's production. The style of pump being bid must be in production for a minimum of 5 years (include users list). Unit shall be of the latest design and in current production completely serviced, ready for work and shall include all standard and optional equipment as specified herein. All bidders must have demonstrated the unit they are bidding, prior to bid date.

G. Bidders must have a fully stocked parts and service facility within 50 miles of the City. The City shall have the right to inspect the office and shall be the sold judge of its adequacy to fulfill this requirement.

1.5. References

A. ANSI/AFBMA 9 Load Ratings and Fatigue Life for Ball Bearings
B. ANSI/AFBMA 11 Load Rating and Fatigue Life for Roller Bearings
C. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings
D. ANSI C50.41 Polyphase Induction Motors for Power Generating Stations
E. ANSI HI11.6 Rotodynamic Submersible Pumps for Hydraulic Performance, Hydrostatic Pressure, Mechanical and Electrical Acceptance Tests
F. ASTM A36 Carbon Structural Steel
G. ASTM A48 Gray Iron Castings
H. AWWA C550 Protective Epoxy Interior Coatings for Valves and Hydrants
I. California Building Code (CBC)

J. ISO 9001 Quality Management Standard
K. NEMA MG1 Motors and Generators.
L. NEMA MG13 Frame Assignments for Alternating Current Integral Horsepower Induction Motors
M. NEMA Standards
N. NEMA/ANSI 250 Enclosures for Electrical Equipment
O. NFPA 70 National Electric Code
P. UL547 Thermal Protectors for Electric Motors

1.6. Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for pumps. Show volutes, impellers, drive assemblies, shafts, bearings, seals, and shaft guards per equipment shop drawing requirements. Show fabrication, assembly, foundation and installation requirements.
	Show lining and coating data and thicknesses.
Catalog Data	Required per catalog data requirements.
	Submit pretest pump curves with specified operating points marked. Curve shall also show NPSHR
Installation Instructions	Required per installation instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements.
Certificate of Compliance	Submit pump system certification per certificate of compliance requirements.
	Submit evidence of ISO 9001 factory certification
	Submit coating system and application certification per certificate of compliance requirements.
	In lieu of factory ragging test, Contractor may submit letter from Manufacturer certifying pumps being furnished have been designed and verified to pass solids and rags, including spheres up to specified diameter, Clorox brand "Heavy Duty Reusable Handi-Wipes", Swiffer Sweeper extra-large cloth mop heads, and other commercial household products of similar construction, size, and durability without ragging the impeller or clogging the pump. Include statement that Manufacturer understands pumps are being purchased in reliance on this promise and that Manufacturer's warranty covers pumping of these materials.
Manufacturer's Statement of Responsibility	Required per Manufacturer's Statement of Responsibility requirements. Include statement pumps installed comply with Contract Documents.
Test Record Transcripts	Before shipping pumps, submit certified pump curves for factory tests per Test Record Transcript requirements. Where variable speed engines are provided, submit certified pump curves in 100-rpm increments throughout pump operating range. Include written report stating date and location pumps were tested and certifying pump curves are accurate and meet specifications.
Testing Procedures	Submit written test procedures in advance of all field pump tests.
Warranty	Furnish 3-year warranty from date of final acceptance for all units. Warranty shall bear appropriate serial numbers and cover all pump parts, including the mechanical seal.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, certificates of compliance, Manufacturer's statements of responsibility, and test record transcripts.

1.7. Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of pumps shall be strictly followed.

1.8. Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum bid amount for which such Work is appurtenant.

PART 2 – PRODUCTS

2.1. Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Back-Up Pump	Godwin Pumps	Bridgeport, New Jersey
	NO OR EQUAL	
Engine	By pump Manufacturer	
Accessories	By pump Manufacturer	

B. The specified pump and pump curve have been selected based on the reference pump noted in Section 2.2 to provide Owner with optimum performance at multiple operating points, and not solely at the best efficiency point. Contractor may substitute other pumps including pumps from other accepted equal manufacturers, provided the following conditions are met:

1. Provisions of HI11.6 limiting pump performance testing to one "guarantee point" shall not apply to pumps furnished on this project.

2. Testing shall demonstrate performance at "Point B Best Efficiency Point (BEP) conforms to Acceptance Level 1E as defined in HI11.6. Efficiencies at BEP shall meet or exceed specified efficiencies.

3. Testing shall demonstrate performance at Points A and C to conform to Acceptance Level 1B as defined in HI11.6. Efficiencies at Points A and C shall be within 3 percent of efficiencies specified for these points.

4. Testing shall demonstrate shutoff head falls within ±10% of specified shutoff head unless Owner elects to waive this requirement.

5. Pump manufacturer, if not listed above, shall in Owner's opinion meet the criteria for product substitution procedures specified in Section 01 63 00.

6. At Owner's option, penalties described under Section 01 22 00 may be assessed for failing pumps in lieu of rejecting installed pumps

2.2. Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being pumped:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	23.76 mm Hg	6.5-8.5	<1.0%

C. Construct pumps and attached motors of materials conforming to industry standards for strength and durability.

D. Pumps and attached motors shall be rated for continuous duty and shall operate smoothly throughout specified pumping range without surging, cavitation or vibration.

E. Castings shall be free from blow holes, sand holes, and all other flaws and shall be accurately machined and fitted to close dimensions.

F. Pump design shall incorporate a direct suction flow path that is in axial alignment with the impeller eye. There shall be no turns, chambers, or valves between the suction flange and the impeller eye.

G. Pumps and motors shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Pump Casing and Bearing Frame	Cast Iron (for pressures 0-131 psi)	ASTM A126 Class B
Sound Attenuated Enclosure	14-gauge sheet metal backed with 1-inch and 2-inch layers of polydamp acoustical sound-deadening material.	The engine and pump shall be completely enclosed. The acoustical enclosure shall reduce pump and engine noise to 68-dBA or less at a distance of thirty feet. The enclosure shall be removable for easy access to the engine / pump for maintenance and repair. The enclosure doors shall all be equipped with latches that are keyed alike. For maintenance and service needs, the enclosure sides shall have hinged doors for quick access to the engine oil fill, fuel fill port, oil dipstick, and filters.
	Light	The unit shall include a single switch operated 12 VDC light within the enclosure
Suction and Separation Tank	Same Material as Casing	
Suction and Discharge Flanges Working Pressures 0-150 psi	Cast Iron	ASME/ANSI B16.1 Class 125 Raised or plain faced
Flange Alignment	Pumps	Boltholes shall straddle horizontal and vertical centerlines of pump.
Flange Bolts, Nuts, and Washers	Various Steels	See Section 33 05 31.
Flange Gaskets		See Section 33 05 31.
Volute Wear Plate	Cast Iron	ASTM A48 Class 35B or ASTM A-532
Pump Casing Wear Plate	Cast Iron	ASTM A48 Class 35B or ASTM A-532
Impeller	Cast Iron	ASTM A48 Class 35B grey cast iron or ASTM A-532 (Alloy III A) 25% chrome cast iron Dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids,

ITEM	MATERIAL	SPECIFICATION
		fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.
Impeller Bearings		Bearings shall be tapered roller bearings of adequate size to withstand imposed loads for sustained pumping at maximum duty points. Minimum ISO L_{10} bearing life to be 100,000 hours.
Impeller Wear Plate	ASTM A-48, Class 35B grey cast iron or ASTM A-532 (Alloy III A) 25% chrome cast iron	Shall be fully adjustable and replaceable, fabricated of cast iron. Wear plate clearances shall have no relationship to the ability of the pump to achieve a prime. The front or inlet wear plate shall be a replaceable inert ring with a cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of (ASTM A-48, Class 35B grey cast iron or ASTM A-532 (Alloy III A) 25% chrome cast iron) and shall provide effective sealing between the multi-vane semi-open impeller and the volute.
Pump Gasket	Fiber and/or Teflon	
Pump Shaft	1.5% chromium alloy	Impeller shafts shall be fabricated of 1.5% chromium alloy.
Exposed Nuts and Bolts	Stainless Steel	SAE Type 316
Steel Fabrications	Steel	ASTM A36
Fasteners, Bolts, Cap screws, Anchor Bolts, Nuts, Washers and all External Hardware	Stainless Steel	SAE Type 304 or Type 316
Nameplates	Stainless Steel	SAE Type 316 permanently attached to pump frame and motor frame with information impressed, engraved or embossed into plate
		Show Manufacturer's name, model and serial number, year of manufacture, rpm, horsepower, impeller diameter, capacity, head rating and NPSHR

H. The following product design criteria, options and accessories are required for pumps:

ITEM	DESCRIPTION				
Pump Design Criteria		Q (gpm)	TDH (ft)	PUMP EFFICIENCY η	HP drawn at operating point
	Shutoff	0	125	n/a	n/a
	A	900	72	66%	30HP
	B (BEP)	1,174	70	62%	34HP
	C	1,350	50	48%	37HP
	Notes:		See Model NC150M, size 8"x8" 10.8" impeller		
	Net Positive Suction Head Available NPSHA		14 ft		
	Specific Speed		2200 RPM		

ITEM	DESCRIPTION	
	Suction Lift	25 feet at sea level
	Pump Speed	2200 RPM with variable speed engine
	Maximum Solid Size	1.5" passing sphere
	Suction Size	8-inches
	Discharge Size	8-inches
	Maximum Sound Power Level, Lw	100 dBA
	Maximum Sound Pressure Level at 3'	90 dBA
Impeller	Design	Dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design.
	Mount so as to minimize contact between solids and impeller. Impeller shall maintain full diameter back shroud regardless of impeller trim. Impellers shall be locked to the shaft, held by an impeller stainless steel bolt, stainless steel washer and stainless steel key and be coated with alkyd resin primer. Do not use lock collets or slip type shaft over motor shaft to connect impeller to motor shaft. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw.	
Pump Bearings	Prelubricated at factory Bearings shall be locked to prevent shaft movement and to withstand high thrust loads.	
	Bearing Life	ANSI/ABMA 9 L_{10} of 100,000 hours. Bearings shall be fitted with a bearing bracket to contain the shaft and bearings. Bearings shall be tapered roller bearings of adequate size to withstand imposed loads for sustained pumping at maximum duty points.
Pump Seals	Type	Mechanical Seals. Seal shall be high pressure, mechanical self-adjusting type with silicon carbide faces capable of withstanding vacuum of 26" hg and suction pressures to 87 psi. The mechanical seal shall be cooled and lubricated in an oil bath reservoir, requiring no maintenance or adjustment. Pump shall be capable of running dry, with no damage, for periods up to twenty-four hours. All metal parts shall be of stainless steel. Elastomers shall be Viton.
Static and Dynamic Balance	Required for all rotating elements after motor has been mounted on pump for shipping. Mass and rotating moment of inertia shall be such that resonant harmonics do not occur within normal operating speed range.	
	Ratio of Relative Speed to Critical Speed	Less than 0.8 or more than 1.3 for pumping unit and all components
Wear plates	Shall be fully adjustable and replaceable. Wear plate clearances shall have no relationship to the ability of the pump to achieve a prime. The front or inlet wear plate shall be a replaceable inert ring with a cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. Insert Ring shall provide effective sealing between the multi-vane semi-open impeller and the volute.	

ITEM	DESCRIPTION	
Check Valve	Description	Pump shall be supplied with an integral ball-type check valve mounted on the discharge of the pump, allowing unrestricted flow from the impeller. The check valve shall prevent in-line return of flow when the pump is shut off. Non-return valve elastomers shall be Nitrile rubber and shall be field replaceable.
Guards	Guard Plates	Provide hinged or bolted plates over exposed couplings, drives and shafts in compliance with requirements of California Department of Industrial Relations, Division of Safety
Fully Automatic Trickle Charger	Desctiption	fully automatic trickle charger powered by 6-amps, 115 VAC
Engine Block / Coolant Heater	Description	The drive unit shall be supplier with an integral thermostatically controlled engine block heater (15-amp, 115 VAC required)

I. Priming System: Pump shall be fitted with a fully automatic priming system incorporating a twin-cylinder compressor and air ejector assembly. The compressor shall be installed on the engine auxiliary drive and shall be gear driven, lubricated and cooled from the engine. The priming system shall require no fail-safe protection float gear or any adjusting at high or low suction lifts. Pumps with self-priming chambers modified with vacuum priming systems shall not be accepted as equal. The pump must be capable of running totally dry for periods up to 24 hours, then re-priming and returning to normal pumping volumes. Pump and priming system is capable of priming the pump from a completely dry pump casing. The pump shall be capable of static suction lifts to 28 vertical feet, at sea level. It shall also be capable of operation using extended suction lines. Equipment acceptance shall be contingent upon the pump's ability to run continuously at full speed in a completely dry condition. The engineer may require a demonstration.

J. The following electrical design criteria are required for electrical equipment specified in this section:

ITEM	DESCRIPTION	
Enclosure		Lockable With powder coat epoxy finish on steel surfaces
Control Panel Mounting	Local Mount	See Subsection 2.3
Floats	Description	The unit shall be supplied with one (1) float assembly including two (2) N/O floats which shall integrate with the engine control panel via a single multi-pin plug
Level Transducer	Description	See Appendix C

K. Drive Unit: The drive unit shall be a diesel water-cooled engine. The engine shall drive the pump by use of direct-connected intermediate drive plate. Starter shall be twelve-volt electric. Low oil pressure safety shutdown, high temperature shutdown, tachometer, and hour-meter shall be integrated into engine control panel. Battery shall have 180-amp hour rating. Drive unit shall be a John Deere 4045T290 Interim Tier 4 or equal, rated at 74HP (continuous) at 2400RPM and labeled as an Emergency Standby Engine. A certified continuous-duty engine curve shall be supplied to the owner/engineer. Drive Unit shall be supplier with an integral engine coolant heater (9-amp, 115VAC required) hard-wired to the junction box within the enclosure.

L. Governor: Governor shall be a mechanical type. Engine speed shall be adjustable to operate the pump between maximum and minimum design operation speeds in manual mode. See section 2.3 for Automatic mode.

M. Fuel Storage: Integral skid fuel tank capacity shall be sufficient to provide at least twenty-four hours of operating time at full load. The engine shall be capable of operating satisfactorily on a commercial grade of distilled No. 2 fuel oil.

N. Exhaust: Exhaust system shall include a critical grade muffler housed in a separate chamber within the enclosure. All exhaust piping and manifolds shall be encased in fitted acoustic blankets. They shall be constructed of high-density fiberglass material with waterproof jacketing.

O. UL Listed Skid Base:

1. The pump base tank shall be a UL-142 approved double wall design constructed in accordance with Flammable and Combustible Liquids Code, NFPA 30; The Standard for Installation and use of Stationary Combustible Engine and Gas Turbines, NFPA 37; and The Standard for Emergency and Standby Power Systems, NFPA 110.

2. The tank design shall be a Closed Top Dike Pump Base Tank. It shall be of double wall construction having a primary tank to contain the diesel fuel, held within another tank or dike, which is intended to collect and contain any accidental leakage from the primary fuel tank. The completed base tank assembly is to incorporate pump mounting locations and must be able to support four times the rated load.

3. The primary tank shall be designed to withstand normal and emergency internal pressures and external loads. It shall be capable of withstanding internal air pressures of 3 to 5 psig without showing signs of excessive or permanent distortion and 25 psig hydrostatic pressure without evidence of rupture or leakage.

4. The primary and secondary tanks or dike shall have venting provisions to prevent the development of vacuum or pressure capable of distorting them as a result of the atmospheric temperature changes or while emptying or filling. The vent shall also permit the relief of internal pressures caused by exposure to fires. The vent size shall be determined by using the calculated wetted surface area in square feet (the top is excluded) in conjunction with venting capacity table 10.1of UL-142. The tank's vent shall also be equipped with a coupling device and shall be located to facilitate connection to a vent piping system. The dike's vent may be an opening for venting directly to the atmosphere and protection from the entrance of natural elements or debris shall be provided.

5. The primary tank is to be constructed of 7 gauge ASTM A569 or A-36 hot rolled steel. Internal baffles or reinforcement plates shall be located on a maximum of 24 inch centers in tanks up to 60 inch width and on a maximum of 19.5 inch centers in tanks over 60 inch width. At least one baffle shall separate the fuel suction pipe from the fuel return line.

6. The outer tank is to be constructed in a manner to be able to support four times the wet load of the pump and housing. All of the load is to be carried by the outer tank so no load or vibration stress is placed on the primary tank. If the pump base tank is wider than the pump set to be supported, structural rails are to be incorporated to span the width of the base tank so that the load is transferred to

the side rails of the tank. Vertical reinforcements shall be welded to the outer sides of the secondary tank or dike at a maximum of 45 inch centers on tanks up to 30 inches high and on 24 inch centers on tanks greater than 30 inches high. At least one vertical reinforcement shall be positioned adjacent to each mounting hole location.

7. Both primary and secondary tanks shall be fitted with the proper welded pipe fittings to accommodate the requirements for the fill port and normal and emergency venting.

8. The completed assembly is to be cleaned with a heated pressure wash followed by a chromium free post treatment to ensure proper paint adhesion. The tank assembly is to be painted with an epoxy ester primer and high quality polyurethane enamel with total paint thickness of 3.5 mils. The painted tank assembly is to be baked at 180 degrees for 30 minutes to provide a hard durable finish.

9. Manufacturing and testing of this system shall be performed within the scope of Underwriters Laboratories, Inc. "Standard for Safety UL 142." A UL label shall be permanently attached to the tank system showing the following information:
   - The registered UL mark and the name: Underwriters Laboratories, Inc.
   - A control number and the word "listed"
   - The product's name as identified by Underwriters Laboratories Inc.
   - The serial number assigned by Underwriters Laboratories, Inc.
   - Other manufacturer's information may also be included.

2.3. Automatic Starting Control System

A. Control Panel shall be fully compatible with pumps furnished.

B. The engine shall be equipped with a factory installed PrimeGuard microprocessor-based controller as supplied by Godwin Pumps of America, Inc. and designed to start/stop the engine at a signal supplied by high and low level floats or a 4-20 mA transducer.

C. **ENGINE / PUMP CONTROL SPECIFICATIONS**
The engine shall be started, stopped, and controlled by a PrimeGuard2 high performance state of the art digital controller as supplied by Godwin Pumps of America, Inc. The controller shall be weather proof enclosed, and contain an external weatherproof 12-position keypad accessible without the need to remove or open any protective cover or enclosure. It shall be designed to start/stop the engine at a signal supplied by high and low level floats or a 4-20 mA transducer. The PrimeGuard2 controller shall provide the following functions without modification, factory recalibration, or change of chips or boards, by simply accessing the keypad.

1. The keypad shall be a capacitive touch sensing system. No mechanical switches will be acceptable. The keypad shall operate in extreme temperatures, with gloves, through ice, snow, mud, grease, etc. and maintain complete weather-tight sealing of the PrimeGuard controller.

2. In automatic mode, the unit shall conserve energy and go to "sleep".

3. The PrimeGuard controller shall function interchangeably from float switches, pressure switch, or transducer, as well as manual start/stop by selection at the keypad. No other equipment or hardware changes are required.

4. The PrimeGuard controller with integrated AutoThrottle shall be capable of varying the engine speed to maintain a constant level in a process without a change to the controller other than via the keypad.

5. The start function can be programmed to provide three separate functions each day for seven days (i.e. a start, warm up, exercise cycle on two separate days at different times and for a varying length of time all via the keypad).

6. Manual-Automatic Button:

    a. In Manual Mode, manual "Start" button starts engine and runs until "Stop" button is depressed or an emergency shutdown occurs.

    b. In Automatic Mode, start/stop sequencing is initiated by either two normally-open narrow angler float switches, pressure switch, transducer, or a signal from a digital input.

7. The controller shall integrate the engine safety shut-off for low and high oil temperature, and provide over-speed protection.

8. The controller shall include standard, field-adjustable parameters for engine cycle crank timer, shutdown time delay, warm-up time delay, and cool-down time delay.

9. The PrimeGuard controller shall have only one circuit board with eight built-in relays. Three (3) of the relays shall be programmable to output desired parameter on display and to be used as dry-contacts for communication with City/Municipality SCADA system, all via the keypad without changing relays, chips, printed circuits, or any hardware or software.

10. Standard components shall consist of (24) digital inputs, (7) analog inputs, (1) magnetic pick-up input, (8) 20-amp form "C" relays, (1) RS232 port, (1) RS485 port, (1) RS232/RS485 port, (1) J1939 port, and (1) 64X128 pixel full graphic LCD display with backlight.

11. The industrially-hardened PrimeGuard Controller shall withstand Vibration of 3 g, 3 axis, frequency swept 10-1000 Hz, in an operating temperature Range of 4° to 176°F (-20° to 80°C) and an operating humidity range of 0-95% Non-Condensing.

PART 3 - EXECUTION

3.1. Preparation

A. Make field measurements needed to install pump before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2. Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install pumps at location shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing, and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install pumps to tolerances recommended by Manufacturer. Unless otherwise shown, install pumps true, plumb, and level using precision gauges and levels.

3.3. Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pumps	6-hour field performance test to demonstrate compliance to Contract Documents and Manufacturer's printed literature	Conform to HI 14.6 to extent possible in field. Tests shall be witnessed by pump supplier's factory authorized representative who shall certify that installed pumping system complies with Contract Documents and Manufacturer's warranty requirements and that no drive equipment is overloaded.	1 six-hour test each pump	Contractor	Contractor
	Ragging	Field-installed pumps shall successfully pass 2 Clorox brand "Heavy Duty Reusable" Handi-Wipes, 2 Swiffer Sweeper X-Large cloth mop heads, and one standard mop head dropped into wet well without ragging impeller. Retrieve Handi-Wipes and other test items at manhole downstream and dispose of into dumpster.	3 tests each pump	Contractor	Contractor
	Passing Sphere	Field-installed pumps shall successfully pass similar spherical object of size specified.	2 tests each pump	Contractor	Contractor
	Installation, Noise, Odors, Heat and Leakage	Visual inspection of finished installation	1 inspection	Owner	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor
	35-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

B. Provide services of factory-authorized representative on-site to witness and inspect startup of pump operation, and certify the system has been properly furnished and is

ready for operation. Before startup, check all equipment for proper lubrication, alignment, rotation, freedom from excessive vibration. Factory-authorized representative shall notify Contractor and Owner of any irregularities of installation which might render Manufacturer's warrantee null and void.

C. Conduct field performance test in presence of Owner's Representative and Owner's personnel after at least 24 hours of field operation have occurred to burn in system.

D. In event field performance tests show excessive vibration or fail to demonstrate compliance with requirements of Contract Documents or certified curves furnished, Owner shall have right to either:

1. Decline acceptance of failing pumps and require Contractor to replace them

   or

2. Deduct agreed upon allowance for Owner's incremental cost of additional power from payment due Contractor.

3.4. Field Training Of Owner's Personnel

A. In addition to the above, provide services of pump Manufacturer's factory-authorized representative on-site for at least 8 man-hours (travel time excluded) to provide classroom instruction of Owner's personnel in proper recommended lubrication, operation and maintenance procedures as well as procedures for proper lockout out of each energy source.

B. The following handouts shall be provided by Manufacturer's factory-authorized representative to all attendees during classroom instruction:

1. Listing of any actions (or inactions) by Owner which would render Manufacturer's warranty null and void.

2. Written description of proper lubrication procedures.

3. Written list of all required scheduled maintenance including recommended service intervals to ensure warrantee remains valid and to ensure equipment remains functional.

4. Written description of procedures for lockout of each energy source.

3.5. Spare Parts

A. Furnish the following spare parts for each pump:

QUANTITY	PART
1	Mechanical seal
1	Pump impeller
2	Sets of all gaskets and o-rings
1	Duplicate nameplate for each pump and motor provided

END OF SECTION

SECTION 33 39 13
PRE-CAST CONCRETE MANHOLES

PART 1 - GENERAL

1.1 Work Included

A. This section includes materials, testing, and installation of pre-cast concrete manholes.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 31 23 00: Excavation and Fill
H. Section 03 20 00: Concrete Reinforcing
I. Section 03 30 00: Cast-in-Place Concrete
J. Section 04 05 00: Masonry Mortaring and Grouting
K. Section 05 56 00: Metal Castings
L. Section 07 92 00: Joint Sealants
M. Section 33 01 39: PVC Lining for Interior Concrete Surfaces

1.3 System Description

A. Furnish and install complete pre-cast concrete manholes including cast-in-place concrete bases, and appurtenant structural and mechanical mountings or connections required for compliance with Manufacturer's installation requirements and compliance with applicable building codes and standards.

B. Manhole dimensions shown on plans are interior dimensions.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Manhole	Watertightness	Visual inspection and leakage test	Once per manhole section	Contractor	Contractor

1.5 References

A. ASTM A48 Gray Iron Castings
B. ASTM A615 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
C. ASTM C478 Pre-cast Reinforced Concrete Manhole Sections
D. ASTM C143 Test Method for Slump of Hydraulic Cement Concrete
E. ASTM C478 (AASHTO M199) Precast Reinforced Concrete Manhole Sections

F. ASTM C923 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
G. ASTM D1248 Polyethylene Plastics Molding and Extrusion Materials
H. ASTM D4101 Polypropylene Injection and Extrusion Materials
A. California Construction Safety Orders Article 4, Section 1532, Confined Spaces

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per shop drawing requirements.
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation instruction requirements.
Certificate of Compliance	Submit coating and/or lining system and application certification per certificate of compliance requirements.
Test Record Transcripts	Submit for factory tests per test record transcript requirements.
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, certificates of compliance, and installation instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery storage and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of pre-cast concrete manholes shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant thereto.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Cast Iron (cont.)	U S Foundry and Manufacturing Corp	Medley, FL
	Accepted equal	
Polypropylene Manhole Steps	M A Industries, Inc.	Peachtree City, GA
	Parson Environmental	Reading, PA
	Accepted equal	

B. Acceptable manufacturers for manhole ring and joint sealing products include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Chimney Seal - External	Cretex Specialty Products	Waukesha, WI
	Accepted equal	
Chimney Seal - Internal	Cretex Specialty Products	Waukesha, WI
	Accepted equal	
Manhole Infiltration Dishes	Cretex Specialty Products	Waukesha, WI
	Parson Environmental	Reading, PA
	Pollard Water	New Hyde Park, NY
	Sealing Systems, Inc.	Loretto, MN
Manhole Lid Plugs and Sealing Gaskets	Cretex Specialty Products	Waukesha, WI
	Accepted equal	
Polypropylene Manhole Adjustment Ring	Cretex Specialty Products Pro-Ring	Waukesha, WI
	Accepted equal	
Wrap Collars	Cretex Specialty Products	Waukesha, WI
	Accepted equal	

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following is being conveyed:

FLUID	VISCOSITY (77°F)	SPECIFIC GRAVITY	TEMP	FREEZING POINT	BOILING POINT	VAPOR PRESS (77°F)	pH	SOLIDS CONTENT
Wastewater	0.894cP	1.01	33-90°F	32°F	212°F	0.46 psia	6.5-8.5	<1.0%

C. Pre-cast concrete manholes shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Pre-Cast Concrete Manhole Sections	Pre-Cast concrete	ASTM C478, class A concrete
	Steel Reinforcement	ASTM A615
Manhole Frames and Covers	Gray Cast Iron	See Section 05 60 00
Manhole Base	Cast-in-Place Concrete	See Section 03 30 00, class A2 (premium non-structural) concrete except slump shall not exceed 2" and aggregate shall not exceed ¾" Base shall extend at least 10" below bottom of lowest pipe and 6" above top of largest pipe.
Pipe Penetrations	Watertight Flexible Pipe Connector or Ring-Type Seal	Incorporate watertight flexible pipe connector or ring-type seal per ASTM C923 Precast manholes shall use either integrally cast embedded pipe connector, or boot-type connector installed in circular block-out opening per ASTM C 923. Connections to existing manholes shall use boot-type connector per ASTM C 923 installed in cored opening. Cast-in-place base shall incorporate ring-type seal on pipe to be embedded in concrete.
Manhole Frames and Covers	Gray Cast Iron	ASTM A48 Class 30 or 35 Design for H-20 highway wheel loading

ITEM	MATERIAL	SPECIFICATION
		Incorporate pick-hole for lifting purposes Castings with blisters, blowholes and shrinkage are not permitted. Clean all castings. Grind and finish cover to fit in frame without rocking.
	Coating	Dip twice in asphalt or coal tar and oil mixture at temperature between 290ºF and 310ºF to form firm and tenacious coating
Manhole Infiltration Inserts	High-Density Polyethylene	ASTM D1248, Type III, Class A, Category 5,
Insert Lift Strap	Woven Polypropylene Web	
Gasket	Neoprene Rubber	Closed Cell
Manhole Steps	Polypropylene with Grade 60 Steel Reinforcement	ASTM D4101
Joint Sealant	Mortar	One part Portland cement to 2 parts well-graded sand passing No. 8 sieve per Section 03 30 00.
	Plastic Sealing Compound	See Section 07 92 00

D. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Pre-Cast Concrete Manhole Sections	Minimum Diameter	48”
	Design Surcharge and Lateral Earth Pressure	AASHTO H-20 Loading
	Minimum 28-day Compressive Strength f'_c	4500 psi
	Steel Reinforcing Yield Strength f_y	60 ksi
Reinforcing of “Non-reinforced Manholes”	Cast minimum #4 wire hoops into each unit at adequate places as precautionary measure for handling	
Manhole Wall Section	Minimum nominal shell thickness shall be ⅛ x internal diameter of riser or largest cone section. Fabricate eccentric taper sections and standard cylinder units of proper internal diameter.	
Damp-Proofing	Water Level	Elevation 20.0 See Geotechnical Report
	Damp-proofing Requirement	Apply damp-proofing material to manhole exterior and as directed by Owner’s Representative on manholes with base at or below water table or where moisture or seepage is evident in trench.
Factory-Applied Lining	PVC Lining	See Section 33 01 39
Manhole Frames and Covers	Loading	AASHTO H-20 Loading
	Manhole Cover Marking	Cast the word “SEWER” into cover No other lettering on cover top is permitted
Manhole Infiltration Inserts	Minimum Dish Thickness	⅛”
	Lift Strap	Required
	Vent Hole or Valve	⅛” located on side of bowl
	Gasket	Minimum ½”-wide ⅛”-thick envelope type

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install pre-cast concrete manhole before submitting shop drawings or ordering. Many locations are fixed and cannot be moved to accommodate pipe manufacturing or laying. If necessary, special lengths shall be provided to meet manhole location requirements. If possible, make minor changes in dimensions, alignments, and locations as approved by Owner to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Refer to Section 31 23 00 for open trench requirements.

C. Furnish and install precast concrete manholes at locations shown on Plans and Submittals.

D. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations including confined space requirements

3. Applicable building code requirements

E. Refer variances between above documents and Contract Documents to Owner's Representative.

F. Install pre-cast concrete manholes to tolerances recommended by Manufacturer. Unless otherwise shown, install pre-cast concrete manholes true, plumb, and level using precision gauges and levels.

G. Do not undertake any Work inside an existing manhole that is part of a sewage system in service until all tests and safety provisions of Article 4, Section 1532 "Confined Spaces" State of California Construction Safety Orders have been made.

H. Core drill new connections through walls and base of existing manholes where stubs have not been provided.

I. Manhole base construction shall occur as follows:

1. Excavate area large enough to accommodate structure, permit grouting of opening, and accommodate backfilling and compaction.

2. Place manhole base concrete against undisturbed soil.

3. Locate and set manhole stubs and sewer main of sizes shown on Plans prior to placing base concrete. Invert elevations of connecting sewers may vary depending on pipe sizes. Set crown elevations of all pipes level with crown elevation of largest pipe unless otherwise indicated on Plans.

4. Set manhole stubs and sewer main before placing manhole base.

5. Recheck for alignment and grade before concrete hardens.

6. Extend manhole base minimum of 12” below bottom of lowest pipe.

7. Handwork invert to provide smooth and accurately-shaped channels conforming in size and shape to lower portions of inlets and outlets. Channels may be formed in base or may consist of half-sewer tile laid in base. Channel diameter shall not exceed outside pipe diameter.

8. Vary channel uniformly in size and shape from inlet to outlet. Construct channel higher than pipe as shown on Plans.

9. Construct all transitions smoothly and of proper radius to give uninterrupted transition of flow. Shape concrete base with wooden float and finish with hard-steel trowel prior to concrete setting.

10. Allow bases to set at least 24 hours before manhole construction is continued. In certain critical situations setting time may be reduced upon Owner’s Representative’s approval.

11. If additional mortar is required in manhole base after initial set has taken place, prime surface to receive mortar and mix mortar with concrete adhesive in amounts and proportions recommended by Manufacturer and as directed by Owner’s Representative to secure as chip-proof a result as possible.

J. Pipe stubs, stoppers and bulkheads shall be constructed as follows:

1. Furnish and install sewer pipe and stubs at locations shown on Plans.

2. Plug stubs five feet or less in length with stoppers.

3. Plug stubs from inside an active manhole prior to beginning new construction of sewer main from existing manhole. Plug shall remain in place until new Work has been completed and tested.

4. Seal inlet to existing tie-in manholes with plug to prevent accidental use of new sewer prior to completion and acceptance. Remove plug at time of final acceptance or as directed by Owner’s Representative.

5. Install brick and mortar bulkheads at upstream end of all unused stub channels over 5 feet in length to prevent creation of septic condition from ponding of sewage and debris in unused channels, until such time as stub is connected and normal sewage flow can occur.

K. Manhole wall sections, cones and grade rings shall be constructed as follows:

1. Do not set wall sections until inverts have been formed and finished, and bases have cured for specified time.

2. Set each manhole wall section, cone, or grade ring in a minimum ½” thick bed of mortar to make a watertight joint.

3. Set wall sections and cones perfectly plumb.

4. Neatly point mortar on inside of manhole

5. Use various heights of grade rings to bring top of manhole to finish grade as shown on Plans or as directed in field by Owner’s Representative.

6. Limit maximum height of grade rings to 18” unless otherwise directed by Owner’s Representative.

L. Apply joint sealants as follows:

1. Band joints inside and out when applying mortar mix

2. When groundwater is encountered or in “dry” conditions with Owner’s Representative’s permission, install pre-formed, cold-applied, ready-to-use plastic sealant uniformly along joint without allowing gaps in sealing compound “rope”.

M. Install select backfill around manholes consisting of clean sand and consolidate backfill to 95% relative density per Section 31 23 00 unless otherwise shown on Plans.

N. Apply manhole frames and covers as follows:

1. In existing pavement or traveled way of existing road shoulder, place flush with existing surface.

2. Outside limits of traveled shoulder, but not in roadside ditch, place 0.10’ above existing ground surface.

3. In existing roadside ditch or “offsite” easement, place approximately 18” above existing ground surface or as directed by Owner’s Representative.

4. If directed by Owner’s Representative, place manhole sections below finished grade in travelways and landscape areas so as not to interfere with construction, set permanent cover below grade to seal manhole, then after finish surfacing is completed, add grade rings to raise manhole cover to finish grade.

5. Secure frames to top pre-cast manhole shaft or grade ring with cement-mortar bed and fillet.

6. Install covers following all necessary cleaning and scraping of foreign materials from frames and covers to ensure satisfactory fit.

7. After final paving or grading, construct Class A concrete ring around manhole frames that are flush with surface as shown on Plans.

3.3 Field Quality Control

A. Manholes and appurtenances shall be watertight and free from infiltration.

B. Plug all inlets and outlets with acceptable stoppers or plugs and fill manhole with water to limits shown above. Repair all leakage to satisfaction of Owner’s Representative.

C. Stop any manhole leaks that may be observed, even if leakage is less than amount specified above.

D. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Ready-Mix	Slump	ASTM C143	1 minimum each batch	Owner	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Concrete					
Sewer Main and Stubs	Alignment and grade	Survey	1 test prior to placing concrete	Contractor	Contractor
Manhole Assembly	Installation & Leakage (may be tested in conjunction with sewer pipe tests or individually upon completion of manhole construction)	Visual inspection of finished installation and leakage test as follows: 1. Fill manhole with water to an elevation 1 foot below start of cone section (minimum depth of 4 feet and maximum of 20 feet). 2. Allow water to stand in manhole for 1 hour to allow manhole material to reach maximum absorption. 3. After one hour, refill manhole with water to original depth. 4. Record drop in water surface after 15-60 minutes, as directed by Owner's Representative. 5. Maximum allowable drop in water surface shall be ½" for each 15-minute test period.	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

END OF SECTION

SECTION 33 71 73
ELECTRIC UTILITY SERVICES

PART 1 GENERAL

1.1 Summary

A. Arrange and coordinate with Utility Company for permanent electric service, payment of Utility Company charges for service, service provisions and utility metering equipment.

1.2 Submittals

A. In accordance with Division 1 requirements.

B. Submit copy of service entrance equipment to Utility Company for their review and approval prior to purchase of the equipment.

1.3 Quality Assurance

A. Perform Work in accordance with Utility Company written requirements.

B. Maintain one copy of each document on site.

1.4 Field Measurements

A. Verify field measurements are as indicated.

1.5 Coordination

A. Coordination with Utility service representative - Mrs. Norma Chacon at (310) 315-3284, to disconnect, modify, extend and provide new 480/277-volt, 3-phase, 4-wire power service as indicated. Bid price shall include an allowance to pay for Utility Co. fees for modifying and providing power service to the service entrance switchboard and installing a new revenue meter. The Owner will reimburse the Contractor for actual service charges incurred and paid to Utility Co. upon receipt of proper documentation.

B. Contact the utility company for any charges related to the service installation. These charges shall be a part of the allowance referenced above.

PART 2 PRODUCTS

2.1 Service Description

A. Service Entrance:
   1. Contractor shall consult the local electric utility (Southern California Edison) regarding their service installation requirements, and shall furnish the service equipment in compliance with these requirements.
   2. Power service equipment to be furnished by Contractor shall include, but is not limited to, meter board, meter socket, disconnecting means, grounding materials, riser conduits, and other service entrance fittings required by the utility and for compliance with local codes and regulations.
   3. Contractor shall also provide trenching and backfill, conduits, concrete for duct banks, and other underground service entrance fittings required by the utility for underground service installation.

4. A weatherhead shall be provided on each service riser conduit.
5. As shown on the Drawings for the pump building, a Milbank Power Products combination meter and panelboard in a corrosion resistant, vandal resistant enclosure shall be furnished and installed to receive power from the utility. The service meter panel shall be rated for 480/277volts three phase power and shall include a 200A main circuit breaker. A meter safety socket with manual bypass shall be provided. Circuit breakers shall be rated 30,000 AIC minimum.
6. Underground service entrance to building service entrance equipment.

2.2 Utility Meters

A. Utility revenue meter will be furnished and installed by Utility Company.

2.3 Utility Meter Base

A. Utility revenue meter base rated for the service size requested. Meter may be 7 jaws or 13 jaws as requested by the Utility Co. Coordinate with Utility Co. prior to release of Switchboard procurement order.

PART 3 EXECUTION

3.1 Examination

A. In accordance with Division 1 requirements.

B. Verify that service equipment is ready to be connected and energized.

3.2 Installation

A. Install service entrance conduits from pull box to building service entrance equipment. Utility Company will provide service entrance conductors.

END OF SECTION

SECTION 40 67 16
CONTROL PANEL AND DEVICES

PART 1 GENERAL

1.1 Summary

A. Section includes control panels, power disconnects switches, level switches, flow meters, control devices, terminal blocks and plastic raceway.

1.2 Related Sections

A. Section 26 05 00: Common Work Results for Electrical

B. Section 26 05 19: Low Voltage Conductors and Cables

C. Section 26 05 33: Raceways and Boxes for Electrical Systems

1.3 References - Codes And Standards

A. NECA (National Electrical Contractors Association) Standard of Installation

B. NEMA ICS 1 (National Electrical Manufacturers Association) - Industrial Control and Systems: General Requirements.

C. NEMA ICS 2 (National Electrical Manufacturers Association) - Industrial Control Devices, Controllers and Assemblies.

D. NEMA ICS 4 (National Electrical Manufacturers Association) - Industrial Control and Systems: Terminal Blocks.

E. NEMA ICS 5 (National Electrical Manufacturers Association) - Industrial Control and Systems: Control Circuit and Pilot Devices.

F. NEMA ICS 6 (National Electrical Manufacturers Association) - Industrial Control and Systems: Enclosures.

1.4 System Description

A. Contractor shall provide and install all power and control devices (starters, circuit breakers, probes, sensor elements, transmitters, switches, power and control wiring, etc) as indicated on the drawings.

B. Contractor shall also provide all raceways, conduit, wiring, panel mounting framework and hardware, power circuits, and all appurtenances for monitoring, controlling and alarming of the various functions, for a complete operating system.

C. Contractor shall provide all raceways, conduits, and wiring between field devices, control panels, control switches, and Motor Control Center and terminate the control and instrumentation cables at each equipment and device.

1.5 Submittals

A. Shop Drawings: Comply with NEMA ICS 1 and submit control panel layouts, point-to-point wiring diagrams, interconnection wiring diagrams, dimensions, and support points, layout of completed assemblies, dimensions, weights, and external power requirements.

B. Schematics: Provide complete elementary and schematic wiring diagrams with wires and terminal block numbered for all control systems. Show all internal and external devices and equipment, control panel devices, etc., in detail on the elementary diagram with all terminal points of such devices and equipment indicated.

C. Product Data:
   1. Submit catalog data for each component being furnished showing control characteristics and connection requirements including supply voltage, frequency, electrical load, accuracy, and description of operation, operating instructions, and calibration procedure.
   2. For measuring instruments and devices, submit completed ISA S20 forms for each device including physical dimensions manufacturer's recommended upstream and downstream straight piping lengths, recommended location of any pressure taps and estimates of pressure losses through the device.

D. Installation Method: The proposed method of mounting sensors and instruments shall accompany all shop drawings.

E. Parts List: Submit a Parts List with current net prices and a list of recommended spares Test Reports: Indicate procedures and results for field calibration and functionality test results of each assembly and component.

F. Coordinate and identify all interconnection wiring between motor control panel, field devices, control panels and other devices. Identification tag designations for each wire shall match those shown on the wiring diagrams.

G. Factory Testing and Calibration: All measuring devices and meters shall be factory tested. Provide a certification of calibration from an independent test laboratory. Calibration curves based on factory and/or laboratory testing (see option below) shall be provided for the Engineer's review. Furnish calibration curves in units of output (inches or rpm / gpm) versus measured flow. Upon receipt of the Engineer's review, Contractor may release the meter(s) for shipment to the job site.
   1. As an option to laboratory testing each meter, the calibration curves of six (6) "like devices" may be substituted provided the calibration data is available from at least one identical device (pipe size, flow range, and type plus accessories such as extension registers).

H. O&M Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and spare parts lists.

I. Affidavits: Furnish affidavits from the manufacturers stating that the meters have been properly installed and tested and each is ready for full time operation.

1.6 Closeout Submittals

A. Project Record Documents: Include interconnection wire and cabling information.

B. Operation and Maintenance Date: Submit bound copies of O&M manuals for each device, including instructions for adjustments, calibration and preventative maintenance.

1.7 Qualifications

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.8 Seismic Protection

A. Seismic restraint for metering devices that are integral with the piping shall be as specified for the piping system in which they are installed.

1.9 Coordination

A. Coordinate work with installation of systems being controlled.

PART 2 PRODUCTS

2.1 Magnetic Flow Meters

A. Manufacturer: Meter and signal converters shall be as manufactured by:
   1. Fischer & Porter
   2. Krohne
   3. Or approved equal

B. General
   1. Magnetic meter(s) shall utilize the principle of electromagnetic induction to produce an output proportional to the rate of fluid flow.
   2. A set of pulsed DC, electrically powered coils shall generate a magnetic field, which in turn shall induce a voltage in the flowing fluid, which is sensed by a pair of electrodes in contact with the fluid.
   3. The coils shall be protected from contact with the fluid.

C. Construction.
   1. The electrodes shall be constructed of Type 316 stainless steel.
   2. The metering tube shall be lined with hard rubber.
   3. Meter shall be resistant to electrode coating.
   4. The electrode shall be designed to be inserted in water pipes and shall not be affected by solids, air bubbles, oil or coating.
   5. The electrode-wetted parts shall be of Type 316 stainless steel.

D. Housing. The meters shall be housed in a NEMA 4 enclosure rated IP 68 (suitable for continuous submerged under water duty).

E. Power Supply. The meters shall be designed to operate from a 120-volt, single phase, 60 Hz power supply. A 10 percent variation in power line voltage or frequency shall not affect the meter output accuracy in excess of 1 percent of full scale.

F. Conductivity. Magnetic flow meter shall be suitable for operation with fluids with conductivities as low as 5.0 micro-mho/cm.

G. Accuracy. Each magnetic flow meter system shall have accuracy within 1 percent of actual, for flow velocities between 10 percent and 100 percent of full scale. Meter shall have repeatability within 0.25 percent of full scale.

H. Signal Converter.
   1. Each magnetic flow meter shall be equipped with a signal converter (transmitter) to transmit an analog 4 - 20 milliamp dc signal proportional to the flow rate.
   2. The signal converter shall be microprocessor-based unit with keypad for calibration. Output span and zero shall be manually adjustable.
   3. Provide span adjustment capable of producing 100 percent strength analog signal at flow rates that are as low as 30 percent of maximum.
   4. Signal shall be linear with flow within the accuracy specified above. The converter shall be suitable for panel mounting.
   5. The signal converter shall have the capability of positive zero return for shutdown conditions.

I. Connection. The magnetic flow meters shall have flanged end connections. Field coils shall be either completely encapsulated in the meter lining material or a protective shield shall be provided suitable for withstanding the scouring velocities of the process fluid at the maximum flow rates.

J. Grounding. Provide a grounding circuit for each magnetic meter. Furnish and install grounding rings or protective shield when meter is installed in nonconductive line.

K. Special Tools: Furnish special tools that are necessary for the replacement of parts and the adjustment of the equipment.

2.2 Submersible Level Indicating Pressure Transducer / Sensor

A. Manufacturers:
   1. Dwyer PBLTX
   2. Or approved equal

B. Description: Hermetically sealed submersible level transducer using differential pressure to determine the depth of the liquid being measured. The signal is compensated for temperature variation.

C. Construction:
   1. Housing: Hermetically sealed 316 stainless steel housing.
   2. Diaphragm Seal: Large Diameter 316 SS.
   3. Transducer shall be suitable for Class I, Div. 1 (intrinsically safe) Group D, NEMA 4X.

D. Sensing Range: 0 psig to 20 psig.

E. Measurement Range: 0 percent through 100 percent level.

F. Measurement Accuracy: +/- 0.25 percent

G. Mounting:
   1. Hanging loop and chain as shown in drawings.
   2. Distance From Floor Surface: 3 inches.
   3. Connecting cable includes integral air tube for pressure compensation.

H. Signal Converter.
   1. Description: The signal converter shall be integral to the sensor.
   2. Temperature Compensation: Automatic.
   3. Device Output: 4-20 mA into a 0 to 900 ohm load, proportional to level.
   4. Supply Voltage: 10-28 VDC, Loop Powered Sensor/Converter

2.3 Float And Level Switches

A. Manufacturers:
   1. Anchor Scientific - Type S
   2. Flygt - ENM-10
   3. Or approved equal

B. Product Description:
   1. Liquid level sensing float-type switch, with restraint device to allow adjustment of contact elevation. Contact elevation shall be adjustable from 6 inches to 10 feet below mounting location.
   2. All wetted parts of float shall be constructed from stainless steel or similar non-corrodible material, hermetically sealed and suitable for Class I, Division 1 hazardous environment.
   3. Float control rod shall also be impervious to corrosion.
   4. Sensing unit housing must be acceptable for mounting in a Class I, Div. 1 hazardous location.
   5. Operate in environment temperatures from –15 to +250 degrees Fahrenheit (-25 to 120°C).
   6. Switching actuator shall use a magnetic couple, such that the electrical contacts have no physical contact with the actual floatation device.
   7. Output switch shall be of the mercury wetted contact type, capable of conducting a minimum of 5-Amp of current at 120-VAC.
   8. Switch contacts shall be form A or B, as required.

2.4 Pressure Transmitter

A. Manufacturer: Endress & Hauser, Foxboro Company IGP10-T, Rosemeount 3051C with LED readout or approved equal

B. Materials: Case SAE Type 316 Stainless Steel, Process-Wetted Materials ABS/SAE Type Stainless Steel, Display 8-digit 14-segment LED display in psi, Display Units psi, Digital Outputs 4 SPDT relay outputs rated for 5 Amp at 250 VAC, One Analog Output

C. Design Criteria: Calibrated Pressure Range 0-50 psi, Accuracy within Flow Range +/-0.5% of calibrated span (ASME B40.100 Grade 2A), Continuously adjustable span, Zero and damping adjustment required, Process connection ¼” NPT, Integral indicator

D. Electrical Design Criteria: Enclosures shall be rated for Class I Division II areas with NEMA 250 rating

2.5 Intrusion Detection

A. In accordance with the drawings.

2.6 Control Panel And Enclosures

A. Each control panel and/or enclosure shall shop fabricated, complete with selector switches, indicating lights, transmitters, power supplies, control devices, wiring, terminal blocks, plastic raceways, convenience receptacle, weep hole and condensation heater, for a complete operating system. The control panel assembly shall meet NFPA 70 – National Electrical Code requirements. Each control panel shall have the following features and devices to monitor and control the process system.
   1. Panel enclosure shall be weatherproof, corrosion resistant, NEMA 4X box, with continuous hinged 3-point latch, pad-lockable, front door to provide easy access to the internal panel door and devices. The control panel shall be suitable for floor, channel

and/or wall mounting as indicated on the drawings. Panel dimensions shall be a minimum of 24-inch wide, 24-inch deep, and 84-inch high unless otherwise indicated on the drawings.
2. Provide interior rear panel for mounting electrical components.
3. Provide inner-hinged door panel for mounting control devices, selector switches and cluster type LED indicating lights etc. Door shall swing open to provide access to rear panel. Inner door panel shall separate the wiring compartment from operator controls.
4. Provide adequate space for conduit entry, termination of control cable, device wiring and raceway.
5. Protective barrier shall be provides to prevent accidental contact with current carrying components (120-volt).
6. Each component shall be identified with suitable permanent plastic identification tags.
7. Panel shall have a metal protective pouch to hold wiring diagrams and process system information.
8. All other standard accessories and devices required for a fully functional system.

B. Control Sequence shall be as specified on the drawings.

C. Provide all necessary wiring and terminal blocks to connect the motor starter, auxiliary control devices; door mounted pilot devices, control relays, remote and/or field devices and accessories for a complete operating system.

2.7 Control Devices

A. Selector Switches and Push Buttons Switches shall be heavy-duty, oil tight, Allen-Bradley Bulletin 800H, Square D Class 9001 Type K, or acceptable equal. Each switch shall have a legend plate - "Hand-Off-Auto", “Local – Remote”, “Start – Stop”, etc. as required to describe the control mode or function.

B. Toggle switches shall be Honeywell Micro Switch Type TL or acceptable equal.

C. Status and Alarm Indicating Lights shall be cluster type Light Emitting Diode (LED) suitable for operation at 120-Volt AC control voltage (or as required). The LED color shall be coordinated with the alarm or indicated function.

Lens Color	Status and Alarm Condition Indication
Red	Equipment Energized - Motor Running, Valve Open or Circuit Breaker Closed. Alarm Indication – Abnormal Condition.
Green	Equipment De-Energized - Motor Stopped, Valve Closed, Circuit Breaker Open.
Amber	Equipment Control in “Auto” Mode. Controlled by Internal or External Control or Sensing Device(s).
Blue	Equipment Control in “Remote” Mode. Controlled from Remote Location – RTU or Remote Panel.
White	Power On Indication

2.8 Control Relays And Limit Switches

A. Manufacturers:
1. Allen-Bradley
2. General Electric Co.

3. Potter & Brumfield
4. Struthers-Dunn
5. Agastat
6. Tork
7. Or approved equal

B. Magnetic Relays
   1. Product Description: NEMA ICS 5, Class A300 magnetic control relay.
   2. Contacts: Form A or B (normally open / normally closed or both) as required.
   3. Contact Ratings: Class A150 or minimum 10 amperes continuous.
   4. Coil Voltage: 120-volts, 60 Hz or as required.
   5. Enclosure: NEMA ICS 6, Type 1 as required to meet conditions of installation.

C. Solid State Relays
   1. Product Description: NEMA ICS 5, solid-state electronic relay.
   2. Contacts: Form A or B (normally open / normally closed or both) as required.
   3. Contact Ratings: Class A150 or minimum 10 amperes continuous.
   4. Coil Voltage: 120-volts, 60 Hz or as required.
   5. Enclosure: NEMA ICS 6, Type 1 as required to meet conditions of installation.

D. Time Delay Relays (On-Time Delay and Off-Time Delay)
   1. Product Description: NEMA ICS 5, solid-state time delay relay – time delay after Energization or after De-Energization as specified or shown on drawings.
   2. Contacts: Form A or B (normally open / normally closed or both) as required.
   3. Contact Ratings: Class A150 or minimum 10 amperes continuous.
   4. Coil Voltage: 120-volts, 60 Hz. or as required.
   5. Enclosure: NEMA ICS 6, Type 1 as required to meet conditions of installation.

E. Plug-in Relays
   1. Product Description: NEMA ICS 5, miniature, hermetically sealed relay.
   2. Contacts: 4 pole double throw (4PDT) Form A or B (normally open / normally closed).
   3. Contact Ratings: Class A150 or minimum 5 amperes continuous.
   4. Coil Voltage: 120-volts, 60 Hz. or as required.
   5. Enclosure: Hermetically sealed, suitable for Class 1, Division 1 and 2 installations.
   6. Socket: To match relay and meet conditions of installation.

F. Limit Switch
   1. Product Description: NEMA ICS 5, heavy-duty, lever-operated limit switch.
   2. Contacts: Form A or B (normally open / normally closed or both) as required.
   3. Contact Ratings: Class A150 or minimum 10 amperes continuous.
   4. Enclosure: NEMA ICS 6, Type 1 as required meeting conditions of installation.

2.9 Uninterruptible Power Supply

A. General
   1. The UPS system shall be designed to protect the RTU, instruments, and telemetry system from line disturbance, subcycle power losses, and power outages. In normal operation the UPS shall supply filtered and regulated ac power to the load. Upon failure of the commercial ac power, the critical load shall continue to be supplied by the inverter, which shall obtain its power from the battery.
   2. The interruption to the critical load upon failure or restoration of the commercial ac source shall not exceed 4 milliseconds. Upon restoration of the commercial source, the inverter/charger shall recharge the battery.
   3. A manually operated switch shall be provided to transfer the load to the bypass line with a safety interlock to prevent the load from being transferred back during servicing.

B. Uninterruptible Power Supply (UPS)
   1. The UPS shall be complete with power indication, common alarm dry contact, running status dry contact and inverter circuit breaker protection.
   2. External batteries shall be sealed leak proof and maintenance free, and mounted adjacent to the UPS main unit.
   3. The UPS unit shall be mounted in a freestanding cabinet provided by the contractor.
   4. The UPS system shall meet the following requirements:
      a. Input/output voltage :120 volts ac, single phase, 60 Hz
      b. Minimum output rating: 1.15KVA
      c. Output Harmonic Distortion: 5 percent maximum at full load
      d. Frequency stability: +/- 0.5 percent
      e. Voltage regulation for line and load: +/-2 percent
      f. Overload capacity: 125 percent for 3 seconds
      g. Full recharge time: 48 hours
      h. Battery life time: 3 years at ambient temperature 45°C.
      i. Isolation/maintenance bypass switch

   5. The UPS system shall be capable of delivering power to the connected load for the minimum time of 24 hours

2.10 Terminal Blocks

A. Product Description: NEMA ICS 4 terminal blocks.
   1. A Power Terminal is defined as any terminal that is required to carry a current greater than 1 amp or a voltage in excess of 50-volts. Power terminals shall be of the unit construction type with closed back and tubular pressure screw connectors, rated 600 volts minimum, and with a continuous current carrying capacity of 15-amp minimum.
   2. A Signal and/or Control Terminal is defined as any terminal that is required to carry a current that may not exceed 1,000 mA instantaneous and a voltage that is not to exceed 50-volt instantaneous. Signal and/or control terminals may be of the modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300-volts minimum.
   3. Include ground bus terminal block, with each connector bonded to enclosure.
   4. Terminal connections shall be made using solid copper conductor. If stranded conductor is to be used, it must be terminated with a “spade” type lug. Stranded wire may not be directly landed on terminal blocks.
   5. A minimum of 20 percent spare terminal blocks shall be provided in each panel.

2.11 Plastic Raceway

A. Product Description: Non-metallic plastic channel with hinged or snap-on cover, suitable for branch circuit wiring, data, voice, video and other low voltage wiring.
   1. To be utilized only in dry interior of a control panel. The raceway and all system components must be UL listed and exhibit non-flammable self-extinguishing characteristics.
   2. Both raceway and cover shall be manufactured from rigid molded polyvinyl-chloride compound.
   3. Raceway splices shall incorporate overlapping joints so that enclosed cables are completely protected.

PART 3 EXECUTION

3.1 Installation

A. Install in accordance with NECA “Standard of Installation.”

B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 260500.

C. Install cabinet fronts plumb.

D. Install individual control devices and relays in enclosures.

E. Make electrical wiring interconnections.

F. Install engraved plastic nameplates in accordance with Section 260553.

G. Provide grounding and bonding of control panel and devices in accordance with Section 260526.

3.2 Adjusting

A. Each device shall be factory calibrated over its operating range.

B. Each device shall be field tested, adjusted and tuned to operate with the process loop. Field test results shall be recorded and submitted to the Owner for their records.

3.3 Field Testing

A. All flow devices shall be field tested against a secondary standard at the normal (or expected) process flow rates.

B. The Contractor may select, at his option, to either install a second flow device of known calibration in the line to verify flow device calibration or perform fluid capacity tests such as volumetric measurement per unit time.

C. All level and pressure instruments will be testing at expected operating ranges.

END OF SECTION

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SECTION 40 90 10
COMMON WORK RESULTS FOR INSTRUMENTATION AND CONTROL

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, installation, and configuration of instrumentation and Process Control System (PCS), including programmable logic control system and local operator interface.

B. Programming of the Central HMI system will be done by the City of Culver City.

C. The following definitions shall apply:

1. PCS Integrator:
   a. Contact: Tom Williams
      Company: US Cubed
      Telephone: 619-398-7799
      Email: Tom.Williams@uscubed.com

      Note: Contractor shall confirm PCS Integrator at the time of Bid and prior to Construction.

   b. The Contractor shall engage the PCS Integrator who will be responsible for integrating, configuring, testing and documenting, RTU, Local HMI, networks, devices connected to network, and instruments.

2. Central: For this Contract whenever term “Central” is used it means City of Culver City’s Water Utility Operations Center at 220 Daisy Street, Culver City, California

3. Virtual RTU I/O: RTU inputs and outputs that are read by RTU or written by RTU over network connection such as Modbus, or Ethernet, via a RTU communications port.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 42 13: Abbreviations and Acronyms
D. Section 01 61 00: Common Product Requirements
E. Section 01 63 00: Product Substitution Procedures
F. Section 01 65 00: Product Delivery Requirements
G. Section 01 66 00: Product Storage and Handling Requirements
H. Section 01 73 00: Execution
I. Section 01 78 39: Project Record Documents
J. Section 01 79 00: Demonstration and Training
K. Section 26 05 00: Common Work Results for Electrical
L. Section 40 67 16: Control Panel and Devices
M. Section 40 94 43: Programmable Remote Terminal Unit
N. Specification Appendix C: General Operations Summary

1.3 System Description

A. Furnish and install complete operating instrumentation and process control system including appurtenant structural, mechanical and/or electrical mountings or connections required for

compliance with Manufacturer's installation requirements and applicable building codes and standards.

B. Where Contract Documents designate control systems, components and elements schematically, these are designated by numbers following Instrument Society of America (ISA) Standards. Nomenclature and numbers designated on Contact Documents shall be used exclusively throughout shop drawings, data sheets, and like. Any other symbols, designations, and nomenclature unique to a manufacturer' standard methods shall not replace those shown on Contract Documents.

C. Attach stainless-steel tags to instruments at factory. Permanently mark stainless-steel tag with instrument tag number. Manufacturer's standard metal nameplate, as a minimum, shall denote model number, serial number, operating electrical voltage and amperage (when applicable), and date of manufacture.

D. Power provided for instrument system shall be as indicated in the drawings.

E. Provide battery backup / UPS system for all components in Main Control Panel, and for instruments and network devices on project. See Section 40 67 16 for requirements and capacity of UPS.

F. Where DC power supplies are not furnished integral with any one instrument system loop, provide separate solid-state power supplies.

G. All display instruments of each type shall have same outward appearance, same size and shape and same size and style of numbers and pointers.

H. PCS subcontractor shall be responsible for software configuration and integration of following as a minimum, to meet these specifications:

1. Motorola ACE Programmable Remote Terminal Unit (RTU).

2. Local HMI on Main Control Panel.

3. Ethernet and Modbus communications networks and network devices.

4. Variable frequency drives (VFDs) and solid state starters.

5. Single loop level controller and PID controllers configured in RTU.

6. Other microprocessor based devices provided as part of this project.

I. Integrator shall configure PCS system so:

1. Operator setpoints and pump duties can be set and changed by an Operator at Local Station HMI. Local HMI shall be configured for both monitoring and control. RTU shall accept most recent Operator set value/instructions entered from local HMI. RTU shall update HMI so it always displays current operational values and setpoints.

2. Access to local HMI for all functions except viewing, shall be password protected.

3. If communications with Central is lost, station shall maintain automatic operation, using last entered operator setpoints. Functionality of Local HMI shall be unaffected by this loss of communications.

J. PCS Integrator shall attend 3-hour workshop no later than 3 weeks after Notice to Proceed, to review PCS specifications requirements, and discuss PCS integrators proposed architecture. PCS Integrator shall present a draft systems architecture at workshop. Purpose of workshop shall be to clarify requirements for PCS and discuss initial approach proposed by PCS integrator. The following topics will be covered:

1. Review of PCS requirements and goals. Led by Owner.

2. Presentation of PCS Integrator's approach. Led by PCS Integrator.

3. Review and discussion of submittal and testing requirements. Led by Owner.

K. Owner will prepare workshop minutes.

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Contractor shall employ experienced and well-qualified PCS Integrator for design and software configuration of RTU, local Operator Interface, and network. All systems shall be unit responsibility of one system supplier for all PCS hardware. Programmable logic control system installation, and wiring connections to peripheral equipment and instruments shall be responsibility of PCS Integrator using qualified personnel possessing necessary equipment and having experience with similar installations.

C. PCS Integrator shall be one of pre-qualified Integrators listed below:

D. PCS Integrator shall furnish and be responsible for the following for PCS:

1. Instrumentation and calibration

2. Programmable logic control system and local HMI

3. PCS Control panel.

4. Spare parts.

5. Special tools and test equipment required by supplier.

6. Installation, integration, configuration and testing.

7. Documentation and PCS submittals

8. Test procedures and testing

9. Operator training.

10. Warranty.

11. Shipping and receiving.

E. All calibration and final checkout of instrumentation and programmable logic control system shall be witnessed by Owner's Representative to verify system complies with Contract

Documents. Instrumentation calibration by Contractor shall include both new and existing instruments, PCS equipment, and devices that are part of system.

F. Coordinate and interface with equipment supplied under these Contract Documents which are an integral part of system. Interfacing shall be incorporated in detailed systems drawings and data section of Contract Documents.

G. System supplier shall provide RTU programs as required by Contract Documents. Descriptions of system operation and RTU functions are provided in Appendix C and Contract drawings, to help Contractor understand complete system and its operation.

H. PCS Integrator shall:

1. Provide RTU and HMI system whose input and output configuration complies with requirements of Contract Documents.

2. Notify Owner of any changes to input/output configurations described by Contract Documents at time of submittal of shop drawings.

3. Continue to notify Owner after submittal review immediately of any RTU input/output changes which impact configuration as defined in Contract Documents.

4. Allow 40 hours of on-site programming changes per Owner's direction. These changes will reflect system control adjustments necessary to fine tune overall control strategy. This effort shall be responsive within 3 days' notice from Owner. This requirement shall be in effect for one year from date of final acceptance at no additional cost to Owner.

I. Perform comprehensive test of Control System to demonstrate system performs as integrated unit to meet requirements of this specification.

J. Conduct all element, subsystem, and system tests necessary to ensure proper operation of control system at various stages of system development.

K. Factory testing shall be conducted at factory where panels are built. If factory is more than 250 miles from jobsite, Contractor shall pay lodging and travel expenses for up to 3 personnel from Owner's and/or Design Engineer's offices.

L. Complete documented un-witnessed factory demonstration test prior to witnessed test. Make documentation of unwitnessed test available for inspection prior to start of witnessed test.

M. Factory testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Control System	Factory Demonstration Test (FDT)	Verify equipment and software is manufactured, assembled and configured correctly, is operating as designed, and complies with contractual requirements. Perform test with power applied to all equipment. Equipment includes: • Completed panels with RTU and communications equipment installed and operational. • RTU software installed, configured, functional and pre-tested.	1 test per control panel	Contractor (Includes lodging and travel expenses for up to 3 personnel from Owner's and/or Design Engineer's	Contractor (Includes lodging and travel expenses for up to 3 personnel from Owner's and/or Design Engineer's

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
		• Local Panel HMI software configured, functional and pre-tested. Organize test procedures to check all functionality required by Contract Documents. Minimum procedures and documentation shall include: • Name and date of Test. • List of documentation available during testing. • List of panels to be tested and test equipment to be used to perform test. • RTU analog I/O calibration sheets. • Calibration of all discrete devices such as trip points. • Verifying functionality of all control strategies, organized on loop-by-loop basis. Verify all strategies in all available modes. Inspections checks shall include: • I/O Subsystem physical layout. • Power supply mounting and power cable routing. • Data cable routing. • Protection of wiring runs across hinges. • Panel cooling. • Power supply and power conditioning correctly installed. • Wire numbering and color coding. • Device labeling. • Enclosure and paintwork integrity. • Adequate spare panel space provided. • Fusing adequate. Functional test: Exercise every specified system function including: • Verifying proper scanning and data acquisition of all status and data points. • Verifiying proper up/down loading of programs to RTUs. • Demonstrating analog input, pulse input, and analog output accuracy. Test accuracy at minimum of 0%, 20%, 50% and 100%. Test is passed if it input/output meets Manufacturer's published accuracy specifications. Check accuracy both at HMI screen and RTU register. • Verifying control strategies by simulating RTU inputs at panel field terminals and entering Operator commands at Local HMI touch screen. Check resulting RTU outputs, condition of control relays and status of local HMI screen displays. • Simulating communication error		offices.)	offices.)

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
		conditions and demonstrating proper error detection, handling and alarming.			

1.5 References

A. ANSI B31.3 Process Piping Guide
B. California Building Code (CBC)
C. California Electrical Code (CEC)
D. California Fire Code (CFC)
E. Instrumentation Society of America (ISA) standards
F. ISA S5.3 Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems
G. ISA S5.4 Instrument Loop Diagrams
H. Joint Industrial Council standards for control logic
I. NEMA/ANSI 250 Enclosures for Electrical Equipment
J. NFPA 70 National Electric Code (NEC)
K. Underwriter's Laboratories (UL) Standards.

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Record Drawings	Submit per Section 01 78 39 and as described below, including hard copies and Microstation CAD files on labeled CD. Submit record drawing equipment configuration sheets for all equipment with user configurable parameters, includeing VFD's SST's controllers and network devices. Submit fully annotated RTU ladder logic diagrams.
Shop Drawings - General	Required for instrumentation and control system under electrically controlled equipment shop drawing requirements. Include block diagrams, panel schematics, scaled panel general arrangement drawings, loop diagrams, and installation details.
	For all drawings provide borders, title block, revision date, Contractor's name, Owner's names, and cross references to related drawings. In drawing revision block identify changes made since last revision.
	Prepare drawings using latest version of MicroStation. Submit hardcopy and MicroStation and PDF electronic files on labeled CD
	Size hardcopy drawings 22 inch by 34 inch, except loop drawings. Size loop drawings 11 inch by 17 inch.
Shop Drawings – Block Diagrams	Block diagrams shall show major subsystems and interrelationships between them to provide overview of complete facility PCS system.
Shop Drawings – Bill of Material	Include complete detailed bills of material.
Shop Drawings – Panel Fabrication and Layout Drawings	Panel Fabrication and Layout Drawings shall show placement, labeling and wiring of components within panels, cabinets and consoles. Include: • Front, back, and side panel elevations with dimensions. • Bill of materials with device tag, English description, manufacturer, model, and quantities. • Sufficient detail to demonstrate material choices, outward appearance, construction methods, and seismic force resistance. • Neutral and earth bars where applicable. • Panel ventilation, heating and cooling systems. • Paint color and dry film thickness. • Conduit entry points. • Draw panel to minimum scale of 1" to 1'. • Show all additions and deletions of devices and wires in existing enclosures.

SUBMITTAL	DESCRIPTION
	• Provide panduits within panel for organizing wire bundles, with at least 20% spare wire capacity. • Provide separate panduits for low voltage DC signal wires. Arrange panel to provide maximum spare panel space to accommodate mounting future equipment. Provide at least 20% spare panel mounting area.
	Owner has right to make modifications to interior and exterior layouts of panels as part of shop drawing review. Provide in bid price at least one panel redesign for incorporating requested Owner modifications.
Shop Drawings – Panel Schematics	Schematic wiring diagrams for each panel, showing all panel devices and wiring internal to panel
Shop Drawings Enclosures	Arrangement and construction drawings for consoles, control panels, and other enclosed assemblies for field installation. Drawings shall include dimensions, identification of all components, preparation and finish data, nameplates, and like. Drawings shall also include enough sufficient detail to define style and overall assembly appearance of assembly. Include finish color sample. Drawings shall include electrical drawings as required by Section 26 05 10.
Shop Drawings – Interconnection Diagrams	Panel interconnection diagrams. Loop diagrams are not acceptable as substitute for connection diagrams. • Show external wiring between terminals of associated equipment, control panels, motor control centers, terminal boxes, field instruments, and any other device, panel, or enclosure. • Show wiring and cable numbers and device tags. Number wiring and cables in conformance with Owner's standards. • Reference related drawings by drawing number.
	Component interconnection drawings showing interconnecting wiring between each component, including equipment supplied under other sections requiring interfacing with control system.
Shop Drawings – Loop Diagrams	Provide loop diagrams for all control and monitoring loops. • Submit loop diagrams to ISA level 3 detail. One loop per sheet, in 11" x 17" format. Show both discrete and analog devices and signals. • Do not combine multiple loops on one drawing • Show all field wiring, field junction boxes, instruments, cabinet terminals and associated RTU inputs/outputs, to level of detail shown on example drawing. • Reference related drawings by drawing number.
Shop Drawings – Ladder Diagrams	Provide fully annotated RTU ladder logic diagrams.
Catalog Data	Required per catalog data requirements for all items, including RTU's, instruments, cabinets, mechanical devices, mounting components, wiring, terminal strips, connectors, accessories, and spare parts. Include catalog cuts, data sheets, performance surveys, test reports, equipment lists, materials list, diagrams, pictures, and descriptive material annotated to clearly show which products, options, sizes, and speeds are proposed as described in Section 01 33 00.
Installation Instructions	Required per installation or application instruction requirements. Include installation, mounting and anchoring detail and entry detail for all components.
O & M Instructions	Required per operation and maintenance instruction requirements. Submit 6 copies of preliminary submittal prior to reliability acceptance test.
	Submit O&M manuals bound in hard-cover binders and arranged for convenient use, including tab sheets, all indexed and cross referenced.
	O&M manuals shall contain all information included in equipment submittals plus: • Updated control strategy narratives in English. • Complete set of record drawings as described above. • Equipment list • Instrument list • Record drawing versions of submittal drawings and equipment Manufacturers' shop drawings • Calibration and maintenance instructions. • Calibration sheets for all field instruments, including 4-20mA analog instruments, pressure, flow, level and temperature instrument switches, RTU analog inputs

SUBMITTAL	DESCRIPTION
	and outputs, and limit switches. • Programming instructions. • Trouble-shooting instructions • Manufacturers' user and installation manuals. • Manufacturer's data sheets • Manufacturer's drawings • Instructions for ordering replacement parts.
	Final O&M Submittal shall consist of 6 hardcopy sets plus 2 electronic sets on labeled CD's of detailed drawings and data prepared and organized by Contractor of record. Submit these drawings and data in complete package at one time, including: • Detailed JIC-style schematic diagrams of each discrete I/O point. • Detailed instrumentation diagrams of each analog I/O instrumentation and control loop, per ISA S5.3 and S5.4 standards. • Detailed RTU connection loop diagrams. • Data sheets for each component, together with technical product brochure or bulletin. Data sheets shall show component name, Manufacturer's model number, project tag number, project location, and input and output characteristics. • Group data sheets together in submittal by systems or loops as separate group for each system or loop. If within a single system or loop, a component is employed more than once, one data sheet with one brochure or bulletin may cover all identical uses of that component in that system.
System Demonstration Plan and Field Test Record Transcripts	Submit within 30 days following pre-construction meeting. Outline each test procedure proposed for final testing. Plan shall describe each system to be tested, test methods, test materials, test instruments and recorders, and results to be recorded. Include functional testing of each system. Procedures shall include demonstration of all instruments, set points, alarms, telemetry, software, safety interlocks and back-up modes of operation. Procedures shall incorporate start-up and demonstration procedures recommended by Manufacturers. Owner may modify proposed procedures as deemed necessary to demonstrate system operation.
	Submit the following documentation for use by Owner during witnessed testing: • Annotated printouts of RTU application programs developed by PCS sub-contractor. • Set of Manufacturers hardware and software manuals. • Copy of completed documentation from un-witnessed tests. • Set of approved test procedure documents, with space for sign-off/ comment by Owner. • Set of current shop drawings. • Hard copy of new HMI graphics developed by PCS sub-contractor for Local HMI. • Copy of RTU I/O list.
	Submit proposed field acceptance test methodology and record sheets for acceptance by Owner before beginning tests. Submit test plans for: • Factory Demonstration Test (FDT) • HMI Communications Test • HMI Demonstration Test • Radio Communications Test • Functional Acceptance Test (FAT) • Reliability Acceptance Test (RAT) Submit transcripts of final acceptance test record results, signed by Owner's Representative.
Warranty	Furnish three -year warranty from date of final acceptance.
	Contractor shall repair or replace defective components, rectify malfunctions, correct software problems (for any software supplied by Contractor), and correct faulty workmanship, all at no additional cost to Owner during warranty period. To fulfill this obligation, Contractor shall use technical service personnel designated by Contractor who were originally assigned project responsibility. Services shall be performed within 5 calendar days after notification by Owner's Representative.

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, O&M instructions, certificates of compliance, engineering calculations, Manufacturer's statements of responsibility, foundry or test record transcripts, and material samples.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of instrumentation and process controls shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following electrical design criteria are required for equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Nonhazardous Class I Division 1 (wet well)
Enclosures – Indoor Dry Locations	NEMA 250 Enclosure Rating	NEMA 12 – Industrial Use
Enclosures – Outdoor or Wet Locations	NEMA 250 Enclosure Rating	NEMA 4X – Watertight, Corrosion-Resistant, Stainless steel
Enclosures – Class 1 Division 1 Wet Well Locations	NEMA 250 Enclosure Rating	None
Other Enclosures	NEMA 250 Enclosure Rating	As shown on plans
All Enclosures	Construction	Lockable With powdercoat epoxy finish on steel surfaces
	IEC 60529 Enclosure Rating for Underground Equipment	IP68 Submergence rated for 72-hours at 20' of head

PART 3 - EXECUTION

3.1 Preparation

A. Examine areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of Work.

B. Provide and install new instruments where shown on Contract Documents.

C. Submit all calibration sheets to Owner for acceptance as required herein.

D. Where an instrument not supplied by Contractor, cannot be properly calibrated because of its condition or is judged by PCS Integrator to be unreliable, inform Owner in writing within

24 hours of failed calibration attempt or negative evaluation. Owner will direct Contractor on action to be taken.

3.2 Installation

A. Refer to Sections 01 73 00, 01 73 24, and 01 73 33 for basic execution and installation requirements.

B. Furnish and install instrumentation and process controls at or near locations shown on Plans and Submittals.

C. Plans show connections for typical equipment only. If equipment furnished differs from that shown, provide modifications necessary for safe and properly operating installation in accordance with equipment Manufacturer's recommendations.

D. Plans show diagrammatically desired location and arrangement of equipment. Field determine exact location based on physical size and arrangement of equipment, finished elevations, and obstructions.

E. Work or equipment not shown or specified but necessary for complete and proper operation of instrumentation and control systems shall be accomplished at no additional cost to Owner.

F. The following installation standards shall be followed:

1. Manufacturer’s installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Other applicable building, fire, plumbing, mechanical and electrical code requirements

G. Refer variances between above documents and Contract Documents to Owner’s Representative.

H. Install instrumentation and process controls to tolerances recommended by Manufacturer. Unless otherwise shown, install instrumentation and process controls true, plumb, and level using precision gauges and levels.

I. Mount equipment such that it is rigidly supported in accordance with submitted installation instructions. Mount in such manner as to provide accessibility; protection from damage; isolation from heat, shock, and vibration; and freedom from interference with other equipment, piping, and electrical work. Do not install consoles, cabinets, and panels until heavy construction work adjacent to computer and telemetry equipment has been completed to extent that there shall be no damage to equipment.

J. Locate devices, including accessories, where they are accessible from grade, except as shown otherwise.

K. Mount local equipment in cabinets or existing panels as specified. Mount associated I/O terminals on a common panel or rack; mounting panels and rack shall be baked enamel.

L. Provide cooling for all cabinets containing electronic equipment. Maintain temperatures inside cabinet to within recommended manufacturer’s limits for equipment mounted in cabinet, and not greater than 8 degrees C above ambient. Submit calculations to Owner for approval prior to manufacturing.

M. Coordinate installation of electrical service to components related to system to assure compatible and functionally correct system. Coordinate and supervise installation of all accessories.

N. Test complete system after installation to assure all components operate throughout specified ranges, and all interlocks function properly.

O. Provide analog signal repeaters if analog signal is required at multiple panels. Wire analog signal to primary panel location and provide repeater for each other panel.

3.3 Field Quality Control

A. Conduct tests and system demonstrations in field or at location of central SCADA equipment as appropriate.

B. Document tests on submitted and Owner-accepted forms. Documentation shall include space for Owner's sign-off and comments for each test subsection. List all deficiencies found. Provide comments as appropriate.

C. Field testing shall include the following:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Control System	Installation and Labeling	Visual inspection of finished installation	1 inspection	Owner	Owner
	Pretest	PCS Integrator shall pretest system following submitted and accepted PCS test procedures and remedy discovered problems prior to witnessed test.	1 test	Contractor	Contractor
	Startup and System Demonstration of Field Performance	Submitted and accepted PCS Test Procedures. Results shall be fully documented by PCS integrator with each test step witnessed and signed off by Owner's Representative.	1 inspection	Contractor	Contractor
		Submitted and accepted PCS Test Procedures. Results shall be fully documented by PCS integrator with each test step witnessed and signed off by Owner's Representative.	1 inspection	Contractor	Contractor
		Demonstrate compliance to Contract Documents and Manufacturers' printed Literature	1 test	Contractor	Contractor
	HMI Demonstration Test	Demonstrate HMI screen to the owners satisfaction.	1 test each installation	Contractor	Contractor
	On-Site Communications Demonstration Test Using Owner-Supplied Radio	Demonstrate full radio communications functionality.	1 test each installation	Contractor	Contractor
	Functional Acceptance Test (FAT)	Perform test on-site after installation is complete, all adjustments and calibrations done, and whole system is functional, ready for Owner's use. Test shall repeat FDT but use final field equipment and instruments, Central HMI, and radio communications to Central.	1 test each installation	Contractor	Contractor

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
		Inspection will include Test shall confirm installed system is functional and complies with Contract Document requirements including those for: • Intrusion detection system (doors and bypass switches).			
	Reliability Acceptance Test (RAT)	Perform test after FAT test has been acdepted by Owner and Work is performing under normal operating conditions to confirm systems supplied will operate reliably for extended period.	1 test each installation	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturers printed Literature	1 test	Owner	Contractor

D. Provide services of factory-authorized representative on-site for at least 3 man-days (travel time excluded) to provide:

1. Installation assistance, inspection and startup of complete instrumentation and process control system.

2. Field testing and adjustment.

3. Instruction of Owner's personnel in operation and maintenance.

E. The following training shall be provided:

1. Local HMI programming training: For 3 Owner maintenance staff.

2. Pump Station controls training: For Operator and maintenance staff.

F. Schedule all training courses Tuesday through Thursday between 8:00am and 3:30 PM.

1. Obtain approval from Owner for proposed training schedule.

2. Pump station controls training:

a. Provider: PCS Integrator.

b. Class length: Minimum of 4 hours and a maximum of 6 hours.

c. Audience: Owner operations and maintenance staff (up to 10 attendees).

d. Location: Part classroom (Utility Administration Building), part at Walnut Pump Station site.

e. Content:

1) Overview of new controls.

2) Control strategies

3) Communications

4) Local HMI screens

5) Control modes, control options and operation.

6) Power failure and recovery

f. Handouts: Provide attendee's with handout material which assist understanding of system.

END OF SECTION

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SECTION 40 91 19
PRESSURE INSTRUMENTS

PART 1 - GENERAL

1.1 Work Included

A. This section includes materials, testing, and installation of pressure instruments.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 01 73 24: Seismic Restraint
H. Section 09 90 00: Painting and Coating in South Coast Air Quality Management District
I. Section 09 96 56: Epoxy Linings and Coatings
J. Section 26 05 00: Common Work Results for Electrical
K. Section 33 05 31: Pipeline Joint Materials
L. Section 40 90 10: Common Work Results for Instrumentation and Control

1.3 System Description

A. Furnish and install complete operating pressure instrumentation to provide continuous pressure monitoring where shown, including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with Manufacturer's installation requirements and applicable standards.

B. Pressure meter instrument output variables shall include:

ITEM	VARIABLE	DESCRIPTION
Output signals (Analog)	Pressure	4-20mA signal
Output signals (Discrete)	PressureAlarm	High Pressure / Low Pressure Cutout per CPC 609.8 set for 10 psi or greater

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

B. Pressure instrumentation shall be UL listed.

1.5 References

A. ASME/ANSI B16.5 Steel Pipe Flanges and Flanged Fittings (Including ratings for Class 150, 300, 400, 600, 900, 1500, and 2500)
B. ASME/ANSI B40.100 Pressure Gauges and Attachments
C. California Plumbing Code (CPC)
D. NEMA/ANSI 250 Enclosures for Electrical Equipment
E. NFPA 70 National Electric Code
F. NSF/ANSI 61 Drinking Water System Components – Health Effects

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required per equipment shop drawing requirements
	Required for pressure instruments under electrically controlled equipment shop drawing requirements
Catalog Data	Required per catalog data requirements
Installation Instructions	Required per installation instruction requirements
O & M Instructions	Required per operation and maintenance Instruction requirements
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions, and O&M instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of Pressure Instruments shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for stem-mount pressure gauges include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Pressure Gauges – Stem-Mounted Bourdon Tube Type	Ashcroft Series B461B	Stratford, CT
	Global Water PG200	Gold Hill, CA
	Marshall Instruments Inc. (Mastergauge)	Anaheim, CA
	United Electric	
	U.S. Gauge Company (Ametek)	Sellersville, PA
	Wika Instrument Corporation Div Ryan Herco	Lawrenceville, GA
	Accepted Equal	
Pressure Gauge – Stem-Mounted Digital Readout type	Ashcroft 2080 Series	Stratford, CT
	Foxboro IGP10 Series	Foxboro, MA
	Global Water PG300	Gold Hill, CA
	Accepted Equal	

B. Acceptable Manufacturers for stem-mount pressure/vacuum gauges include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Pressure/Vacuum Gauges – Stem-Mounted Bourdon Tube Type	Ashcroft	Stratford, CT
	Accepted Equal	

C. Acceptable Manufacturers for flanged in-line sleeve-style pressure sensor/transmitters include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Pressure Sensor/Transmitters and Gauges – Flanged in-line Sensor Sleeve Style	Cla-Val Company CVPS	Newport Beach, CA
	Onyx Valve	Cinnamonson, NJ
	Red Valve Company (Series 40)	Pittsburgh, PA
	Accepted Equal	

D. Acceptable Manufacturers for pressure sensor/transmitters include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Pressure Sensor/Transmitter Strain-Gauge Type	Endress & Hauser	Greenwood IN
	Foxboro Company IGP10-T	Foxboro, MA
	Rosemount Div Emerson Process Management Model 3051C with LED readout	Chanhassen, MN
	Accepted Equal	

E. Acceptable Manufacturers for pressure switches include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Pressure Switches	Ashcroft Series B461B	Stratford, CT
	Barksdale Control Products Div Crane Co	Vernon, CA
	Plast-O-Matic	Cedar Grove, NJ
	SOR, Inc.	Lenexa, KS
	United Electric Series 400	
	Accepted Equal	

F. Pressure sensors, indicators, recorders, controllers, and transmitters where shown shall be manufactured by same Manufacturer as pressure sensing equipment and shall be fully compatible with equipment furnished.

2.2 Materials

A. Refer to Section 01 61 00 / 02 05 00 for basic requirements for products and materials.

B. Stem-mount pressure instruments shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Pressure Sensors	Case	SAE Type 316 Stainless Steel
		Dry Case
	Process-Wetted Metal Materials	SAE Type 316 Stainless Steel
Bourdon Tube Type Gauge	Case	SAE Type 316 Stainless Steel
	Process-Wetted Materials (Bourdon Tube)	SAE Type 316 Stainless Steel
	Window	Acrylic
	Sleeve	Pure Gum Rubber
	Fill Fluid	Halocarbon
Pressure/Vacuum Gauges	Case	SAE Type 316 Stainless Steel
	Process-Wetted Materials (Bourdon Tube)	SAE Type 316 Stainless Steel
	Window	Acrylic
	Sleeve	Pure Gum Rubber
	Fill Fluid	Halocarbon
Chemical Gauge Corrosion Guards	Case	PVC ASTM D1784 Cell Class 12454
	Diaphragm	PTFE
Pressure Indicators	Case	SAE Type 316 Stainless Steel
	Process-Wetted Materials	SAE Type 316 Stainless Steel
Pressure Switches	Case	SAE Type 316 Stainless Steel

ITEM	MATERIAL	SPECIFICATION
	Diaphragm	Buna N
Pressure Sensor/Transmitters	Case	SAE Type 316 Stainless Steel
	Process-Wetted Materials	SAE Type 316 Stainless Steel
	Display	8-digit 14-segment LED display in psi
	Display units	Psi
	Digital Outputs	4 SPDT relay outputs rated for 5a @ 250VAC
	Analog Output	1 analog output
	Analog Accuracy	0.5% full scale
Submersible Pressure Sensor/Transmitters	Submersible Case	SAE Type 316 Stainless Steel
	Submersible Cable	Tefzel

C. Flanged in-line sensor-sleeve style pressure instruments shall be constructed of the following materials:

ITEM	MATERIAL	SPECIFICATION
Body	Cast Carbon Steel (for pressures over 300 psi)	ASTM A216 Grade WCB
Sleeve	NR Natural Gum Rubber (Natural Polyisoprene)	ASTM D1418, ASTM D2000 Vulcanized Temperature Standard Class I to 180°F Meet NSF 61 for potable water applications
	CR Neoprene Synthetic Rubber (Chloroprene)	ASTM D1418, ASTM D2000 Black Temperature Standard Class II to 230°F Meet NSF 61 for potable water applications
	EPDM Synthetic Rubber (Ethylene-Propylene Diene Monomer)	ASTM D1418, ASTM D2000 ASTM D429 Peroxide cured Temperature Standard Class III to 300°F
Fill Fluid	Halocarbon	
Flanges Sizes 2½"-24" Working Pressures 0-150 psi	Carbon Steel	AWWA C207 Class D, or ANSI /ASME 16.5 Class 150 Raised or plain faced ASME/ANSI B16.47 Class 150 Raised or plain faced for valves 26" and larger
	Stainless Steel	AWWA C207 Class D, or ANSI /ASME 16.5 Class 150 Raised or plain faced ASME/ANSI B16.47 Class 150 Raised or plain faced for valves 26" and larger
Flanges Sizes 2½"-24" Working Pressures 150-250 psi	Carbon Steel	AWWA C207 Class E, or ANSI /ASME 16.5 Class 150 Raised or plain faced ASME/ANSI B16.47 Class 150 Raised or plain faced for flanges 26" and larger
	Stainless Steel	AWWA C207 Class E, or ANSI /ASME 16.5 Class 150 Raised or plain faced ASME/ANSI B16.47 Class 150 Raised or plain faced for flanges 26" and larger
Flange Alignment	Horizontal Pipelines	Boltholes shall straddle horizontal and vertical centerlines of pipe run to which valves are attached.
	Vertical Pipelines	Boltholes shall straddle plant North-South and plant East-West centerlines of pipe run to which valves are attached.
Flange Bolts, Nuts, and Washers	Various Steels	See Section 33 05 31.
Flange Gaskets		See Section 33 05 31.
Grooved Ends	Provide where shown	AWWA C606 Compatible with adjacent coupling
Epoxy Lining (4" and larger) Epoxy Lining (4" and larger)	Fusion-Bonded Epoxy	See Section 09 96 56. AWWA C550 12 -mil minimum DFT Meet NSF 61 for potable water applications Do not coat sealing areas or bronze or stainless steel

ITEM	MATERIAL	SPECIFICATION
(cont.)		parts.
Exterior Finish Coat	Epoxy Urethane	See Section 09 90 00.
Chemical Gauge Corrosion Guards	Case	PVC ASTM D1784 Cell Class 12454
	Diaphragm	PTFE
Pressure Indicators	Case	ABS / SAE Type 316 Stainless Steel
	Process-Wetted Materials	SAE Type 316 Stainless Steel
Pressure Transmitters	Case	SAE Type 316 Stainless Steel
	Process-Wetted Materials	ABS / SAE Type 316 Stainless Steel
Submersible Pressure Transmitters	Submersible Case	SAE Type 316 Stainless Steel / Titanium
	Submersible Cable	Tefzel

D. The following product design criteria, options and accessories are required:

ITEM	DESCRIPTION	
Pressure Sensors	Sensing Element	Analog pressure sensor with all hardware required to allow insertion and removal without system shutdown.
	Calibrated Pressure Range	0-100 psi / 0-150 psi unless otherwise shown on Plans.
	Accuracy within Pressure Range	±0.5% of calibrated span (ASME B40.100 Grade 2A)
	Fluid Metered	Sewage
	Fluid Temperature Range	32-90°F
	Maximum Operating Pressure	150 psi
	Process Connection	¼" NPT / ½" NPT
		Stem mount / Lower back mount
	Output Signal	4-20mA
Pressure Gauges – Stem-Mounted Bourdon Tube Type	Style	Liquid-filled with dampers, stem-mounted Comply with ASME/ANSI B40.100
	Calibrated Pressure Range	0-100 psi / 0-150 psi unless otherwise shown on Plans.
	Accuracy within Flow Range	±3-2-3% of calibrated span (ASME B40.100 Grade B)
	Fluid Metered	Sewage
	Fluid Temperature Range	32-90°F
	Stem Connection	¼" NPT / ½" NPT
	Indicator Units	0-100 psi / 0-150 psi
	Dial Size	4"
	Readout	Single readout in psi
	Adjustable Dampening Wheel	Required
Pressure Sensors and Gauges – Flanged In-Line Sensor Sleeve Style	Ends	Flanged
	Calibrated Pressure Range	0-100 psi / 0-150 psi unless otherwise shown on Plans.
	Accuracy within Flow Range	±02.5% of calibrated range
	Fluid Metered	Sewage
	Accuracy within Flow Range	±0.5% of calibrated span (ASME B40.100 Grade 2A
	Fluid Temperature Range	32-90°F
	Maximum Operating Pressure	150 psi
	IP Code	IP 65 water jet
	Output Signal	4-20mA
Pressure Indicator - Digital	Indicator Units	-14.7-1000 psi 5-digit LCD display with minimum 0.48" character

ITEM	DESCRIPTION	
		size
	Readout	Single readout in psi
	Dial Size	4”
Pressure Switch	Sensing Element	Diaphragm-actuated
	Adjustment Range	0-100 psi / 0-150 psi unless otherwise shown on Plans.
	Process Connection	¼” NPT / ½” NPT
	Switch	Single-adjustment Automatic reset type
	Contacts	DPDT Rated for at least 5 amps at 120VAC
Pressure Transmitter	Calibrated Pressure Range	0-100 psi / 0-150 psi unless otherwise shown on Plans.
	Accuracy within Flow Range	±0.5% of calibrated span (ASME B40.100 Grade 2A)
	Span	Continuously Adjustable
	Fluid Metered	Sewage
	Fluid Temperature Range	32-90°F
	Maximum Operating Pressure	150 psi
	Process Connection	¼” NPT / ½” NPT
	Zero Adjustment	Required
	Damping Adjustment	Required
	Indicator	Integral with transmitter Single readout scaled in psi
	Output Signal	4-20mA

E. The following electrical design criteria are required for equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Nonhazardous Class I Division 1 (wet well) Class I Division 2 (dry well)
Enclosures – Indoor Dry Locations	NEMA 250 Enclosure Rating	NEMA 12 – Industrial Use
Enclosures – Outdoor or Wet Locations	NEMA 250 Enclosure Rating	NEMA 4X – Watertight, Corrosion-Resistant, Stainless steel
Other Enclosures	NEMA 250 Enclosure Rating	As shown on plans
All Enclosures	Construction	Lockable With powdercoat epoxy finish on steel surfaces
	IEC 60529 Enclosure Rating for Underground Equipment	IP 65 water jet
Indicator Mounting	Local Mount	Panel-mount Surface-mount on wall / instrument board Pipe-mount See plans
	Remote Mount	Telemetry cabinet See plans
Power Supply	Pressure Instruments	None – Provide battery as recommended by Manufacturer 24 VDC at control panel 120VAC – 1 phase – 60Hz 230VAC – 1 phase – 60Hz

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install pressure instruments before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Sections 01 73 00 and 01 73 24 for basic execution and installation requirements.

B. Furnish and install pressure instruments at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. California Plumbing Code Chapter 6 "Water Supply and Distribution" Section 609.8 "Low Pressure Cutoff Required on Booster Pumps for Water Distribution Systems"

4. Other applicable building, fire and plumbing code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Pressure Instruments	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturer's printed Literature	1 test	Contractor	Contractor
	Integration with Owner's Telemetry	Verify successful operation with telemetry.	As directed	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

3.4 Adjusting and Cleaning

A. Provide services of Manufacturer's representative as needed for startup, inspection and necessary adjustments as needed to integrate new pressure instrumentation into existing telemetry network.

END OF SECTION

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SECTION 40 91 20
TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 Work Included

A. Materials, testing, and installation of thermostats.

1.2 Related Work

A. Section 01 33 00: Submittal Procedures
B. Section 01 40 00: Quality Requirements
C. Section 01 61 00: Common Product Requirements
D. Section 01 65 00: Product Delivery Requirements
E. Section 01 66 00: Product Storage and Handling Requirements
F. Section 01 73 00: Execution
G. Section 26 05 00: Common Work Results for Electrical
H. Section 40 90 10: Common Work Results for Instrumentation and Control

1.3 System Description

A. Furnish and install complete operating temperature instruments including appurtenant structural, mechanical and/or electrical mountings or connections required for compliance with manufacturer's installation requirements and compliance with applicable building codes and standards.

B. Temperature instruments control system output variables shall include:

ITEM	VARIABLE	DESCRIPTION
Output Signals (Analog)	Temperature	4-20mA signal
Output Signals (Discrete)	Relay Control Output	For solenoid valves / constant-speed pumps with adjustable run time
	Alarms 1 alarm per cell (Red lamp or LED)	High limit relay / Low limit relay / High and low limit relay

1.4 Quality Assurance

A. Use adequate numbers of skilled workmen trained and experienced in necessary trades and crafts and completely familiar with specified requirements and methods for proper performance of Work of this section.

1.5 References

A. California Electrical Code (CEC)
B. California Energy Code (CEnC)
C. California Green Building Standards Code (CALGreen Code)
D. California Mechanical Code (CMC)
E. NSF/ANSI 61 Drinking Water Standards Health Effects
F. NEMA/ANSI 250 Enclosures for Electrical Equipment
G. NFPA 70 National Electric Code

1.6 Submittals

A. Furnish the following submittals.

SUBMITTAL	DESCRIPTION
Shop Drawings	Required for temperature instruments under electrically controlled equipment
Catalog Data	Required per catalog data requirements.
Installation Instructions	Required per installation or application instruction requirements.
O & M Instructions	Required per operation and maintenance instruction requirements
Warranty	Furnish one-year warranty from date of final acceptance

B. Refer to Section 01 33 00 for definition of requirements for shop drawings, catalog data, installation instructions and O&M instructions.

1.7 Delivery, Storage and Handling

A. Refer to Sections 01 65 00 and 01 66 00 for delivery, storage, and handling requirements.

B. Manufacturer's instruction and warranty requirements for delivery, storage and handling of temperature instruments shall be strictly followed.

1.8 Unit Prices

A. Payment for Work in this section shall be included as part of lump-sum or unit-price bid amount for which such Work is appurtenant.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

A. Acceptable Manufacturers for thermostats include:

ITEM	MANUFACTURER	MANUFACTURER LOCATION
Thermostats – Two Position Type	Honeywell, Inc. T631C-1020	Morristown, NJ
	Accepted equal	
Thermostats – Two Position Type with Reversing Feature	Honeywell, Inc.	Morristown, NJ
	Accepted equal	
Thermostats – Modulating	Honeywell, Inc.	Morristown, NJ
	Accepted equal	

B. Temperature indicators, transmitters, recorders and controllers where shown shall be manufactured by same Manufacturer as temperature sensing equipment and shall be fully compatible with equipment furnished.

2.2 Materials

A. Refer to Section 01 61 00 for basic requirements for products and materials.

B. The following product design criteria, options and accessories are required for temperature sensors:

ITEM	DESCRIPTION	
Thermometer	Temperature Sensor	Analog output sensor with all hardware required to allow insertion and removal without system shutdown.
	Design	Bimetal with Thermowell

C. The following product design criteria, options and accessories are required for thermostats:

ITEM	DESCRIPTION	
Thermostats	Type	Line voltage heavy-duty two-position type / Line voltage heavy-duty modulating type.
	Switch	On-Off-Auto Switch with thermometer
	Contacts	Rated for Motor Current
	Reversing Feature	Required on 1-coil unitary constant-volume (CV) systems using chilled water in summer and warm water in winter. On temperature rise, thermostat shall throttle water regulating valve in winter heating cycle, but open water regulating valve in summer cooling cycle. / Required on 1-coil unitary variable-air-volume (VAV) systems using face-and bypass dampers using chilled water in summer and warm water in winter. On temperature rise, thermostat shall open bypass dampers to bypass airflow around coil on winter heating cycle and shall throttle bypass dampers to increase airflow over coil on summer cooling cycle.
	Safety Cutout Feature	Required on 2-coil (in series) unitary systems to ensure water regulating valve on cooling coil closes at low temperatures and water regulating valve on heating coil closes at high temperatures.
	Set Point Range	60-95 / 50-120 °F
	Thermometer	32-120°F
	Features	Concealed adjustments
		Adjustable sensitivity
	Cover	Locking
	Thermometer	32-120°F

D. The following electrical design criteria are required for equipment specified in this section:

ITEM	DESCRIPTION	
Electrical Work	NEC Article 505 Classification	Nonhazardous Class I Division 1 (wet well) Class I Division 2 (dry well)
Enclosures – Indoor Dry Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 1 – General Purpose NEMA 12 – Industrial Use
Enclosures – Outdoor or Wet Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 3R – Rainproof, Sleet-Resistant NEMA 4X – Watertight, Corrosion-Resistant, Stainless steel
Enclosures – Class 1 Division 1 Wet Well Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 7 – Explosion Proof, Rated for Class I Locations
Enclosures – Class 1 Division 2 Dry Well Locations	NEMA 250 Enclosure Rating	As shown on plans NEMA 9 – Explosion Proof, Rated for Class II Locations
Other Enclosures	NEMA 250 Enclosure Rating	As shown on plans NEMA 3 – Dust-tight, Rain-tight NEMA 4 – Watertight NEMA 13 – Oil-tight, Dust-tight
All Enclosures	Construction	Lockable With powdercoat epoxy finish on steel surfaces
	IEC 60529 Enclosure Rating for Underground Equipment	IP 65 water jet
Enclosure or Instrument	Local Mount	Panel-mount

ITEM	DESCRIPTION	
Mounting		Surface-mount on wall / instrument board Pipe-mount Skid-mount See plans
	Remote Mount	MCC Telemetry cabinet See plans
Power Supply	Thermostats	As shown on plans None – Provide battery as recommended by Manufacturer 24 VDC at control panel 120VAC – 1 phase – 60Hz 230VAC – 1 phase – 60Hz
	Battery Backup	Required / Not required
	Other Temperature Instruments	As shown on plans None – Provide battery as recommended by Manufacturer 24 VDC at control panel 120VAC – 1 phase – 60Hz
	Battery Backup	Required / Not required

PART 3 - EXECUTION

3.1 Preparation

A. Make field measurements needed to install temperature instruments before submitting shop drawings or ordering. Make minor changes in dimensions and alignments as needed to avoid utilities or structural conflicts.

3.2 Installation

A. Refer to Section 01 73 00 for basic execution and installation requirements.

B. Furnish and install temperature instruments at locations shown on Plans and Submittals.

C. The following installation standards shall be followed:

1. Manufacturer's installation and warranty requirements

2. Applicable OSHA and Cal OSHA regulations

3. Applicable building, fire, plumbing and electrical code requirements

D. Refer variances between above documents and Contract Documents to Owner's Representative.

E. Install temperature instruments to tolerances recommended by Manufacturer. Unless otherwise shown, install temperature instruments true, plumb, and level using precision gauges and levels.

3.3 Field Quality Control

A. Field testing shall include:

ITEM	TEST FOR	TEST STANDARD (ASTM OR OTHER TEST STANDARD)	FREQUENCY	FIRST TEST PAID FOR BY	RETESTS PAID FOR BY
Temperature Instruments	Installation & Leakage	Visual inspection of finished installation	1 inspection	Owner	Owner
	Field Performance	Demonstrate compliance to Contract Documents and Manufacturers' printed Literature	1 test	Contractor	Contractor
	Integration with Owner's Telemetry	Verify successful operation with telemetry.	As directed	Contractor	Contractor
	11-month Warranty Inspection	Demonstrate compliance to Contract Documents and Manufacturer's printed literature	1 test	Owner	Contractor

3.4 Adjusting and Cleaning

A. Provide services of Manufacturer's representative as needed for startup, inspection and necessary adjustments as needed to integrate new temperature instrumentation into existing telemetry network.

END OF SECTION

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SECTION 40 94 43
PROGRAMMABLE REMOTE TERMINAL UNIT

PART 1 GENERAL

1.1 Summary

A. This Section includes Programmable Remote Terminal Unit (RTU) hardware for control and interface of process and measurement equipment, control systems and ancillary systems.

1.2 Related Sections:

A. Section 27 05 13: Two Way Radio Data Transmission Systems

B. Section 40 67 16: Control Panel and Devices

C. Section 40 90 10: Common Work Results for Instrumentation and Control

1.3 References

A. Instrumentation, Systems, and Automation Society (ISA):
   1. S5.1, Instrumentation Symbols and Identification.
   2. S5.4, Standard Instrument Loop Diagrams.
   3. S20, Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.
   4. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.

B. National Electrical Manufacturers Association (NEMA):
   1. ICS 1, Industrial Control and Systems: General Requirements.
   2. ICS 2, Industrial Control Devices, Controllers and Assemblies.
   3. ICS 3, Industrial Control and Systems: Factory Built Assemblies.
   4. ICS 4, Industrial Control and Systems: Terminal Blocks.
   5. ICS 5, Industrial Control and Systems: Control Circuit and Pilot Devices.
   6. ICS 6, Industrial Control and Systems: Enclosures.
   7. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   8. IA 2.2, Programmable Controllers - Equipment Requirements and Tests.
   9. IA 2.3, Programmable Controllers - Programming Languages.

1.4 System Integrator

A. The Contractor shall engage the City's Integrator to undertake all programming activities and provide startup and testing for control functionality. Refer section 40 90 10.

1.5 System Description

A. Configuration:
   1. Programmable controller shall use a combination of discrete, analog, programmable logic and programmable algorithms to control, annunciate and interface with connected systems.
   2. The programmable controller shall be part of a completely assembled control panel with all components required for operation, including all associated components shown and where specified in other sections. Control panels shall be assembled by a UL508A certified contractor and contain labeling indicating UL508A compliance with a unique UL serial number.

1.6 Submittals

A. Programming Approach: Indicate listing of I/O Points, Device specific communications translation protocols (e.g. HART), HMI to RTU programming approach and SCADA I/O interface description, complete with tag designations for new and existing system.

B. Programming narrative: Include a narrative that describes device and I/O functionality. Narrative shall include connected devices, derived values and runtime scenarios to demonstrate function.

C. Shop Drawings: Provide shop drawings indicating the arrangement and layout of panel, component spacing and enclosure size. Indicate electrical characteristics and connection requirements, including layout of completed assemblies, interconnecting cabling, dimensions, weights, and external power requirements.

D. Product Data: Submit catalog data for each component specified showing electrical characteristics and connection requirements.

E. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

F. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.7 Closeout Submittals

A. Project Record Documents: Record actual locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information, and terminal block layouts in controller cabinets. Include copy of as-built drawings.

B. Operation and Maintenance Data: Submit bound copies of operating and programming instructions, and include card replacement, adjustments, and preventive maintenance procedures and materials.
   1. Provide 1 Compact Disk (CD) containing all programmable logic code to the City upon project closeout for each unique program.

1.8 Qualifications

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience.

1.9 Environmental Requirements

A. Conform to specified service conditions during and after installation of programmable controllers. Maintain area free of dirt and dust during and after installation of products.

PART 2 PRODUCTS

2.1 Programmable Controller

A. Manufacturers:
   1. Motorola F7594 ACE3600 RTU.

B. Product Description: Controller conforming to NEMA IA 2.2, and with required memory and functional capacity to perform specified sequence of operation with scheduled input and output points, communications capability with HMI and SCADA interfacing functionality.

C. CPU Module: module to include on-board memory, communication ports, I/O bus interface and other circuits. CPU memory includes FLASH, SDRAM and SRAM plug-in memory.

D. Networking Connections: MOSCAD/MLDC

E. Supply Voltage: As shown on drawings or as specified elsewhere

F. System shall be fully assembled, programmed and tested offsite.
   1. Contractor shall submit test results in writing for approval indicating tests performed and subsequent results.
   2. Tests shall include device connected simulation of systems.

2.2 Input And Output Modules (I/O Modules)

A. Manufacturers:
   1. Motorola V245 Mixed I/O Module

B. Product Description: Mixed I/O modules include a mixture of Digital Inputs, Relay Outputs and Analog Inputs on the same module (16 DI + 4 DO + 4 AI).

2.3 Control Panel Enclosure

A. Refer specification section 40 67 16.

2.4 Power Supply

A. Description: Panel mounted linear power supply:
   1. Motorola V261 120VAC Power Supply with Battery Charger

B. Use Limitations: Power supplies shall be used for powering RTU's, Radios and other active low voltage control panel devices.

C. Provide 6.5 AH backup battery (Motorola V114)

D. Provide fused disconnecting means for each connected control power distribution leg.

E. Maintain a minimum 2 inch separation form adjacent devices located within the control panel.

2.5 Plug-In Power Supply

A. Description: 24VDC plug-in power supply for powering devices from a nearby 120V outlet.
   1. Motorola FPN1653 Plug-In Power Supply

2.6 I/O Slots Frame

A. Description: Mounting frame for I/O modules
   1. Motorola V103 I/O Slots Frame

2.7 Source Quality Control

A. The contractor shall provide 5 days' notice to the Owner prior to factory inspection and acceptance testing for the control panel to allow an Owners representative to witness the testing.

B. The entire control panel assembly shall be complete and ready for packaging and shipment, prior to the scheduled factory acceptance testing.

C. Test programmable controller in accordance with NEMA IA 2.2.

PART 3 EXECUTION

3.1 Software Programming

A. Prior to commencing work, coordinate with City for RTU programming requirements. Provide I/O listing for each unique RTU configuration that lists each I/O point and configuration options.

3.2 Installation

A. Do not install products until major construction is complete and building interior is enclosed.

B. Install and connect control panel assembly.

C. Connect and configure input and output devices.

D. Establish network communications over SCADA network.

E. Participate in commissioning activities that include testing and verify that all controls and systems function as intended.

F. Perform loop tuning and PID control adjustments for intended operation.

3.3 Field Quality Control

A. Procedures, Forms, and Checklists:
   1. Conduct all testing in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
   2. Describe each test item to be performed.
   3. Have space after each test item description for sign off by appropriate party after satisfactory completion.

B. Perform operational testing on control systems to verify proper operation and field wiring connections to verify intended system function as part of the project commissioning.

C. Calibrate connected devices and adjust programming characteristics, where required to provide a fully functional system.

3.4 Integrator Field Services

A. Program and testing for programmable controller, HMI and SCADA.

3.5 Demonstration And Training

A. Furnish eight (8) hours of instruction, to be conducted at project site with manufacturer's representative. Coordinate with the City for times and locations of training. Training times and locations shall be as directed by the City.

B. Training shall cover detailed instruction on standard, preventative and emergency maintenance repairs including but not limited to:
   1. Uploading/downloading program
   2. Review of functionality
   3. Battery replacement
   4. Module replacement
   5. Troubleshooting

END OF SECTION

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APPENDICES

APPENDIX A

GEOTECHNICAL REPORT

NMG Geotechnical, Inc.

June 29, 2015

Project No. 14038-01

To: PSOMAS
3 Hutton Centre Drive, Suite 200
Santa Ana, CA 92707

Attention: Mr. Harvey R. Gobas

Subject: Geotechnical Exploration and Preliminary Design Report for the Proposed Bankfield Sewage Pump Station, 5722 Bankfield Avenue, Culver City, California

EXECUTIVE SUMMARY

NMG Geotechnical, Inc. (NMG) has conducted a geotechnical study for a proposed sewage pump station at 5722 Bankfield Avenue in Culver City. The purpose of this study was to evaluate the geotechnical conditions at the subject site and evaluate the suitability for the proposed pump station and improvements. This report summarizes our findings and conclusion and provides preliminary recommendations for the design and construction of the pump station and associated improvements.

This study included a background review of the geologic conditions at the site and prior land use. The background research and review included evaluation of historic aerial photographs and prior geotechnical maps and reports. The site-specific subsurface exploration performed for this study included two hollow-stem auger borings (H-1 and H-2) which were excavated, sampled and visually logged to a depth of up to 54 feet below ground surface (bgs) and two cone penetrometer tests (CPT-1 and CPT-2) which provided continuous cone sounding data to depths of 36 to 50 feet bgs. NMG performed laboratory testing on selected soil samples to evaluate the engineering soil properties. The compilation of this data was used to characterize the site, subsurface conditions and geotechnical constraints. The borings and CPTs by NMG found the upper 15 to 16 feet of soil underlying the site to be silt and clay with granular, sandy alluvium at depth. The groundwater was encountered in both exploratory borings at depths of 23 feet bgs during drilling. Based on published historic high groundwater data, the water table may be as shallow as 5 to 10 feet bgs (CDMG, 1998). NMG also obtained hydrology information for the site based on the slug tests conducted by Conestoga-Rovers & Associates, 2015 (CRA, 2015a). CRA also installed groundwater monitoring wells that indicate the current water level is 20 feet bgs.

The existing shallow groundwater, stability of the temporary excavations and the potential for seismic shaking during an earthquake are considered to be the primary geotechnical constraints at the site. The subject site is also located within a mapped liquefaction area as defined by the

California Geological Survey (Figure 1). Based on our site specific geotechnical review and analysis, the liquefaction potential is considered to be low for the design earthquake.

The proposed improvements will likely require deep excavations, dewatering and temporary shoring systems during construction. The temporary excavations may be prone to lateral movement and failure if left unsupported. The small size of the site and existing improvements will restrict the ability to lay-back excavations for stability purposes. The type of temporary shoring selected will need to protect the existing improvements in-place. Due the shallow groundwater conditions, the deeper excavations will require construction dewatering.

Environmental evaluation of onsite soil is not a part of this report and is the purview of others.

If you have any questions regarding this report, please contact our office. We appreciate this opportunity to provide our services.

Respectfully submitted,

NMG GEOTECHNICAL, INC.

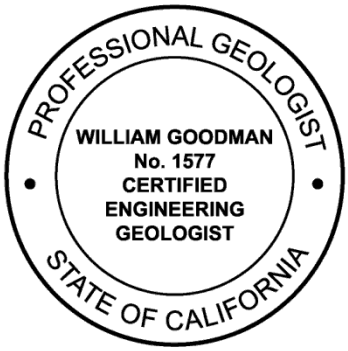
Anthony Zepeda, PG 9294
Senior Staff Geologist

Karlos Markouizos, RCE 50312
Principal Engineer

William Goodman, CEG 1577
Principal Geologist

AZ/KGM/WG/je

Distribution: (3) Addressee



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Appendix B – Geotechnical Boring and CPT Logs
Appendix C – Laboratory Test Results
Appendix D – Seismicity Data
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Appendix F – General Earthwork and Grading Specifications

1.0 INTRODUCTION

1.1 Purpose and Scope of Services

NMG Geotechnical, Inc. (NMG) conducted a geotechnical study for the proposed sewage pump station at the subject site. The purpose of this exploration was to determine the existing subsurface conditions and provide our geotechnical findings, conclusions, and recommendations for the proposed improvements. NMG's scope of services are based primarily on the Request for Proposal (RFP), communications with you and the project team, and our experience with similar projects.

Our scope of services for this study included the following:

- Review of geotechnical information pertaining to the subject site, including review of site geology, groundwater data, seismic hazard maps, historic aerial photographs, topographic maps, and pertinent geotechnical reports available. A list of references is presented in Appendix A.
- Site reconnaissance to identify the existing site conditions and mark the boring locations.
- Notification of and coordination with Underground Service Alert to clear boring locations of existing underground utilities.
- Permitting the borings and CPTs through the County of Los Angeles Public Health/Environmental Drinking Water Program.
- Drilling, logging, and sampling of two hollow-stem auger borings (H-1 and H-2) to a depth of approximately 51.5 to 54 feet below ground surface (bgs) and two CPT's (CPT-1 and CPT-2) to a depth of 36 to 50 feet. Relatively undisturbed soil samples were obtained from the borings at 5 foot intervals. Bulk samples from cuttings at various depths were collected during the exploration. The borings were backfilled with the cuttings generated during drilling below 30 feet bgs; the remainder of the borings were backfilled with cement-bentonite grout and provided with an asphalt concrete patch at the surface. The CPTs were backfilled with hydrated granulated bentonite. The boring and CPT logs are presented in Appendix B.
- Laboratory testing to classify the onsite soils and evaluate in-situ moisture and density, shear strength properties, maximum dry density and optimum moisture content, grain-size distribution, Atterberg limits, expansion index, soluble sulfate, and soil corrosivity. A Soil corrosivity report and corrosion protection recommendations were prepared by HDR Schiff. Laboratory test results and corrosion report are included in Appendix C.
- Geotechnical analysis of subsurface information collected during our field exploration and laboratory testing to evaluate the geotechnical conditions that will impact the design and construction of the proposed improvements. This includes evaluation of temporary excavations and shoring, liquefaction and settlement analysis, remedial measures and design parameters for the pump station and other improvements. The seismic and liquefaction analysis are presented in Appendix D and Appendix E, respectively.

- Preparation of this report, accompanying figures and NMG's general earthwork and grading specifications (Appendix F).

1.2 Site Location and Existing Conditions

The subject site is located at 5722 Bankfield Avenue, southeast of State Route 90 (SR-90) and the Interstate 405 freeway (I-405) interchange in Culver City, California (Figure 1). The site is bound on the west by a freeway off ramp, and by alleyways and adjacent buildings to the north, east, and south. The overall site consists of a triangular shaped paved lot that is currently utilized as a staging/storage area for the city. The site ranges in elevation from approximately 24 to 25 feet above mean sea level (msl). The Bankfield pump station site situated in an industrial area and is an approximately 3,900 square feet lot. The adjacent alleyway has power poles and underground pipelines, the depth of which is not known at this time. Also, the perimeter of the site has an old chain link fence.

During the NMG site visit, the ground surface was capped with existing asphalt pavement that is covered by a thin dirt layer and there are minor weeds and miscellaneous debris/trash scattered across the site. The existing asphalt concrete pavement encountered in NMG borings had a thickness of 3 to 3.5 inches with no underlying aggregate base.

1.3 Proposed Pump Station

We understand the proposed sewage pump station site will include construction of a wet well (with three submersible pump stations), a by-pass pump, a valve vault with new discharge lines, a meter vault, a new pump house and other appurtenances. The Bankfield Sewage Pump Station is part of a larger overall project, portions of which are being designed by others. The larger project will allow the City to divert flows from four existing pump stations to the Bankfield site, thus allowing the existing pump stations to be taken out of service. The wet well will be approximately 25 feet deep. The site will also have new pavement (concrete or asphalt surface), lighting and perimeter walls.

We anticipate that the future finish grades at the site will be similar to the existing grades (with minor design cuts and fills). However, the site construction will require remedial grading and deep excavations for the proposed wet well improvements and underground pipelines. The site earthwork may result in export of fill.

1.4 Site History

Based on review of historic aerial photographs, the subject site has had multiple uses over the last 60+ years. The earliest aerial photograph from 1952 shows the subject site occupied by industrial buildings. Based on the configuration of the buildings it appears as though these were different structures than those currently occupying the site. At this time both the I-405 and SR-90 freeways did not exist. Bankfield Avenue, Selmarine Drive, and Sepulveda Boulevard are roughly in the current configuration. An open field was located southeast of the subject site, possibly used for agricultural purposes.

By 1970, the I-405 freeway is in its current configuration and grading/construction of SR-90 freeway was underway. Centinela Creek, southwest of the subject site, was reconfigured and channelized as it appears today. A number of the industrial buildings noted on or adjacent to the subject site in prior aerial photos appear to have been demolished to accommodate the I-405 and associated on/off-ramps and interchanges.

Since the time of the I-405 freeway construction, the subject site looks roughly in its current condition. Based on aerial photographs through the 1990's and recent Google Earth satellite imagery, it appears the site has been used as a storage yard or staging area up until current time.

Review of the Phase 1 Environmental Site Assessment (CRA, 2015b) revealed the site had been used as early as the 1950's for mixed industrial purposes. Past uses include a machine shop, wood crafting facility, and scrap metal storage. Since the 1980's the site has been used as vehicle storage and impound yard by the neighboring towing company.

A list of the aerial photographs reviewed is located in Appendix A.

1.5 Subsurface Exploration

Our field exploration consisted of excavation of two 10-inch-diameter, hollow-stem auger borings to depths of 51.5 to 54 feet bgs. The borings were geotechnically logged, and samples were collected at selected intervals.

Relatively undisturbed soil ring samples were obtained from the exploratory borings with a 2.5-inch, inside-diameter, split-barrel sampler. The samplers were driven into the soil with a 140-pound automatic safety hammer, free-falling 30 inches. The drive samples were also used to obtain a measure of resistance of the soil to penetration (recorded as blows-per-foot on our geotechnical boring logs). Representative bulk samples of onsite soil were collected from the drill cuttings and used for additional soil identification purposes. Groundwater was encountered in our borings at approximately 23 feet bgs. Borings were backfilled with soil cuttings below 30 feet bgs; the remainder of the boring was backfilled with cement-bentonite grout. The approximate locations of the borings are shown on Figure 4. Boring logs are provided in Appendix B.

Two CPT soundings (CPT-1 and CPT-2) were also advanced to depths up to 50 feet bgs. CPT-2 was planned to be deeper; however, the CPT was not able to be advanced below a depth of 36 feet bgs due to refusal on very dense gravelly sands at depth. A CPT sounding is made by advancing a 15-cm^2 probe (cone) into the ground at a constant velocity of 2 centimeters per second (cm/s) using hydraulic rams that apply the full 30-ton weight of the CPT truck. Continuous measurements are made of the resistance to penetration of the tip and the frictional sliding resistance of the sleeve of the cone. The penetration resistance is digitized at 5-centimeter depth intervals and allows for detailed inferences about stratigraphy, lithology and soil types. The CPT data was also used for evaluating liquefaction potential. The approximate locations of the CPT soundings are shown on Figure 4 and the logs are presented in Appendix B.

The logs for the slug test borings (SLUG#1, SLUG#2 and SLUG#3) performed by CRA also indicate similar subsurface soil and groundwater conditions. These borings ranged in depth from 35 to 40 feet bgs and the logs are also presented in Appendix B.

1.6 Laboratory Testing

We performed laboratory testing on representative samples of onsite soils collected during our field exploration to characterize their engineering properties. Laboratory tests performed on selected relatively undisturbed and bulk soil samples included:

- Moisture content and dry density;
- Grain-size distribution;
- Atterberg limits;
- Direct shear (undisturbed samples);
- Consolidation;
- Expansion;
- Maximum dry density and optimum moisture content;
- R-value; and
- Soluble sulfate and corrosivity testing with report.

Laboratory tests were conducted in general conformance with applicable American Society for Testing and Materials (ASTM) standard test methods. Laboratory test results for this study are presented in Appendix C. In-situ moisture content and dry density data are included on the geotechnical boring logs presented in Appendix B.

2.0 FINDINGS

2.1 Geologic Setting and Earth Units

The site is located southeast of Ballona Creek and northeast of Centinela Creek Channel within the Los Angeles basin. The Baldwin Hills lie to the northeast of the site and the Santa Monica Mountains lie to the north. The site is mapped by the Dibble and Minch (2007) as underlain by Holocene alluvial deposits composed of unconsolidated gravel, sand, and clay derived mostly from the Santa Monica Mountains.

The alluvium encountered during our exploration typically consisted of sandy silts and clays in the upper 15 feet with generally silty to clean sandy alluvium below with some gravels encountered at depths below 30 feet. Minor amounts of fill materials were encountered near-surface during excavation of the borings but did not extend to a depth below 2.5 feet bgs, the depth of the shallowest sample collected during our exploration.

2.2 Geotechnical Conditions

The sandy silts (ML) and clays (CL) had in-situ moisture content and dry densities ranging from 8.6 to 26.4 percent and 96.0 to 114.1 pounds per cubic foot (pcf). The clayey and silty fine to coarse sands (SM and SC) and poorly graded sands (SP) had in-situ moisture and dry densities ranging from 8.5 to 26.4 percent and 100.0 to 129.9 pcf. The blow counts varied from 16 to 98 blows per foot but were generally higher than 40 blows per foot below a depth of 20 feet bgs. Blow counts and in-situ dry densities indicate that the subsurface soils were generally stiff or medium dense to very dense. The results of maximum dry density testing indicate that the onsite sandy silt sampled at depths of approximately 2.5 to 10 feet bgs, have a maximum dry density of 115 to 117 pounds per cubic foot (pcf) with an optimum moisture content of 14 percent. The sandy soil at a depth of 20- to 25-feet in Boring H-1 was tested and had a Sand Equivalent (SE) of 28. Additional SE testing on the upper finer grained soil samples had values of 5 or less.

Soil Grain Size and Plasticity: Grain-size distribution tests were conducted on selected samples considered representative of the upper 5 to 10 feet of soil. The fines content (passing No. 200 sieve) varied from 71 to 75 percent. The Atterberg limits test was also performed on these near-surface soil samples to confirm the soil classifications, the results indicated the sandy silts were non-plastic. A sample of the sandy clay collected at 10 feet bgs had a fine content of 65 percent, a liquid limit of 53 percent and a plastic index of 35 percent. The thickness of the sandy clay zone was found to vary from 5 to 15 feet.

Shear Strength: Direct shear testing was conducted on three relatively undisturbed ring samples at depths of 7.5, 15, and 17.5 feet bgs in order to evaluate the strength properties of the onsite alluvial materials. The samples tested varied from clayey/silty sand to sand clay. The results of the testing performed indicate ultimate and peak soil friction angles of 24 to 30 degrees with ultimate and peak cohesions of 100 to 950 psf.

Compressibility: Consolidation testing was performed on three relatively undisturbed ring samples collected at depths ranging of 7.5, 10 and 17.5 feet bgs to evaluate the compressibility of

the alluvium. The soil sample had relatively low compressibility and low hydro-consolidation potential. The sandy clay sample collected at a depth of 10 feet swelled 2.6 percent (under a vertical load of 1.4 ksf).

Soil Subgrade and Corrosivity: The silty soil sample collected from the upper 5 feet was tested and found to have low expansion potential (Expansion Index of 35). The existing near-surface soils are considered to be moderate for pavement subgrade. The R-value test result for a silty soil sample indicated a value of 22. Corrosivity testing was performed on selected samples and found the onsite soils to be severely corrosive to ferrous metals, aggressive to copper and severe for sulfate attack on concrete.

2.3 Groundwater

Groundwater was encountered in NMG's borings at the subject site during drilling at a depth of approximately 23 feet bgs. Groundwater monitoring wells were recently installed by CRA to perform slug testing to determine aquifer properties. The groundwater levels measured in the wells after completion of well development was approximately 20 feet bgs. The groundwater levels indicated on the boring logs by NMG may not represent groundwater level data as accurately as well monitoring data, due to slow groundwater level stabilization in silty and clayey soils as well as disturbance of the soils due to the boring action (e.g., clayey soils sealing the boring walls).

Additional boring and groundwater data publicly available on the GeoTracker website, from a nearby environmental cleanup (approximately 600 feet north of the subject site), indicate groundwater level variations from 9.0 to 18.6 feet bgs (Stantec 2011 and 2015). This monitoring data was recorded over a period of 4 years, beginning in 2010 through 2014 and has, in general, declined due to the current drought conditions.

In addition to seasonal and annual groundwater fluctuations, historic high groundwater contour maps produced by the State indicate groundwater as shallow as 5 to 10 feet bgs (CDMG, 1998) at and surrounding the subject site (Figure 3). Based on the relatively shallow (9 feet bgs) groundwater level measurements and seasonal/annual variability at the nearby site, it is reasonable to expect that groundwater levels may return to within 5 to 10 feet bgs given a high rainfall year.

The slug testing and analysis by CRA (2015) indicated the shallow aquifer has an average site hydraulic conductivity of 45.9 ft/day (1.62×10^{-4} m/s) and transmissivity of 688 ft^2/day (1.62×10^{-4} m^2/s). The transmissivity is based on an assumed aquifer thickness of 15 feet. Based on published correlations, hydraulic conductivity values for clean sands can range between 10^{-3} to 10^{-5} m/s. However, the silty and clayey soils in the upper $\pm$15 feet will have lower hydraulic conductivity (on the order 10^{-6} to 10^{-8} m/s based on published correlations).

2.4 Faulting and Seismicity

No evidence of active faulting was observed at the subject site during this study, or prior regional studies by others. The site is not located in an Alquist-Priolo Fault Rupture Hazard Zone (Hart

and Bryant, 2007). Also, based on mapping by the State (Jennings and Bryant, 2010), there are no active faults mapped at the site. Therefore, the potential for primary ground rupture is considered very low. The closest active faults to the subject site are the Newport-Inglewood, Santa Monica, and Puente Hills Thrust Faults, located 1.98, 4.72, and 4.97 miles east, north, and northeast, respectively (USGS, 2013).

The site is located in an area of potential liquefaction (Figure 1), as defined by the State's Seismic Hazard Mapping Act (CDMG, 1999). Based on our geotechnical investigation, the overall potential for liquefaction at the site is considered low. Soils encountered in the upper 15± feet are generally finer grained silts and clays that are not liquefiable. The silty and clean sands below this depth are relatively dense with few thin layers of loose sandy soils susceptible to liquefaction. Section 2.5 below provides a more detailed discussion of the liquefaction assessment for the site.

2.5 Liquefaction Potential

Liquefaction is a phenomenon in which earthquake-induced cyclic stresses generate excess pore-water pressure in low density (loose), saturated, sandy soils and soft silts below the water table. This causes a loss of shear strength and, in many cases, ground settlement. For liquefaction to occur, all of the following four conditions must be present:

- There must be severe ground shaking, such that occurs during a strong earthquake.
- The soil material must be saturated or nearly saturated, generally below the water table.
- The corrected normalized standard penetration test (SPT) blow counts (N_1) or the CPT tip resistance (Q) must be relatively low.
- The soil material must be granular (usually sands or silts) with, at most, only low plasticity. Clayey soils and silts of relatively high plasticity are generally not subject to liquefaction.

NMG assessed the liquefaction potential of the alluvial soils at the site based primarily on the data obtained from two CPT soundings. The data from the two borings and laboratory testing supplemented the CPT data. The liquefaction evaluation was performed in general accordance with the recommended procedures for implementation of California Geologic Survey Special Publication 117. The liquefaction evaluation is based on a design earthquake magnitude of 7.35, a peak acceleration of 0.65g and a design groundwater level of 5 feet bgs. At this time, the groundwater is 20 feet bgs.

Our analysis indicates the site has a Liquefaction Potential Index (LPI) of less than 3.7 which is classified low risk and the overall probability for liquefaction is also categorized as low. The liquefaction analysis indicates some of the sand layers may liquefy during the design earthquake resulting in minor settlement (less than 1 inch total). The primary liquefaction zone is between a depth of 30 to 37 feet bgs and could have up to 0.35 inches of settlement. A secondary zone that may have additional liquefaction is between 15 to 17 feet bgs although this layer is above the current groundwater level. The liquefiable sand layers are generally less than 2 feet thick. The silty and clayey soils encountered in the upper 15± feet are generally not liquefiable. The liquefaction analysis is presented in Appendix E.

2.6 Settlement

Once the remedial grading and construction is completed, the site will generally be underlain by engineered fill and relatively dense native alluvium with low settlement potential. Since the anticipated future fill and structural loading will be minor, the total static settlement will also be minor. We would anticipate total settlements on the order of ½- to 1 inch. The differential settlement is typically estimated to be half of the total settlement. The maximum differential settlement should not exceed ½-inch over a 40-foot span. The actual settlement will depend upon the final design grades, the extent of the remedial grading and foundation loads of the future structures/improvements.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 General Conclusions and Recommendations

Based on our findings from the subsurface exploration, laboratory testing and analysis, the site is considered geotechnically suitable for construction of a new pump station provided the recommendations presented in this report are implemented for the future design and construction. Based on the preliminary design information, we would expect the new pump station would be founded on compacted fill and competent alluvial deposits. Temporary excavations for the pump station would mostly expose alluvium that consists of sandy silts and sandy clays. Excavations deeper than approximately 15 to 20 feet will expose wet sandy alluvium and groundwater. Deeper excavations will require some dewatering and temporary shoring or laybacks for stability. The overall probability for liquefaction at the site is low and we expect only minor settlement during the design earthquake. Conventional shallow foundations should be suitable for the site.

The recommendations in this report are considered preliminary and subject to some modifications once design plans are available for review. Also, the recommendations in this report are considered minimum and may be superseded by more restrictive requirements of the City or others. The additional recommendations from the Phase I environmental site assessment prepared by CRA/GHD may also be more stringent and supersede the geotechnical recommendations.

3.2 General Earthwork and Grading

In general, the grading and excavations should be performed in accordance with the governing agencies' requirements and NMG's General Earthwork and grading Specifications presented in Appendix F. In the event of a conflict between the following recommendations and our general specifications, the recommendations within this report will supersede.

Clearing and grubbing of the site includes removal of weeds and miscellaneous abandoned material, and trash/debris that are to be disposed of offsite. Undocumented fill and trench backfill encountered during grading shall also be removed (and may be reused for placement as compacted fill if determined to be suitable material). Deleterious materials (i.e., concrete, asphalt, pipelines and construction materials, etc.) encountered during grading operations should be removed and disposed of offsite. Existing improvements that are to be protected in-place may require additional geotechnical evaluation of the existing conditions and remedial measures during grading to ensure they are not adversely impacted. At minimum, existing structures, improvements and utilities adjacent to the site that are to be protected in place should be located and visually marked prior to demolition and grading operations.

Geotechnical observation and testing shall be performed during the grading and construction operations. Field and laboratory testing will be conducted in accordance with project specifications and the relevant ASTM test procedures related to fill placement and compaction control. The fill shall be placed in nearly horizontal, loose lifts no more than 8 inches in

thickness, moisture-conditioned and compacted to a minimum relative compaction of 90 percent (per ASTM 1557). Fills are to be placed at above optimum moisture content.

The moisture content of the onsite soils may vary from dry and damp near the ground surface to wet near the groundwater level and thus appropriate measures (e.g., mixing, drying or moisture-conditioning) may be required to achieve the correct moisture content for fill placement. From a geotechnical standpoint, the native materials that are relatively free of deleterious material should be suitable for use as compacted fill except for areas requiring select material. However, based on the Phase I environmental site assessment prepared by CRA/GHD and the historic use of the site for industrial purposes, there is a potential for the presence of hazardous substances and/or petroleum products in the subsurface soil that may not be suitable for reuse. If impacted soils are encountered they will need to be evaluated by the project environmental consultant based on the Phase I site assessment.

Stockpiling of soils (more than 5 feet in height) at or near existing structures and over utility lines that are to remain in place should not be allowed without review and acceptance by the geotechnical consultant and the structure/utility line owner(s).

The upper 5 feet of the onsite soils could have up to 10 percent shrinkage and the deeper soils are anticipated to have 0 to 3 percent shrinkage.

3.3 Remedial Measures

The existing soils in the upper 3 to 5 feet consist of unsuitable soils that will need to be removed and recompacted to provide a uniform compacted fill blanket across the site. Existing backfill for pipelines or other improvements is considered undocumented fill and will need to be removed and recompacted. Deeper removals may be required locally where unsuitable soils and undocumented fills are encountered during construction. The recommended removals should be performed across the entire site. Remedial removal are not anticipated for the areas with deeper excavations (below 5 feet) provided that the excavation bottoms are clean and expose firm alluvium. The removal and excavation bottoms should be reviewed and approved by the geotechnical consultant prior to fill placement. The removal bottom should expose competent alluvium that has sufficient moisture content (near or above optimum) and a minimum relative compaction of 85 percent in accordance with ASTM Test Method D1557. The approved excavation bottoms should be scarified a minimum of 6 inches, moisture-conditioned as needed, and compacted in place prior to placement of fill materials.

Excavations adjacent to existing structures, utilities or improvements to be protected in-place should be performed in accordance with the requirements of the governing agencies and avoid destabilizing the adjacent ground or undermining the improvements/foundations.

Excavations less than 5 feet deep may consist of near vertical sidewalls; however, due to drier and more weathered near-surface soils conditions, some caving of vertical cuts may occur. If remedial removals deeper than 5 feet are necessary, the excavation will need to be laid back at a minimum of 1.5H:1V inclination. Removals next to existing structures and deeper removals may

require shoring or other special measures for safety (i.e., setback or laybacks) and to mitigate the potential for lateral/vertical soil movements may be required.

3.4 Seismic Design Parameters

The following table summarizes the seismic design criteria for the subject site developed in accordance with ASCE 7-10 and 2013 CBC (Appendix D).

Selected Seismic Design Parameters from 2013 CBC/ASCE 7-10	***Seismic Design Values***	***Reference***
Latitude	33.9867 North	
Longitude	118.3970 West	
Nearest Seismic Sources	Puente Hills Thrust, Newport-Inglewood, and Santa Monica Faults	USGS 2013
Distance to Nearest Seismic Source	1.98 to 4.97 Miles (3.2 to 8 km)	USGS 2013
Site Class per Table 20.3-1 of ASCE 7-10	D	USGS, 2014
Spectral Acceleration for Short Periods (Ss)	1.797 g	USGS, 2014
Spectral Accelerations for 1-Second Periods (S1)	0.655 g	USGS, 2014
Site Coefficient F_a, Table 11.4-1 of ASCE 7-10	1.0	USGS, 2014
Site Coefficient F_v, Table 11.4-2 of ASCE 7-10	1.5	USGS, 2014
Design Spectral Response Acceleration at Short Periods (S_{DS}) from Equation 11.4-3 of ASCE 7-10	1.198 g	USGS, 2014
Design Spectral Response Acceleration at 1-Second Period (S_{D1}) from Equation 11.4-4 of ASCE 7-10	0.655 g	USGS, 2014
Peak Ground Acceleration (MCE_R) Corrected for Site Class Effects from Equation 11.8-1 of ASCE 7-10	0.647 g	USGS, 2014
Seismic Design Category, Section 11.6 of ASCE 7-10	D	USGS, 2014

3.5 Static and Seismic Settlement

The amount of settlement expected will depend on the actual design grading and foundation loading. Based on our geotechnical exploration and analysis, and considering relatively light structural loads, we anticipate that the total and differential settlement at the site should not exceed approximately 1-inch and ½ -inch over span of 40 feet, respectively. This take takes into account the static and seismic settlements. The static and seismic settlement do not need to be combined since the timing and mechanics of these settlements are different. Based on the anticipated small settlement, conventional shallow foundations should be suitable.

3.6 Lateral Earth Pressures for Permanent Retaining Structures

The recommended lateral earth pressures for approved native soils in drained and undrained conditions are as follows:

Conditions	*Level-Drained (pcf)*	*Level-Undrained (pcf)*
Active	47	84
At-Rest	67	84
Passive	300	220

These parameters are based on a soil internal friction angle of 27 degrees and soil unit weight of 120 pcf. The undrained values correspond to below ground water conditions.

To design an unrestrained retaining wall, such as a cantilever wall, the active earth pressure may be used. For a restrained retaining wall, such as a vault/well or at restrained wall corners, the at-rest pressure should be used. Passive pressure is used to compute lateral soils resistance developed against lateral structural movement. The passive resistance is taken into account only if it is ensured that the soil against embedded structure will remain intact with time. Excessive soil disturbance, trenches (excavation and backfill), future landscaping adjacent to footings and over-saturation can adversely impact retaining structures and result in reduced lateral resistance. For sliding resistance, the friction coefficient of 0.33 may be used at the concrete and soil interface. The retaining structures may also need to be designed for additional lateral loads if other structures or walls are planned within a 1H:1V projection.

The seismic lateral earth pressure for walls retaining more than 6 feet of soil and level backfill conditions may be estimated to be an additional 21 pcf for active and at-rest conditions. The seismic lateral earth pressure does not apply to walls retaining less than 6 feet of soil (2013 CBC Section 1803.5.12). The earthquake soil pressure has a triangular distribution and is added to the static pressures. For the active and at-rest conditions, the additional earthquake loading is zero at the top and maximum at the base.

Typical recommendations for wall drainage are provided on the attached detail (Figure 5). Proper surface drainage should also be provided.

3.7 Foundation Design Parameters

The proposed foundations will be underlain by certified fills and/or competent alluvial deposits depending on the depth of the foundation. The onsite soils are anticipated to be suitable for shallow foundations and slabs-on-grade. The recommended allowable bearing capacity for footings may be calculated based on the following equation:

$$q_{all} = 1000 + 300\ B + 500\ D \leq 3{,}000 \text{ psf}$$

(where B = footing width in feet and D = footing depth in feet)

The allowable bearing pressure may be increased to a maximum value of 3,000 psf for increase in footing width (W) and embedded depth (D). The allowable bearing pressure may be increased by one-third for wind and seismic loading. The coefficient of resistance of 0.33 against unwanted sliding is considered appropriate.

The following elastic soil properties are based on published/commonly used values and may be used for the design:

- Poisson's Ratio: 0.35
- Modulus of Elasticity of Soil (Es): 2,000 psi
- Modulus of Soil Reaction for Pipe Embedment (E'b): 600 psi
- Modulus of Subgrade Reaction: 200 pci

We recommend that strip and isolated footings have a minimum embedment depth of 18 inches. The footings of free-standing and isolated structures, such as walls and pilasters, should have a minimum embedment depth of 24 inches into approved soils.

The onsite soils have "low" expansion potential. The design of foundations is the responsibility of the project structural engineer based on the anticipated loads, settlement and code requirements. The building code (CBC) provides design requirements for slab-on-grade foundations to be constructed on expansive soil based on the Wire Reinforcement Institute (WRI) and the Post-Tension Institute (PTI) procedures.

3.8 Groundwater and Construction Dewatering

In general, it appears the groundwater levels in the area have declined due to the current drought conditions. However, the groundwater level will be subject to seasonal and annual groundwater fluctuations. Nearby groundwater data recorded over the last 4 years indicate groundwater level fluctuations up to 9.6 feet (9.0 to 18.6 feet bgs). It is our opinion that groundwater level will likely rise during high rainfall periods.

The majority of the proposed improvements in the upper 15 to 20 feet will be excavated in predominantly the silty and clayey alluvium that has relatively low permeability. The soils in this zone will vary from damp to very moist. The bottom of excavations may require some additional bedding and stabilization measures if wet soils or groundwater are encountered.

The improvements excavated deeper than 20 feet will encounter groundwater and predominantly sandy alluvium with higher permeability. The slug testing and analysis by CRA (2015a) indicated the shallow aquifer has an average site hydraulic conductivity of 45.9 ft/day (1.62×10^{-4} m/s) and transmissivity of 688 ft^2/day (1.62×10^{-4} m^2/s). The contractor should evaluate the anticipated conditions and provide mitigation based on their experience and expertise. A qualified dewatering specialist should be retained to design the appropriate dewatering system.

A significant amount of dewatering could result in ground settlements within the area of dewatering influence. Depending on the amount of dewatering to be performed, additional analysis should be considered to quantify both the amount of settlements, as well as the lateral zone of influence. Potential impacts on adjacent improvements should be evaluated. In addition, water quality and discharge issues will need to be addressed for the dewatering.

3.9 Utility and Trench Excavations and Backfill

We recommend that all excavations be performed in accordance with the requirements set forth by the Greenbook Section 306 and CAL/OSHA Excavation Safety Regulations (Construction Safety Orders). The native soils at the site are anticipated to be classified as Type C (and locally Type B). Excavations adjacent to existing utilities or structures to be protected in place may require special measures (i.e., providing a minimum setback distance, layback or temporary shoring) to reduce the potential for ground movement and other adverse impacts. The steepest allowable slopes in Type C soil are 1.5:1 (horizontal to vertical) for excavations less than 20 feet deep. Where there is no room for these layback slopes, we anticipate that shoring will be necessary. Excavations should be reviewed periodically by the contractor's qualified person to confirm compliance with Cal OSHA requirements.

The bottom of deeper excavations will likely expose saturated sandy alluvium that may require some additional stabilization for the proposed improvement. We recommend a minimum of 12-inch-thick layer of crushed aggregate base (CAB) be placed below for subgrade stabilization. If groundwater is present, an additional 12-inches of crushed rock/gravel may be required as approved by the geotechnical consultant. Also, an approved Type II nonwoven geofabric (i.e., Mirafi 180N), should be placed on the wet subgrade and around the crushed rock/gravel material. The stabilization method may need to be revised in the field based on the actual conditions encountered, as determined by the geotechnical consultant. The CAB layer shall be compacted to a minimum 95 percent relative compaction. The crushed rock/gravel shall be placed and compacted to create a firm surface.

The bedding, shading, and structural backfill of the pipe and structures shall also comply with approved project plan and Greenbook specifications (Section 306). Structural backfill material shall have a sand equivalent not less than 20 and meet the gradation requirements per Greenbook Table 300-3.5.1(A).

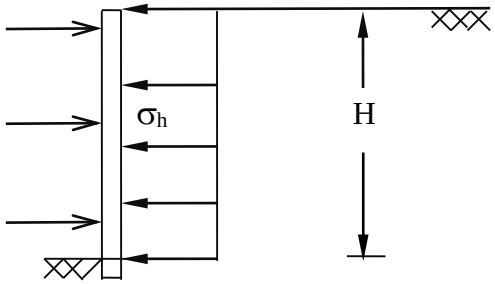
Geotechnical observation and testing should be performed during excavation and backfill operations. Field and laboratory testing should be conducted in accordance with project specifications and the relevant test procedures related to fill placement and compaction control. The trench backfill shall be compacted to the minimum relative compaction of 90 percent by ASTM Test Method D1557.

Native materials that are relatively free of deleterious material, should be suitable for use as trench backfill provided they are not determined to be impacted by hazardous substances. Fills should be moisture-conditioned and processed, as necessary to achieve a uniform moisture content that is over optimum, and within moisture limits required to assure adequate bonding and compaction. The moisture content of the existing soils varies and additional measures (e.g., mixing, drying or wetting) may be required to achieve the appropriate moisture content for fill placement. Native backfill materials should be compacted to a minimum of 90 percent relative compaction. Select granular backfill (SE 30 or better) or approved slurry may be used in lieu of native soils for trench backfill, but shall be placed and densified in accordance with the requirements of the governing agency. Rocky material (materials greater than 3 inches) may not be suitable for

structural backfill. Trenches excavated next to structures and foundations should also be properly backfilled and compacted to provide full lateral support and reduce settlement potential.

3.10 Temporary Shoring and Stability

Excavations should be performed in accordance with Cal OSHA requirements. The contractor's qualified person should verify compliance with Cal OSHA requirements. Shoring that deviates from OSHA standards or for excavations greater than 20 feet in depth should be designed by a registered professional engineer. The pressure distribution below may be used for shoring design.



σ_h = **30 H** for drained conditions, and
55 H for undrained conditions (below the groundwater)
where: H is in feet and σ_h is in lbs/ft^2.

These parameters are based on a soil internal friction angle of 27 degrees and soil unit weight of 120 pcf. Due to the relatively shallow groundwater conditions, we recommend the lateral earth pressure of undrained conditions be used for shoring design. The deeper excavations that have shallow groundwater will be prone to lateral movement and failure if left unsupported. The type of temporary shoring selected will need to prevent caving and protect the existing street improvements and utilities in-place. Special attention should be provided when moving or removing the shoring to minimize the potential for lateral movement of the unsupported excavations.

Heavy construction loads and stockpiles of excavated soils should be kept away from the edge of the trench, at minimum, a distance equal to the depth of the excavation. Otherwise, these surcharges will need to be considered for the design of the shoring system. Stockpiling of soils (more than 5 feet in height) at or near existing structures and over utility lines that are to remain in place should not be allowed without review by the geotechnical consultant and the structure/utility line owner(s).

3.11 Cement Type and Corrosivity

We anticipate that the onsite soil will have "severe" sulfate exposure level (based on the classification for concrete exposed to sulfate in Table 4.2.1 in ACI-318-08). Cement type and mix design for structural concrete with respect to sulfates should conform to the Greenbook requirements which specify a water cement ratio of 0.40 and a minimum compressive strength of 5,000 psi.

The site soils severely corrosive to ferrous metals and may also be aggressive to copper. The pH and chloride exposure determined for the onsite soils do not result in special requirements. Specific recommendations pertaining to corrosion protection are provided in the report prepared by HDR, Inc. included in Appendix C.

3.12 Non-Structural Concrete

Exterior concrete elements, such as curb and gutter, sidewalks and other improvements, are susceptible to lifting and cracking when constructed over expansive soils. The upper 12 inches of the soil subgrade for concrete improvements should be presaturated to have a minimum moisture content of 110 percent of optimum.

Concrete Thickness: The nominal thickness for the concrete improvements should be 4 inches, except where heavier loads are anticipated. Pavements anticipated to have vehicular traffic (H-5 to H-20 loading) should be a minimum 6 inches thick and provided with the appropriate aggregate base, reinforcement and restraints, as discussed below. City standards may govern the required minimum thicknesses for the exterior concrete elements.

Aggregate Base: The approved subgrade soils should be adequate for support of the proposed pavements and should not require aggregate base sub-layer. For pavements that have vehicular loading, a minimum 6-inch-thick layer of aggregate base material should be provided. Steel reinforcement may be added in lieu of the aggregate base for concrete pavements that will have soft soil conditions, provided it is acceptable to the governing agency. Additional information pertaining to reinforcement is presented below.

Aggregate base should be crushed miscellaneous base (CMB) in accordance with Standard Specifications for Public Works Construction (Greenbook). The material should be free of any detrimental quantity of deleterious materials. The aggregate base should be observed and tested by the geotechnical consultant to verify that it is compacted to a minimum of 95 percent relative compaction based on ASTM Test Method D1557.

Reinforcement: Proper subgrade preparation and presaturation, placement of aggregate base material and sufficient control and expansion joints can be used in lieu of reinforcement for most conditions. However, reinforcement should be considered for pavements that will be constructed will have vehicular loading. The minimum reinforcement should consist of No. 3 rebar placed 24 inches on center (both directions) and placed near mid-height of the slab. Where used, reinforcing steel should be protected with the appropriate concrete cover.

Joints: We recommend that longitudinal and transverse joint spacing for the concrete pavement be no more than 10 feet apart to control cracking. The depth of jointing must be at least ¼ of the slab thickness. Expansion joints need to be incorporated into the concrete pavements to allow for soil and thermal expansion.

Please also note that reducing cracking of concrete is often a function of proper concrete mix design, placement, and curing/finishing practices. Adherence to guidelines of the American

Concrete Institute (ACI) is recommended. Also, the amount of post-construction watering, or lack thereof, can have a significant impact on the adjacent concrete flatwork.

3.13 Pavement Design

The R-value test result for the near-surface soil sample was 22. The following pavement section is designed based on a traffic index (TI) of 5 and an R-value of 20.

Description	***Structural Section***
Composite Asphalt Pavement	0.30' AC over 0.50' AB

AC = Asphalt Concrete, AB = Aggregate Base

Prior to construction of pavement sections, the subgrade soils should be scarified to a minimum depth of 6 inches, moisture-conditioned as needed, and recompacted in-place to a minimum of 90 percent relative compaction (per ASTM Test Method D1557). Subgrade should be firm prior to AB placement.

AB materials can be crushed aggregate base or crushed miscellaneous base in accordance with the Greenbook (Section 200-2). The materials should be free of any deleterious materials. Aggregate base materials should be placed in 6- to 8-inch loose lifts, moisture-conditioned as necessary, and compacted to a minimum of 95 percent relative compaction (per ASTM Test Method D1557). Asphalt concrete should also be compacted to a minimum relative compaction of 95 percent.

3.14 Surface Drainage and Irrigation

Inadequate control of run-off water, heavy irrigation after development of the site, or regional groundwater level changes may result in shallow groundwater conditions. Maintaining adequate surface drainage, proper disposal of run-off water, and control of irrigation will help reduce the potential for future moisture-related problems and differential soil movements.

Surface drainage should be carefully taken into consideration during grading, landscaping, and construction. Positive surface drainage should be provided to direct surface water away from structures and slopes and toward the street or suitable drainage devices. Ponding of water adjacent to the structures should not be allowed. Buildings should have roof gutter systems and the run-off should be directed to parking lot/street gutters by area drain pipes or by sheet flow over paved areas. Paved areas should be provided with adequate drainage devices, gradients, and curbing to prevent run-off flowing from paved areas onto adjacent unpaved areas.

3.15 Geotechnical Review of Future Plans

Once a construction or grading plan becomes available, it should be reviewed by the geotechnical consultant. The geotechnical consultant should work with the structural engineer and project team as needed during design to provide more detailed recommendations.

3.16 Geotechnical Observation and Testing

Geotechnical observation and testing during grading and construction should be conducted during the following stages:

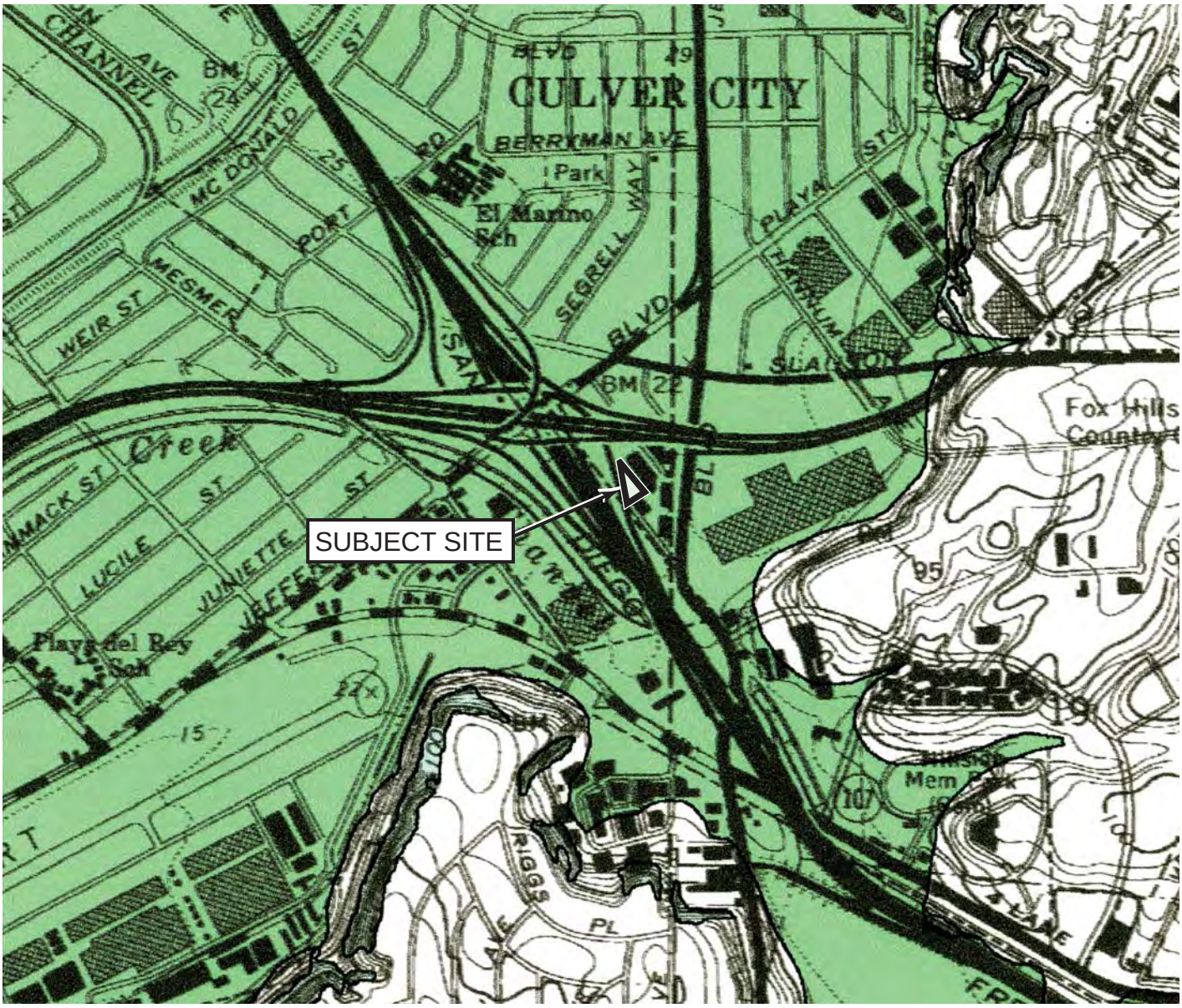
- During site preparation and clearing;
- During remedial removal and excavation;
- During placement of compacted fill;
- During trench excavation and backfill;
- During installation of temporary shoring;
- During jetting/hydraulic compaction of pipe bedding;
- During installation and removal of shoring;
- During structure and trench backfill operations;
- During preparation of subgrade soils for pads and pavements;
- During placement of aggregate base and asphalt cement; and
- When any unusual or unexpected geotechnical conditions are encountered during construction.

Please note that the items listed above are for the construction phase and not included in NMG's scope of work. If NMG is not retained as the geotechnical consultant during construction, the future consultant will need to review this report and concur with the geotechnical findings and conclusions and take responsibility for all the geotechnical aspects of the project.

4.0 LIMITATIONS

This report has been prepared for the exclusive use of our client, the city of Culver City, based on the specific scope of services requested by our client for the project described herein. This report or its contents should not be used or relied upon for other projects or by other parties without the consent of NMG and the involvement of a geotechnical professional. The means and methods used by NMG for this study are based in part on local geotechnical standards of practice, care, and requirements of governing agencies. No warranty or guarantee, express or implied is given.

The findings, conclusions, and recommendations are professional opinions based on interpretations and inferences made from geologic and engineering data from specific locations and depths, observed or collected at a given time. By nature, geologic conditions can vary from point to point, can be very different in between points, and can also change over time. Therefore, our conclusions and recommendations are by nature preliminary and are subject to verification and possible modification as plans develop and with more exploration and/or observations during grading and construction when more subsurface data becomes available.



Liquefaction

Areas where historic occurrence of liquefaction, or local geological, geotechnical and groundwater conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslides

Areas where previous occurance of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

SITE LOCATION AND SEISMIC HAZARDS MAP

BASE: DIVISION OF MINES AND GEOLOGY SEISMIC HAZARDS MAP,
VENICE QUADRANGLE
Dated: March 25, 1999

N

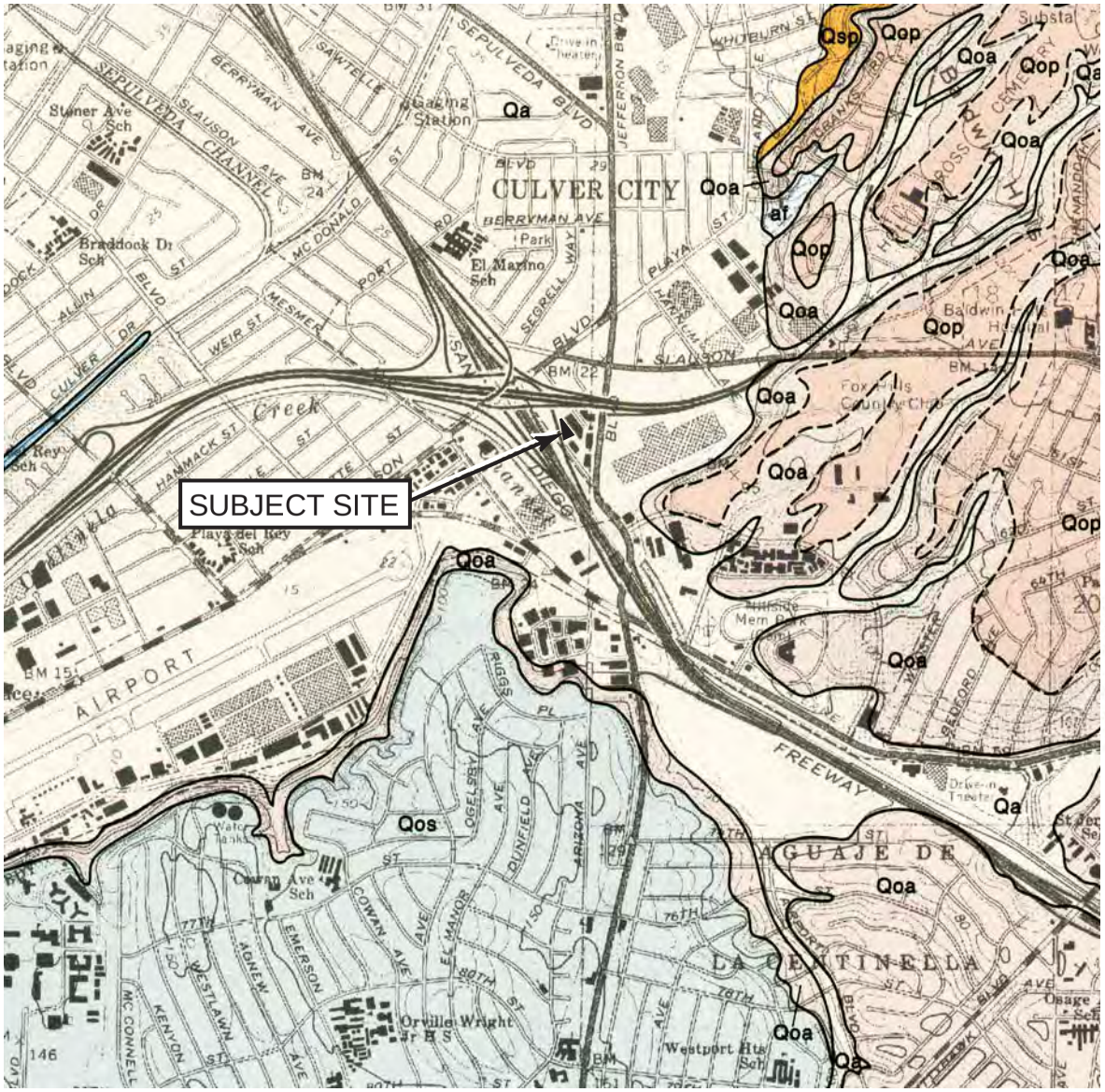
BANKFIELD SEWAGE PUMP STATION
5722 BANKFIELD AVENUE
CULVER CITY, CALIFORNIA

Project Number: 14038-01

Project Name PSOMAS/Bankfield PS

Date: 6/29/15 Figure No. 1

NMG Geotechnical, Inc.



Base: Geologic Map of the Venice and Inglewood Quadrangles
Thomas W. Dibblee, 2007

VENICE AND INGLEWOOD MAP (DF-322)

LEGEND

Qa

Qa *Alluvial gravel, sand, and clay, derived mostly from Santa Monica mountains; includes gravel and sand of minor stream channels*

Qos | Qae | Qop | Qoa

OLDER SURFICIAL SEDIMENTS

Unconsolidated to weakly consolidated alluvial sediments, dissected where elevated; age, late Pleistocene

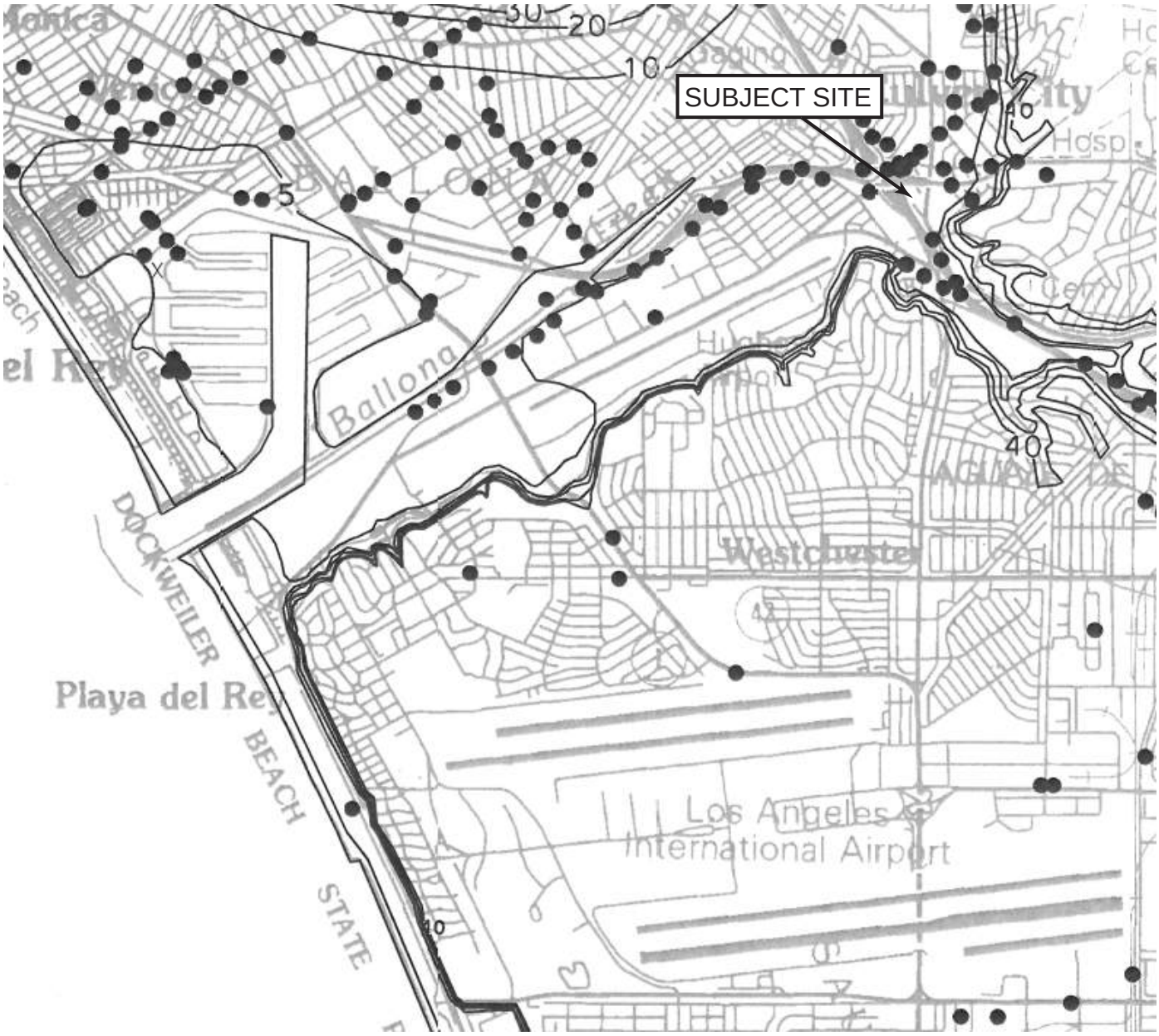
Qos *Old sand dune deposits*
Qae *Alluvial gravel, sand, and clay, slightly elevated and dissected*
Qop *Paleosol in Baldwin Hills (Fox Hills paleosol of Weber et al., 1982), gray to rusty brown, sandy, locally pebbly, moderately indurated "hardpan" on* **Qoa**
Qoa *Older alluvium of gray to light brown pebble-gravel, sand, and silt-clay, elevated and dissected; in Baldwin Hills designated as Baldwin Hills sandy gravel by Weber et al., 1982, where it is much dissected and eroded*

N

GEOLOGIC MAP
BANKFIELD SEWAGE PUMP STATION
CULVER CITY, CALIFORNIA

Project Number: 14038-01
Project Name: PSOMAS/Bankfield PS
Date: 6/29/15
Figure No. 2

NMG Geotechnical, Inc.



Historically Highest Ground Water Contours and Borehole Log Data Locations, Venice Quadrangle

● Borehole Site

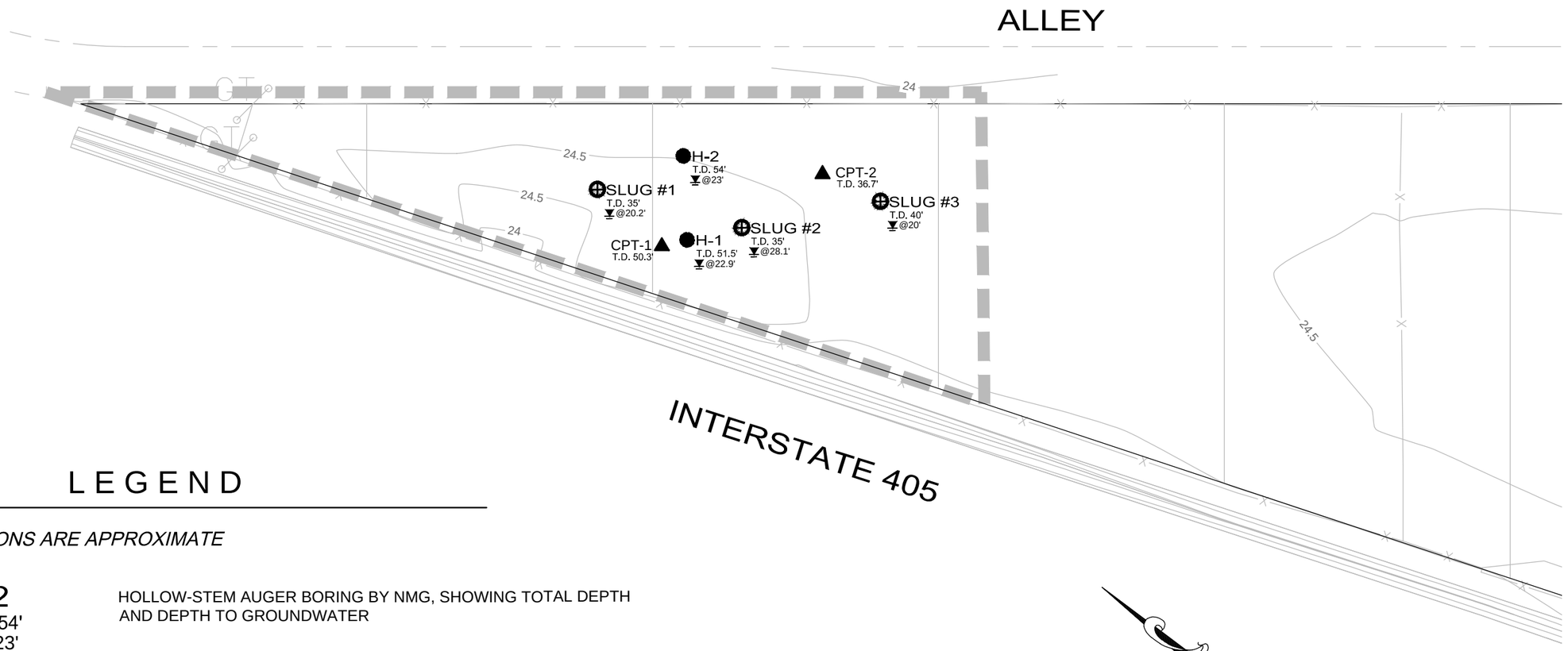
30 Depth to ground water in feet

N

HISTORIC HIGH GROUNDWATER CONTOUR MAP

SOURCE: SEISMIC HAZARD ZONE EVALUATION REPORT FOR THE VENICE QUADRANGLE, CALIFORNIA DIVISION OF MINES AND GEOLOGY, 1998

BANKFIELD SEWAGE PUMP STATION 5722 BANKFIELD AVENUE CULVER CITY, CALIFORNIA	Project Number: 14038-01 Project Name: PSOMAS / Bankfield PS Date: 6/29/15 Figure No. 3	NMG Geotechnical, Inc.



LEGEND

LOCATIONS ARE APPROXIMATE

H-2
T.D. 54'
@23'
HOLLOW-STEM AUGER BORING BY NMG, SHOWING TOTAL DEPTH AND DEPTH TO GROUNDWATER

CPT-2
T.D. 36.7'
CONE PENETROMETER TEST BY NMG, SHOWING TOTAL DEPTH

SLUG #3
T.D. 40'
@20'
GROUNDWATER WELL AND SLUG TEST LOCATION BY CRA, SHOWING TOTAL DEPTH AND DEPTH TO GROUNDWATER

LIMITS OF PROJECT SITE

GRAPHIC SCALE

20 0 10 20 40

(IN FEET)
1 inch = 20 ft.

FIGURE 4

BASE MAP PROVIDED BY PSOMAS, DATED APRIL 10, 2015

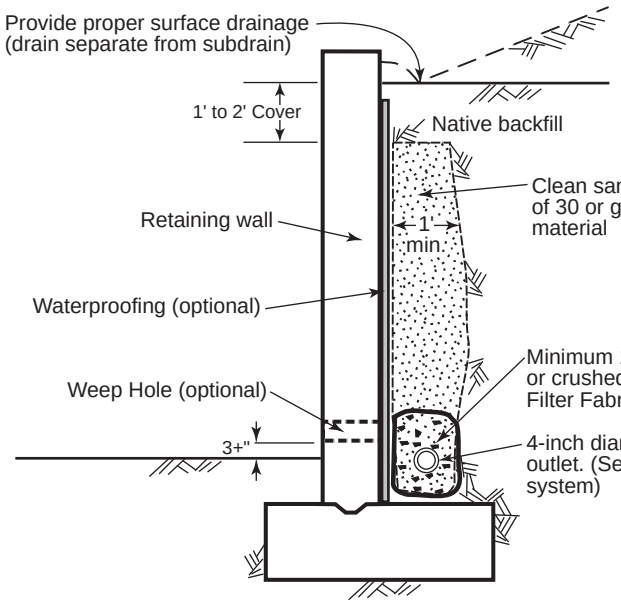
BORING LOCATION MAP
PROPOSED BANKFIELD PUMP STATION
5722 BANKFIELD AVENUE
CULVER CITY, CALIFORNIA

Project No.: 14038-01 By: KGM/WG
Project Name:PSOMAS/Bankfield PS
Date: 6/29/15 Scale: 1"=20'

NMG Geotechnical, Inc.

OPTION 1:

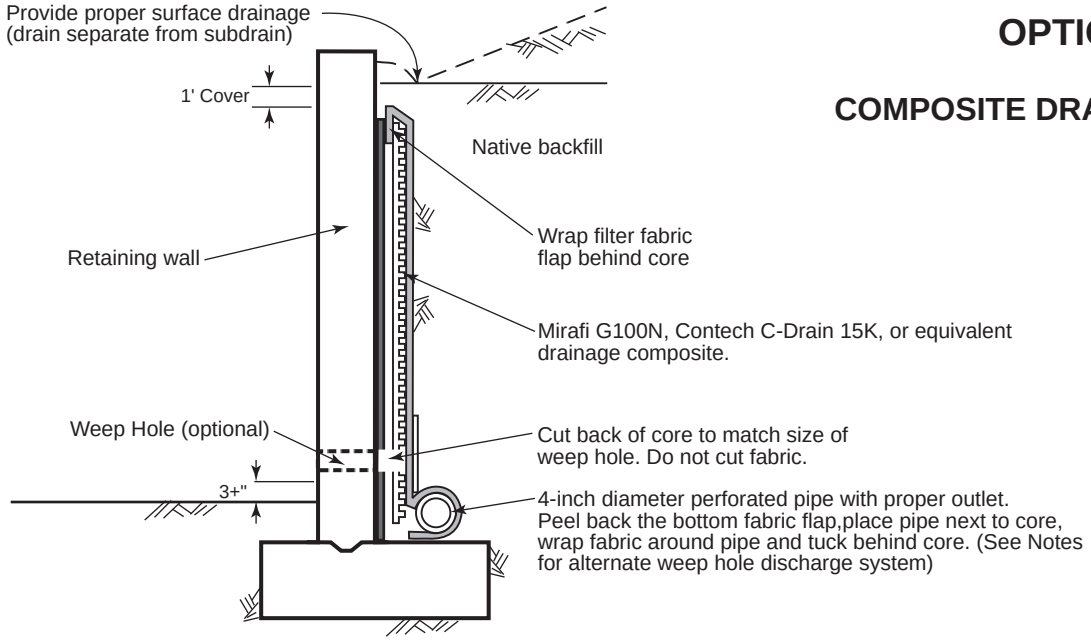
AGGREGATE SYSTEM DRAIN



Alternative: Class 2 permeable filter material (Per Caltrans specifications) may be used for vertical drain and around perforated pipe (without filter fabric)

OPTION 2:

COMPOSITE DRAINAGE SYSTEM



NOTES:

1. **PIPE TYPE SHOULD BE PVC OR ABS, SCHEDULE 40 OR SDR35 SATISFYING THE REQUIREMENTS OF ASTM TEST STANDARD D1527, D1785, D2751 , OR D3034.**
2. **FILTER FABRIC SHALL BE APPROVED PERMEABLE NON-WOVEN POLYESTER, NYLON, OR POLYPROPYLENE MATERIAL.**
3. **DRAIN PIPE SHOULD HAVE A GRADIENT OF 1 PERCENT MINIMUM.**
4. **WATERPROOFING MEMBRANE MAY BE REQUIRED FOR A SPECIFIC RETAINING WALL (SUCH AS A STUCCO OR BASEMENT WALL).**
5. **WEEP HOLES MAY BE PROVIDED FOR LOW RETAINING WALLS (LESS THAN 3 FEET IN HEIGHT) IN LIEU OF A VERTICAL DRAIN AND PIPE AND WHERE POTENTIAL WATER FROM BEHIND THE RETAINING WALL WILL NOT CREATE A NUISANCE WATER CONDITION. IF EXPOSURE IS NOT PERMITTED, A PROPER SUBDRAIN OUTLET SYSTEM SHOULD BE PROVIDED.**
6. **IF EXPOSURE IS PERMITTED, WEEP HOLES SHOULD BE 2-INCH MINIMUM DIAMETER AND PROVIDED AT 25-FOOT MAXIMUM SPACING ALONG WALL. WEEP HOLES SHOULD BE LOCATED 3+ INCHES ABOVE FINISHED GRADE.**
7. **SCREENING SUCH AS WITH A FILTER FABRIC SHOULD BE PROVIDED FOR WEEP HOLES/OPEN JOINTS TO PREVENT EARTH MATERIALS FROM ENTERING THE HOLES/JOINTS.**
8. **OPEN VERTICAL MASONRY JOINTS (I.E., OMIT MORTAR FROM JOINTS OF FIRST COURSE ABOVE FINISHED GRADE) AT 32-INCH MAXIMUM INTERVALS MAY BE SUBSTITUTED FOR WEEP HOLES.**
9. **THE GEOTECHNICAL CONSULTANT MAY PROVIDE ADDITIONAL RECOMMENDATIONS FOR RETAINING WALLS DESIGNED FOR SELECT SAND BACKFILL.**

RETAINING WALL DRAINAGE DETAIL

NMG Geotechnical, Inc.

FIGURE 5

APPENDIX A

APPENDIX A

REFERENCES

California Division of Mines and Geology, 1998, Seismic Hazard Zone Evaluation Report for the Venice 7.5-Minute Quadrangle, Los Angeles County, California, Seismic Hazard Zone Report 036.

California Division of Mines and Geology, 1999, Seismic Hazard Zones, Venice Quadrangle, Official Map dated March 25, 1999.

Conestoga-Rovers & Associates, 2015a, Well Installation and Slug Test Report, Bankfield Sewage Pump Station, 5722 Bankfield Avenue, Culver City, California, Ref. No. 086977 (2), dated February 27, 2015.

Conestoga-Rovers & Associates, 2015b, Phase I Environmental Site Assessment, Bankfield Sewage Pump Station, 5722 Bankfield Avenue, Culver City, California, Ref. No. 086977, dated March 2015.

Conestoga-Rovers & Associates, 2015c, Revised Phase I Environmental Site Assessment Recommendations, 5722 Bankfield Avenue, Culver City, California, Ref No. 086977, dated June 19, 2015.

Dibblee, T.W. and Minch, J.A., 2007, Geologic Map of the Venice and Inglewood Quadrangles, Los Angeles County, California, Dibblee Foundation Map DF-322.

Geotracker, 2015, California Environmental Protection Agency, Water Resources Control Board, 2015, Geotracker Groundwater Data Program, website address: http://geotracker.waterboards.ca.gov/default.asp#.

Hart, E. W. and Bryant, W.A., 2007, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault zones Maps, Department of Conservation, Division of Mines and Geology, Special Publication 42, Revised 1997, Interim Revision 2007.

Jennings, Charles W. and Bryant W.A., 2010, Fault Activity Map of California, Department of Conservation, California Geological Survey, Geologic Data Map No. 6.

Stantec Consulting Corp., 2011, Semi-Annual Groundwater Monitoring Report – January through June 2011, Former Texaco Service Station, Jefferson Plaza, 11467-11469 Jefferson Boulevard, Culver City, California, Project No.: 211802250, dated July 12, 2011.

Stantec Consulting Corp., 2015, Semi-Annual Groundwater Monitoring Report – July through December 2014, Former Texaco Service Station, Jefferson Plaza, 11467-11469 Jefferson Boulevard, Culver City, California, Project No.: 211802250, dated January 15, 2015.

APPENDIX A

REFERENCES (Continued)

U.S. Geological Survey, 2013, 2008 Interactive Deaggregations Program; web site address: https://geohazards.usgs.gov/deaggint/2008/.

U.S. Geological Survey, 2014, U.S. Seismic Design Maps, web site address: http://geohazards.usgs.gov/designmaps/us/application.php.

AERIAL PHOTOGRAPHS REVEIWED

Date	*Scale*	*Photographs*	*Source*
2/23/1999	1"=2000'	C-133-30-5/6	Continental Aerial Photo
10/16/1997	1"=2000'	C-119-30-199/200	Continental Aerial Photo
7/11/1995	1"=2000'	C-114-30-41/42	Continental Aerial Photo
6/9/1993	1"=2000'	C-93-18-10/11	Continental Aerial Photo
1/23/1992	1"=2000'	C-85-1-29/30	Continental Aerial Photo
1/2/1990	-	C-83-12-51/52	Continental Aerial Photo
7/7/1988	1"=2167'	19303	Continental Aerial Photo
1/27/1986	-	F-302/303	Continental Aerial Photo
5/12/1979	-	FCLA-7-45/46	Continental Aerial Photo
3/16/1978	-	78049-39/40	Continental Aerial Photo
1/30/1970	-	60-5-133/134	Continental Aerial Photo
11/19/1953	-	14K-67/68	Continental Aerial Photo

APPENDIX B

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	*GRAVEL AND GRAVELLY SOILS* MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	*CLEAN GRAVELS* (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	*CLEAN SANDS* (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	*SILTS AND CLAYS* LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: Dual symbols are used to indicate gravels or sand with 5-12% fines and soils with fines classifying as CL-ML. Symbols separated by a slash indicate borderline soil classifications.

Sampler and Symbol Descriptions

- Modified California sample (63.5 mm diameter)
- Standard Penetration Test
- Undisturbed pushed tube sample
- Large bulk sample
- Small bulk sample
- Approximate depth of perched water or groundwater

Note: Number of blows required to advance driven sample 300 mm (or length noted) is recorded; blow count recorded for seating interval (initial 150 mm of drive) is indicated by an asterisk.

Laboratory and Field Test Abbreviations

MD	Laboratory compaction test
CN	Laboratory consolidation test
DS	Laboratory direct shear test
AL	Atterberg limits
SE	Sand Equivalent
GS	Grain Size Analysis (Sieve and/or Hydro.)
RV	R-Value
CC	Chemical Testing incl. Soluble Sulfate
EI	Expansion Index
UU	Unconsolidated Shear Strength

GENERAL NOTES

1. Station location is indicated with offset to right (R) or left (L) of centerline (CL).
2. Soil classifications are based on the Unified Soil System and include color, moisture, and relative density or consistency. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate. Bedrock descriptions are based on visual classification and include rock type, moisture, color, grain size, strength, and weathering.
3. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were made. They are not warranted to be representative of subsurface conditions at other locations or times.

KEY TO LOG OF BORING

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

Date(s) Drilled	3/17/15	Logged By	AZ/DNG
Drilling Company	2R Drilling	Drill Bit Size/Type	10"
Drill Rig Type	CME 75	Hammer Data	140 lbs. @ 30" Drop
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	22.9' During Drilling		
Comments			

H-1

Sheet 1 of 2

Total Depth Drilled (ft)	51.5
Approximate Ground Surface Elevation (ft)	24.5 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					ML	Surface: 3.5" AC, No AB. **Alluvium (Qal)**			
20	5		D-1	23			@ 5': Light yellowish brown fine sandy SILT, damp, stiff, trace caliche nodules.	8.6	96.5	GS, AL
			B-1							B-1 @ 5-10' GS, MD, SE, RV, CC
	10		D-2	19		CL	@ 10': Upper: Dark brown sandy CLAY, very moist to wet, stiff, trace cliche, trace root hairs. Lower: grayish brown sandy CLAY, damp, stiff, caliche.	26.4	96.0	AL, CN
10	15		D-3	37		SC	@ 15': Upper: Olive gray clayey silty SAND, very moist, medium dense.	16.2	113.2	DS
						SM	Lower: Olive gray silty SAND, very moist, medium dense, trace mica.			
	20		D-4	72			@ 20': Dark gray silty fine to coarse SAND, saturated, dense, friable.	15.6	107.8	
			B-2				▽			B-2 @ 20-25' GS, SE
0	25		D-5	71		SP-SM	@ 25': Light brownish gray silty fine to coarse SAND, saturated, dense, trace mica, friable.	13.1	113.3	
	30									

LOG OF BORING

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG

Elevation (ft) / Depth (ft)	SAMPLES Type Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
30	D-6	44		SP-SM	@ 30': Dark gray silty fine to coarse SAND, saturated, medium dense, trace mica, trace fine gravel, friable.	13.4	110.8	
35	D-7	23		SC	@ 35': Black clayey coarse SAND, saturated, medium dense.	13.3	109.2	GS, AL
40	D-8	89		SP	@ 40': Very dark gray medium to coarse SAND, saturated, very dense, friable.	8.5	124.2	GS Sandy Gravel @ 41'
45	D-9	92			@ 45': Very dark gray medium to coarse SAND, saturated, very dense, trace gravel, friable.	11.0	129.9	
50	D-10	88		SM	@50': Dark olive gray silty fine SAND, saturated, very dense.	23.9	102.7	
55					Notes: Total Depth: 51.1 Feet. Groundwater Encountered at 22.9 Feet. Backfilled with Cuttings Up to 30 Feet Below Ground Surface. Remainder Backfilled with Cement-Bentonite. Asphalt Patched with Cold Patch Asphalt.			
60								
65								

LOG OF BORING

PSOMAS/Bankfield Pump Station
Culver City, CA

PROJECT NO. 14038-01

NMG

Date(s) Drilled	3/17/15	Logged By	AZ/DNG
Drilling Company	2R Drilling	Drill Bit Size/Type	10"
Drill Rig Type	CME 75	Hammer Data	140 lbs. @ 30" Drop
Sampling Method(s)	Modified California, Bulk		
Approximate Groundwater Depth:	23' During Drilling		
Comments			

H-2

Sheet 1 of 2

Total Depth Drilled (ft)	54.0
Approximate Ground Surface Elevation (ft)	24.5 msl

Elevation (ft)	Depth (ft)	SAMPLES Type	SAMPLES Number	Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
	0					ML	Surface: 3" AC, No AB. **Alluvium (Qal)**			
			D-1 B-1	16			@ 2.5': Upper: Very dark brown fine sandy SILT, very moist, stiff, weathered, pinhole pores. Lower: Light olive brown sandy SILT, moist, stiff.	17.7	96.6	B-1 @ 1-5' GS, MD, EI, SE, CC
20	5									
			D-2	20		CL	@ 7.5': Upper: Dark brown fine sandy CLAY, wet, stiff, pinhole pores, caliche. Lower: very dark brown sandy CLAY, wet, stiff, pinhole pores.	23.3	103.5	CN, DS
	10									
			D-3	25			@ 12.5': Dark grayish brown sandy CLAY, moist, stiff, caliche.	14.9	114.1	GS, AL
10	15									
			D-4	25		SM	@ 17.5': Upper: Olive brown silty SAND, wet, medium dense.	22.3	106.6	CN, DS
						CL	Lower: Dark grayish brown silty CLAY, wet to saturated, very stiff.			
	20									
			D-5	70		SM	▽@ 22.5': Light olive brown silty fine to course SAND, saturated, dense, friable.	13.8	113.5	GS
0	25									
			D-6	84		SP-SM	@ 27.5': Light yellowish brown silty medium to course SAND, saturated, very dense, friable.	11.8	117.7	
	30									

LOG OF BORING

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG

Elevation (ft) / Depth (ft)	SAMPLES Type	SAMPLES Number	SAMPLES Blows per foot	Graphic Log	USCS	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	OTHER TESTS and REMARKS
30					SP-SM				
	D	7	78		SP	@ 32.5': Dark olive gray fine to course SAND, saturated, very dense, trace fine gravel, friable.	10.9	124.9	
35									
	D	8	18		SC	@ 37.5': Very dark gray clayey fine to course SAND, saturated, medium dense, trace fine gravel.	13.6	115.5	GS, AL
40									
	D	9	84		SP	@ 42.5': Gray find to course SAND, saturated, very dense, friable, trace fine gravel.	11.8	121.4	
45									
	D	10	50			@ 47.5': Gray fine to course gravel in sampler tip. Sample Disturbed.			Sandy Gravel @ 48-49'
50									
	D	11	98		SM	@ 52.5': Dark gray silty fine to medium SAND, saturated, very dense, slightly friable.	26.4	100.0	
55						Notes: Total Depth: 54 Feet. Groundwater Encountered at 23 Feet. Backfilled with Cuttings Up to 30 Feet Below Ground Surface. Remainder Backfilled with Cement-Bentonite. Asphalt Patched with Cold Patch Asphalt.			
60									
65									

LOG OF BORING

PSOMAS/Bankfield Pump Station
Culver City, CA

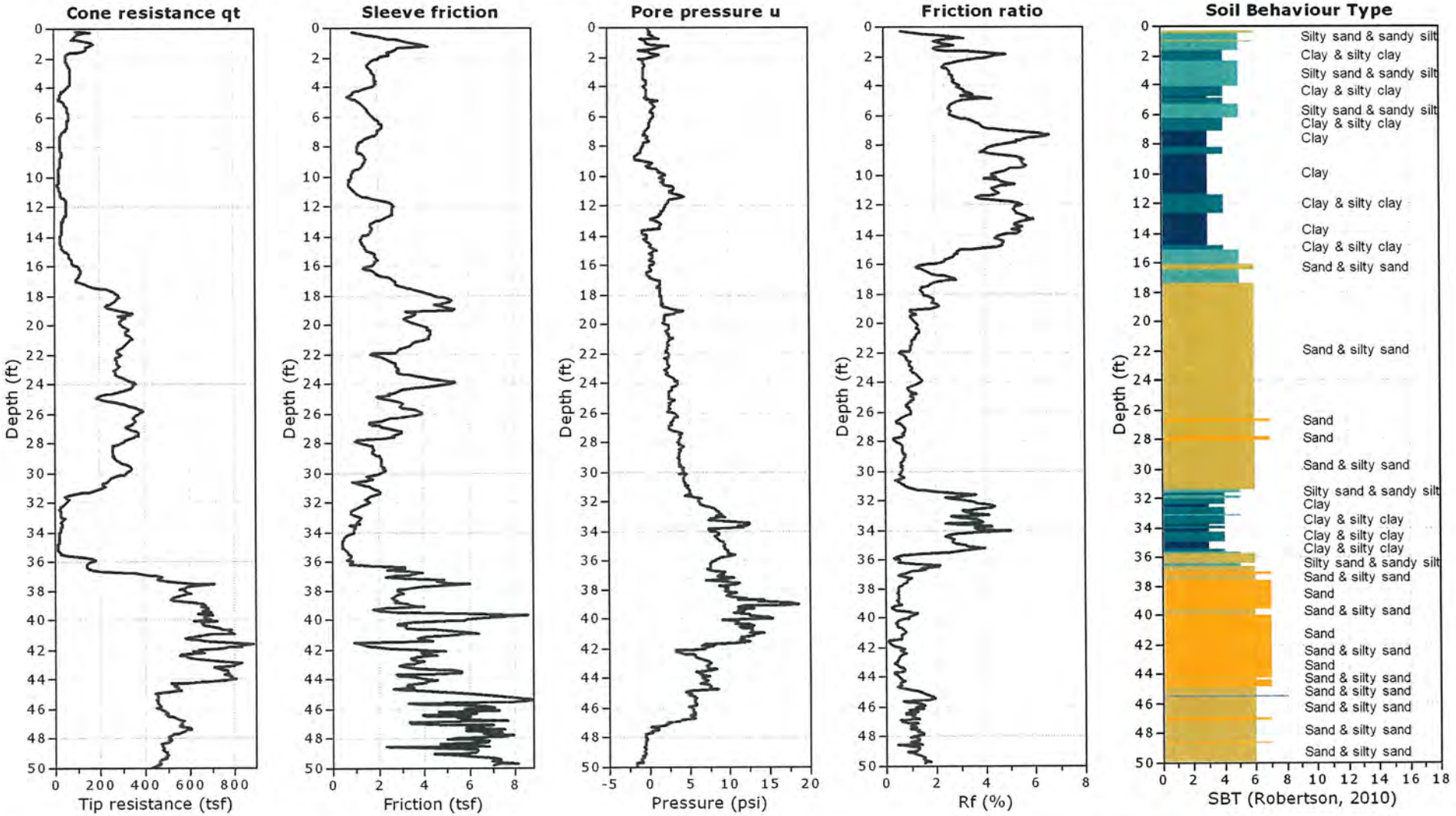
PROJECT NO. 14038-01

NMG

Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

Project: NMG Geotechnical, Inc.
Location: 5722 Bankfield Ave Culver City, CA

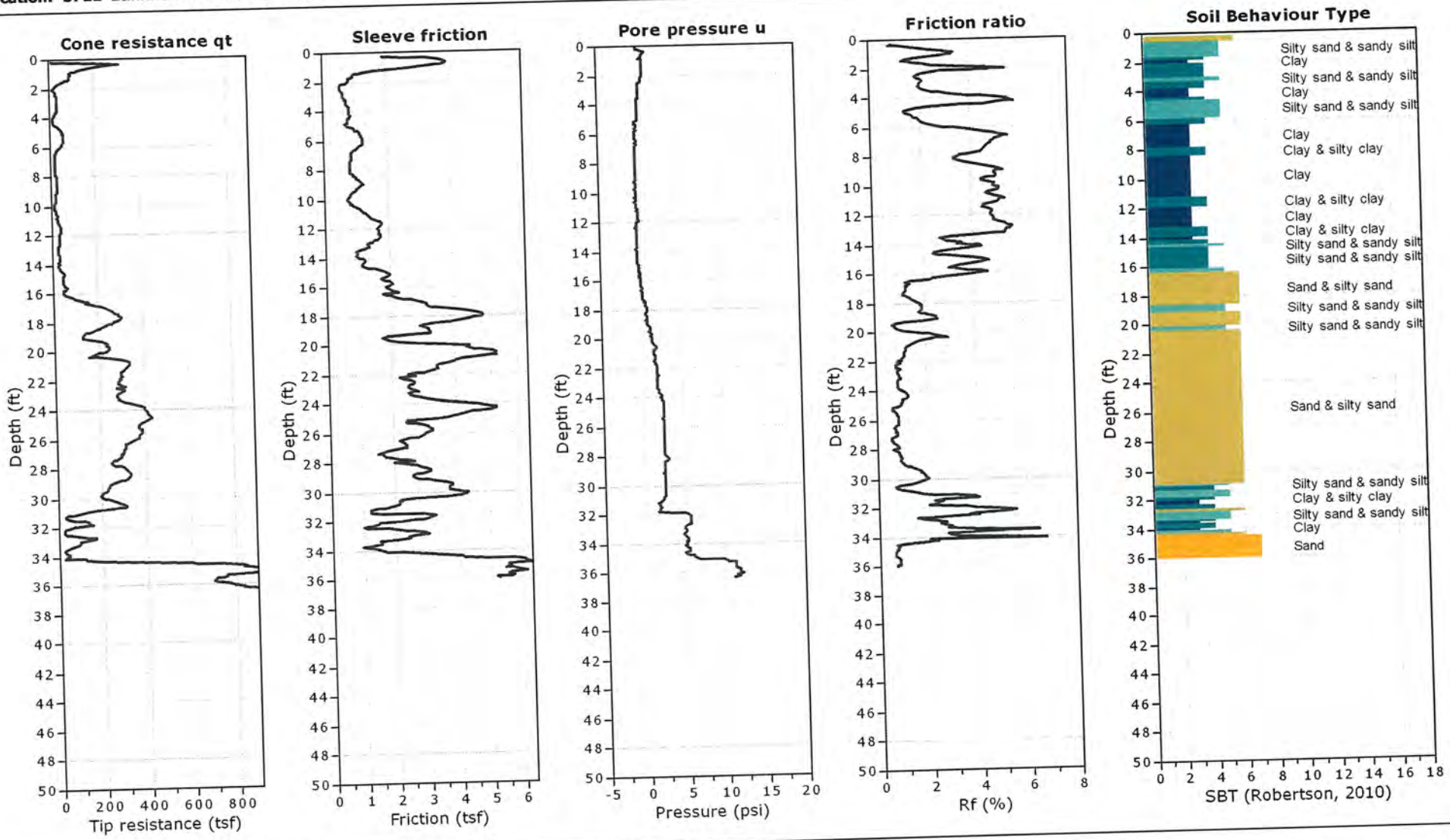
CPT: CPT-1
Total depth: 50.25 ft, Date: 3/17/2015
Cone Type: Vertek



Kehoe Testing and Engineering
714-901-7270
rich@kehoetesting.com
www.kehoetesting.com

Project: NMG Geotechnical, Inc.
Location: 5722 Bankfield Ave Culver City, CA

CPT: CPT-2
Total depth: 36.36 ft, Date: 3/17/2015
Cone Type: Vertek



CPeT-IT v.1.7.6.42 - CPTU data presentation & interpretation software - Report created on: 3/18/2015, 1:58:30 PM
Project file: C:\NMGCulverCity\CPeT Data\Plot Data\Plots.cpt

BORING LOGS BY:

CRA, 2015

Conestoga-Rovers & Associates
175 Technology Drive, Suite 200
Irvine, CA 92618
Telephone: 949-648-5200
Fax: 949-648-5299

BORING/WELL LOG

CLIENT NAME	City of Culver City	**BORING/WELL NAME**	SLUG #1
JOB/SITE NAME	Culver City Pump Station	**DRILLING STARTED**	11-Feb-15
LOCATION	5722 Bankfield Ave., Culver City, CA	**DRILLING COMPLETED**	13-Feb-15
PROJECT NUMBER	086977	**WELL DEVELOPMENT DATE (YIELD)**	17-Feb-15
DRILLER	BC2 Environmental	**GROUND SURFACE ELEVATION**	NA
DRILLING METHOD	Hollow-stem auger	**TOP OF CASING ELEVATION**	NA
BORING DIAMETER	8"	**SCREENED INTERVAL**	15 to 35 fbg
LOGGED BY	A. Leung	**DEPTH TO WATER (First Encountered)**	20.0 ft (13-Feb-15) ▽
REVIEWED BY	M. Smith	**DEPTH TO WATER (Static)**	20.16 ft (17-Feb-15) ▼
REMARKS	Air-knifed to 5.5 fbg.		

PID (ppm)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (fbg)	U.S.C.S.	GRAPHIC LOG	SOIL DESCRIPTION	CONTACT DEPTH (fbg)	WELL DIAGRAM
					CL		**3" of asphalt at surface** **CLAY:** dark brown, moist, few silt, micaceous.	0.3	Flush mount well box in concrete
				5	ML		**Sandy SILT:** light grayish brown, moist, firm, fine sand, micaceous.	3.0	Bentonite grout
0.0	7 11 14			10	CL		**CLAY:** dark brown, moist, very stiff, with silt, trace fine sand, oxide staining.	8.0	2" diam., Schedule 40 PVC Hydrated bentonite chips
0.0	9 10 13			15	SM		**Silty SAND:** medium brown, moist, medium dense, trace clay, fine to medium sand.	13.0	#2/16 sand
0.0	6 7 9			20	SP		**SAND:** medium brown, wet, medium dense, medium to coarse sand. ▼	18.0	
0.0	8 10 12			25			@ 25' medium grayish brown, increased coarse sand.		2"-diam., 0.020" Slotted Schedule 40 PVC
0.0	6 10 11			30			@ 30' medium gray, trace fine gravel up to 0.5" diameter, black and orange gravel.		
0.0	9 11 12			35	SP-SM		**SAND with silt and gravel:** dark gray with tan gravel, wet, medium dense, medium to coarse sand, fine and coarse gravel up to 1.5" diameter.	34.0 35.0	Bottom of Boring @ 35 ft

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BORING/WELL LOG

CLIENT NAME	City of Culver City	**BORING/WELL NAME**	SLUG #2
JOB/SITE NAME	Culver City Pump Station	**DRILLING STARTED**	11-Feb-15
LOCATION	5722 Bankfield Ave., Culver City, CA	**DRILLING COMPLETED**	12-Feb-15
PROJECT NUMBER	086977	**WELL DEVELOPMENT DATE (YIELD)**	17-Feb-15
DRILLER	BC2 Environmental	**GROUND SURFACE ELEVATION**	NA
DRILLING METHOD	Hollow-stem auger	**TOP OF CASING ELEVATION**	NA
BORING DIAMETER	8"	**SCREENED INTERVAL**	15 to 35 fbg
LOGGED BY	A. Leung	**DEPTH TO WATER (First Encountered)**	20.0 ft (12-Feb-15) ▽
REVIEWED BY	M. Smith	**DEPTH TO WATER (Static)**	20.11 ft (17-Feb-15) ▼
REMARKS	Air-knifed to 5.5 fbg.		

PID (ppm)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (fbg)	U.S.C.S.	GRAPHIC LOG	SOIL DESCRIPTION	CONTACT DEPTH (fbg)	WELL DIAGRAM
							3.5" of asphalt at surface	0.3	Flush mount well box in concrete
				5	SM		**Silty SAND:** light grayish brown, moist, fine sand, trace clay, micaceous. @ 1.3" metal debris.		Bentonite grout
								8.0	
0.0	10 14 19			10	CL		**CLAY:** dark brown, moist, hard, trace fine sand, oxide staining.		2" diam., Schedule 40 PVC Hydrated bentonite chips
								13.0	
0.0	9 12 14			15	SM		**Silty SAND:** medium brown, moist, medium dense, fine to medium sand, trace clay.		#2/16 sand
								18.0	
0.0	9 11 12			20	SP		**SAND:** medium brown, moist to wet, medium dense, fine to coarse sand, trace silt. ▼		
0.0	5 7 9			25			@ 25' wet.		2"-diam., 0.020" Slotted Schedule 40 PVC
0.0	7 11 13			30				31.5	
					SM		**Silty SAND:** medium gray, wet, medium dense, fine sand, micaceous.	33.0	
0.0	10 12 15				SP		**SAND:** medium brown, wet, medium dense, fine to coarse sand.	34.5	
				35	CL		**CLAY:** dark gray, wet, very stiff, few silt.	35.0	Bottom of Boring @ 35 ft

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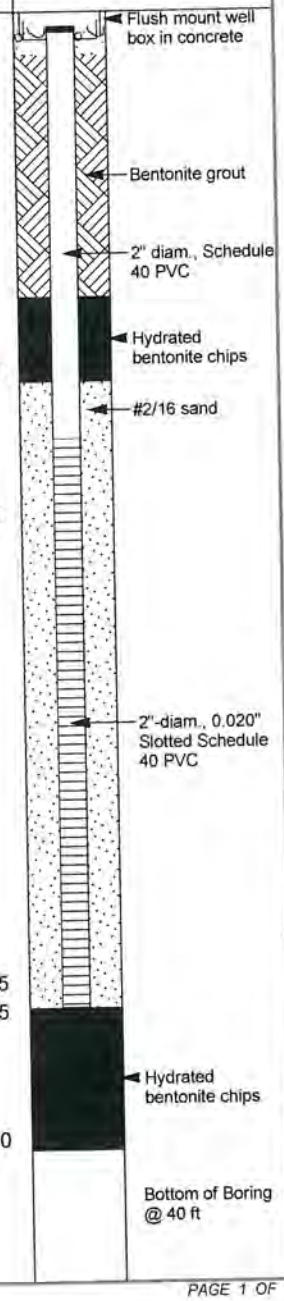
BORING/WELL LOG

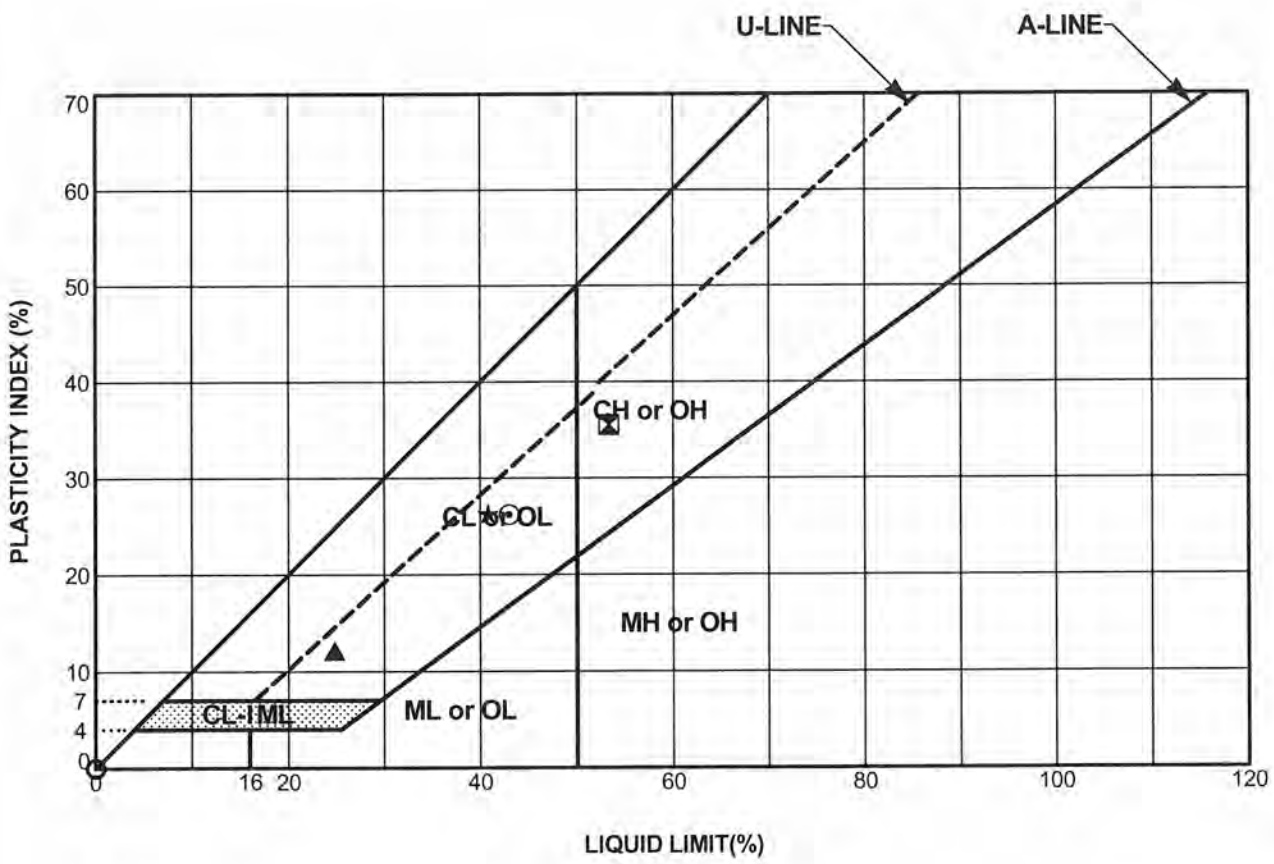
CLIENT NAME	City of Culver City	**BORING/WELL NAME**	SLUG #3
JOB/SITE NAME	Culver City Pump Station	**DRILLING STARTED**	11-Feb-15
LOCATION	5722 Bankfield Ave., Culver City, CA	**DRILLING COMPLETED**	12-Feb-15
PROJECT NUMBER	086977	**WELL DEVELOPMENT DATE (YIELD)**	17-Feb-15
DRILLER	BC2 Environmental	**GROUND SURFACE ELEVATION**	NA
DRILLING METHOD	Hollow-stem auger	**TOP OF CASING ELEVATION**	NA
BORING DIAMETER	8"	**SCREENED INTERVAL**	15 to 35 fbg
LOGGED BY	A. Leung	**DEPTH TO WATER (First Encountered)**	18.0 ft (12-Feb-15) ▽
REVIEWED BY	M. Smith	**DEPTH TO WATER (Static)**	20.01 ft (17-Feb-15) ▼
REMARKS	Air-knifed to 5.5 fbg.		

PID (ppm)	BLOW COUNTS	SAMPLE ID	EXTENT	DEPTH (fbg)	U.S.C.S.	GRAPHIC LOG	SOIL DESCRIPTION	CONTACT DEPTH (fbg)
							6" of asphalt at surface.	0.5
				5	SM		**Silty SAND:** light grayish brown, moist, fine sand, trace clay, micaceous.	
								8.0
0.0	8 12 17			10	SC		**Clayey SAND:** medium brown, moist, medium dense, fine to medium sand, trace coarse sand.	
								13.0
0.0	12 18 21			15	SM		**Silty SAND:** medium brown, moist, dense, fine to medium sand, trace clay, micaceous.	
								18.0 ▽
0.0	17 23 25			20			**SAND:** medium brown, wet, dense, fine to coarse sand, trace silt, trace oxide staining. ▼	
0.0	19 25 27			25	SP		@ 25' medium gray, very dense, trace fine gravel, no silt.	
0.0	22 24 28			30			@ 30' increasing coarse sand.	
								34.5
0.0	14 18 25			35	ML		**SILT with sand:** dark gray, wet, hard, fine sand, trace coarse gravel up to 2" diameter.	35.5
					SP		**SAND:** medium gray, wet, medium dense, medium to coarse sand, poor recovery.	
	6 7 9			40				40.0



WELL LOG (PID) - DEFAULT C:\USERS\MCDONALD\DOCUMENTS\PROJECT WORK AREA\GINT BORING LOGS\086977 - PSDMAS CULVER CITY PUMP STATION\086977-BORING LOGS.GPJ DEFAULT.GDT 2/26/15

APPENDIX C



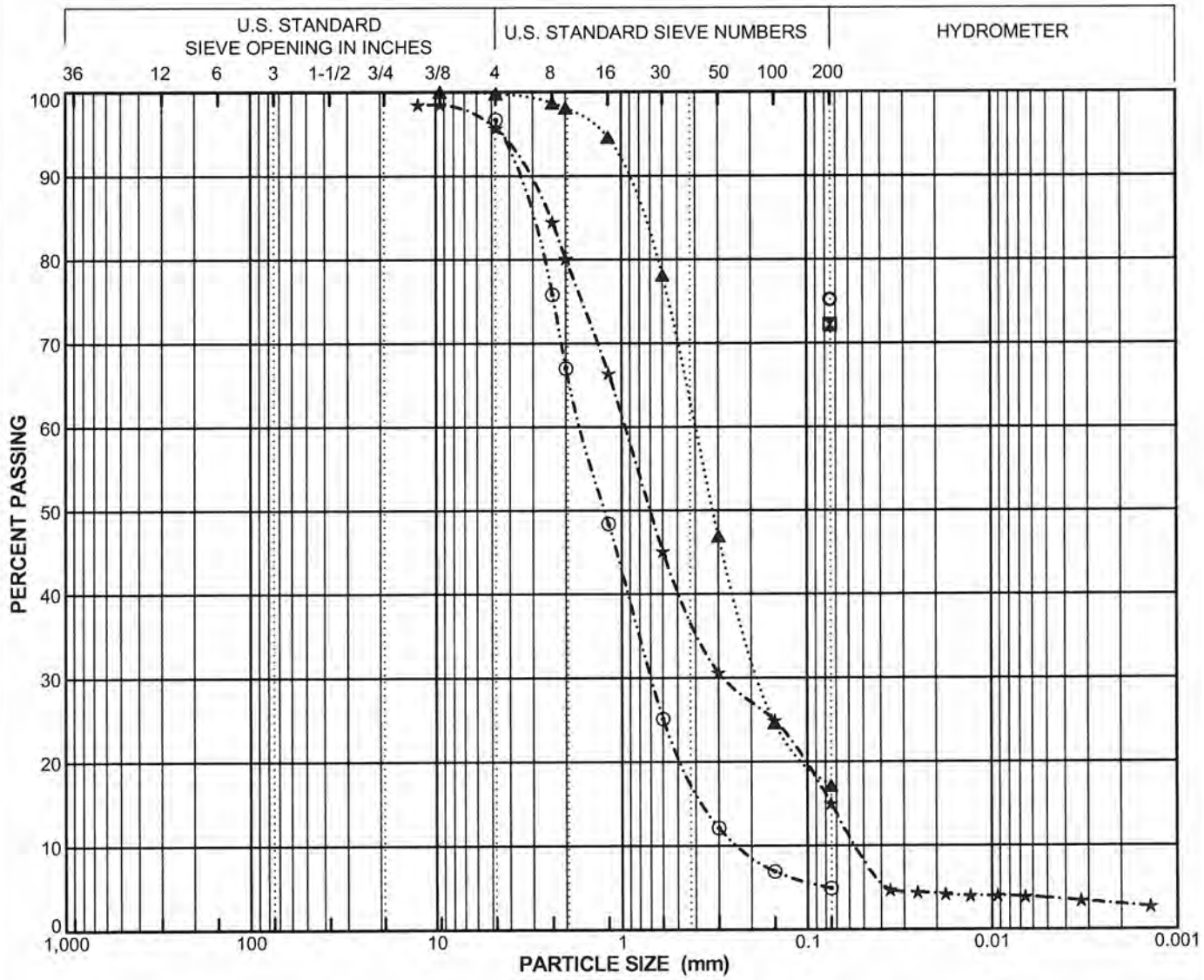
Symbol	Boring Number	Depth (feet)	Sample Number	Passing No. 200 Sieve (%)	LL	PI	USCS	Description
○	H-1	5.0	D-1	75	NP	NP	ML	(Qal) Olive gray sandy SILT
⊠	H-1	10.0	D-2		53	35	CH	(Qal) Dark brown sandy CLAY
▲	H-1	35.0	D-7	15	25	12	SC	(Qal) Black clayey SAND
★	H-2	12.5	D-3	65	41	27	CL	(Qal) Dark brown sandy CLAY
⊙	H-2	37.5	D-8	32	43	26	SC	(Qal) Dark gray clayey SAND

PLASTICITY CHART

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	



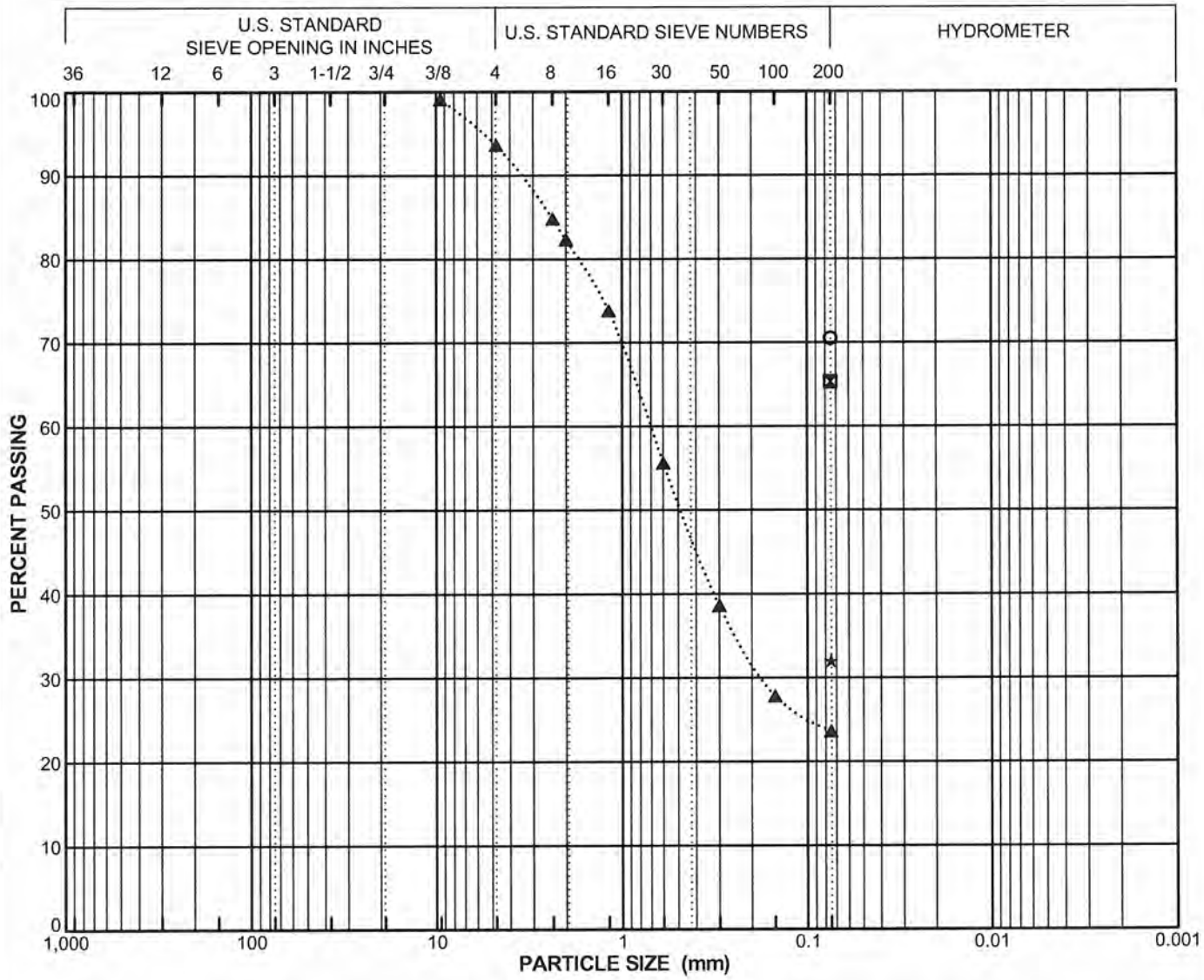
Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
○	H-1	D-1	5.0	9	NP	NP				75		ML
⊠	H-1	B-1	5.0							72		ML
▲	H-1	B-2	20.0							17		SM
★	H-1	D-7	35.0	13	25	12				15	3	SC
⊙	H-1	D-8	40.0	9						5		SP

PARTICLE SIZE DISTRIBUTION

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		coarse	fine	coarse	medium	fine	

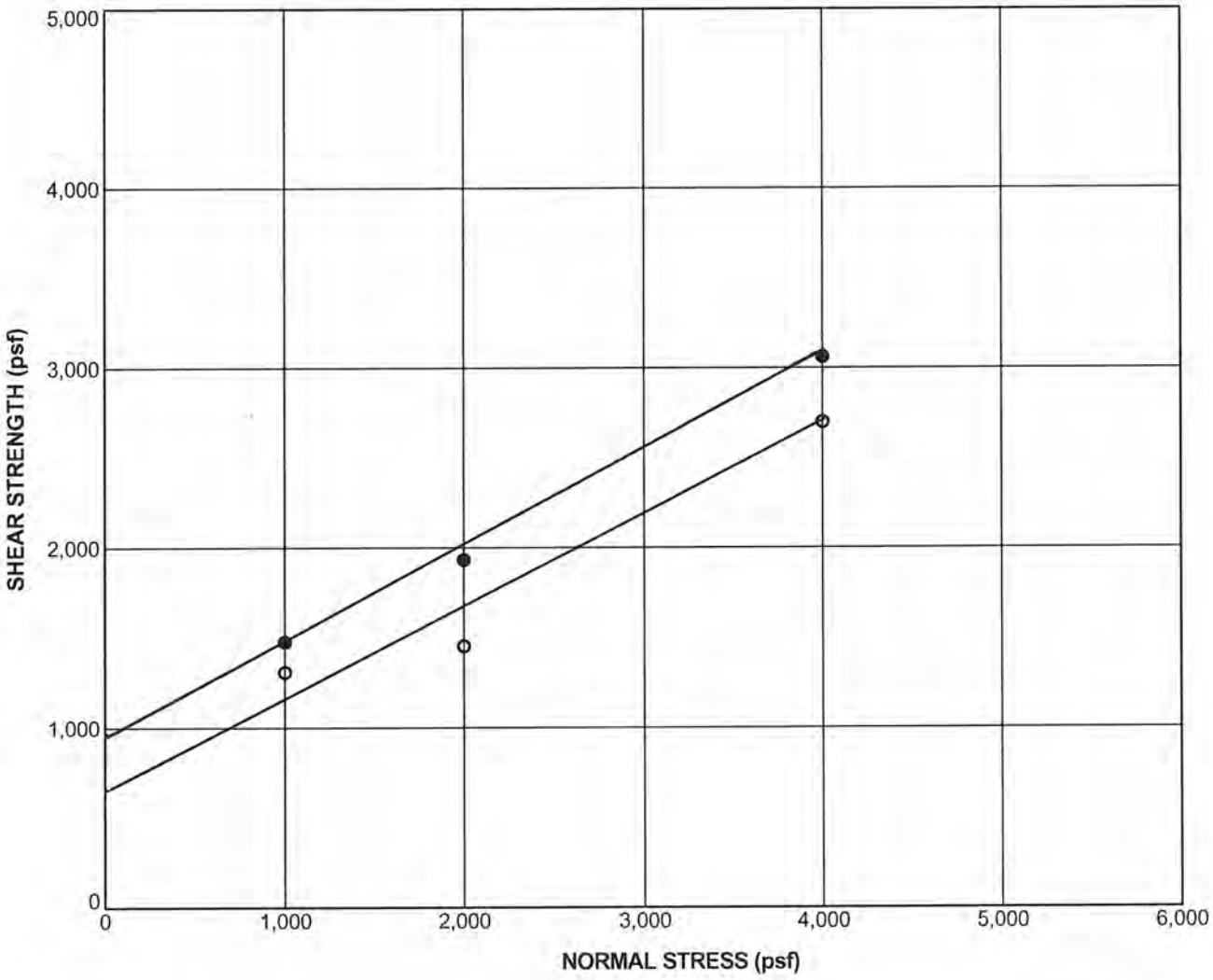


Symbol	Boring Number	Sample Number	Depth (feet)	Field Moisture (%)	LL	PI	Activity PI/-2μ	C_u	C_c	Passing No. 200 Sieve (%)	Passing 2μ (%)	USCS
O	H-2	B-1	1.0							71		ML
⊠	H-2	D-3	12.5	15	41	27				65		CL
▲	H-2	D-5	22.5	14						24		SM
★	H-2	D-8	37.5	14	43	26				32		SC

PARTICLE SIZE DISTRIBUTION

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.



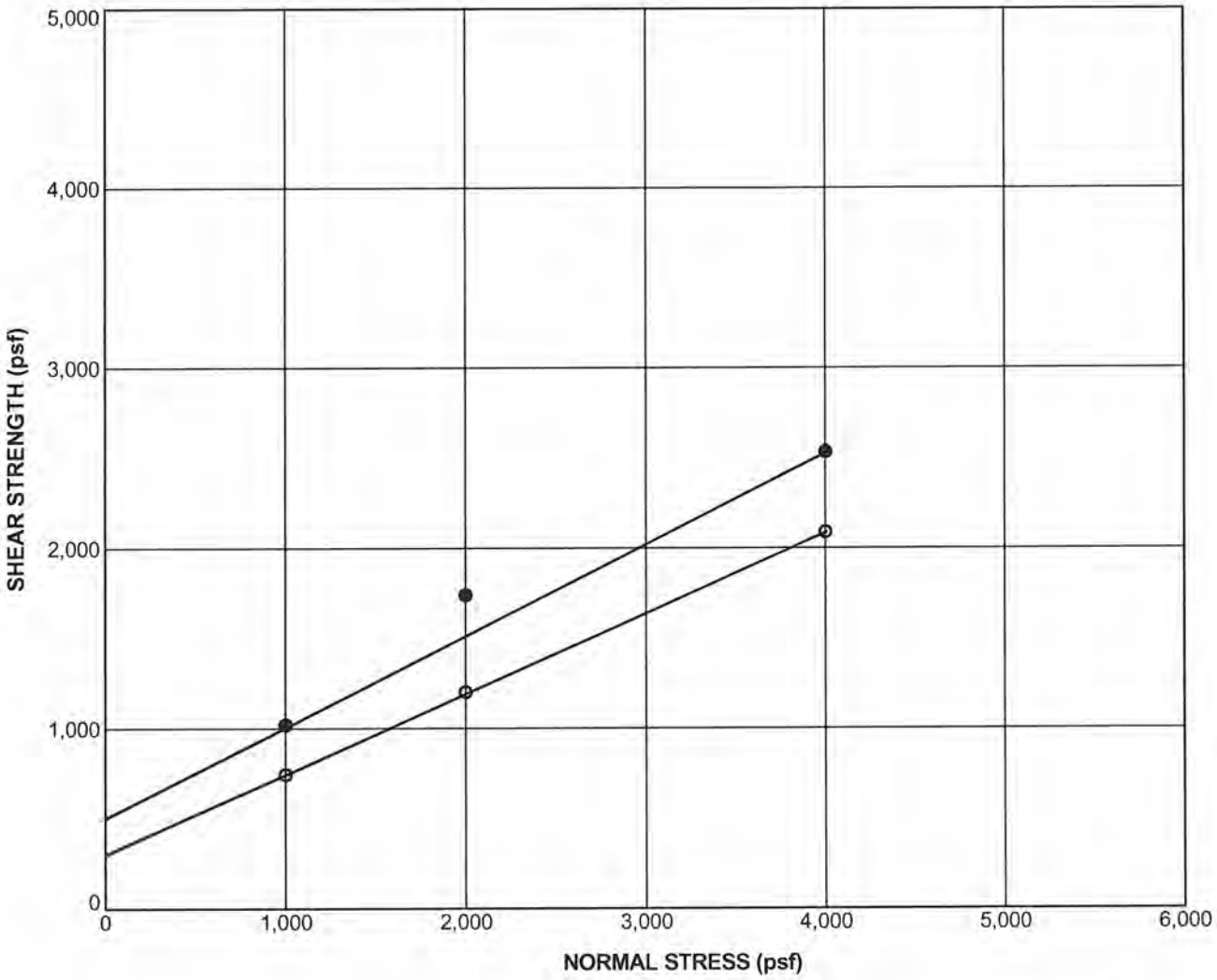
Boring No. H-1	Sample No. D-3	Depth: 15.0 ft
Sample Description:	(Qal) Gray clayey silty SAND	
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:
Moisture Content (%): 23.3	Dry Density (pcf): 110.1	Degree of Saturation (%): 100
Sample Type: Undisturbed	Rate of Shear (in./min.): 0.05	

SHEAR STRENGTH PARAMETERS		
Parameter	Peak ●	Ultimate O
Cohesion (psf)	950	650
Friction Angle (degrees)	28.0	27.0

DIRECT SHEAR TEST RESULTS

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.



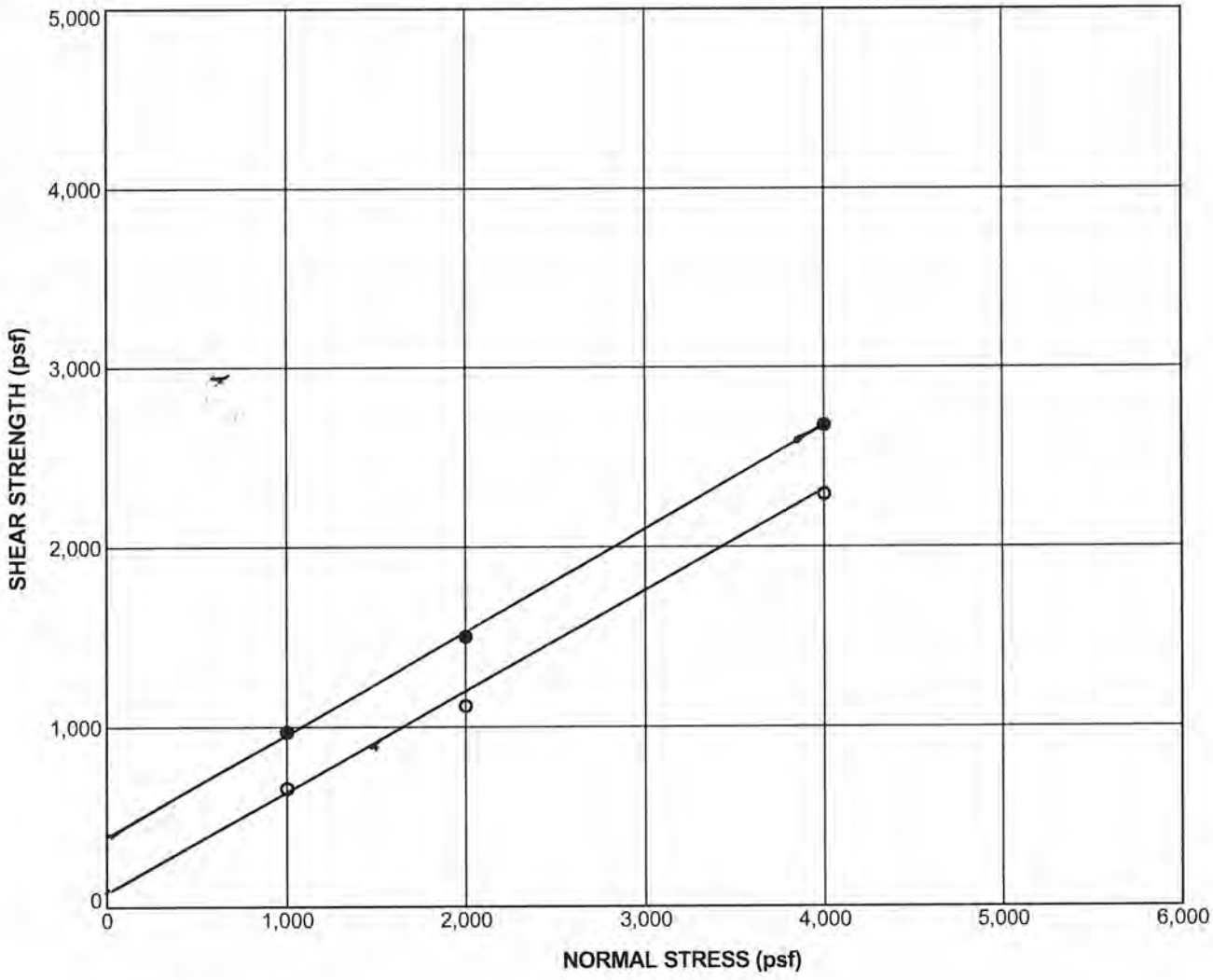
Boring No. H-2	Sample No. D-2	Depth: 7.5 ft
Sample Description:	(Qal) Brown sandy CLAY	
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:
Moisture Content (%): 22.3	Dry Density (pcf): 108.2	Degree of Saturation (%): 100
Sample Type: Undisturbed	Rate of Shear (in./min.): 0.05	

SHEAR STRENGTH PARAMETERS		
Parameter	Peak ●	Ultimate ○
Cohesion (psf)	500	300
Friction Angle (degrees)	27.0	24.0

DIRECT SHEAR TEST RESULTS

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.



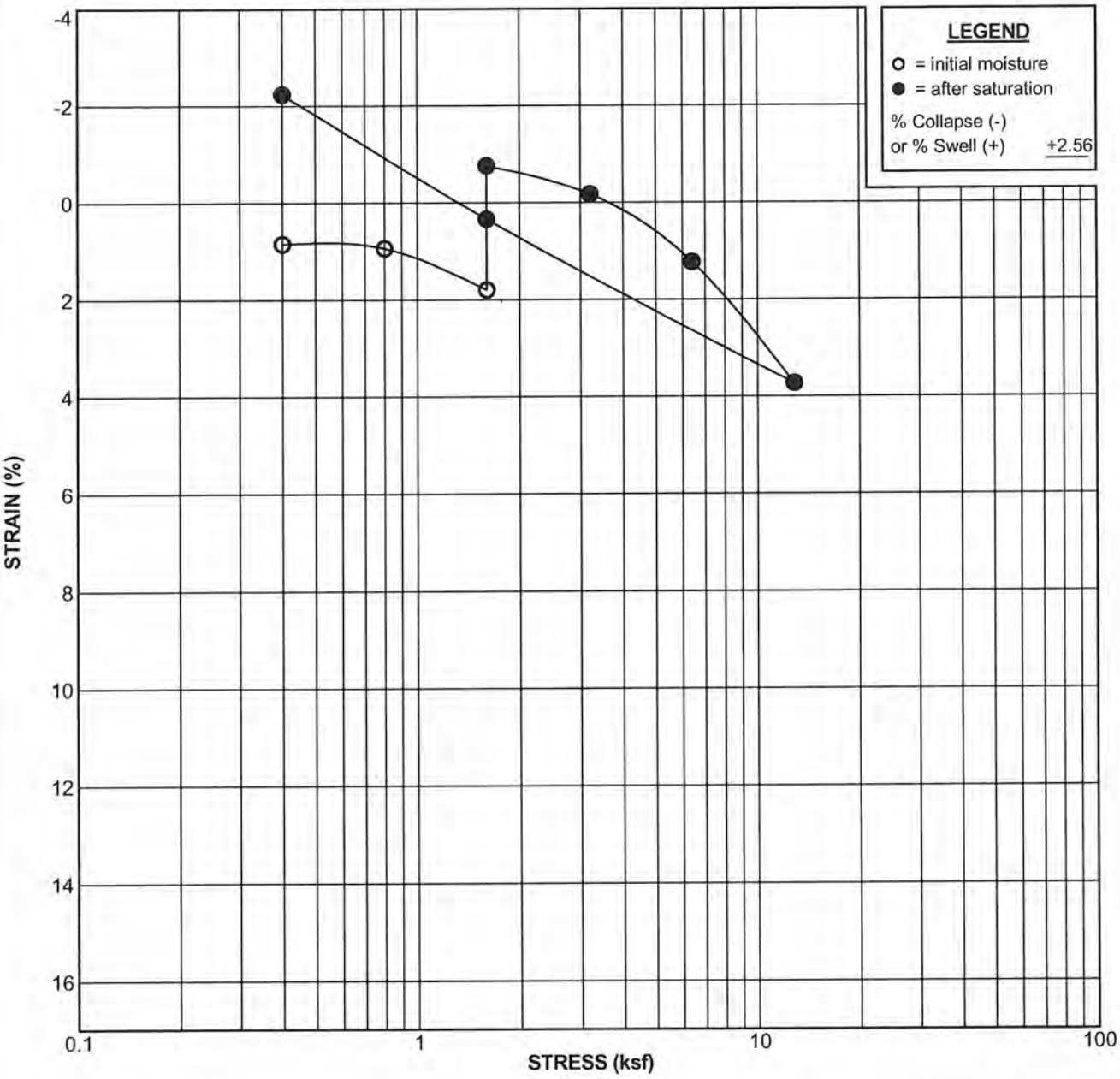
Boring No. H-2	Sample No. D-4	Depth: 17.5 ft
Sample Description:	(Qal) Brown silty SAND	
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:
Moisture Content (%): 22.7	Dry Density (pcf): 107.3	Degree of Saturation (%): 100
Sample Type: Undisturbed	Rate of Shear (in./min.): 0.05	

SHEAR STRENGTH PARAMETERS		
Parameter	Peak ●	Ultimate O
Cohesion (psf)	400	100
Friction Angle (degrees)	30.0	29.0

DIRECT SHEAR TEST RESULTS

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.



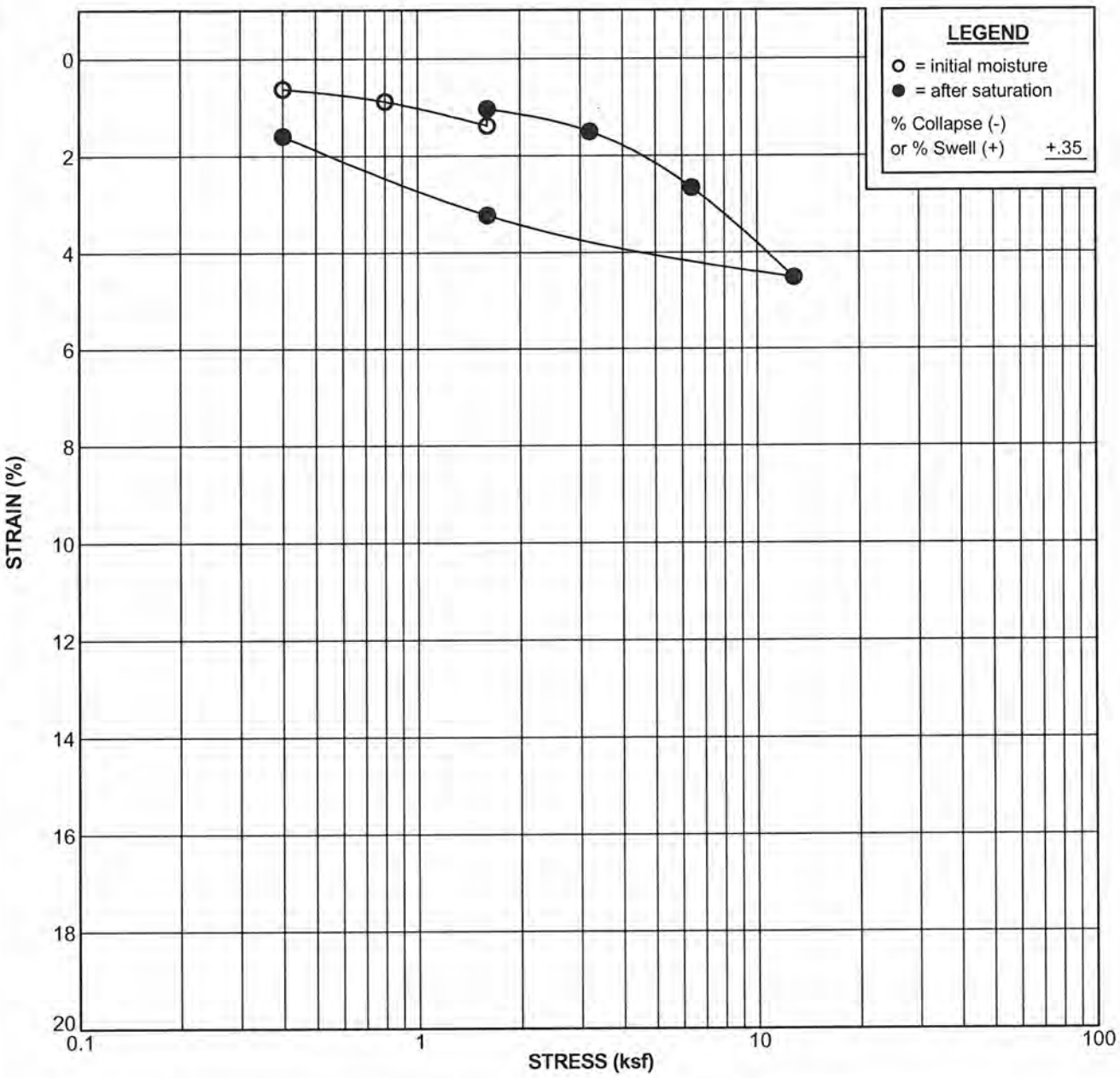
Boring No. H-1	Sample No. D-2	Depth: 10.0 ft
Sample Description:	(Qal) Dark brown sandy CLAY	
Liquid Limit: 53	Plasticity Index: 35	Percent Passing No. 200 Sieve:

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	27.3	93.3	93.7	0.772
Final	31.7	95.4	114.6	0.733

CONSOLIDATION TEST RESULTS

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.



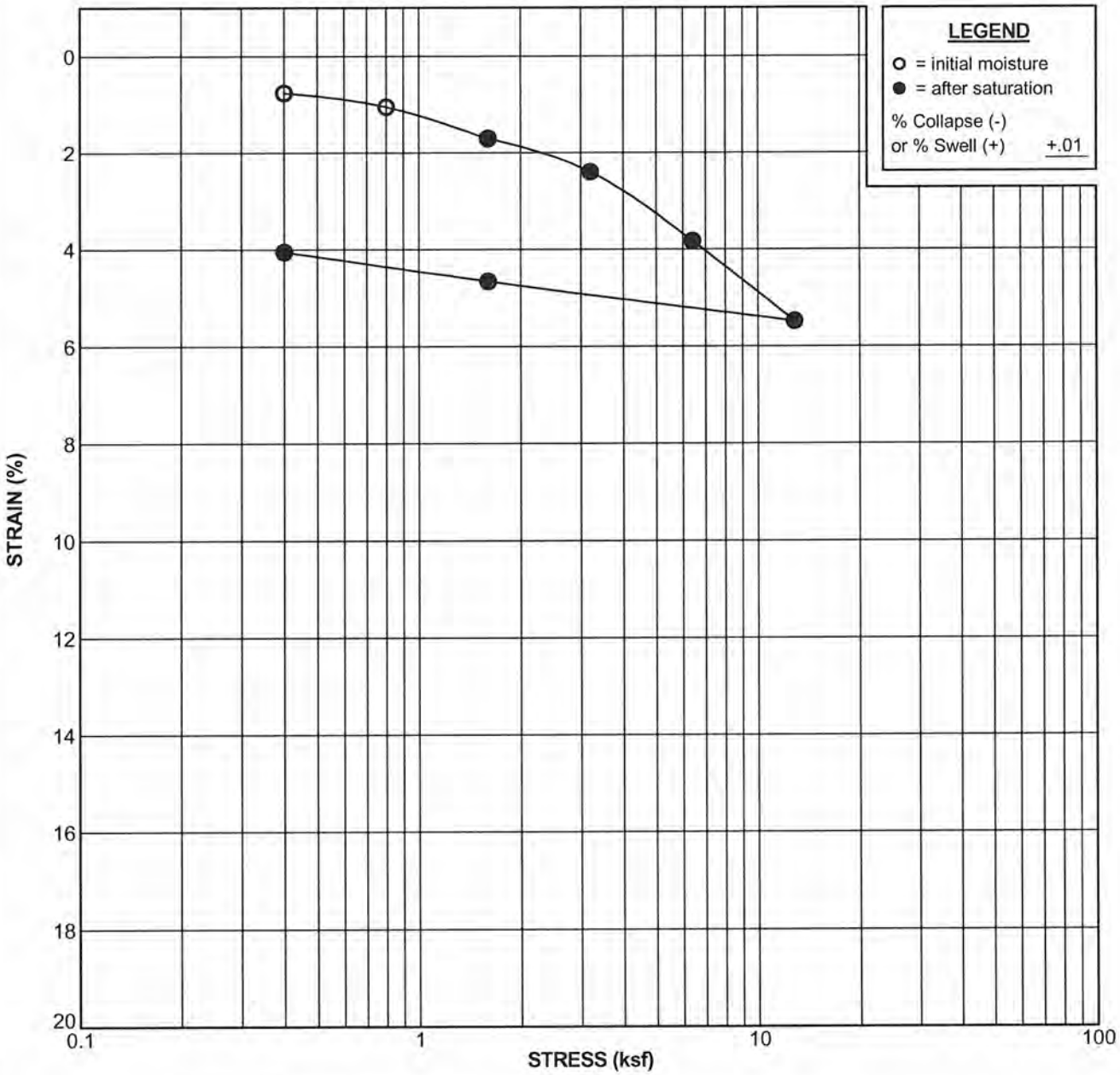
Boring No. H-2	Sample No. D-2	Depth: 7.5 ft
Sample Description:	(Qal) Brown sandy CLAY	
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	15.2	111.9	81.2	0.506
Final	17.8	113.7	99.8	0.482

CONSOLIDATION TEST RESULTS

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.



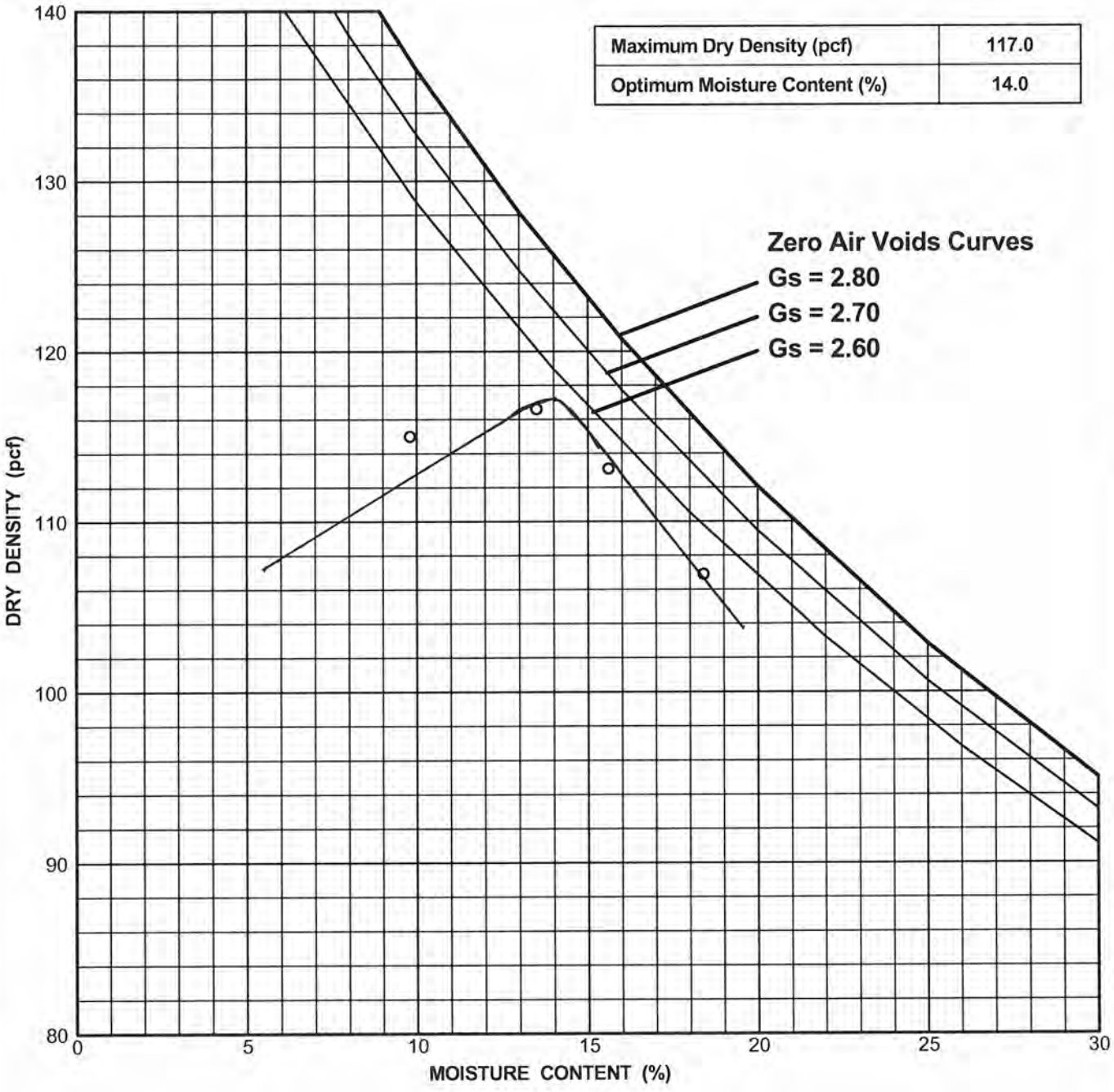
Boring No. H-2	Sample No. D-4	Depth: 17.5 ft
Sample Description:	(Qal) Brown silty SAND	
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve:

Test Stage	Moisture Content (%)	Dry Density (pcf)	Degree of Saturation (%)	Void Ratio
Initial	21.6	103.5	87.0	0.700
Final	21.0	107.7	93.4	0.634

CONSOLIDATION TEST RESULTS

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.



Maximum Dry Density (pcf)	117.0
Optimum Moisture Content (%)	14.0

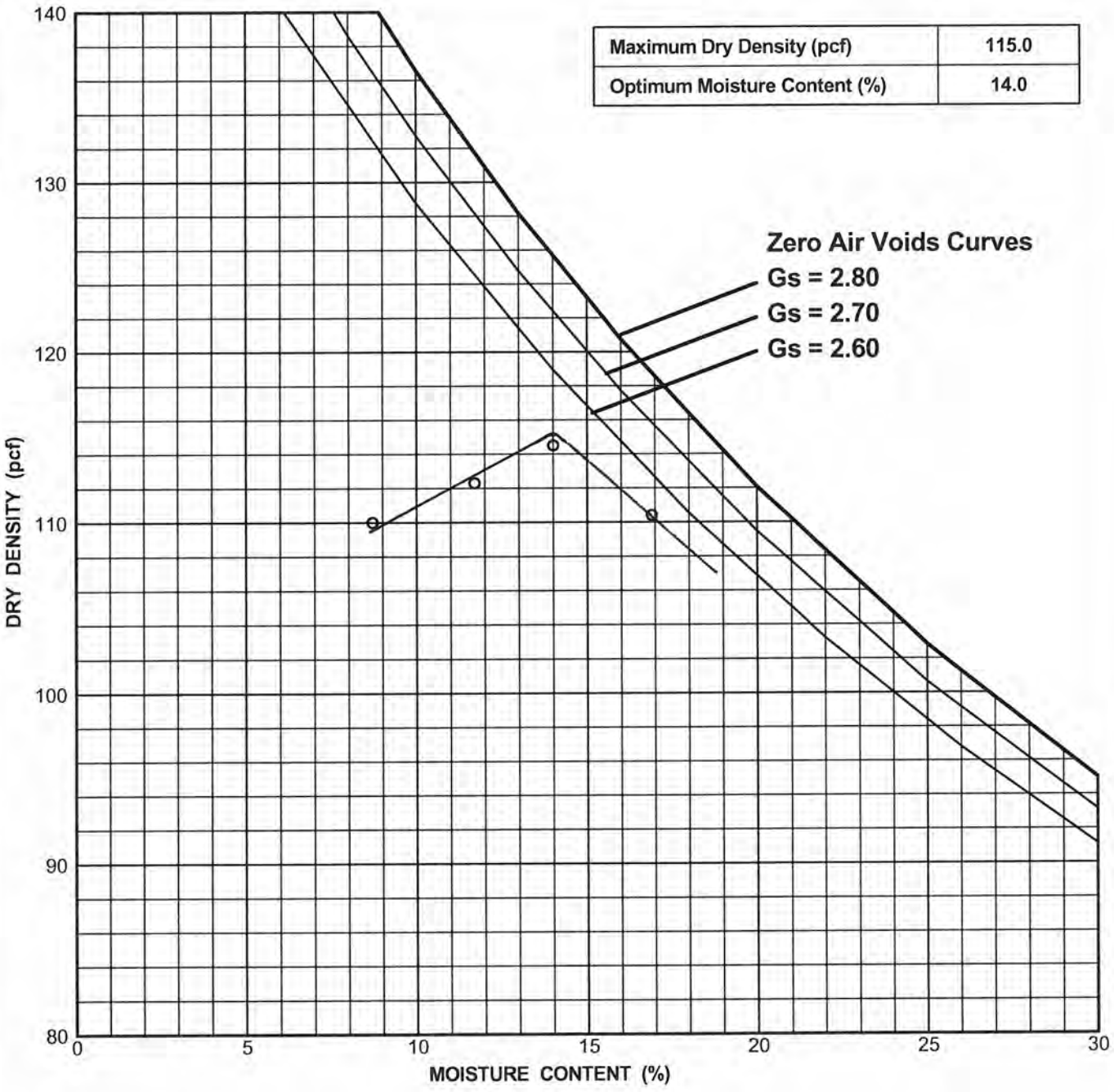
Boring No. H-1	Sample No. B-1	Depth: 5.0 ft
Sample Description: (Qal) Brown sandy SILT		
Liquid Limit:	Plasticity Index:	Percent Passing No. 200 Sieve: 72
Comments:		

COMPACTION TEST RESULTS

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.

Maximum Dry Density (pcf)	115.0
Optimum Moisture Content (%)	14.0



Boring No. H-2	**Sample No. B-1**	**Depth: 1.0 ft**
Sample Description: (Qal) Brown sandy SILT		
Liquid Limit:	**Plasticity Index:**	**Percent Passing No. 200 Sieve:** 71
Comments:		

COMPACTION TEST RESULTS

PSOMAS/Bankfield Pump Station
Culver City, CA
PROJECT NO. 14038-01

NMG Geotechnical, Inc.

Sample No.	Sand Equivalent	Remarks
SE-1	4	Boring H-1, Sample B-1 @ 5'-10' (ML)
SE-2	28	Boring H-1, Sample B-2 @ 20'-25' (SM)
SE-3	5	Boring H-2,Sample B-1 @ 1'-5' (ML)

Test Method:

ASTM D2419

Notes:

Sand Equivalent Test Results

(FRM018 Rev.3)

Project No 14038-01

Project Name: Psomas/Bankfield PS

NMG

Sample	Compacted Moisture (%)	Compacted Dry Density (pcf)	Final Moisture (%)	Volumetric Swell (%)	Expansion Index[1] Value/Method		Expansive Classification[2]	Soluble Sulfate (%)	Sulfate Exposure[3]
H-2 B-1 1-5'	11.5	99.0	26.4	3.8	35	B	Low	--	--

Test Method:
ASTM D4829

HACH SF-1 (Turbidimetric)

Notes:
1. Expansion Index (EI) method of determination:
   [A] E.I. determined by adjusting water content to achieve a 50 ±1% degree of saturation
   [B] E.I. calculated based on measured saturation within the range of 40% and 60%
2. ASTM D4829 *(Classification of Expansive Soil)*
3. ACI-318 Table 4.3.1 *(Requirement for Concrete Exposed to Sulfate-Containing Solutions)*

Expansion Index and Soluble Sulfate Test Results

(FRM001 Rev.5)

Project No. 14038-01

Project Name: Psomas/Bankfield PS

NMG

R-VALUE TEST DATA CTM 301 / ASTM D2844

Project: Psomas/Bankfield P.S.	Project No: 14038-01	Date: 4/9/2015
Boring Trench No: H-1	Sample No: B-1	Sample Depth: 5'-10'
Field Description: ML		
Lab Description: Dark Olive Brown Clayey SILT (ML)		

Specimen Number	1	2	3	4
Mold Number	1	2	3	
Water Adjustment (g)	+65	+75	+90	
Compactor Pressure (psi)	200	150	75	
Exudation Pressure (psi)	588	400	146	
Gross Weight (g)	3174.1	3193.2	3182.1	
Mold Tare (g)	2096.1	2114.9	2099.5	
Wet Weight (g)	1078.0	1078.3	1082.6	
Sample Height (in)	2.47	2.48	2.56	
Initial Dial Reading	0.0512	0.0519	0.0521	
Final Dial Reading	0.0650	0.0636	0.0549	
Expansion (in $x10^{-4}$)	138	117	28	
Stability(psi) at 2,000 lbs (160 psi)	42 100	44 104	54 120	
Turns Displacement	3.09	3.07	3.05	
R-Value Uncorrected	33	30	21	
R-Value Corrected	33	30	22	
Moisture Content (%)	15.3	16.3	17.6	
Dry Density (pcf)	114.7	113.3	108.9	
Assumed Traffic Index	4.0	4.0	4.0	
G.E. by Stability	0.69	0.72	0.80	
G.E. by Expansion	4.60	3.90	0.93	
Gf	1.25			

Moisture Content				
Dish No.	FF	I	P	
Weight of Moist Soil and Dish (g)	285.6	303.6	284.3	
Weight of Dry Soil and Dish (g)	254.3	268.1	249.2	
Water Loss (g)	31.3	35.5	35.1	
Weight of Dish (g)	50.1	50.3	50.1	
Dry Soil (g)	204.2	217.8	199.1	
Moisture Content (%)	15.3	16.3	17.6	

R-Value by Exudation = 27

R-Value by Expansion = 22

R-Value at Equilibrium = 22 by Expansion

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301 and/or ASTM Standard D2844

Remarks: A traffic index of 4.0 was used for calculation purposes.

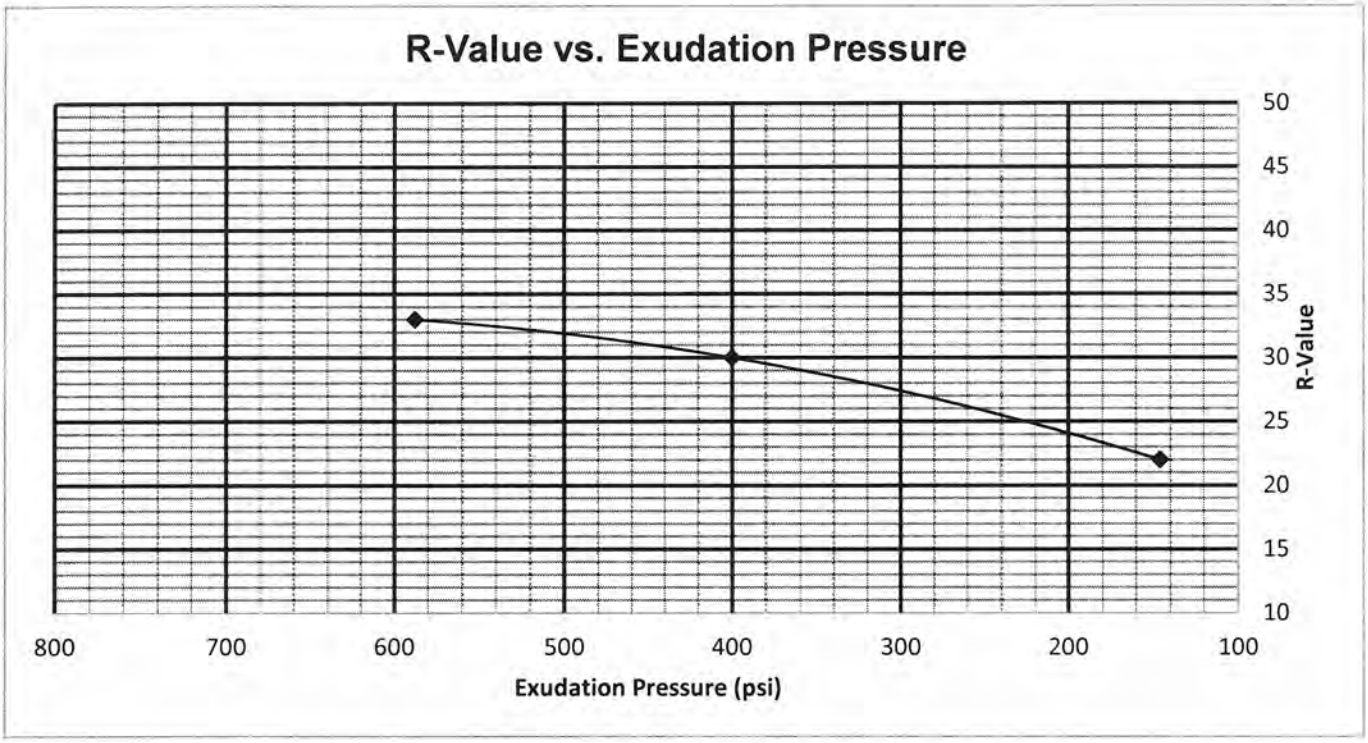
Set up by: GEH Run by: GEH

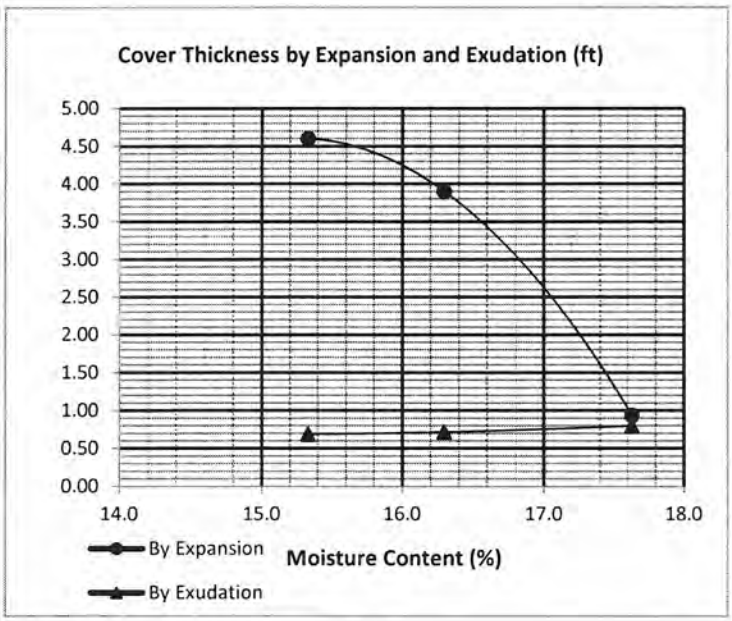
Calculated by: BAJ Checked by: Date Completed: 4/10/2015

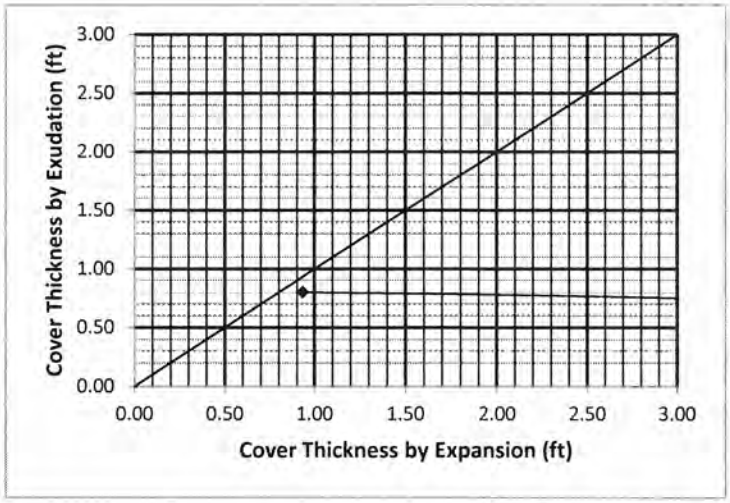
NMG Geotechnical, Inc.

R-VALUE GRAPHICAL PRESENTATION

Project: Psomas/Bankfield P.S.	Project No: 14038-01	Date: 4/9/2015
Boring Trench No: H-1	Sample No: B-1	Sample Depth: 5'-10'
Field Description: CL		
Lab Description: Dark Olive Brown Silty CLAY (CL)		







Cover Thickness (ft) = 0.80

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301 and/or ASTM Standard D2844

Remarks:	A traffic index of 4.0 was used for calculation purposes.			
Set up by:	GEH	Run by: GEH		
Calculated by:	BAJ	Checked by:	Date Completed:	4/10/2015

NMG Geotechnical, Inc.

April 13, 2015 via email: kmarkouizos@nmggeo.com

NMG GEOTECHNICAL, INC.
17991 Fitch
Irvine, CA 92614

Attention: Mr. Karlos Markouizos, PE

Re: Soil Corrosivity Study
Bankfield Sewage Pump Station
Culver City, CA
HDR #254962, NMG #14038-01

Introduction

Laboratory tests have been completed on three soil samples provided for the Bankfield Sewage Pump Station project. The purpose of these tests was to determine if the soils might have deleterious effects on underground utility piping and concrete structures. HDR Engineering, Inc. (HDR) assumes that the samples provided are representative of the most corrosive soils at the site.

The proposed construction of a pump station that includes a wet well—approximately 10 feet by 17 feet and 25 feet deep—as well as associated equipment and piping. The site is located at 5722 Bankfield Avenue in Culver City, California, and the water table is reportedly 20 feet deep.

The scope of this study is limited to a determination of soil corrosivity and general corrosion control recommendations for materials likely to be used for construction. HDR's recommendations do not constitute, and are not meant as a substitute for, design documents for the purpose of construction. If the architects and/or engineers desire more specific information, designs, specifications, or review of design, HDR will be happy to work with them as a separate phase of this project.

Laboratory Soil Corrosivity Tests

The electrical resistivity of each sample was measured in a soil box per ASTM G187 in its as-received condition and again after saturation with distilled water. Resistivities are at

about their lowest value when the soil is saturated. The pH of the saturated samples was measured per CTM 643. A 5:1 water:soil extract from each sample was chemically analyzed for the major soluble salts commonly found in soil per ASTM D4327, ASTM D6919, and Standard Method 2320-B[1]. Laboratory analysis was performed under HDR laboratory number 15-0250SCS and the test results are shown in the attached Table 1.

Soil Corrosivity

A major factor in determining soil corrosivity is electrical resistivity. The electrical resistivity of a soil is a measure of its resistance to the flow of electrical current. Corrosion of buried metal is an electrochemical process in which the amount of metal loss due to corrosion is directly proportional to the flow of electrical current (DC) from the metal into the soil. Corrosion currents, following Ohm's Law, are inversely proportional to soil resistivity. Lower electrical resistivities result from higher moisture and soluble salt contents and indicate corrosive soil.

A correlation between electrical resistivity and corrosivity toward ferrous metals is:[2]

Soil Resistivity in ohm-centimeters	Corrosivity Category
Greater than 10,000	Mildly Corrosive
2,001 to 10,000	Moderately Corrosive
1,001 to 2,000	Corrosive
0 to 1,000	Severely Corrosive

Other soil characteristics that may influence corrosivity towards metals are pH, soluble salt content, soil types, aeration, anaerobic conditions, and site drainage.

Electrical resistivities were in the moderately corrosive and corrosive categories with as-received moisture. When saturated, the resistivities were in the corrosive and severely corrosive categories. The resistivities dropped considerably with added moisture because the samples were dry as-received.

---

[1] *American Public Health Association (APHA). 2012. Standard Methods of Water and Wastewater. 22nd ed. American Public Health Association, American Water Works Association, Water Environment Federation publication. APHA, Washington D.C.*

[2] *Romanoff, Melvin. Underground Corrosion, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, pp. 166–167.*

Soil pH values varied from 7.5 to 7.6. This range is mildly alkaline.[3] These values do not particularly increase soil corrosivity.

The soluble salt content of the samples ranged from moderate to very high.

The soluble salt content was very high in the combined sample from boring H-1 & H-2 @ 7.5 & 10' and less in the others. Sulfate salts were the predominant constituents. High concentrations of sulfate, as was measured in the soil samples, can react with components in concrete to cause degradation and reduced strength in a mechanism known as sulfate attack.

Ammonium was not detected in the soil samples. The nitrate concentration was high enough to be aggressive to copper.

Tests were not made for sulfide and negative oxidation-reduction (redox) potential because these samples did not exhibit characteristics typically associated with anaerobic conditions.

This soil is classified as severely corrosive to ferrous metals, aggressive to copper, and severe for sulfate attack on concrete.

Corrosion Control Recommendations

The life of buried materials depends on thickness, strength, loads, construction details, soil moisture, etc., in addition to soil corrosivity, and is, therefore, difficult to predict. Of more practical value are corrosion control methods that will increase the life of materials that would be subject to significant corrosion.

The following recommendations are based on the soil conditions discussed in the Soil Corrosivity section above. Unless otherwise indicated, these recommendations apply to the entire site or alignment.

Steel Pipe

Implement *all* the following measures:

---

[3] *Romanoff, Melvin. Underground Corrosion, NBS Circular 579. Reprinted by NACE. Houston, TX, 1989, p. 8.*

1. Underground steel pipe with rubber gasketed, mechanical, grooved end, or other nonconductive type joints should be bonded for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.
2. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:
    a. At each end of the pipeline.
    b. At each end of all casings.
    c. Other locations as necessary so the interval between test stations does not exceed 1,200 feet.
3. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically isolate each buried steel pipeline per NACE SP0286 from:
    a. Dissimilar metals.
    b. Dissimilarly coated piping (cement-mortar vs. dielectric).
    c. Above ground steel pipe.
    d. All existing piping.
4. Choose one of the following corrosion control options:

    OPTION 1

    a. Apply a suitable dielectric coating intended for underground use such as:
        i. Polyurethane per AWWA C222 *or*
        ii. Extruded polyethylene per AWWA C215 *or*
        iii. A tape coating system per AWWA C214 *or*
        iv. Hot applied coal tar enamel per AWWA C203 *or*
        v. Fusion bonded epoxy per AWWA C213.
    b. Apply cathodic protection to steel piping as per NACE SP0169.

OPTION 2

a. As an alternative to dielectric coating and cathodic protection, apply a ¾-inch cement mortar coating per AWWA C205 or encase in concrete 3 inches thick, using ASTM C150 Type V cement. Joint bonds, test stations, and insulated joints are still recommended for these alternatives.

NOTE: Some steel piping systems, such as for oil, gas, and high-pressure piping systems, have special corrosion and cathodic protection requirements that must be evaluated for each specific application.

Iron Pipe

Implement *all* the following measures:

1. To prevent dissimilar metal corrosion cells and to facilitate the application of cathodic protection, electrically insulate underground iron pipe from dissimilar metals and from above ground iron pipe with insulating joints per NACE SP0286.
2. Bond all nonconductive type joints for electrical continuity. Electrical continuity is necessary for corrosion monitoring and cathodic protection.
3. Install corrosion monitoring test stations to facilitate corrosion monitoring and the application of cathodic protection:
    a. At each end of the pipeline.
    b. At each end of any casings.
    c. Other locations as necessary so the interval between test stations does not exceed 1,200 feet.
4. Choose one of the following corrosion control options:

    OPTION 1

    a. Apply a suitable coating intended for underground use such as:
        i. Polyethylene encasement per AWWA C105; *or*
        ii. Epoxy coating; *or*

iii. Polyurethane; *or*

iv. Wax tape.

NOTE: The thin factory-applied asphaltic coating applied to ductile iron pipe for transportation and aesthetic purposes does not constitute a corrosion control coating.

b. Apply cathodic protection to cast and ductile iron piping as per NACE SP0169.

OPTION 2

a. As an alternative to coating systems described in Option 1 and cathodic protection, concrete encase all buried portions of metallic piping so that there is a minimum of 3 inches of concrete cover provided over and around surfaces of pipe, fittings, and valves using ASTM C150 Type V cement.

Copper Tubing

Implement *all* the following measures:

1. Electrically insulate underground copper pipe from dissimilar metals and from above ground copper pipe with insulating devices per NACE SP0286.
2. Electrically insulate cold water piping from hot water piping systems.
3. Protect buried copper tubing by one of the following measures:

    a. Prevention of soil contact. Soil contact may be prevented by placing the tubing above ground or encasing the tubing using PVC pipe with solvent-welded joints.

    b. Installation of a factory-coated copper pipe with a minimum 25-mil thickness such as Kamco's Aqua Shield™, Mueller's Streamline Protec™, or equal. The coating must be continuous with no cuts or defects.

    c. Installation of 12-mil polyethylene pipe wrapping tape with butyl rubber mastic over a suitable primer. Protect wrapped copper tubing by applying cathodic protection per NACE SP0169.

Plastic and Vitrified Clay Pipe

1. No special precautions are required for plastic and vitrified clay piping placed underground from a corrosion viewpoint.

2. Protect all metallic fittings and valves with wax tape per AWWA C217 or epoxy.

All Pipe

1. On all pipes, appurtenances, and fittings not protected by cathodic protection, coat bare metal such as valves, bolts, flange joints, joint harnesses, and flexible couplings with wax tape per AWWA C217 after assembly.

2. Where metallic pipelines penetrate concrete structures such as building floors, vault walls, and thrust blocks use plastic sleeves, rubber seals, or other dielectric material to prevent pipe contact with the concrete and reinforcing steel.

Concrete

1. Protect concrete structures and pipe from sulfate attack in soil with a severe sulfate concentration, 0.2 to 2.0 percent. Use ASTM C150 Type V cement, a maximum water/cement ratio of 0.45, and minimum strength of 4,500 psi per applicable code.[4,5,6]

2. Standard concrete cover over reinforcing steel may be used for concrete structures and pipe in contact with these soils due to the low chloride concentration[7] found onsite.

3. Due to the high ground water table encountered at this site, cyclical or continual wetting may be an issue. Any contact between concrete structures and ground water should be prevented. Contact can be prevented with an impermeable waterproofing system.

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[4] *2012 International Building Code (IBC) Section 1904.3*

[5] *2012 International Residential Code (IRC) which refers to American Concrete Institute (ACI) 318 Table 19.3.2.1*

[6] *2013 California Building Code (CBC) which refers to American Concrete Institute (ACI) 318 Table 19.3.2.1*

[7] *Design Manual 303: Concrete Cylinder Pipe. Ameron. p.65*

Concrete Wet Well

1. Protect a concrete wet well the same way as concrete structures under the concrete section in this report.

Closure

The analysis and recommendations presented in this report are based upon data obtained from the laboratory samples. This report does not reflect variations that may occur across the site or due to the modifying effects of construction. If variations appear, HDR should be notified immediately so that further evaluation and supplemental recommendations can be provided.

HDR's services have been performed with the usual thoroughness and competence of the engineering profession. No other warranty or representation, either expressed or implied, is included or intended.

Please call if you have any questions.

Respectfully Submitted,
HDR Engineering, Inc.

Lucy Quijarquez

Brien L. Clark, PE

LICENSED PROFESSIONAL ENGINEER
BRIEN L. CLARK
CH 6291
EXP 12/31/15
CHEMICAL
STATE OF CALIFORNIA
4-13-15

Enc: Table 1

Table 1 - Laboratory Tests on Soil Samples

NMG Geotechnical, Inc.
Bankfield Sewage Pump Station
Your #14038-01, HDR Lab #15-0250SCS
31-Mar-15

Sample ID			H-1 @ 5-10' SM	H-2 @ 1-5' SM	H-1 & H-2 @ 7.5 & 10' CL
Resistivity		**Units**			
as-received		ohm-cm	1,680	3,040	2,080
saturated		ohm-cm	560	1,020	840
pH			7.5	7.6	7.6
Electrical Conductivity		mS/cm	0.48	0.32	1.41
Chemical Analyses					
Cations					
calcium	Ca^{2+}	mg/kg	124	105	597
magnesium	Mg^{2+}	mg/kg	35	49	190
sodium	Na^{1+}	mg/kg	326	157	690
potassium	K^{1+}	mg/kg	13	17	21
Anions					
carbonate	CO_3^{2-}	mg/kg	ND	ND	ND
bicarbonate	HCO_3^{1-}	mg/kg	281	259	278
fluoride	F^{1-}	mg/kg	10.0	8.3	5.7
chloride	Cl^{1-}	mg/kg	126	53	132
sulfate	SO_4^{2-}	mg/kg	483	191	2,490
phosphate	PO_4^{3-}	mg/kg	ND	ND	ND
Other Tests					
ammonium	NH_4^{1+}	mg/kg	ND	ND	ND
nitrate	NO_3^{1-}	mg/kg	227	281	107
sulfide	S^{2-}	qual	na	na	na
Redox		mV	na	na	na

Electrical conductivity in millisiemens/cm and chemical analysis were made on a 1:5 soil-to-water extract.
mg/kg = milligrams per kilogram (parts per million) of dry soil.
Redox = oxidation-reduction potential in millivolts
ND = not detected
na = not analyzed

431 West Baseline Road · Claremont, CA 91711
Phone: 909.962.5485 · Fax: 909.626.3316

APPENDIX D

USGS Design Maps Detailed Report

ASCE 7-10 Standard (33.9867°N, 118.397°W)

Site Class D - "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] $S_S = 1.797$ g

From Figure 22-2 [2] $S_1 = 0.655$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3-1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.797 g, F_a = 1.000

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.655 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_a S_S = 1.000 \times 1.797 = 1.797$ g

Equation (11.4–2): $S_{M1} = F_v S_1 = 1.500 \times 0.655 = 0.983$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

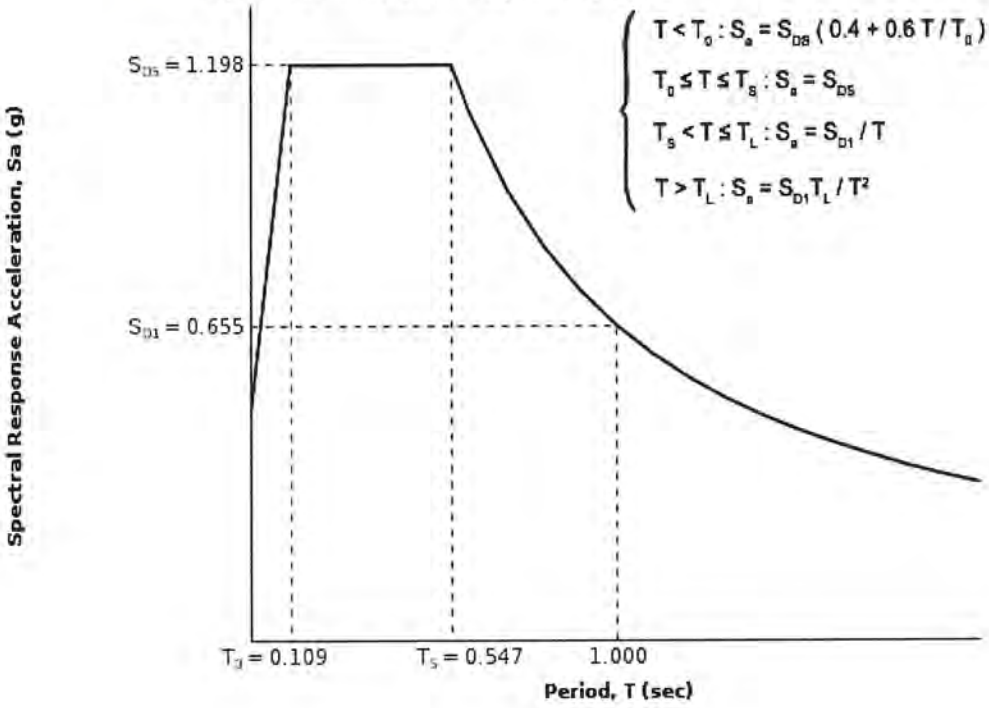
Equation (11.4–3): $S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.797 = 1.198$ g

Equation (11.4–4): $S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.983 = 0.655$ g

Section 11.4.5 — Design Response Spectrum

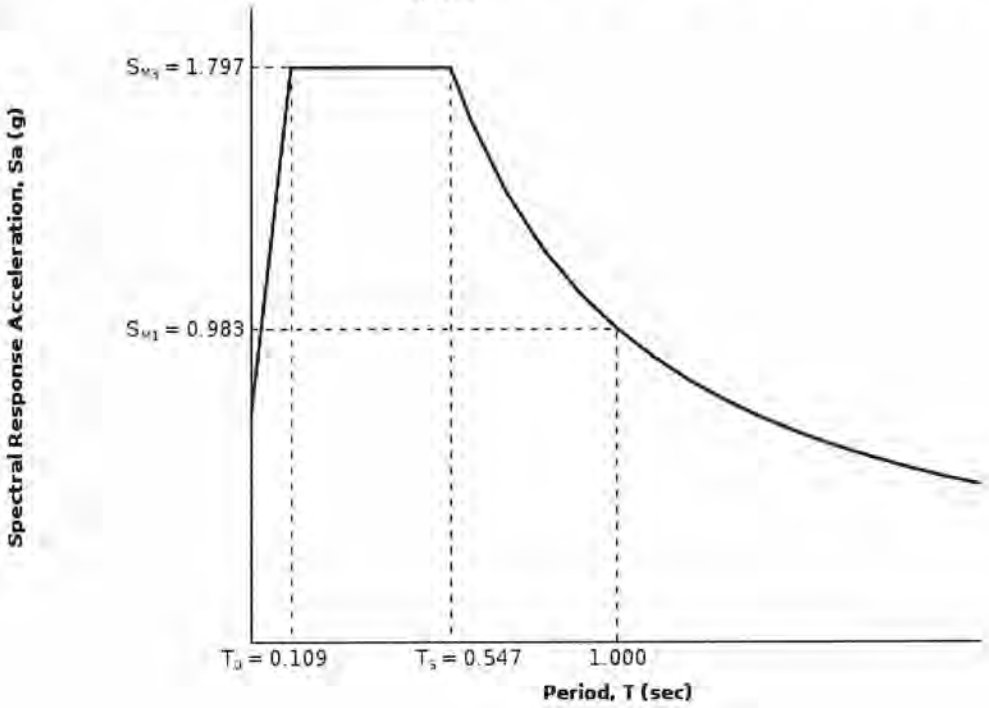
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.647

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.647 = 0.647$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.647 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 1.000

From Figure 22-18 [6] C_{R1} = 1.004

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.198 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.655 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

*** Deaggregation of Seismic Hazard at One Period of Spectral Accel. ***
*** Data from U.S.G.S. National Seismic Hazards Mapping Project, 2008 version ***
PSHA Deaggregation. %contributions. site: Unnamed long: 118.397 W., lat: 33.987 N.
Vs30(m/s)= 760.0 (some WUS atten. models use Site Class not Vs30).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.6340 g. Weight * Computed_Rate_Ex
0.404E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00047
#This deaggregation corresponds to Mean Hazard w/all GMPEs

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
6.1	5.05	1.114	0.670	0.443	0.000	0.000	0.000	0.000
6.2	5.20	2.437	1.224	1.214	0.000	0.000	0.000	0.000
6.5	5.40	2.654	1.129	1.390	0.135	0.000	0.000	0.000
14.2	5.41	0.085	0.085	0.000	0.000	0.000	0.000	0.000
6.7	5.60	2.647	0.941	1.417	0.289	0.000	0.000	0.000
14.4	5.60	0.142	0.142	0.000	0.000	0.000	0.000	0.000
6.8	5.80	2.420	0.763	1.335	0.323	0.000	0.000	0.000
14.6	5.80	0.187	0.187	0.000	0.000	0.000	0.000	0.000
6.9	6.01	2.695	0.770	1.565	0.360	0.000	0.000	0.000
13.7	6.02	0.384	0.358	0.025	0.000	0.000	0.000	0.000
7.2	6.21	3.877	1.066	2.256	0.555	0.000	0.000	0.000
14.2	6.23	0.579	0.524	0.054	0.000	0.000	0.000	0.000
7.5	6.41	5.543	1.593	3.196	0.754	0.000	0.000	0.000
13.4	6.47	3.862	3.322	0.540	0.000	0.000	0.000	0.000
22.6	6.43	0.164	0.164	0.000	0.000	0.000	0.000	0.000
7.2	6.60	7.826	2.056	4.902	0.848	0.020	0.000	0.000
13.5	6.59	4.810	3.785	1.025	0.000	0.000	0.000	0.000
24.4	6.59	0.302	0.302	0.000	0.000	0.000	0.000	0.000
7.0	6.79	7.120	1.470	4.670	0.963	0.017	0.000	0.000
13.2	6.78	3.017	1.943	1.073	0.001	0.000	0.000	0.000
26.5	6.78	0.642	0.642	0.000	0.000	0.000	0.000	0.000
5.6	7.02	10.392	1.459	6.174	2.717	0.041	0.000	0.000
13.6	7.03	4.055	2.021	1.961	0.073	0.000	0.000	0.000
27.2	6.97	0.381	0.354	0.026	0.000	0.000	0.000	0.000
32.6	7.03	0.106	0.106	0.000	0.000	0.000	0.000	0.000
5.8	7.20	6.270	0.850	3.528	1.854	0.038	0.000	0.000
13.5	7.19	3.519	1.494	1.887	0.138	0.000	0.000	0.000
26.9	7.15	0.170	0.165	0.005	0.000	0.000	0.000	0.000
32.1	7.20	0.104	0.104	0.000	0.000	0.000	0.000	0.000
5.9	7.38	12.738	1.647	7.153	3.806	0.132	0.000	0.000
13.3	7.36	2.663	1.103	1.537	0.022	0.000	0.000	0.000
32.5	7.35	0.101	0.101	0.000	0.000	0.000	0.000	0.000
4.4	7.56	3.406	0.312	1.487	1.570	0.037	0.000	0.000
13.0	7.63	1.016	0.445	0.553	0.018	0.000	0.000	0.000
3.4	7.71	0.521	0.045	0.239	0.224	0.014	0.000	0.000
12.9	7.75	1.498	0.385	0.977	0.136	0.000	0.000	0.000
12.9	7.91	0.232	0.065	0.141	0.025	0.000	0.000	0.000
67.9	7.99	0.052	0.052	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 100.0
Mean src-site R= 8.7 km; M= 6.75; eps0= 1.18. Mean calculated for all sources.
Modal src-site R= 5.9 km; M= 7.38; eps0= 0.70 from peak (R,M) bin
MODE R*= 6.0km; M*= 7.38; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 7.153

Principal sources (faults, subduction, random seismicity having > 3% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values).
California B-faults Char	52.54	9.0	7.13	1.11
California B-faults GR	21.50	9.3	6.80	1.30
CA Compr. crustal gridded	25.75	7.3	5.93	1.20

Individual fault hazard details if its contribution to mean hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0	Site-to-src azimuth(d)

Palos Verdes Char	3.73	12.9	7.26	1.55	-126.6
Hollywood Char	3.29	10.9	6.60	1.89	-4.5
Anacapa-Dume, alt 2 Char	2.24	14.8	7.16	1.50	-75.4
Newport-Inglewood, alt 1 Char	4.08	3.2	7.15	0.54	67.1
Newport-Inglewood, alt 2 Char	3.79	3.7	7.15	0.60	61.0
Elysian Park (Upper) Char	2.36	16.9	6.61	2.07	41.3
Puente Hills Char	2.05	13.1	7.06	1.24	49.0
Puente Hills (LA) Char	4.99	8.0	6.88	0.94	48.3
Palos Verdes Connected Char	2.81	12.9	7.71	1.31	-126.6
Newport Inglewood Connected alt	3.78	3.2	7.50	0.45	67.1
Newport Inglewood Connected alt	3.53	3.7	7.50	0.50	61.0
Santa Monica, alt 2 Char	2.28	7.6	6.69	1.43	-41.0
Santa Monica Connected alt 1 Cha	4.37	8.2	7.31	0.95	-36.5
Santa Monica Connected alt 2 Cha	5.11	7.6	7.35	0.73	-41.0
Newport-Inglewood, alt 1 GR	2.05	4.7	6.87	0.84	87.8
Puente Hills (LA) GR	4.21	8.0	6.69	1.06	49.8
Santa Monica Connected alt 2 GR	3.18	8.9	7.02	1.03	-44.0

#*********End of deaggregation corresponding to Mean Hazard w/all GMPEs *********#

PSHA Deaggregation. %contributions. site: Unnamed long: 118.397 W., lat: 33.987 N.
Vs30(m/s)= 760.0 (some WUS atten. models use Site Class not Vs30).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.6340 g. Weight * Computed_Rate_Ex
0.922E-04
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00000
#This deaggregation corresponds to Boore-Atkinson 2008

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
5.2	5.05	0.157	0.157	0.000	0.000	0.000	0.000	0.000
5.2	5.20	0.364	0.326	0.038	0.000	0.000	0.000	0.000
5.3	5.40	0.417	0.320	0.096	0.000	0.000	0.000	0.000
5.4	5.60	0.446	0.321	0.125	0.000	0.000	0.000	0.000
5.6	5.80	0.454	0.279	0.175	0.000	0.000	0.000	0.000
5.7	6.01	0.563	0.271	0.292	0.000	0.000	0.000	0.000
12.9	6.04	0.015	0.015	0.000	0.000	0.000	0.000	0.000
6.2	6.20	0.742	0.381	0.361	0.000	0.000	0.000	0.000
13.4	6.24	0.052	0.052	0.000	0.000	0.000	0.000	0.000
6.9	6.41	1.044	0.629	0.415	0.000	0.000	0.000	0.000
12.6	6.47	0.531	0.492	0.039	0.000	0.000	0.000	0.000
22.3	6.46	0.042	0.042	0.000	0.000	0.000	0.000	0.000
6.8	6.60	1.300	0.649	0.632	0.019	0.000	0.000	0.000
13.0	6.58	1.127	1.050	0.077	0.000	0.000	0.000	0.000
23.2	6.58	0.088	0.088	0.000	0.000	0.000	0.000	0.000
6.7	6.79	1.550	0.568	0.936	0.046	0.000	0.000	0.000
12.8	6.78	0.740	0.589	0.151	0.000	0.000	0.000	0.000
25.3	6.77	0.213	0.213	0.000	0.000	0.000	0.000	0.000
33.1	6.78	0.020	0.020	0.000	0.000	0.000	0.000	0.000
5.4	7.01	1.909	0.416	1.132	0.361	0.000	0.000	0.000
13.5	7.04	1.070	0.682	0.388	0.000	0.000	0.000	0.000
26.2	6.97	0.188	0.186	0.002	0.000	0.000	0.000	0.000
32.6	7.03	0.096	0.096	0.000	0.000	0.000	0.000	0.000
5.6	7.20	2.460	0.381	1.555	0.524	0.000	0.000	0.000
13.4	7.20	0.959	0.505	0.453	0.000	0.000	0.000	0.000
26.7	7.17	0.083	0.080	0.003	0.000	0.000	0.000	0.000
32.2	7.20	0.087	0.087	0.000	0.000	0.000	0.000	0.000
5.4	7.38	2.485	0.439	1.376	0.669	0.000	0.000	0.000
13.2	7.36	0.928	0.398	0.530	0.000	0.000	0.000	0.000
27.0	7.34	0.027	0.024	0.003	0.000	0.000	0.000	0.000
32.8	7.35	0.079	0.079	0.000	0.000	0.000	0.000	0.000
4.3	7.55	1.288	0.165	0.785	0.338	0.000	0.000	0.000
13.1	7.59	0.223	0.078	0.144	0.000	0.000	0.000	0.000
32.5	7.58	0.016	0.015	0.001	0.000	0.000	0.000	0.000
3.4	7.71	0.156	0.015	0.079	0.062	0.000	0.000	0.000
12.9	7.74	0.718	0.213	0.476	0.029	0.000	0.000	0.000

32.6	7.76	0.018	0.017	0.001	0.000	0.000	0.000	0.000
67.9	7.80	0.012	0.012	0.000	0.000	0.000	0.000	0.000
12.9	7.91	0.086	0.022	0.056	0.008	0.000	0.000	0.000
67.9	7.99	0.050	0.050	0.000	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 22.9
Mean src-site R= 9.0 km; M= 6.88; eps0= 1.34. Mean calculated for all sources.
Modal src-site R= 5.4 km; M= 7.38; eps0= 0.85 from peak (R,M) bin
MODE R*= 5.6km; M*= 7.19; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 1.555

Principal sources (faults, subduction, random seismicity having > 3% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values).
California B-faults Char	13.78	9.3	7.17	1.28
California B-faults GR	4.50	9.2	6.85	1.54
CA Compr. crustal gridded	4.38	6.1	5.96	1.24

Individual fault hazard details if its contribution to mean hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0	Site-to-src azimuth(d)
Palos Verdes Char	1.42	12.9	7.26	1.53	-126.6
Hollywood Char	0.92	10.9	6.62	1.95	-4.5
Anacapa-Dume, alt 2 Char	0.50	14.8	7.16	1.69	-75.4
Newport-Inglewood, alt 1 Char	1.17	3.2	7.15	0.67	67.1
Newport-Inglewood, alt 2 Char	1.07	3.7	7.15	0.74	61.0
Elysian Park (Upper) Char	0.35	16.9	6.64	2.31	41.3
Puente Hills Char	0.34	13.1	7.07	1.62	49.0
Puente Hills (LA) Char	0.76	8.0	6.90	1.42	48.3
Palos Verdes Connected Char	1.05	12.9	7.71	1.31	-126.6
Newport Inglewood Connected alt	1.12	3.2	7.50	0.57	67.1
Newport Inglewood Connected alt	1.03	3.7	7.50	0.63	61.0
Santa Monica, alt 2 Char	0.57	7.6	6.70	1.57	-41.0
Santa Monica Connected alt 1 Cha	1.11	8.2	7.31	1.15	-36.5
Santa Monica Connected alt 2 Cha	1.01	7.6	7.35	1.08	-41.0
Newport-Inglewood, alt 1 GR	0.56	4.8	6.89	1.00	87.8
Puente Hills (LA) GR	0.56	8.0	6.70	1.60	49.8
Santa Monica Connected alt 2 GR	0.55	8.8	7.06	1.38	-44.0

#*********End of deaggregation corresponding to Boore-Atkinson 2008 *********#

PSHA Deaggregation. %contributions. site: Unnamed long: 118.397 W., lat: 33.987 N.
Vs30(m/s)= 760.0 (some WUS atten. models use Site Class not Vs30).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.6340 g. Weight * Computed_Rate_Ex
0.130E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00000
#This deaggregation corresponds to Campbell-Bozorgnia 2008

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
5.7	5.05	0.205	0.199	0.006	0.000	0.000	0.000	0.000
6.0	5.20	0.549	0.448	0.101	0.000	0.000	0.000	0.000
6.4	5.40	0.770	0.582	0.188	0.000	0.000	0.000	0.000
6.7	5.60	0.833	0.586	0.247	0.000	0.000	0.000	0.000
14.2	5.61	0.028	0.028	0.000	0.000	0.000	0.000	0.000
6.9	5.80	0.732	0.479	0.253	0.000	0.000	0.000	0.000
14.4	5.80	0.042	0.042	0.000	0.000	0.000	0.000	0.000
7.0	6.01	0.777	0.503	0.274	0.000	0.000	0.000	0.000
13.4	6.02	0.098	0.098	0.000	0.000	0.000	0.000	0.000
7.3	6.21	1.211	0.739	0.472	0.000	0.000	0.000	0.000
14.1	6.24	0.176	0.170	0.006	0.000	0.000	0.000	0.000
7.5	6.41	1.971	0.910	1.061	0.000	0.000	0.000	0.000
13.8	6.46	1.183	0.992	0.192	0.000	0.000	0.000	0.000
22.8	6.42	0.055	0.055	0.000	0.000	0.000	0.000	0.000
7.3	6.60	3.216	0.756	2.160	0.299	0.000	0.000	0.000
13.8	6.56	1.819	1.462	0.356	0.000	0.000	0.000	0.000
23.4	6.58	0.073	0.073	0.000	0.000	0.000	0.000	0.000

7.2	6.78	2.920	0.561	2.020	0.338	0.000	0.000	0.000
13.7	6.77	1.226	0.866	0.359	0.001	0.000	0.000	0.000
25.5	6.76	0.090	0.090	0.000	0.000	0.000	0.000	0.000
5.9	7.01	3.696	0.509	2.273	0.914	0.000	0.000	0.000
13.8	7.01	1.058	0.481	0.560	0.017	0.000	0.000	0.000
26.7	6.97	0.062	0.062	0.000	0.000	0.000	0.000	0.000
5.9	7.20	2.028	0.282	1.176	0.570	0.000	0.000	0.000
13.7	7.17	1.157	0.533	0.592	0.032	0.000	0.000	0.000
26.6	7.15	0.016	0.016	0.000	0.000	0.000	0.000	0.000
6.5	7.35	3.171	0.448	1.842	0.881	0.000	0.000	0.000
13.4	7.35	0.590	0.305	0.282	0.003	0.000	0.000	0.000
4.4	7.53	1.784	0.200	0.972	0.612	0.000	0.000	0.000
13.0	7.62	0.157	0.120	0.037	0.000	0.000	0.000	0.000
3.4	7.71	0.144	0.015	0.076	0.053	0.000	0.000	0.000
12.9	7.75	0.260	0.122	0.138	0.000	0.000	0.000	0.000
12.9	7.91	0.037	0.020	0.017	0.000	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 32.2
Mean src-site R= 8.4 km; M= 6.74; eps0= 1.18. Mean calculated for all sources.
Modal src-site R= 5.9 km; M= 7.01; eps0= 0.75 from peak (R,M) bin
MODE R*= 5.9km; M*= 7.01; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 2.273

Principal sources (faults, subduction, random seismicity having > 3% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values).
California B-faults Char	16.68	8.7	7.07	1.12
California B-faults GR	7.76	9.1	6.77	1.24
CA Compr. crustal gridded	7.72	7.2	6.00	1.23

Individual fault hazard details if its contribution to mean hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0	Site-to-src azimuth(d)
Palos Verdes Char	0.77	12.9	7.25	1.74	-126.6
Hollywood Char	1.05	10.9	6.59	1.91	-4.5
Anacapa-Dume, alt 2 Char	0.88	14.8	7.15	1.44	-75.4
Newport-Inglewood, alt 1 Char	1.26	3.2	7.14	0.59	67.1
Newport-Inglewood, alt 2 Char	1.17	3.7	7.14	0.65	61.0
Elysian Park (Upper) Char	1.09	16.9	6.59	1.99	41.3
Puente Hills Char	0.67	13.1	7.05	1.30	49.0
Puente Hills (LA) Char	2.26	8.0	6.88	0.82	48.3
Palos Verdes Connected Char	0.47	12.9	7.71	1.62	-126.6
Newport Inglewood Connected alt	1.08	3.2	7.50	0.56	67.1
Newport Inglewood Connected alt	1.01	3.7	7.50	0.61	61.0
Santa Monica, alt 2 Char	0.78	7.6	6.68	1.43	-41.0
Santa Monica Connected alt 1 Cha	1.14	8.2	7.30	1.10	-36.5
Santa Monica Connected alt 2 Cha	1.94	7.6	7.34	0.67	-41.0
Newport-Inglewood, alt 1 GR	0.62	4.5	6.87	0.88	87.8
Puente Hills (LA) GR	2.05	8.0	6.69	0.91	49.8
Santa Monica Connected alt 2 GR	1.33	8.9	7.00	0.95	-44.0

#*********End of deaggregation corresponding to Campbell-Bozorgnia 2008 *********#

PSHA Deaggregation. %contributions. site: Unnamed long: 118.397 W., lat: 33.987 N.
Vs30(m/s)= 760.0 (some WUS atten. models use Site Class not Vs30).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 2475 yrs. Exceedance PGA =0.6340 g. Weight * Computed_Rate_Ex
0.182E-03
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.00143
#This deaggregation corresponds to Chiou-Youngs 2008

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
6.4	5.05	0.752	0.609	0.142	0.000	0.000	0.000	0.000
6.6	5.20	1.525	1.136	0.389	0.000	0.000	0.000	0.000
14.1	5.21	0.040	0.040	0.000	0.000	0.000	0.000	0.000
6.8	5.40	1.467	0.969	0.498	0.000	0.000	0.000	0.000
14.2	5.41	0.076	0.076	0.000	0.000	0.000	0.000	0.000

7.0	5.60	1.368	0.828	0.539	0.000	0.000	0.000	0.000
14.5	5.60	0.114	0.114	0.000	0.000	0.000	0.000	0.000
7.2	5.80	1.235	0.667	0.567	0.000	0.000	0.000	0.000
14.6	5.80	0.145	0.145	0.000	0.000	0.000	0.000	0.000
7.2	6.01	1.355	0.685	0.670	0.000	0.000	0.000	0.000
13.8	6.02	0.270	0.268	0.002	0.000	0.000	0.000	0.000
7.6	6.20	1.923	0.929	0.994	0.000	0.000	0.000	0.000
14.4	6.22	0.350	0.340	0.010	0.000	0.000	0.000	0.000
7.6	6.41	2.527	0.978	1.546	0.003	0.000	0.000	0.000
13.5	6.46	1.636	1.466	0.170	0.000	0.000	0.000	0.000
22.7	6.43	0.067	0.067	0.000	0.000	0.000	0.000	0.000
7.2	6.61	3.312	0.848	2.219	0.245	0.000	0.000	0.000
13.1	6.59	2.154	1.496	0.658	0.000	0.000	0.000	0.000
25.3	6.59	0.119	0.119	0.000	0.000	0.000	0.000	0.000
6.9	6.79	2.793	0.510	1.910	0.373	0.000	0.000	0.000
13.3	6.78	1.324	0.865	0.459	0.000	0.000	0.000	0.000
27.6	6.77	0.298	0.298	0.000	0.000	0.000	0.000	0.000
5.5	7.02	4.004	0.490	2.308	1.173	0.033	0.000	0.000
13.6	7.02	1.622	0.738	0.829	0.056	0.000	0.000	0.000
28.2	6.96	0.208	0.185	0.022	0.000	0.000	0.000	0.000
6.4	7.21	3.534	0.349	1.693	1.455	0.038	0.000	0.000
13.4	7.18	1.657	0.589	0.962	0.106	0.000	0.000	0.000
27.2	7.15	0.057	0.052	0.004	0.000	0.000	0.000	0.000
5.7	7.39	5.019	0.518	2.652	1.717	0.132	0.000	0.000
13.2	7.36	1.145	0.401	0.725	0.020	0.000	0.000	0.000
4.3	7.57	1.285	0.109	0.538	0.602	0.037	0.000	0.000
13.0	7.60	0.359	0.113	0.228	0.018	0.000	0.000	0.000
3.4	7.71	0.221	0.015	0.084	0.109	0.014	0.000	0.000
12.9	7.75	0.798	0.185	0.507	0.107	0.000	0.000	0.000
12.9	7.91	0.109	0.023	0.068	0.017	0.000	0.000	0.000

Summary statistics for above PSHA PGA deaggregation, R=distance, e=epsilon:
Contribution from this GMPE(%): 45.0
Mean src-site R= 8.7 km; M= 6.69; eps0= 1.10. Mean calculated for all sources.
Modal src-site R= 5.7 km; M= 7.39; eps0= 0.56 from peak (R,M) bin
MODE R*= 6.1km; M*= 7.38; EPS.INTERVAL: 1 to 2 sigma % CONTRIB.= 2.652

Principal sources (faults, subduction, random seismicity having > 3% contribution)

Source Category:	% contr.	R(km)	M	epsilon0 (mean values).
California B-faults Char	22.08	9.0	7.14	0.99
California B-faults GR	9.24	9.4	6.80	1.23
CA Compr. crustal gridded	13.65	7.8	5.87	1.18

Individual fault hazard details if its contribution to mean hazard > 2%:

Fault ID	% contr.	Rcd(km)	M	epsilon0	Site-to-src azimuth(d)
Palos Verdes Char	1.55	12.9	7.26	1.47	-126.6
Hollywood Char	1.31	10.9	6.59	1.84	-4.5
Anacapa-Dume, alt 2 Char	0.85	14.8	7.17	1.45	-75.4
Newport-Inglewood, alt 1 Char	1.65	3.2	7.15	0.40	67.1
Newport-Inglewood, alt 2 Char	1.54	3.7	7.15	0.46	61.0
Elysian Park (Upper) Char	0.91	16.9	6.61	2.06	41.3
Puente Hills Char	1.04	13.1	7.06	1.08	49.0
Puente Hills (LA) Char	1.97	8.0	6.89	0.91	48.3
Palos Verdes Connected Char	1.29	12.9	7.71	1.19	-126.6
Newport Inglewood Connected alt	1.58	3.2	7.50	0.29	67.1
Newport Inglewood Connected alt	1.48	3.7	7.50	0.34	61.0
Santa Monica, alt 2 Char	0.92	7.6	6.69	1.35	-41.0
Santa Monica Connected alt 1 Cha	2.13	8.2	7.31	0.76	-36.5
Santa Monica Connected alt 2 Cha	2.15	7.6	7.35	0.61	-41.0
Newport-Inglewood, alt 1 GR	0.88	4.8	6.87	0.71	87.8
Puente Hills (LA) GR	1.60	8.0	6.69	1.06	49.8
Santa Monica Connected alt 2 GR	1.30	9.0	7.02	0.96	-44.0

#*********End of deaggregation corresponding to Chiou-Youngs 2008 *********#

APPENDIX E

GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

LIQUEFACTION ANALYSIS REPORT

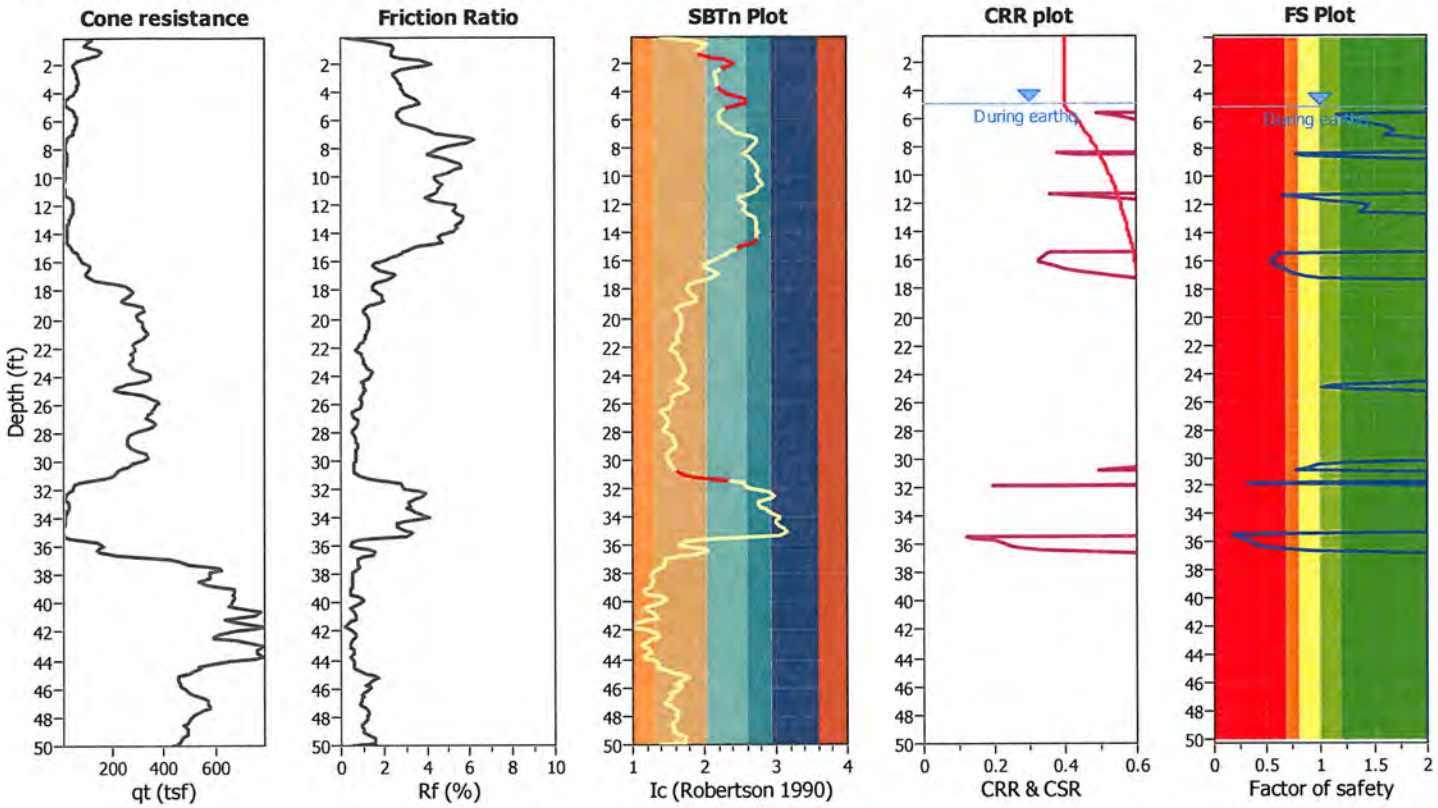
Project title : Psomas/Bankfield PS

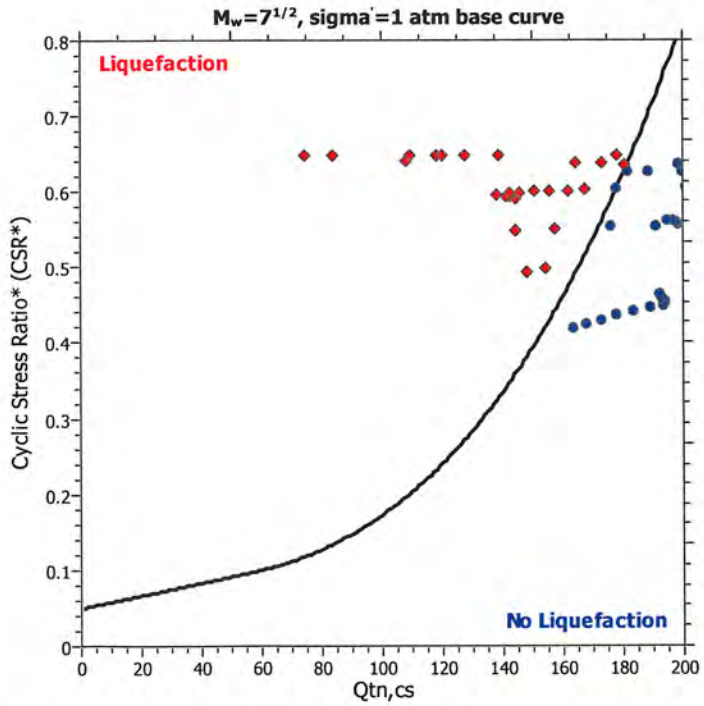
Location : Culver City

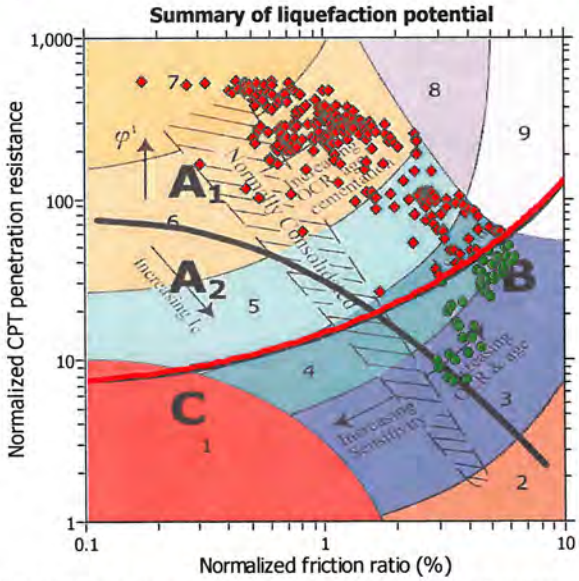
CPT file : CPT-1

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.35	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

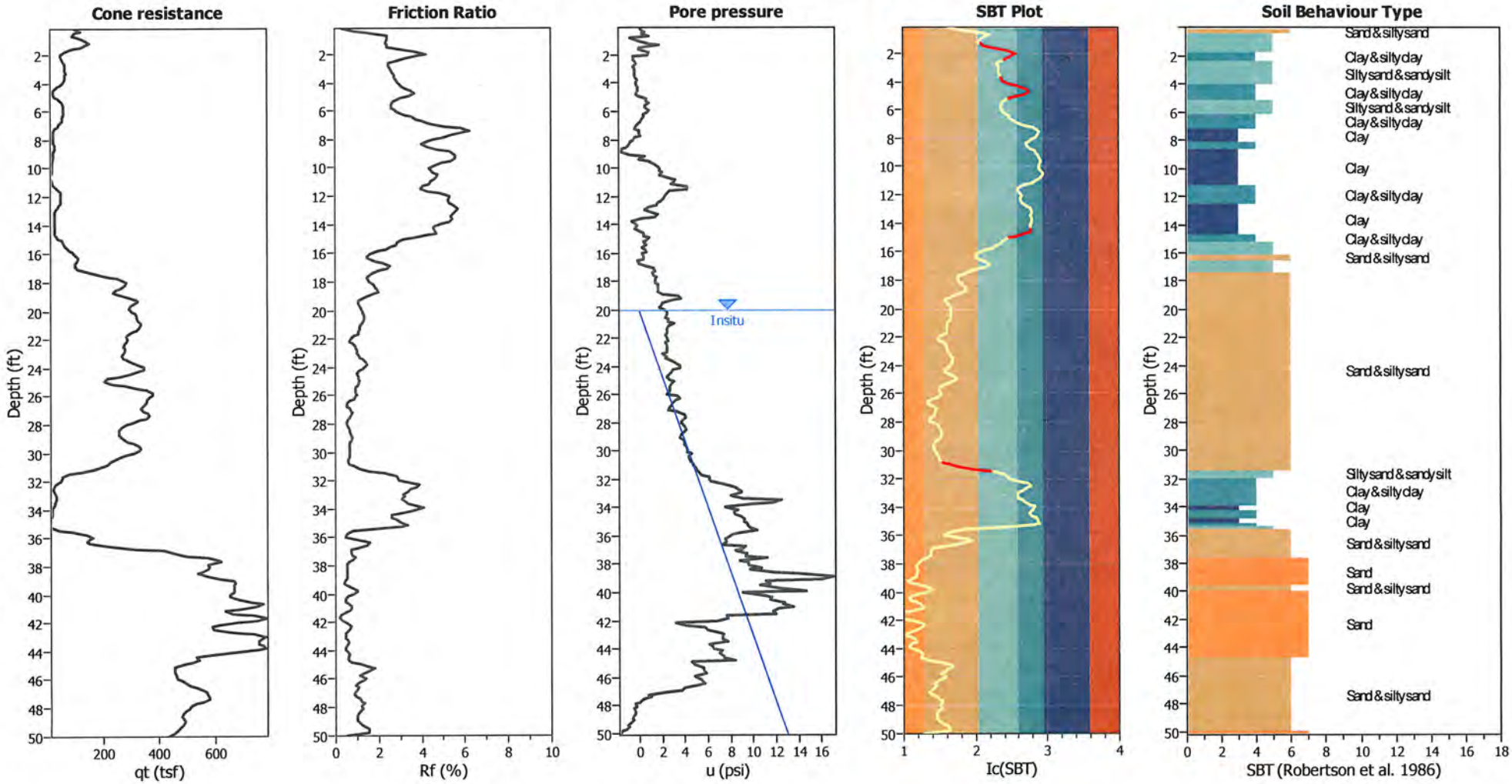






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



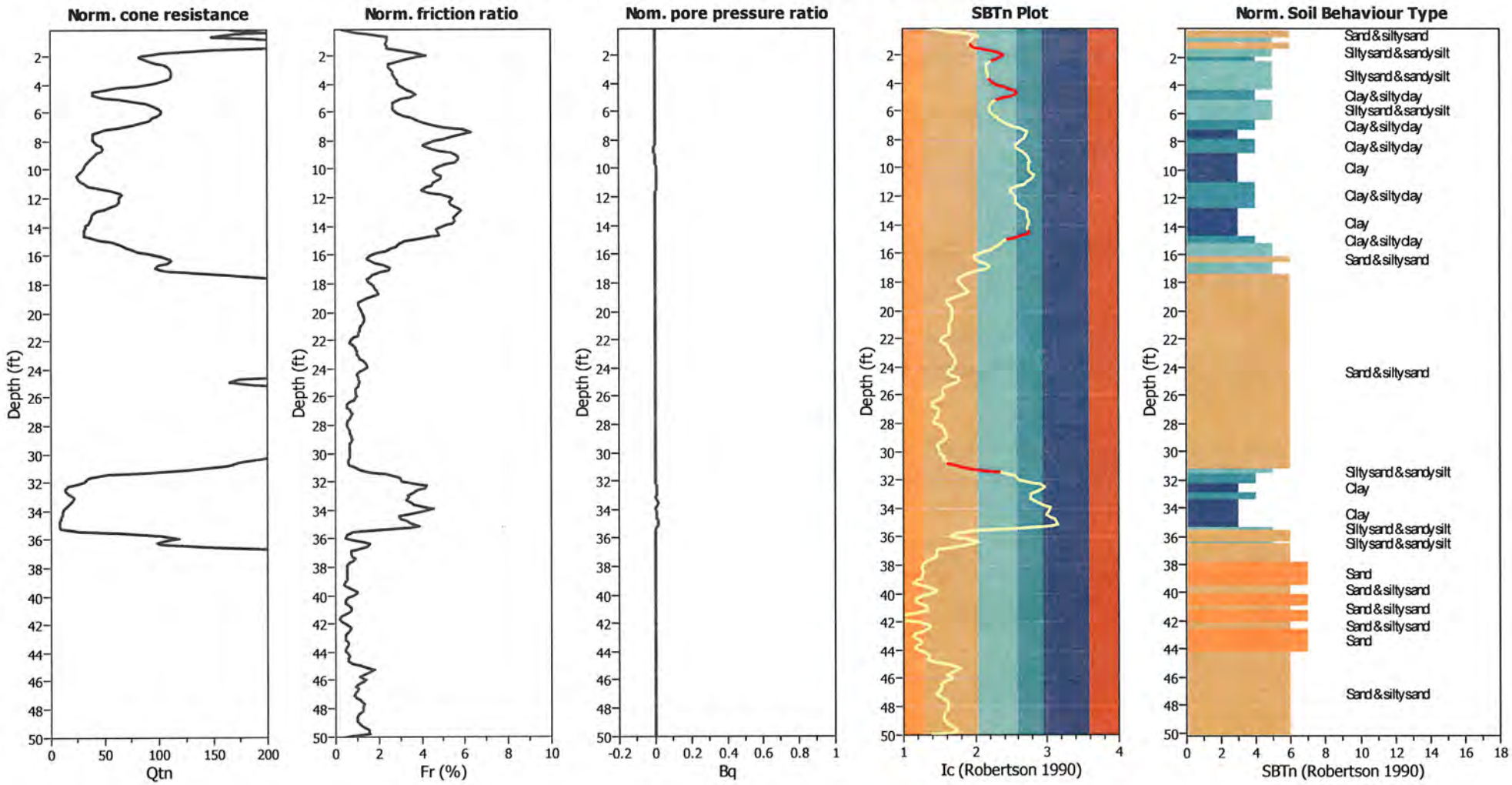
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.35	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



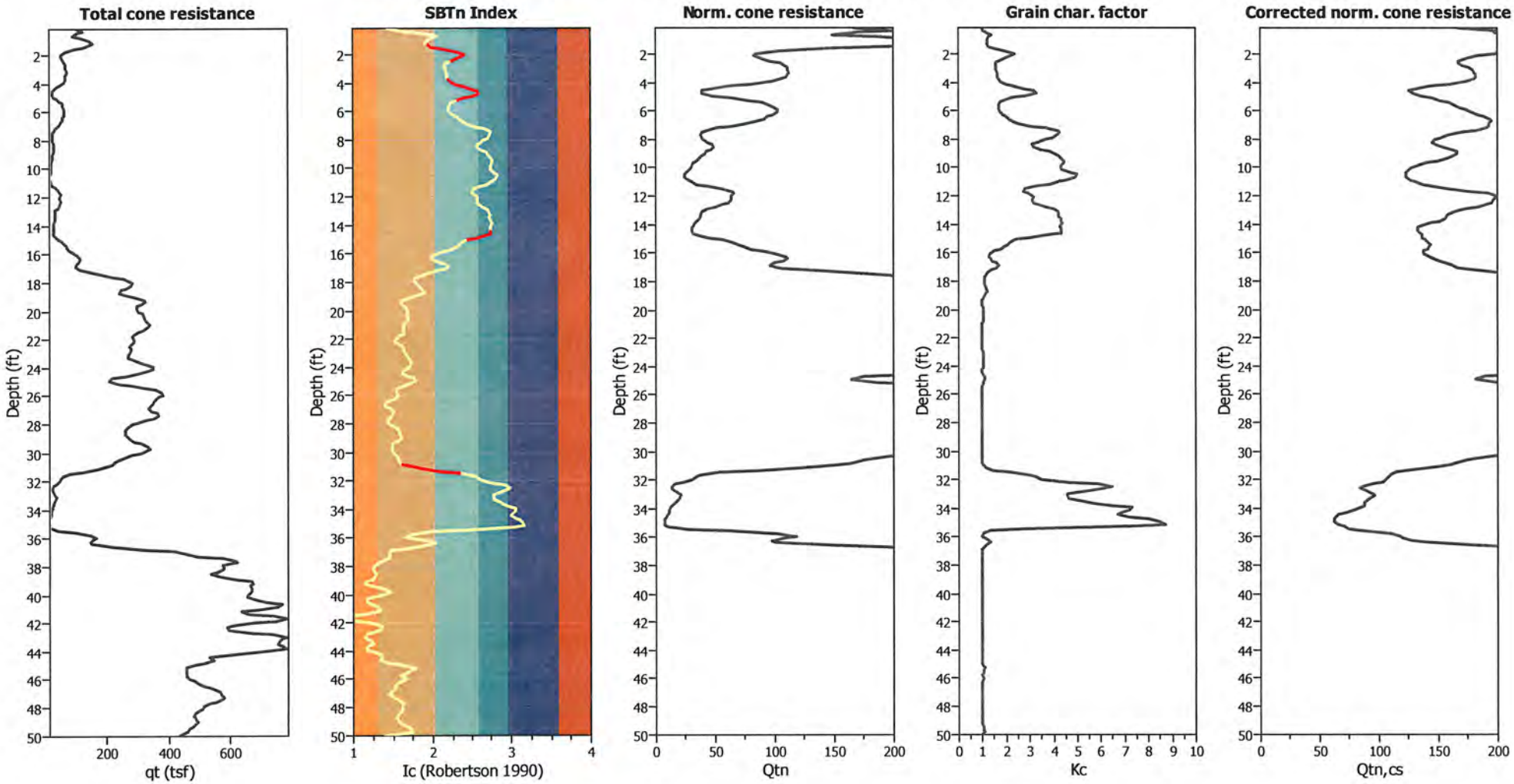
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.35	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

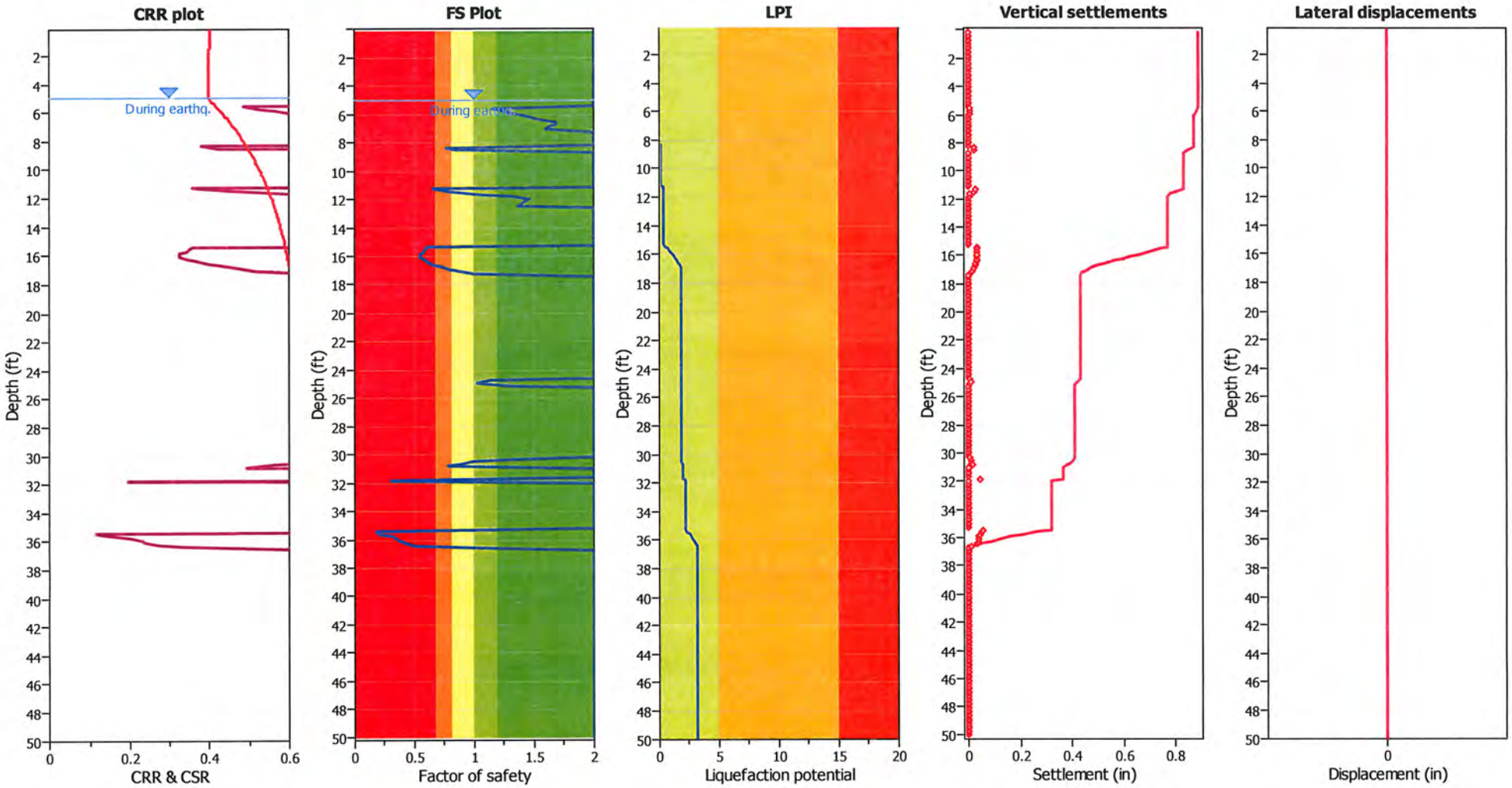
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.35	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.35	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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http://www.geologismiki.gr

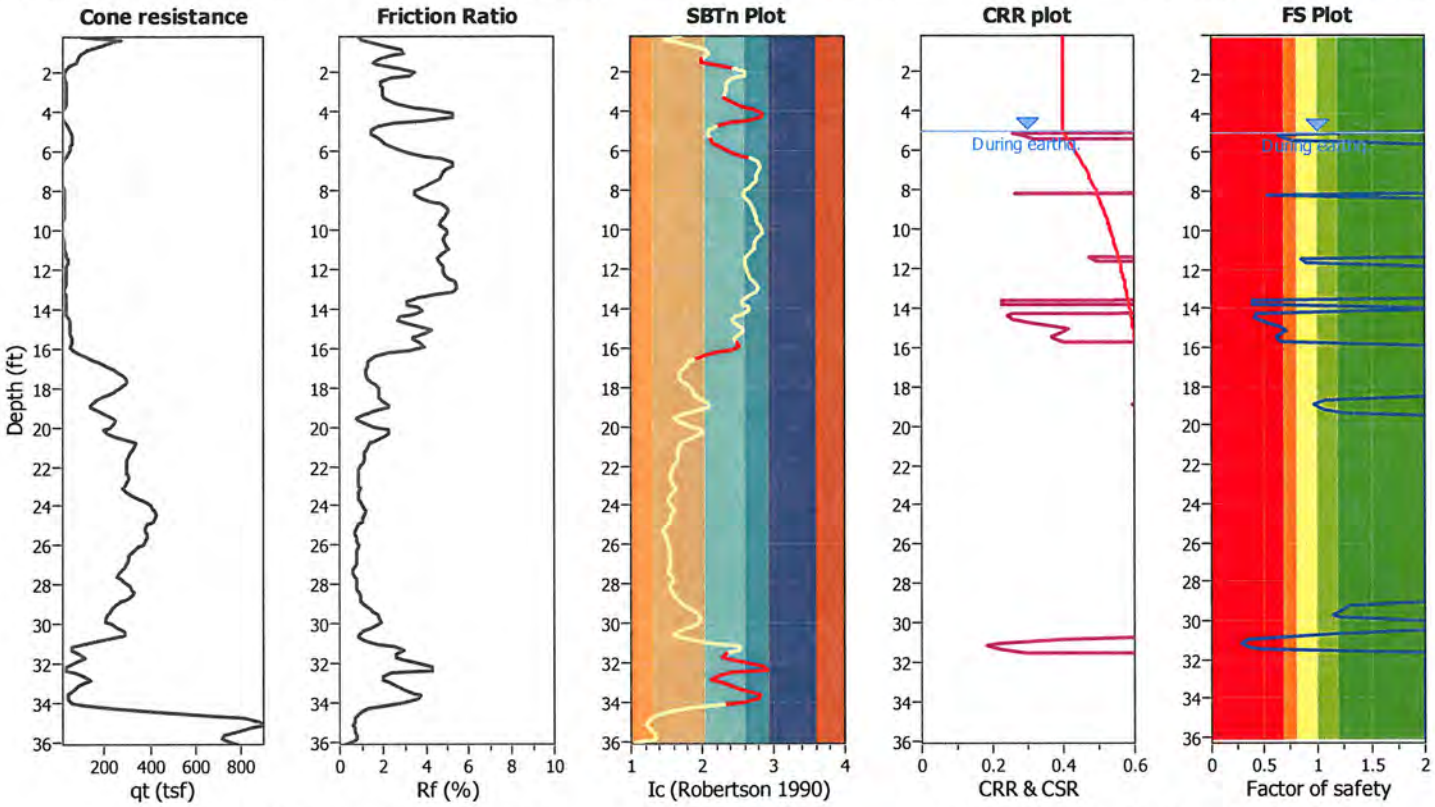
LIQUEFACTION ANALYSIS REPORT

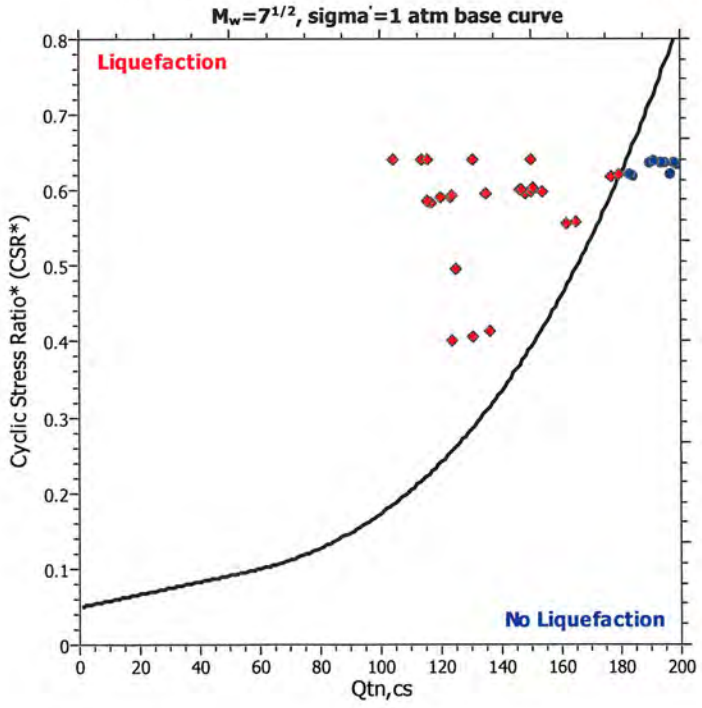
Project title : Psomas/Bankfield PS **Location : Culver City**

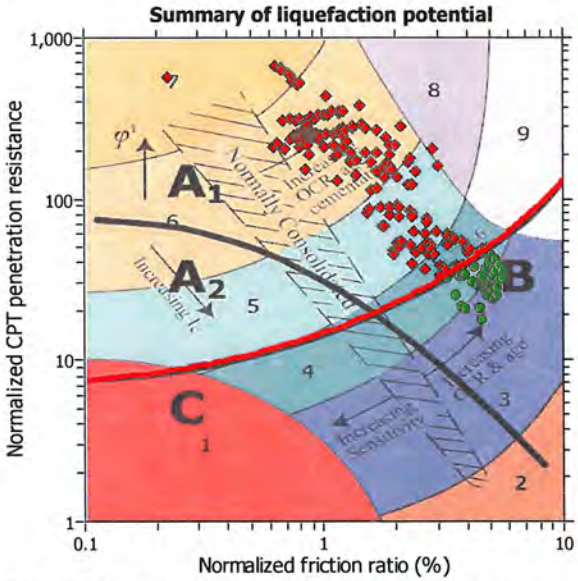
CPT file : CPT-2

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	5.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.35	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.65	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

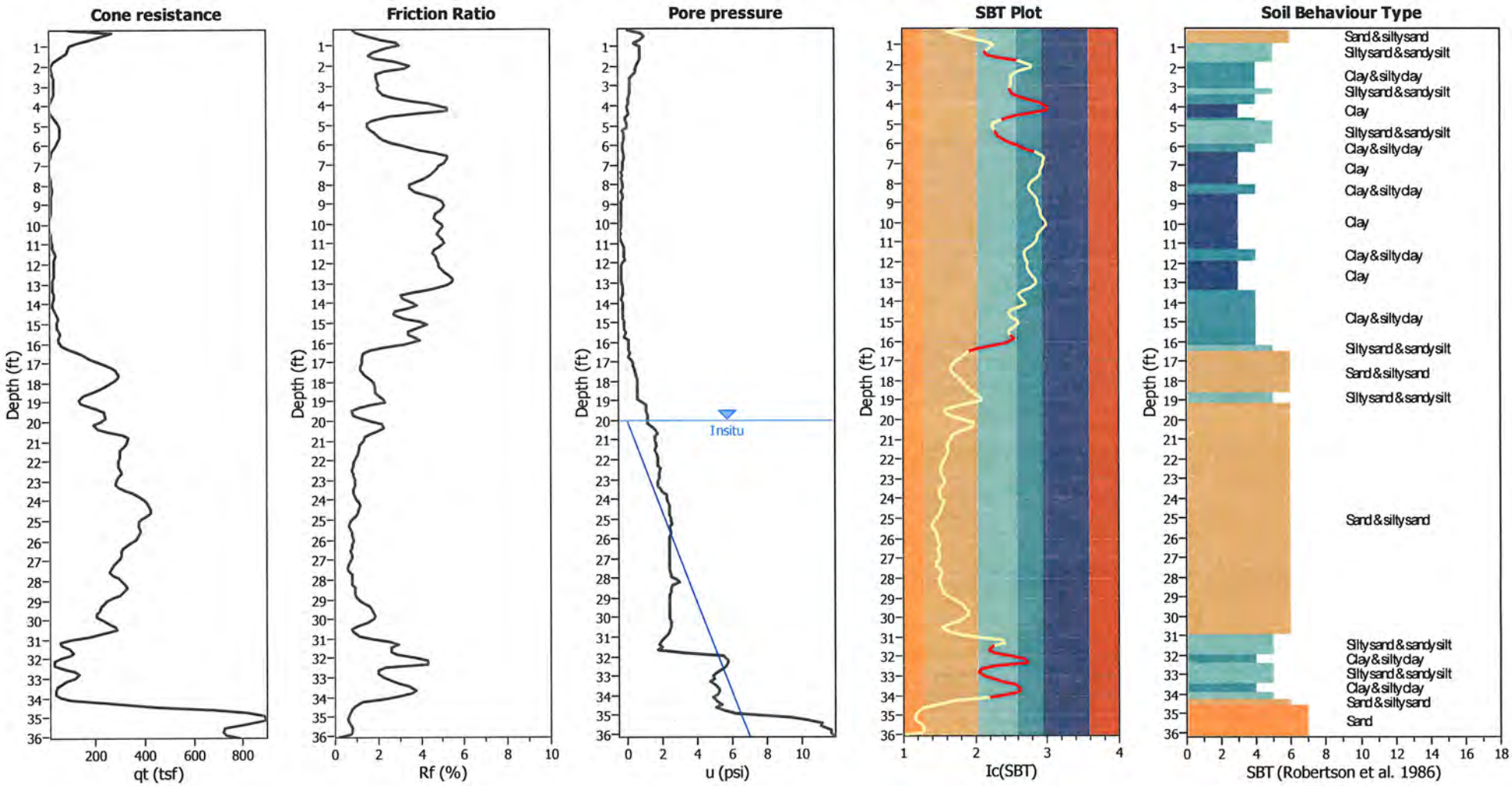






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



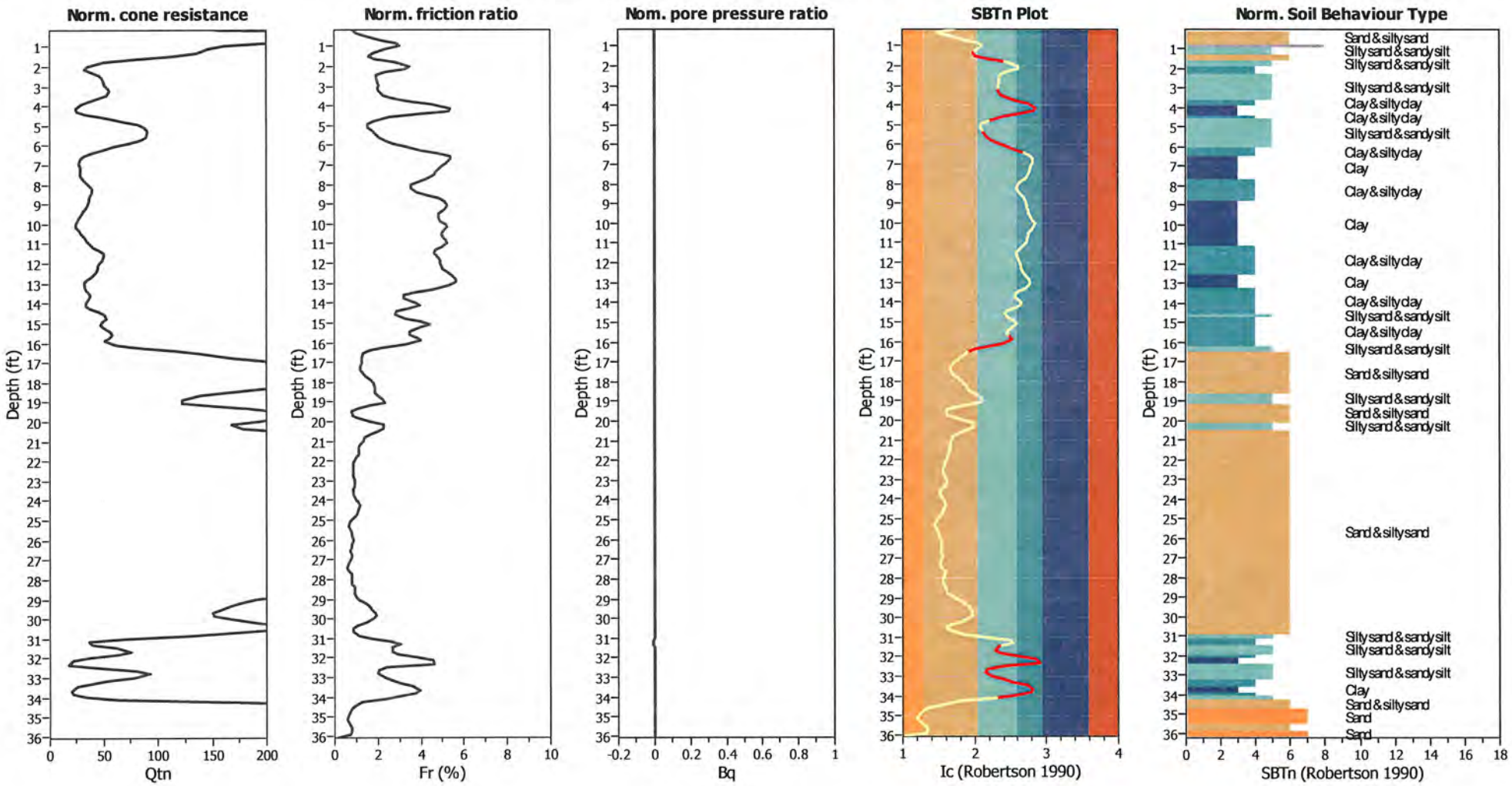
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_o applied:	Yes
Earthquake magnitude M_w:	7.35	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
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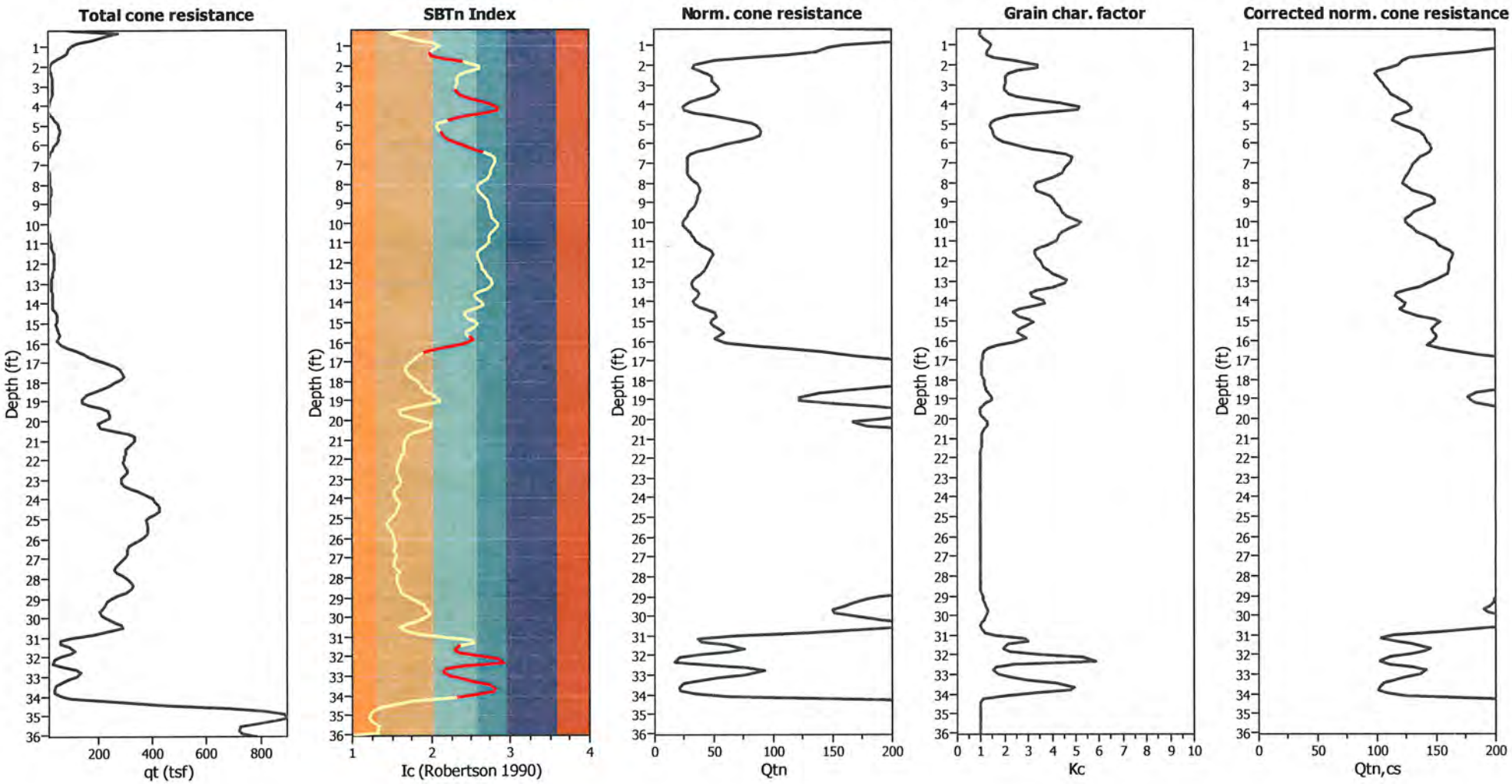
Earthquake magnitude M_w:	7.35	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	5.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.35	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.65	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

APPENDIX F

APPENDIX F

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1.0 General

1.1 Intent: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 Geotechnical Consultant: Prior to commencement of work, the owner shall employ a geotechnical consultant. The geotechnical consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the plans and specifications.

The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed

immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation: In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching: Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas: All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General: Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import: If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers: Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning: Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557-91).

4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes: In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 Compaction Testing: Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing: Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations: The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum 90 percent of maximum from 1 foot above the top of the conduit to the surface, except in traveled ways (see Section 7.6 below).

7.3 Jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

7.4 Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

7.6 Trench backfill in the upper foot measured from finish grade within existing or future traveled way, shoulder, and other paved areas (or areas to receive pavement) should be placed to a minimum 95 percent relative compaction.

APPENDIX B

LSWPPP CITY REQUIREMENTS

LOCAL STORM WATER POLLUTION PREVENTION PLAN (LSWPPP)

This plan is in addition to standard City requirements for erosion control plans

If project is 1 acre or more:

State WDID#

attach copy of certified letter

OWNER NAME _____

OWNER ADDRESS _____

_____

PHONE _____

SITE NAME _____

SITE ADDRESS _____

_____

TRACT NUMBER _____

CONTRACTOR NAME _____

CONTRACTOR ADDRESS _____

_____

PHONE _____

Indicate Size of Disturbed Area
Including stockpiles

_____ **Acres**

Building/Grading or Plan Check Number

_____

Estimated start/finish date: _____

In addition to the SWPPP required under the State GCASP program, the MS4 Permit requires an LSWPPP for all construction projects one acre or greater. The preparer should assess site conditions, identify construction activities with the potential to cause storm water pollution, and identify the BMPs that will best suit the construction activities.

Project Description	Provide a narrative description of the major features of the proposed project (e.g. Low density housing commercial development industrial complex, etc.) Attach additional sheets, if necessary.

The attached tables indicate which Best Management Practices (BMPs) will be used to control storm water pollution from the project site. In addition, a Site Plan example is included showing BMP locations.

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. The project contractor is aware that the selected BMPs must be installed, monitored, and maintained. As the Project Owner, I certify the appropriate BMPs will be implemented to effectively minimize the negative impacts of this project's construction activities on storm water quality. I am aware that submitting false and/or inaccurate information, failing to update the Local SWPPP to reflect current conditions, or failing to properly and/or adequately implement the Local SWPPP may result in revocation of grading and/or other permits or other sanctions provided by law.

_____
Owner or Authorized Representative Signature

_____
Owner or Authorized Representative Name (printed)

_____
Date

As the architect/engineer of record, I have selected appropriate BMPs to effectively minimize the negative impacts of this project's construction activities on storm water quality. The project owner and contractor are aware that the selected BMPS must be installed, monitored, and maintained to ensure their effectiveness. The BMPs not selected for implementation are redundant or deemed not applicable to the proposed construction activity.

Project Architect or Engineer of Record, stamp and date

This is a separate submittal and NOT a substitute for the SWPPP the State requires under the GCASP Program. Verification that an SWPPP has been prepared must be submitted.

LOCAL STORM WATER POLLUTION PREVENTION PLAN (LSWPPP)

Indicate on the following tables which BMP will be used to control stormwater pollution at the project site.

Project Name and Address:

General Site Management			
BMP Description	Will BMP be used? YES	NO	If YES, show on plans or describe on additional sheet. If NO, state reason (attach additional sheets if necessary)
Site Planning Considerations			
Project Scheduling (EC-1)			
Preservation of Existing Vegetation (EC-2)			
Construction Practices			
Sediment Control Procedures			
Dewatering Operations (NS-2)			
Paving Operations (NS-3)			
Wind Erosion Control (WE-1)			
Vehicle & Equipment Management			
Vehicle and Equipment Cleaning (NS-8)			
Vehicle and Equipment Cleaning (NS-9)			
Vehicle and Equipment Cleaning (NS-10)			
Tracking Control			
Stabilized Construction Entrance (TR-1)			
Self-Inspections	✔		Self inspections will be made before, after and during a 0.25 inch rainfall event.

Construction Materials and Waste Management			
BMP Description	Will BMP be used? YES	NO	If YES, show on plans or describe on additional sheet. If NO, state reason (attach additional sheets if necessary)
Material Management			
Material Delivery and Storage (WM-1)			
Material Use (WM-2)			
Spill Prevention and Control (WM-4)			
Waste Management			
Solid Waste Management (WM-5)			
Hazardous Waste Management (WM-6)			
Contaminated Soil Management (WM-7)			
Concrete Waste Management (WM-8)			
Sanitary Septic Management (WM-9)			

BMP locations must be shown on plans

BMPs must conform to the latest edition of the California Storm Water Best Management Practice Handbooks

LOCAL STORM WATER POLLUTION PREVENTION PLAN (LSWPPP)

Indicate on the following tables which BMP will be used to control stormwater pollution at the project site.

Project Name and Address:

_____

_____

Erosion Control Practices

BMP Description	Will BMP be used? YES	Will BMP be used? NO	If YES, show on plans or describe on additional sheet. If NO, state reason (attach additional sheets if necessary)
Vegetative Stabilization			
Hydroseeding (EC-4)			
Mulching (EC-3, EC-6, EC-8)			
Physical Stabilization			
Geotextiles and Mats (EC-7)			
Streambank Stabilization (EC-12)			
Construction Road Stabilization (TR-2)			
Diversion Runoff			
Earth Dike (EC-9)			
Drainage Swales (EC-9)			
Slope Drains (EC-11)			
Velocity Reduction			
Velocity Dissipation Devices (EC-10)			
Check Dams (SE-4)			

Sediment Control Practices

BMP Description	Will BMP be used? YES	Will BMP be used? NO	If YES, show on plans or describe on additional sheet. If NO, state reason (attach additional sheets if necessary)
Sediment Control			
Silt Fence (SE-1)			
Straw Bale Barrier (SE-9)			
Sand Bag Barrier (SE-8)			
Storm Drain Inlet Protections (SE-10)			
Sediment Trap (SE-3)			
Sediment Basin (SE-2)			

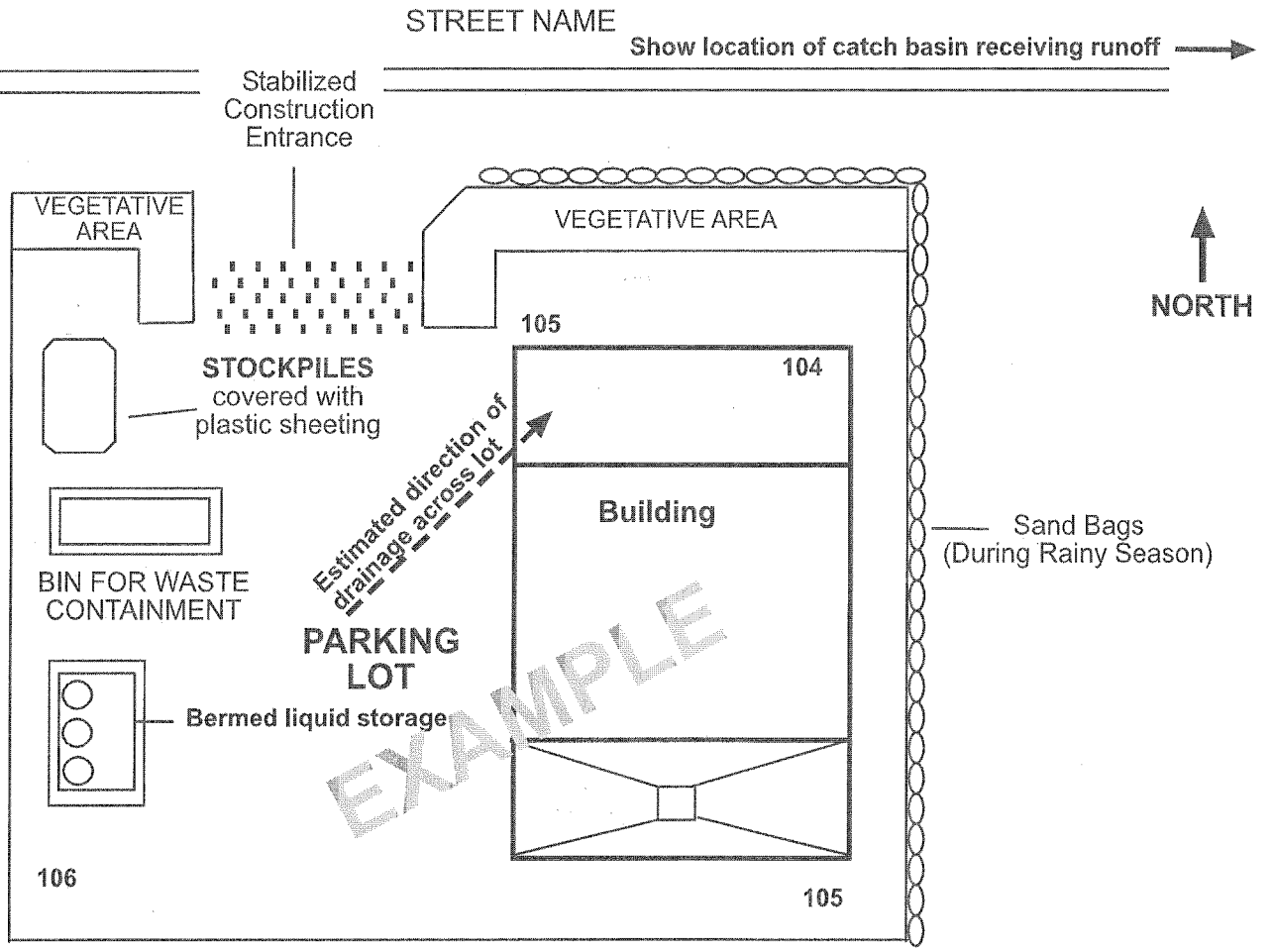
BMP locations must be shown on plans

BMPs must conform to the latest edition of the California Storm Water Best Management Practice Handbooks

LOCAL STORM WATER POLLUTION PREVENTION PLAN (LSWPPP)

Sample Project Site Diagram

Example



Submit three sets of plans showing BMPs.

INCLUDE THE FOLLOWING

Project Name Project Location Scale or Dimensions

And,

1) The project boundary and limits of grading and soil disturbance.

2) The footprint of existing facilities and facilities that will be built during construction.

3) The existing and final grades of the site, along with any intermediate grades during construction that will significantly affect site drainage patterns.

4) The location(s) where runoff from the site may enter storm drain(s), channel(s), and/or receiving water(s).

5) Specific locations where construction materials, vehicles, and equipment will be stored, handled, used, maintained, and disposed, along with locations of structural measures that will be used to contain these materials on site.

BMPs must **ALSO** be shown on grading/construction plans.
Existing grading/construction plans may be substituted provided all required information is included.

Storm Water Construction notes

Minimum BMP Requirements for Construction Activities for All Development Construction Projects

- Eroded sediments and other pollutants must be retained on site and may not be transported from the site via sheetflow, swales area drains, natural drainage courses or wind.
- Stockpiles or earth and other construction related materials must be protected from being transported from the site by the force of wind and water.
- Fuels, oils, solvents and other toxic materials must be stored in accordance with their listing and are not to contaminate the soil and surface waters. All approved storage containers are to be protected from the weather. Spills must be cleaned up immediately and disposed of in a proper manner. Spills may not be washed into the drainage system.
- Non-storm water runoff from equipment and vehicle washing and any other activity shall be contained at the project site.
- Excess or waste concrete may not be washed into the public way or any other drainage system. Provisions shall be made to retain concrete wastes on site until they can be disposed of as solid waste.
- Trash and construction related solid wastes must be deposited into a covered receptacle to prevent contamination of rainwater and dispersal by wind.
- Sediments and other materials may not be tracked from the site by vehicle traffic. The construction entrance roadways must be stabilized so as to inhibit sediments from being deposited into the public way. Accidental depositions must be swept up immediately and may not be washed down by rain or other means.
- Any slope with disturbed soils or denuded of vegetation must be stabilized so as to inhibit erosion by wind and water.
- Additional BMPs will be implemented as deemed necessary by City inspectors.

WM-1 MATERIAL DELIVERY AND STORAGE

Provide a material storage area with secondary containment and/or weather protection. Note the maintenance practices and schedule proposed for this area.

WM-2 MATERIAL USE

Hazardous materials, fertilizers, pesticides, plasters, solvents, paints, and other compounds must be properly handled in order to reduce the risk of pollution or contamination. Training and information on procedures for the proper use of all materials must be available to the employees that apply such materials.

WM-4 SPILL PREVENTION AND CONTROL

Identify spill prevention and control measures that will be taken for all proposed materials. Identify the methods, by which accidental spills will be cleaned and properly disposed of.

WM-5 SOLID WASTE MANAGEMENT

Provide designated waste collection areas and containers. Arrange for regular disposal. Provide covered storage with secondary containment. Containers are required to protect waste from rain to prevent water pollution and prevent wind dispersal.

WM-6 HAZARDOUS WASTE MANAGEMENT

Hazardous materials must be disposed of in accordance with State and Federal regulations. Identify the proposed methods of disposal and any special handling contracts that may be applicable.

WM-7 CONTAMINATED SOIL MANAGEMENT

Prevent or reduce the discharge of pollutants to stormwater from contaminated soil and highly acidic or alkaline soils by conducting pre-construction surveys, inspecting excavations regularly, and remediating contaminated soil promptly.

WM-8 CONCRETE WASTE MANAGEMENT

Store dry and wet materials under cover. Avoid on-site washout except in designated areas away from drains, ditches, streets, and streams. Concrete waste deposited on site shall set-up, be broken apart, and disposed of properly. Containment and proper disposal is required for all concrete waste.

WM-9 SANITARY / SEPTIC WASTE MANAGEMENT

Untreated raw wastewater is not to be discharged or buried. Sanitary sewer facilities on site are required to be in compliance with local health agency requirements. Sanitary or septic wastes must be treated or disposed of in accordance with State and local requirements.

TC-1 STABILIZED CONSTRUCTION ENTRANCE

A stabilized entrance is required for all construction sites to ensure that dirt and debris are not tracked onto the road or adjacent property. Maintenance of such a system is required for the duration of the project. Such stabilization may be of rock or paved.

SE-1 SILT FENCE
SE-3 SEDIMENT TRAP
SE-8 SAND BAGS

Eroded sediments must be retained on site and not permitted to enter the drainage system. May be waived at the sole discretion of the City Inspector if other erosion control BMPs are deemed sufficient.

These notes must appear on plans

Self Inspection Forms

BMPs for construction sites are usually temporary measures that require frequent maintenance to maintain their effectiveness and may require relocation and reinstallation, particularly as the project progresses.

Regular inspections are required, particularly during rainy season.

In order to ensure that BMPs are properly implemented and function effectively, and to identify necessary maintenance and repairs, developers and contractors are required to perform self-inspections. The attached Construction Site Inspection Checklists must be completed:

-Before and after every rainfall with 0.25 inches or more of predicted or actual precipitation

and

-At 24-hour intervals during extended rainfall events.

Construction Site Inspection Checklist

Inspected By: _____

Project: _____

Contractor: _____

Date: _____

Circle "YES" or "NO" or "N/A" if not applicable

YES NO N/A 1. Has there been rain at the site since the last inspection?

YES NO N/A 2. Are all sediment barriers (e.g., sandbags, straw bales, and silt fences in place in accordance with the Plan and are they functioning properly?

YES NO N/A 3. If present, are all exposed slopes protected from erosion through the implementation of acceptable soil stabilization practices?

YES NO N/A 4. If present, are all sediment traps/basins installed and functioning properly?

YES NO N/A 5. Are all material handling and storage areas reasonably clean and free of spills, leaks, or other deleterious materials?

YES NO N/A 6. Are all equipment storage and maintenance areas reasonably clean and free of spills, leaks, or any other deleterious materials?

YES NO N/A 7. Are all materials and equipment properly covered?

YES NO N/A 8. Are all external discharge points (i.e., outfalls) reasonably free of any noticeable pollutant discharges?

YES NO N/A 9. Are all internal discharge points (i.e. storm drain inlets) provided with inlet protection?

YES NO N/A 10. Are all external discharge points reasonably free of any significant erosion or sediment transport?

YES NO N/A 11. Are all BMPs identified on the Plan installed in the proper locations and according to the specifications for the Plan?

YES NO N/A 12. Are all structural control practices in good repair and maintained in functional order?

YES NO N/A 13. Are all on-site traffic routes, parking, and storage of equipment and supplies restricted to areas designated in the Plan for those uses?

YES NO N/A 14. Are all locations of temporary soil stockpiles or construction materials in approved areas and properly contained?

YES NO N/A 15. Are all seeded or landscaped areas properly maintained?

YES NO N/A 16. Are sediment controls in place at discharge points from the site?

YES NO N/A 17. Are slopes free of significant erosion?

YES NO N/A 18. Are all points of ingress and egress from the site provided with stabilized construction entrances?

YES NO N/A 19. Is the sediment, debris, or mud being cleaned from public roads at intersections with site access roads?

YES NO N/A 20. Does the Plan reflect current site conditions?

If you answered "no" to any of the above questions (except Number 1), describe any corrective action(s) that must be taken to remedy the problem and when the corrective action is to be completed:

Checklist Item	Corrective Action(s) Needed	Date to be Completed

Inspection Log

This site shall be inspected before and after storm events with 0.25 inches or greater predicted or actual precipitation, and documented on the Construction Site Inspection Checklist Form. Incidents of noncompliance must be reported to the Engineer. A log of all inspections, as shown below, shall be kept current.

Date	Inspector	Type of Inspection			Observations (If post-storm inspection, note size of storm in inches)
		Routine	Pre-Storm	Post-Storm	

APPENDIX C

GENERAL OPERATIONS SUMMARY

APPENDIX C – BANKFIELD PUMP STATION GENERAL OPERATION

19-1 General

19-1.1 Bankfield Pump Station will be constructed to centralize the city's sewage demands to one pump station and decommission 2 – 4 existing pump stations including Mesmer Pump Station and Overland Pump Station in Phase 1 of the project. Bristol and Fox Hills Pump Stations will be potentially decommissioned in a later phase. The Bankfield Pump Station will replace the Mesmer and Overland Pump Stations by intersecting the gravity flow to the existing lift stations and constructing new sewers to gravity flow to the Bankfield Pump Station located between an alley just west of Selmaraine Drive and Bankfield Drive.

19-1.2 Two new 10" sewage force mains will be constructed approximately 1,000 feet to the point of connection where the 10" force main connects to the existing 12" and 18" Fox Hills Lift Station force mains. Therefore, the Bankfield Lift Station will convey the City of Culver City's sewage demands from the Bankfield Pump Station to the LA City Interceptor Sewer through a new 1,000 foot 10" force main and approximately 1,000 feet of either 12" or 18" existing force main from that point to where it connects to the City of Los Angeles Interceptor north of Green Valley Circle (i.e., a total of approximately 2,000 feet from the Bankfield Pump Station to the City of Los Angeles Interceptor). The facility is equipped with two pumps that will operate a Lead and Lag (standby) pump for the normal operation plus a third emergency engine driven pump unit which will serve as a backup if the Level Transmitter and/or Remote Terminal Unit (RTU) system fails and/or if the sewage level reaches the "Diesel Engine Pump On" set point until it goes down to the "Diesel Engine Pump Off" set point. The pumps will have the ability to operate with the use of a variable frequency drive (VFD) controller to maintain a constant level by matching the inflow rate with the pumped rate or a constant speed operation where the pump will run at full speed in fill/draw wet well operation.

19-1.3 The normal operation sequence will use the Lead pump to maintain a constant wet well level and match the inflow rate with the pump rate. If the flow rate increases the level would rise and the Level Transmitter will send a signal to the RTU to increase the pump speed to match the inflow rate and maintain the wet well "Control Level Set Point". Likewise, if the flow rate decreases the level will drop down and the Level Transmitter will signal the RTU to slow the pump down to maintain the constant level. As the RTU reduces the motor speed to 900 rpm the minimum operating speed (approximately 400 gpm), the RTU will stop reducing the motor speed and the pump will continue to lower the wet well level until the level matches the "All Pumps Off" set point. If the inflow rate continues to rise and the wet well level continues to rise, the Lead pump will increase the motor speed to the highest speed and if the level

continues to rise with a flow rate greater than the Lead pump's maximum pump rate, then the level in the wet well would increase to the "Lag pump ON" set point. When the Lead pump is running at full speed and the "Lag pump ON" level has been reached, then the Lag pump starts to run at full speed with the Lead pump until the level is decreased to "All Pumps Off" set point and the sequence is reset. If the Lead and Lag pumps or controls have failed and the level continues to rise to the "Emergency Engine Pump ON" set point, then the emergency engine pump will start and operate at full speed in the sequence until pumps and/or control have cleared the failure and reset.

19-1.4 In addition, the facility will operate with: (1) a sewage flow meter to measure the pumped flow rate and (2) a Float Switch Control system that will monitor and signal wet well levels to the MCC. The MCC will use the level data to signal and control the pump operation. The RTU is capable of storing the Level and Flow Rate Data or transmitting to the SCADA Central where the information could be stored or charted. The pumped flow data will require monthly totals for the City of LA's Bureau of Sanitation's monthly treatment costs. A pressure transducer will be installed in the Meter vault to monitor and record system discharge pressures in the force main.

19-2 Operational Modes

19-2.1 General

19-2.1.1 The facility will be equipped with two (2) independent control systems to operate and sequence the pumps. In addition to normal station control systems and pumps, an emergency engine driven pump system with a separate float control system will be installed as an emergency backup pump system which will not operate until the level in the wet well has increased to the "Emergency Engine Pump ON" level shown in Table 19-1. The emergency engine pump start level is 10.75 feet above the bottom of the wet well and would not reach this level in the wet well without an extreme onsite control system and/or pump system failure. The emergency engine driven pump system will provide the city assurance that the sewage level in the wet well will always be maintained at that level or below. Each pump will have a HAND-OFF-AUTO switch which will allow local control only in HAND (manual) mode, and RTU control or back up flow control in AUTO mode. HAND mode will be used to operate the pumps to clean the wet well of debris. The normal two (2) modes of operation will be installed to maintain continuous service for the normal operation and during emergency repairs and maintenance as provided in Table 19-1 Pump Start/Stop and Alarm Wet Well Summary.

Table 19-1

Pump Start/Stop and Alarm Wet Well Summary

Operation Mode	Mode 1 Normal Wet Well Level Transmitter Control	Mode II Normal Wet Well Float Switch Control
Emergency Engine Pump On		**El. +4.5 (10.75)**
Emergency Engine Pump Off		**+2.5 (8.75)**
High Water Alarm/Pumps ON Float (Backup)	**-1.0 (5.25)**	**-1.0 (5.25)**
Lag Pump ON	**-2.0 (4.25)**	
Lead Pump ON	**-3.0 (3.25)**	
Control Level Set Point	**-4.0 (2.25)**	
All Pumps OFF	**-5.25 (1.0)**	
Low Level Alarm/ Pumps OFF Float	**-5.50 (0.75)**	**-5.50 (0.75)**
Bottom of Wet Well	**-6.25 (0.0)**	

Note: All levels may be adjusted during normal operation testing procedures
Elevation MSL -5.0 Distance off bottom of wet well (1.25)

19-2.2 Mode I-Wet Well Level Transmitter Control

19-2.2.1 The normal daily operating system will be controlled from a RTU that has been programmed with pump operating levels and sequences. The 3-way HAND – OFF – AUTO selector switch should be placed in AUTO mode for RTU control; in the HAND mode the pump will be operated at the front panel of the VFD. In AUTO operation, the RTU receives the well level from a submersible Level Transmitter and then determines how to control the pumps accordingly. There are two submersible Level Transmitters in the wet well which will report on the level. The operator will have the ability to select the duty Level Transmitter for control purposes from SCADA. If there is a discrepancy between the two readings an alarm will be generated and reported to SCADA.

In AUTO mode, when the level reaches the pre-programmed "Lead Pump ON" level, the RTU signals the lead pump to start and run up to full speed. The RTU monitors the wet well level and signals the pump motor to reduce speed to adjust the wet well level to match the "Control Level Set Point". The RTU signals the pump motor to slow down when the wet well level drops below the Control Level Set Point and speed up the motor if wet well level is above the Control Level Set Point. The RTU will use a PID controller to continuously monitor the process variable (level) and adjust the speed of the pump to maintain the "Control Level Set Point".

The Lag pump unit will be started by the RTU when the level rises to the "Lag Pump ON" set point in the wet well. When the Lag Pump is called to run both pumps will operate at full speed until the wet well level decreases to the "All Pumps Off" level set point.

At the end of each pumping cycle where the "All Pumps Off" level is achieved, the pumps all stop and the RTU will automatically re-assign the Lead pump to the Lag pump and the Lag pump to Lead pump sequence.

If the submersible level transmitter signal is unavailable, the wet well levels will increase to the high water level, which will initiate automatic operation of the pumps at full speed until the "Low Level Alarm" level is activated. The wet well levels of operation are summarized in Table 19-1.

19-2.3 Mode II – Wet Well Float Control System

19-2.3.1 The wet well will be equipped with float level switches to start/stop the pumps and annunciate the alarms at the high and low levels. The wet well float levels and functions are further described in Table 19-1.

19-2.3.2 The float control system is a backup hardwired control system for the Level Transmitter and/or RTU failure, which operates the station automatically when the normal control system has failed. The float switches will be installed at levels above and below the RTU level controlled system set points. This allows the normal wet well level to rise slightly above the normal pump cycles and maintain a continuous operating pumping system. The flow switches are wired directly to the MCC for full speed pump operating in a fill/draw control sequence without the station's RTU controller system. The float backup system will maintain continuous operation capability during the facility's RTU and submersible Level Transmitter maintenance or failures. Under wet well float control Pump #1 will always be the lead pump and Pump #2 will always be the lag pump. Pump #2 will start a pre-configured length of time after

Pump #1 (to be configured during commissioning), if the "High Water Level Alarm" float is still activated. Both pumps will then run until the "Low Level Alarm" float is activated, at which time Pump #1 will stop and Pump #2 will stop a pre-configured amount of time afterwards (to be configured during commissioning).

19-3 Emergency Bypass Operation

19-3.1 The Emergency Bypass System is able to bypass the normal station operation by isolating the submersible pumps from the pumping operations and pumping out the wet well utilizing the onsite engine driven pump unit P-3 (Godwin skid-mounted pump) or a portable pump unit connected downstream of the check valve to the tee in the valve vault. The onsite engine driven pump P-3 uses a self-priming pump. However, the pump is limited to pumping no more than 25 ft above the pumping level of the wet well. Therefore, with site elevation of +24.5 and the pump 3.0 ft above the ground limit, the pump will be prevented from operating below Elevation +2.5 and will have a starting set point at Elevation +4.5.

To isolate the submersible pumps from the pumping operations each pump would need to be placed in the OFF position at its associated 3-way HAND – OFF - AUTO switch at the MCC. Note that the engine driven pump unit P-3 will also have a HAND-OFF-AUTO selector, but this will be located at the local pump controller set to AUTO.

19-3.2 The other emergency mode of operation would allow the operator to pump out the wet well into a storage tanker truck in the event both force mains are out of service. The operator would isolate the force main by closing the 8" plug valve in the valve vault and removing the flange on the tee connection downstream of the check valve and then connecting a flexible temporary line from the tee to the storage tanker truck to fill the truck and haul offsite to the treatment plant. This operation would use the submersible pumps to pump out the wet well.

19-4 Emergency Backup Generator Operation

19-4.1 Initial Operation

Bankfield Pump Station shall provide the space and accommodation for an emergency backup generator and related improvements for future installations and shall function with the following parameters.

In the event of a power failure of 10 seconds or more, an alarm shall be generated and displayed via SCADA, through the UPS-backed control system. Under this scenario if the

operator wishes to restore power before utility power is restored they will need to attend site with a portable generator and connect to a generator connection lug box. A manual transfer switch will be provided to switch power from the utility to the generator connection facility.

19-4.2 Future Operation

In future it is expected that a permanent standby generator and automatic transfer switch (ATS) will be installed. Under this future scenario, in the event of a power failure, an ATS will sense any electrical outage which lasts more than 10 seconds. At that time the ATS will call the backup emergency generator system to start and transfer the facility's generated power to the station's electrical grid and continue the normal startup sequence as described in Table 19-1.

Upon return of utility power, the ATS will sense the utility power is available. At that time, the ATS will automatically transfer the ATS from the generated power to the utility power source. The generator unit will continue to operate for a 10-minute cool-down adjustable period prior to automatically shutting off the unit. The future emergency generator set test exercise mode will utilize a radiator-mounted load bank with resistive loads. The test mode may be activated either from the genset unit and load bank and/or from the automatic transfer switch (ATS) test mode. In the event the genset is operating in the test mode, a power outage incidence will automatically shut off the load bank loads and resume the genset normal operation and power of all the facility's site loads until manually transferred back to the utility source by the operator.

The intended future permanent standby generator signals and alarms are shown in the Input/Output Summary.

19-5 Manual Wet Well Cleaning with Pre-Rotation Pump P-1

19-5.1 The P-1 pump is equipped with a pre-rotation basin and HAND selector switch to manually control the pump to clean the wet well at monthly or at another predetermined period. The operator will place P-1 and P-2 in HAND mode which will isolate the controls for the Level Transmitters and Floats from the RTU and the MCC so no signals will be sent to the RTU or MCC to control the pumps. The wet well level will be drawn down to the "All pumps OFF" level. The operator will then place P-2 in OFF mode and P-1 in the HAND mode position. As the wet well level and solids are lowered below the inlet to the pre-rotation basin, the pump rate will be reduced to the pre-rotation basin level while still be running at full speed. During this manual pumping operation, the operator will need to hose down the wet well and direct the any solids or trash to the P-1 pump to clean debris from the wet well. Once the

wet well has been cleaned the operator needs to select AUTO operation on the MCC panel for P-1 and P-2 pumps and reactivate the Level Transmitters and floats system to place the operation back in automatic mode operation.

19-6 Input/Output Control Operation Signal/Alarms/Status

19-6.1 The summary of the I/O schedule has been provided on the instrumentation plans and summarized herein in Table 19-2 to clearly illustrate all the RTU, level control, MCC and appurtenant equipment operation status locally and remotely at SCADA headquarters. The summary has been prepared per the City's operation requirements.

19-6.2 The Contractor will need to develop an I/O schedule of each input and output signal description identifying the location the signal is sent to, the point of operation, statuses and control that is required. The I/O schedule will also need to identity whether the I/O point is a control signal, status of operation or an alarm with a summary of the I/O status registered at local panels or SCADA headquarters.

19-6.3 The pump room, valve vault, meter vault, and by pass vault will each be equipped with a summon help (panic) button and provided on the electrical plans and summarized herein in Table 19-2.

19-6.4 Check valve monitoring is used to confirm pump running status. When the pump is called for, if the check valve is open and the pump running signal is received from the MCC, then SCADA will show the pump as running. If the check valve remains closed a Pump Fail alarm will be generated by the RTU. When the pump is called stop, if the check valve remains open, a Check Valve Failed alarm is generated by the RTU.

TABLE 19-2

BANKFIELD PUMP STATION

Input/Output Summary

RTU I/O Digital Inputs	From
Building Intrusion	Electrical Building doors
Hatch Intrusion	Field Hatches
Check Valve #1 Open (Limit Switch)	MCC
Check Valve #2 Open (Limit Switch)	MCC
Check Valve #3 Open (Limit Switch)	Terminal Panel
Pump #1 VFD Fail	MCC
Pump #2 VFD Fail	MCC
Pump #1 Seal Fail	MCC
Pump #2 Seal Fail	MCC
Pump #1 High Motor Temperature	MCC
Pump #2 High Motor Temperature	MCC
Pump #1 in Auto	MCC
Pump #2 in Auto	MCC
Pump #1 in Hand	MCC
Pump #2 in Hand	MCC
Pump #1 Call	MCC
Pump #2 Call	MCC
Pump #1 Run Status	MCC
Pump #2 Run Status	MCC
Generator Run (FUTURE)	Generator (FUTURE)
Generator Fail (FUTURE)	Generator (FUTURE)
ATS on Normal (FUTURE)	ATS (FUTURE)
ATS on Generator (FUTURE)	ATS (FUTURE)
Utility Power Fail (FUTURE)	ATS (FUTURE)
Summon Help (Electrical Room)	Electrical Room
Summon Help (Valve Vault)	Valve Vault
Summon Help (Meter Vault)	Meter Vault
Summon Help (Bypass Vault)	Bypass Vault
Valve Vault Flooded	Valve Vault
Meter Vault Flooded	Meter Vault
Bypass Vault Flooded	Bypass Vault
Low Level Alarm /Pumps off Float	Float System (Termination Panel)
High Water Alarm/ Pumps ON Float	Float System (Termination Panel)
Emergency Engine Pump ON Float	Float System (Termination Panel)
Emergency Engine Pump OFF Float	Float System (Termination Panel)
Engine Running	Engine Pump Control Panel
Engine Off	Engine Pump Control Panel

Engine Fail	Engine Pump Control Panel
Control Power Fail	CP-1
UPS Power Fail	UPS (CP-1)
UPS Battery Low	UPS (CP-1)
Utility Power Fail	MTS
Active Harmonic Filter Running	MCC
Active Harmonic Filter Failed	MCC

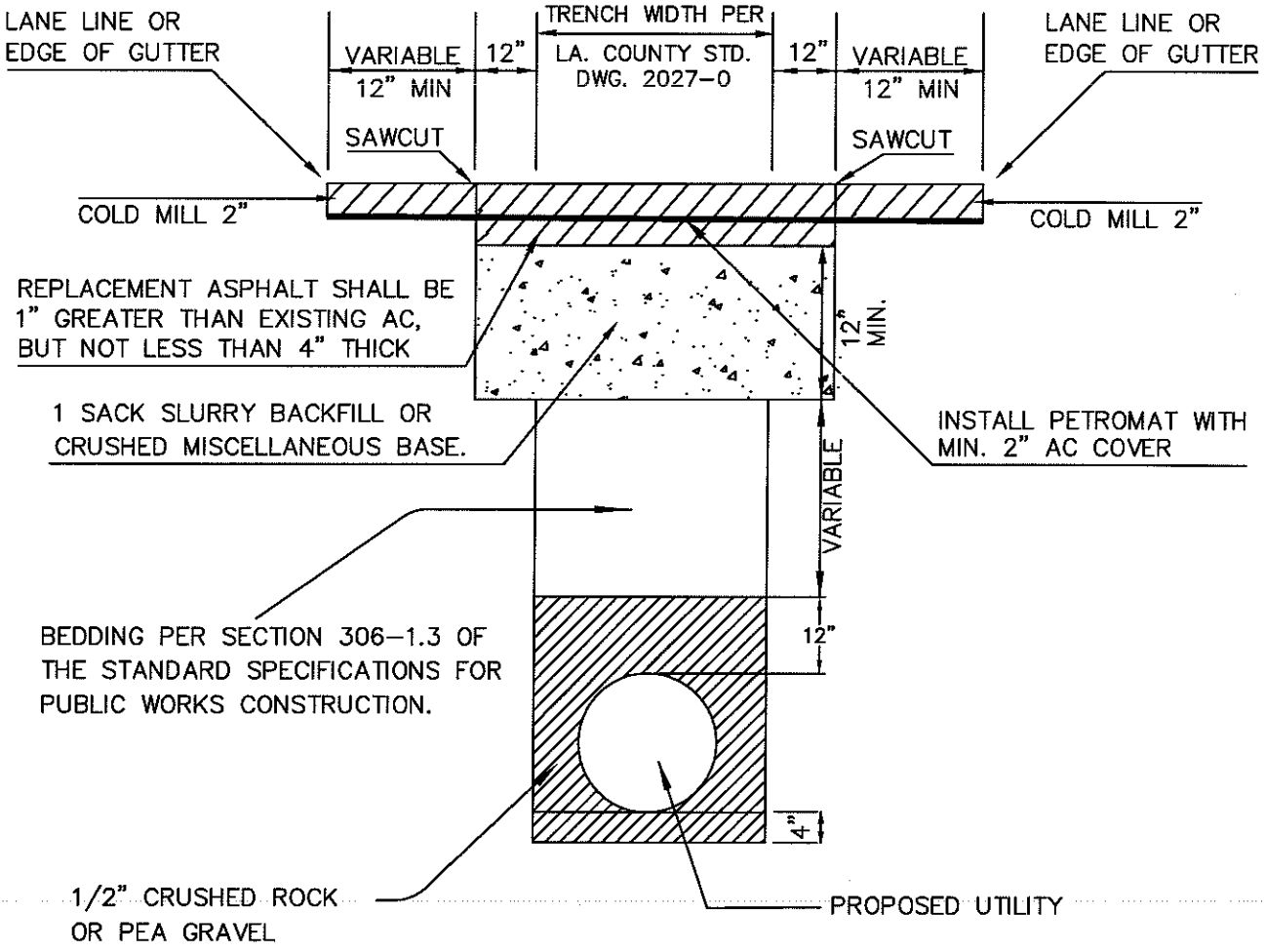
Digital Outputs	To
Pump #1 Start/Stop	MCC
Pump #2 Start/Stop	MCC
Pump Remote Reset	MCC
Pump Remote Reset	MCC
High Level Alarm	CP-1 panel lights
Common Fault Alarm	CP-1 panel lights

Analog Inputs	From
Wet Well Level 1	LT-101
Wet Well Level 2	LT-102
Flow Rate	FIT-101
Force Main Pressure	PIT-101
Pump #1 Speed	MCC (VFD #1)
Pump #2 Speed	MCC (VFD #2)
Engine Pump Fuel Level	Engine Pump Control Panel
Pump Station current	MCC

Analog Outputs	To
Pump #1 Speed	MCC (VFD #1)
Pump #2 Speed	MCC (VFD #2)

APPENDIX D

CITY OF CULVER CITY TRENCH PAVING DETAILS



NOTE: A MINIMUM OF ONE LANE WIDTH OF NEW PAVING SHALL BE INSTALLED

CALL DIG ALERT!

PUBLIC WORKS DEPARTMENT

ENGINEERING DIVISION

CITY OF CULVER CITY

TRENCH PAVING DETAIL (≥ 4 FT. DEEP AND ≥ 12" WIDE)

Approved

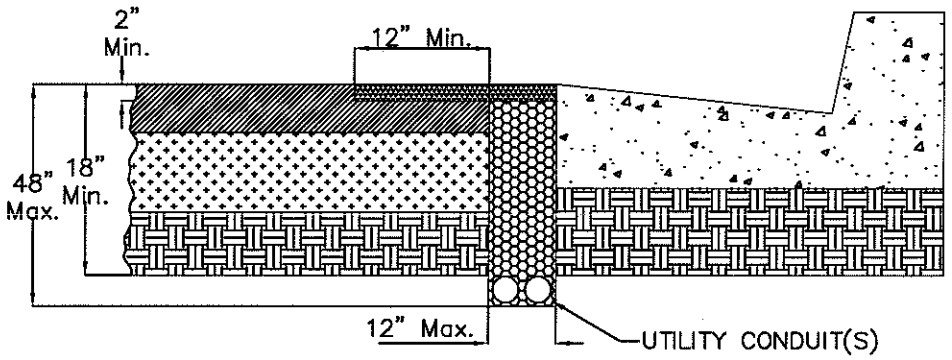
CHARLES D. HERBERTSON, CITY ENGINEER — DATE

Drawing No.

Sheet 1 of 2 Sheets

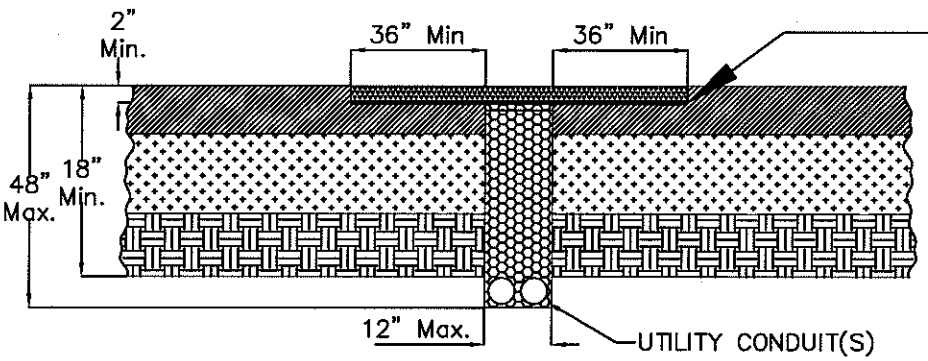
Z:\ENG DIV\ENGINEERING STANDARDS\STANDARD PLANS\WIDE-TRENCH DETAIL.DWG

Drawn: RAS Reviewed: WACO Submitted: MG Last Revised: 01/04/07



Remove AC pavement to a depth of 2" by cold planing. Place and compact 2" AC pavement (C2–AR4000).

LONGITUDINAL @ EDGE OF GUTTER



Install Petromat with min. 2" AC cover.

TRANSVERSE TRENCH

New AC Pavement

Existing AC Pavement

Existing Crushed Aggregate Base

1 Sack PCC Sand Slurry

Existing Sub Base

CALL DIG ALERT!

PUBLIC WORKS DEPARTMENT

CULVER CITY excellence PUBLIC WORKS

ENGINEERING DIVISION

CITY OF CULVER CITY

TRENCH PAVING DETAIL (<4 FT DEEP & ≤ 12" WIDE)

Approved

CHARLES D. HERBERTSON, CITY ENGINEER DATE

Drawing No.

Sheet 2 of 2 Sheets

Z:\ENG DIV\ENG STANDARDS\STANDARD PLANS\TRENCH DETAIL02

Drawn: RAS Reviewed: WACO Submitted: MG Last Revised: 05/16/07

APPENDIX E
PHASE I ENVIRONMENTAL SITE ASSESSMENT SUMMARY

CONESTOGA-ROVERS
& ASSOCIATES

175 Technology, Suite 200, Irvine, California 92618
Telephone: (949) 648-5200 Fax: (949) 648-5299
www.CRAworld.com

June 19, 2015 Reference No. 086977

Harvey Gobas, PE
PSOMAS
3 Hutton Centre Drive
Suite 200
Santa Ana, CA 92707

Dear Mr. Gobas,

Re: 5722 Bankfield Avenue
Revised Phase I Environmental Site Assessment Recommendations
Culver City, California

1.0 Phase I Environmental Site Assessment Summary

Conestoga-Rovers & Associates (CRA) was retained to complete a Phase I Environmental Site Assessment (ESA) at the property and building located at 5722 Bankfield Avenue in Culver City, California (Site). The City of Culver City is proposing to divert sewage flows from four existing sewage pump stations to a single new pump station to be located at the Site. The purpose of the Phase I ESA is to identify recognized environmental conditions (RECs), as defined in ASTM International (ASTM) Standard E1527-13 (the Standard), at the Site. In addition to identifying RECs at the Site, this ESA included an evaluation of specific non-scope considerations as defined in the Standard.

The Site consists of a 0.46-acre lot that is composed of three contiguous parcels (Assessor Parcel Numbers: 4134-001-900, 4134-001-901 and 4134-001-902) located in the southern portion of Culver City, California. The northernmost parcel (APN 4134-001-900) is a triangular-shaped parcel, surrounding by a chain link fence and used for outdoor storage of metal roll-offs, empty 55-gallon drums, and traffic cones and barricades. The other two parcels (APNs 4134-001-901 and 4134-001-902) are open rectangular-shaped paved areas used as vehicle impoundment lots. The southernmost parcel (APN 4134-001-902) is developed with one approximately 1,200 square-foot building. The southern parcels (APNs 4134-001-901 and 4134-001-902) are currently leased and occupied by Redwood Towing. A small portion of the southernmost parcel is used as an unpaved parking area for adjoining businesses to the northeast (along Selmaraine Avenue). Prior use of the Site has included a residence, a machine shop, a wood crafting facility, a factory, a storage facility, and another vehicle towing business.

2.0 Findings and Opinion

Based on the Phase I ESA, including the Site reconnaissance, database search, historical records reviewed, information provided by Site personnel, and interviews, the following findings were identified regarding RECs, historical recognized environmental conditions (HRECs), controlled recognized environmental conditions (CRECs), business environmental risk (BER), and/or de minimis conditions, as defined in the Standard, at the Site:

Garage and Pavement Oil Staining: During CRA's Site reconnaissance, oil staining (covered with sand) was observed on the garage floor and on the pavement outside of the building where impounded vehicles are stored. The oil staining on the pavement was found mostly underneath damaged vehicles that have been in accidents. The oil staining the garage floor and pavement is considered a de minimis condition.

Former Industrial and Vehicle Storage Yard Operations: Based on CRA's review of Sanborn Fire Insurance Maps, historical aerial photographs, historical topographic maps, records review, interviews, and a 2006 Phase I ESA for the Site, the Site has been used for commercial and industrial purposes as early as the 1950s. The Site has been used as a machine shop and wood crafting facility in the 1950s, a factory and storage of scrap metal in the 1960s, and a vehicle storage yard in the 1980s until present. Historical information reported vehicle washing, the suspected presence of hazardous materials (including paint) and junkyard operations on the Site. Commercial and industrial operations on the Site were primarily conducted prior to current environmental regulation and are of the type that typically would use hazardous substances and petroleum products as part of typical operations. No other detailed information regarding the historical operations of these facilities was available for review. The historic use of the Site for industrial purposes and as a vehicle storage yard indicates the presence or potential presence of hazardous substances and/or petroleum products with potential impact to the Site. While no direct Site evidence exists to suggest that a release of hazardous substances or petroleum products associated with activities conducted at the Site has occurred. Therefore, historic land use at the Site should be considered when evaluating business environmental risk and future land use at the Site.

Agricultural Chemicals: Based on a review of historical aerial photographs of the Site, the Site appears to have historically been used for agricultural purposes and as such, agricultural chemicals such as pesticides, herbicides, and fertilizer would likely have historically been used

on the Site. Information regarding historical use, storage or application rates was not available. If the chemicals were applied in accordance with manufacturer recommendations, residuals remaining in Site soils would be expected to be similar to other area properties. No information was available to determine whether residual concentrations exceeded government use or exposure criteria. Application of agricultural chemicals for intended use is not considered a release; therefore, potential residuals remaining would not be considered an REC. However, the potential presence of agricultural chemicals may have resulted in Site impairment that may have or could result in adverse impact to Site soil and groundwater. Consideration should be given to the potential presence of these chemicals when evaluating business environmental risk and future land use of the Site.

3.0 Non-Scope Considerations

The following potential issues were identified regarding the non-scope considerations evaluated:

Asbestos Containing Material (ACM): In conjunction with the Phase I ESA, a limited destructive asbestos survey was conducted at the Site by Patriot Environmental Laboratory Services, Inc. (Patriot) in February of 2015. Patriot identified asbestos present in roof mastic (approximately 20 linear feet) and in a six-inch diameter oval transite pipe at the wall heater in the garage (approximately 20 linear feet). Patriot concluded that all ACM present at the Site is in good condition without need for abatement. Additional potential ACM may be present in areas inaccessible to Patriot during the Site reconnaissance. Additional potential ACMs (i.e., behind walls, in crawl spaces, etc.) that will require destruction and/or demolition of building materials for sampling cannot be accessed until the building is vacated.

Lead-Based Paint (LBP): A LBP survey was completed at the Site by Patriot and summarized in a report dated February 27, 2015. Based on the "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing," as established by the Department of Housing and Urban Development (HUD), materials with concentrations above 1.0 milligrams per square centimeter (mg/cm^2) of lead or its compounds are identified to be lead containing. In Los Angeles County, Title 11, 11.28.010 further defines lead-based paint as any paint, varnish, lacquer, putty, plaster or similar coating or structural material which contains lead or its compounds in excess of 0.7 mg/cm^2. The following surface coatings at the Site were identified by Patriot to contain greater than 0.7 mg/cm^2 of lead based on Patriot's x-ray fluorescence (XRF) testing.

- Exterior Blue Wood Window Packages throughout
- Exterior White Wood Garage Door Casing
- Exterior Beige Wood Eaves throughout
- Exterior White Metal Downspouts throughout
- Exterior White Wood Window Sash and Casings throughout
- Exterior Grey and White Door Casings throughout

This summary does not contain all of the information that is found in the full report. The report should be read in its entirety to obtain a more complete understanding of the information provided, and to aid in any decisions made, or actions taken, based on this information.

4.0 Recommendations

Based on the Phase I ESA, including the Site reconnaissance, database search, historical records reviewed, information provided by Site personnel, and interviews, CRA has the following recommendations:

- Based on the historic use of the Site for industrial purposes, there is a potential for the presence of hazardous substances and/or petroleum products in the subsurface. The Site was used for agricultural production as well as a vehicle storage yard, scrap metal yard, storage yard and/or junk yard, and auto repair during years prior to environmental regulations. Hazardous substances and petroleum products were likely associated with the former operations (including pesticides, herbicides, insecticides, fuels, lubricants, and solvents). Additionally, it is unknown when the Site was originally paved and if the former automotive repair activities were conducted on unpaved ground; therefore, the potential presence of hazardous materials in the Site subsurface due to historical chemical handling practices cannot be ruled out. CRA understands that the City of Culver City is proposing to divert sewage flows from four existing sewage pump stations to a single new pump station to be located at the Site, and that the Site will be undergoing a complete redevelopment, including excavation and grading activities that could potentially uncover and/or disturb impacted materials not previously identified. In the event that discolored, odorous, and/or otherwise suspicious materials are uncovered during construction activities, CRA recommends that all work is halted for

further investigation and/or remediation by properly trained and licensed firms in order to protect human health and the environment.

- Regardless of building construction date, the EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) requires that an asbestos survey adhering to AHERA sampling protocol (i.e., a "destructive" ACM survey) be performed prior to complete demolition or renovation activities that may disturb ACMs, which cannot be completed until the building is vacated. This requirement may be enforced by the local air pollution control or air quality management district. Similarly, OSHA regulations require that specific work practices be implemented when handling construction materials and debris that contain lead-containing materials.

We appreciate the opportunity to provide this service and look forward to our continued collaboration on this project. Please contact the undersigned with any questions, comments, and/or concerns at (949) 648-5224.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Kristin de Soto

KDS/bw/1
Encl.

cc: Fred Blickle, CRA
Greg Watanabe, GHD

APPENDIX F
CULVER CITY GENERAL PERMIT/ CONDITIONAL REQUIREMENT NOTES

Culver City

Public Works Department

General Permit/Conditional Requirement Notes

1. **Authority**: This permit is issued in pursuant to Chapter 9.08 of Title 9 of the Culver City Municipal Code.
2. **Standards:** All work shall be performed in accordance with the current edition of the Standard Specifications for Public Works Construction (Greenbook) and any amendments hereto, other city standards, and to the satisfaction of the City Engineer.
3. **Certificate of Insurance**: Contractors or subcontractors that permittee engages for any or all of the work to be completed by this permit shall have a City business license, liability insurance with the City named as additionally insured, and workers compensation insurance. The liability insurance shall have a minimum coverage of one million dollars per incident and two million dollars aggregate and include automobile liability of one million dollars.
4. **Inspection**: At least two (2) working days prior to start of construction or street occupancy, the contractor shall schedule for a pre-construction field meeting with the City inspector to discuss construction and/or occupation in the public right-of-way. Contact the Culver City Public Works Permit Counter at (310) 253-5600 for initial and any subsequent inspection meeting, including final sign off and approval.
5. **Contractor's License**: Applicant performing work in the public right-of-way, including street occupation, shall have the appropriate valid contractor license issued by the State of California. The required license class shall correspond to the specific type of work being performed, i.e. A-General Engineering. C8- Concrete, C36-Plumbing, C42-Sanitation Systems, etc. Applicant shall present a valid proof of license prior to issuance of any permits.
6. **Permit on Site**: A copy of the permit shall be kept at the jobsite at all times and representable upon request by City official including any law enforcement officer.
7. **Underground Service Alert (Dig Alert):** Permittee must notify the Underground Service Alert (USA) at (800) 422-4133 at least 48 hours in advance of start of work for any undergrounding and excavation work in the public right-of-way.
8. **Construction Staging and Traffic Control:** Prior to start of construction, construction staging and traffic control requirements (if any) shall be reviewed and approved by the City. All material and work shall conform to the Latest Edition of the California Manual on Uniform Traffic Control Devices (CA MUTCD).

9. **Construction Notification Letter:** Permittee shall notify affected businesses and/or residents affected by the proposed work at least fourteen (14) calendar days prior to start of work. Notification letter shall contain the scope of project, proposed driveway or access closures, construction duration, engineering permit number, and the contact information of the Construction Manager and Construction Superintendent. Notice shall be review and approved prior to distribution. Failure to distribute the said notices at least fourteen calendar days prior to start of work may result in revocation of the issued permit.
10. **Access to Fire Hydrant and Local Access:** Access to fire hydrant shall be maintained at all times. Unless otherwise directed by the Engineer, local and emergency vehicular access shall be maintained through the construction area.
11. **NPDES Requirements:** Permittee shall comply with all National Pollutant Discharge Elimination System (NPDES) Permit Regulations and Requirements. These requirements and forms may be obtained from the Engineering Division and must be completed and approved by the Engineering Division prior to issuance of this permit.
12. **Sewer Location:** Permittee shall be responsible for determining the horizontal and vertical location of mainline sewers.
13. **Clean up of Right-of-Way:** Upon completion of work, all brush, timber, scraps and other construction materials and debris shall be entirely removed and the right-of-way left in a condition satisfactory to the City Engineer.
14. **Maintenance and Repair:** Permittee shall promptly make any and all repairs to the existing public right-of-way or underground utilities that are damaged by the work authorized by this permit. These repair work shall be completed to the satisfaction of the City Engineer.
15. **Storage of Materials:** Absolutely no stockpiling of construction materials shall be allowed in the public right-of-way unless otherwise approved and authorized by the City Engineer.
16. **Excavation:** All excavations in the public right-of-way shall be backfilled and fully restored within three (3) calendar days unless otherwise authorized by the City Engineer.
17. **Concrete Specification:** Unless otherwise specified, all concrete place for public improvements shall achieve a minimum of 3250 psi compressive strength at 28 days.
18. **Asphalt Concrete Specifications:** Unless otherwise specified, all asphalt concrete placed in the public works right-of-way shall be a design mix of "PG-C2-64-!0".
19. **Public Works Improvements:** Owner shall repair or replace any damaged, defective, off-grade, or any non-conforming sidewalk, driveway approach, curb and gutter, parkway, or non-conforming conditions that exist in the public right-of-way considered hazardous by the City Engineer (per Municipal Ordinance 9.08.415). This work will require a separate permit through the Engineering Division of Public Work Department and shall be completed prior to the final inspection and approval of the project.
20. **Public Works Improvement Plans:** All work proposed in the public right-of-way will require a separate construction plan submittal for review, approval and issuance of permit by the Engineering Division of Public Works Department. All public right-of-way improvement shall be completed prior to final inspection and issuance certificate of occupancy.

21. **Trash Enclosure:** The trash enclosure shall meet the City's standard requirements. The applicant shall obtain a written approval from Lee Torres (Leonardo.torresjr@culvercity.org) (310) 253-6457 or May Ng (May.ng@culvercity.org) (310) 253@6406) for design of new trash enclosures.
22. **Sewer Fees:** In accordance to the City Municipal Code, applicant may be subject to pay City of Los Angeles and City of Culver City Sewer Facility Charges (SFC) as calculated by the Culver City Public Works Department. SFC must be paid prior to the issuance of the Building Permit.
23. **Sidewalk Dining:** In accordance to the Culver City Municipal, applicant shall obtain a sidewalk dining permit from the Public Works Department.
24. **Liability Insurance:** Permittee shall obtain Liability Insurance at its sole cost, keep in full force and effect during the term of this permit, and for one year thereafter, broad form property damages, automobile, employer's and comprehensive liability insurance in at least the minimum limits specified in Part 1, Section 7 of the Standard Specifications. The City, its officers, agents and employees, shall be named as an additional insured under the policy. The policy shall stipulate that such insurance will operate as primary, and that no other insurance maintained by the City will be called upon to cover any loss.
25. **Liability of Damages:** Permittee shall indemnify, hold harmless and defend, in any actions at law or in equity, the City of Culver City, its officers, employees, agents, and elective and appointed boards from all claims, losses, damage, including property damage, personal injury, including death, and liability of every kind, nature and description arising out of or in any way connected with the work performed pursuant to this permit by Permittee, or any contractor or subcontractor. This indemnification shall extend to claims, losses, damage, injury and liability for injuries occurring after completion of this work, as well as during the work's progress.
26. **Permit Duration:** This permit shall expire 60 days after its issuance, unless otherwise specified by the City Engineer. A 60-day after its issuance, at the discretion of the City Engineer, with payment of the original fee and any adjustments that may be required. The City Engineer, upon 30 day written notice, may terminate this permit.

(TO BE PROVIDED)

APPENDIX G
SOUTHERN CALIFORNIA EDISON (SCE)
NEW METER AND SERVICE PLAN